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Enhancing education for sustainable development with tools for quality assurance

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“if you want to run, run a mile. If you want to experience a different life, run a marathon.”

Emil Zátopek

Emil Zátopek was a Czech long-distance runner best known for winning three gold medals at the 1952 Summer Olympics in Helsinki. He won gold in the 5000 metres and 10,000 metres runs, but his final medal came when he decided at the last minute to compete in the first marathon of his life. He was nicknamed the "Czech Locomotive" for his multiple gold medals.

Contents

List of original papers

The thesis in based on the following Papers, which are referred in the text by their Roman numerals:

I Holm, T., Vuorisalo, T. and Sammalisto, K, in press. Integrated management systems for enhancing education for sustainable development in universities: A memetic approach. Journal of Cleaner Production. Available online 5 April 2014. doi: 10.1016/j.jclepro.2014.01.074

II Holm, T., Sammalisto, K., Vuorisalo, T. and Grindsted, T., S., 2012. A model for enhancing education for sustainable development with management systems: experiences from the Nordic countries, in: Leal Filho, W. (Ed.), Sustainable Development at Universities: New Horizons. Peter Lang Scientific Publishers, Frankfurt am Main, pp. 261-272.

III Holm, T., Sammalisto, K. and Vuorisalo, T, in press. Education for sustainable development and quality assurance in universities in China and the Nordic countries: a comparative study. Journal of Cleaner Production. Available online 6 February 2014. doi: 10.1016/j.jclepro.2014.01.074

IV Holm, T., Sammalisto, K., Sandberg-Kilpi, E. A change process for education for sustainable development in universities**.** Manuscript presented at the COPERNICUS Alliance Conference held at the University of Gloucestershire, UK, 10-11 January 2014.

V Holm, T., Sammalisto, K., Grindsted, T., S. and Vuorisalo, T. Process model for integrating education for sustainable development and identifying sustainability aspects in university curricula. Submitted manuscript. Conference paper accepted for presentation at the EMSU Conference in Istanbul, Turkey, 4-7 June, 2013.

Executive summary

This thesis deals with enabling change in universities, more explicitly enhancing education for sustainable development with tools for quality assurance.

Change management is a discipline within management that was developed in the 1980s because business changed from being predictable to unpredictable. The PEST mnemonic is a method to categorize factors enabling change; such as political, economic, socio-cultural and technological factors, which all affect higher education. A classification of a change, in either hard or soft, can help understanding the type of change that an organization is facing. Hard changes are more applied to problems that have clear objectives and indicators, with a known cause of the problem. Soft changes are applied to larger problems that affect the entire organization or beyond it.

The basic definition for sustainable development is: the future generations should have similar opportunities as the previous. The UN has set as a global goal an integration of education for sustainable development (ESD) at all levels of education during 2005- 2014. The goal is set also in universities, the graduates of which are future leaders for all labor markets. The objective for ESD in higher education is that graduates obtain the competence to take economic, social and environmental costs and benefits into account when making decisions. Knowledge outcomes should aim for systematic and holistic thinking, which requires cross disciplinary education. So far, the development of ESD has not achieved its goals. The UN has identified a need for more transdisclipnary research in ESD.

A joint global requirement for universities is quality assurance, the aim of which is to secure and improve teaching and learning. Quality, environmental and integrated management systems are used by some universities for filling the quality assurance requirements.

The goal of this thesis is to open up new ways for enhancing ESD in universities, beyond the forerunners; by exploring how management systems could be used as tools for promoting ESD.

The thesis is based on five studies. In the first study, I focus on if and how tools for quality assurance could be benefitted for promoting ESD. It is written from a new perspective, the memetic, for reaching a diversity of faculty. A meme is an idea that diffuses from brain to brain. It can be applied for cultural evolution. It is a theory that is based on the evolutionary theory by Darwin, applied for social sciences. In the second Paper, I present the results from the development of the pilot process model for enhancing ESD with management systems. The development of the model is based on a study that includes earlier studies, a survey in academia and an analysis of the practice in 11 universities in the Nordic countries. In the third study, I explore if the change depends on national culture or if it is global. It is a comparative study on both policy and implementation level, between the Nordic countries and China. The fourth study is a single case study based on change management. In this study, I identify what to consider in order to enable the change: enhancing ESD

with tools for quality assurance in universities. In the fifth Paper, I present the results of the process model for enhancing ESD with management systems. The model was compared with identified drivers and barriers for enhancing ESD and for implementing management systems. Finally, the process model was piloted and applied for identifying sustainability aspects in curricula.

Action research was chosen as methodology because there are not already implemented approaches using quality management for promoting ESD, why the only way to study this is to make it happen. Another reason for choosing action research is since it is essential to involve students and faculty for enhancing ESD. Action based research consists of the following phases: a) diagnosing, b) planning action, c) taking action and d) evaluating action. This research was made possible by a project called Education for Sustainable Development in Academia in the Nordic countries, ESDAN, in which activities were divided into these four phases. Each phase ended with an open seminar, where the results of the study were presented. The objective for the research project was to develop a process for including knowledge in sustainable development in curricula, which could be used in the quality assurance work. Eleven universities from the Nordic countries cooperated in the project. The aim was, by applying the process, to identify and publish examples of relevant sustainability aspects in different degree programs in universities in the Nordic countries. The project was partly financed by the Nordic Council of Ministers and partly by the participating pilot universities.

Based on the results of my studies, I consider that quality, environmental and integrated management systems can be used for promoting ESD in universities. Relevant sustainability aspects have been identified in different fields of studies by applying the final process model. The final process model was compared with drivers and barriers for enhancing ESD and for implementing management systems in universities and with succeeding with management systems in industry. It corresponds with these, meaning that drivers are taken into account and barriers tackled. Both ESD and management systems in universities could be considered successful memes, which can reflect an effective way of communication among individuals. I have identified that management systems could be used as tools for hard changes and to support the soft change of enhancing ESD in universities with management system. Based on the change management study I have summarized recommendations on what to consider in order to enable the studied change.

The main practical implications of the results are that the process model could be applied for assessment, benchmarking and communication of ESD, connected to quality assurance, when applied. This is possible because the information can be assembled in one picture, which facilitates comparison. The memetic approach can be applied for structuring. It is viable to make comparative studies between cultures, for getting insight in special characteristics of the own culture. Action based research is suitable for involving faculty. Change management can be applied for planning a change, which both enhancing ESD and developing management systems are identified to be.

Tiivistelmä (Executive Summary in Finnish)

Tämä väitöskirja käsittelee muutoksen mahdollistamista korkeakouluissa, etenkin kestävän kehityksen koulutuksen edistämistä, laadunvarmistustyökalujen avulla.

Muutoksenhallinta on johtamisen tieteen haara, joka kehitettiin 1980-luvulla, koska liiketoiminta muuttui ennustettavissa olevasta arvaamattomaksi. Metodi, joka ryhmittää muutoksen mahdollistavia tekijöitä, on PEST muistisääntö: poliittiset, taloudelliset (economic), sosiokulttuuriset ja teknologiset tekijät, jotka kaikki vaikuttavat korkeakoulutukseen. Muutoksen luokittelu joko kovaan tai pehmeään voi auttaa ymmärtämään millainen muutos organisaatiolla on edessään. Kovat muutokset ovat rajoitetumpia ongelmia, joilla on selkeät tavoitteet ja indikaattorit, ja joiden syy ongelmaan on tiedossa. Pehmeät muutokset ovat laajempia ongelmia, jotka vaikuttavat koko organisaatioon tai sen yli.

Kestävän kehityksen perusmääritelmä on, että tulevilla sukupolvilla tulisi olla samanlaiset mahdollisuudet kuin edellisillä. YK on asettanut maailmanlaajuisen tavoitteen integroida kestävän kehityksen koulutusta kaikkiin koulutuksen asteisiin 2005- 2014 aikana, myös korkeakouluihin, jonka valmistuneet ovat tulevia johtajia kaikilla työmarkkinoilla. Korkeakouluissa kestävän kehityksen koulutuksen tavoitteet ovat, että valmistuneet saavat tietoa ja taitoa huomioida taloudelliset, sosiaaliset ja ympäristöön kohdistuvat kustannukset ja hyödyt tehdessään päätöksiä. Koulutuksen tavoitteena on tukea/kehittää järjestelmällistä ja kokonaisvaltaista ajattelua, joka edellyttää poikkitieteellistä koulutusta. Toistaiseksi kehitys ei ole saavuttanut suunniteltuja tavoitteita. YK on tunnistanut lisää tutkimustarvetta kestävän kehityksen koulutukselle, jonka pitäisi olla poikkitieteellistä.

Laadunvarmistus on yhteinen maailmanlaajuinen vaatimus korkeakouluille, jonka tavoite on turvata ja parantaa opetusta ja oppimista. Laatu-, ympäristö- ja yhdistettyjä hallintajärjestelmiä hyödynnetään joissakin korkeakouluissa laadunvarmistuksen vaatimusten täyttämiseksi.

Tämän väitöskirjan tavoitteena on avata uusia tapoja edistää kestävän kehityksen koulutusta useammassa korkeakoulussa edelläkävijöiden lisäksi selvittämällä, miten hallintajärjestelmiä voisi käyttää kestävän kehityksen koulutuksen edistämisen välineinä.

Väitöskirja perustuu viiteen tutkimukseen. Ensimmäisessä tutkimuksessa tarkastelen, miten laadunvarmistusta voisi hyödyntää kestävän kehityksen koulutuksen edistämiseen ja onko se ylipäänsä mahdollista. Se on kirjoitettu uudesta, memeettisestä näkökulmasta, monimuotoisen opettavan ja tutkivan henkilökunnan jäsenten tavoittamiseksi. Meemi on idea joka leviää aivoista aivoihin, ja jota voi soveltaa kulttuuriseen evoluutioon. Se on teoria joka perustuu Darwin evoluutioteoriaan, sovellettuna yhteiskuntatieteisiin. Toisessa artikkelissa esitän tulokset pilottiprosessimallin kehityksestä. Mallin kehitys perustuu tutkimukseen, joka koostuu aikaisempiin tutkimuksiin, kyselyyn ja 11 Pohjoismaisen korkeakoulun käytäntöjen analysointiin. Kolmannessa tutkimuksessa selvitän onko muutos paikallinen vai globaali. Se on vertaileva tutkimus sekä politiikan

että käytännön tasolla Pohjoismaissa ja Kiinassa. Neljäs tutkimus on yksittäinen tapaustutkimus, joka perustuu muutoksenhallintaan. Tutkimuksessa tarkastelen, mitä pitää huomioida mahdollistamaan muutos: edistää kestävän kehityksen koulutusta laadunvarmistuksen työkalujen avulla korkeakouluissa. Viidennessä artikkelissa esittelen prosessimallin, jonka avulla voi edistää kestävän kehityksen koulutusta hallintajärjestelmän avulla. Mallia verrattiin tunnistettuihin ajureihin ja esteisiin edistää kestävän kehityksen koulutusta ja hallinta-järjestelmän toteuttamista. Lopulta prosessimalli pilotoitiin ja sovellettiin kestävyysnäkökohtien todentamiseen opetussuunnitelmissa.

Opiskelijoiden ja henkilökunnan mukaan ottaminen on olennaista kestävän kehityksen koulutuksen edistämisessä, minkä takia valitsin toimintatutkimuksen menetelmäksi. Toimintatutkimus koostuu seuraavista vaiheista: a) määritteleminen, b) toiminnan suunnittelu, c) toiminnan toteuttaminen ja d) toiminnan arviointi. Tämän tutkimuksen on mahdollistanut projekti, jonka toiminta jaettiin näihin neljään vaiheeseen. Jokainen vaihe päättyi avoimeen seminaarin, jossa tutkimuksen tulokset esiteltiin. Tavoitteet hankkeessa oli kehittää prosessi, jonka avulla kestävää kehitystä voitaisiin sisällyttää opetussuunnitelmiin, ja jota voitaisiin käyttää laadunvarmistustyössä. Tavoitteena oli tunnistaa ja julkaista esimerkkejä kestävän kehityksen näkökohdista eri koulutusohjelmissa Pohjoismaisissa korkeakouluissa. Hankeen rahoitti osittain Pohjoismaiden Ministerineuvosto ja osittain osallistuvat yksitoista, pilottikorkeakoulua.

Tulosteni perusteella väitän että laatu- (, ympäristö) ja yhdistettyjä hallintajärjestelmiä voidaan käyttää keinona edistää kestävän kehityksen koulutusta korkeakouluissa. Olennaisia kestävän kehityksen näkökohtia on todettu eri aloilla hyödyntämällä lopullista prosessimallia. Lopullinen prosessimalli verrattiin kestävän kehityksen koulutuksen ja hallintajärjestelmien toteutumisen ajureihin ja esteisiin korkeakouluissa ja hallintajärjestelmien menestymiseen teollisuudessa. Näissä on samankaltaisuuksia, mitä tarkoittaa että ajurit on otettu huomioon ja esteisiin puututtu. Sekä kestävän kehityksen koulutus että hallintajärjestelmät korkeakouluissa voitaisiin pitää onnistuneina meemeinä, joka heijastaa tehokasta viestintää yksilöiden välillä. Olen todentanut, että hallintajärjestelmiä voidaan hyödyntää kovien muutosten välineenä ja tukea pehmeä muutos edistää kestävän kehityksen koulutusta korkeakouluissa hallintajärjestelmien avulla. Muutoksenhallinta-tutkimuksen perusteella olen tiivistänyt suosituksia mahdollistamaan tutkittu muutos.

Tärkeimmät käytännön seuraukset tuloksista on, että prosessimallia voisi käyttää kestävän kehityksen koulutuksen arviointiin, vertailukohtana ja viestittämiseen, yhdistettynä laadunvarmistukseen, sovellettaessa. Tämä on mahdollista koska tiedot voi koota yhteen kuvaan, mikä helpottaa vertailua. Memeettistä lähestymistapaa voi hyödyntää jäsentämiseen. On kannattavaa tehdä vertailevia tutkimuksia eri kulttuurien välillä oman kulttuurin erityispiirteiden oivaltamiseksi. Toimintatutkimus soveltuu henkilökunnan saamiseksi mukaan. Muutosjohtaminen voi hyödyntää muutoksen suunnitteluun, joka sekä edistää kestävän kehityksen koulutusta että kehittää hallintajärjestelmiä.

1. Introduction

This PhD thesis is not about running, but it has to do with setting long-term challenging multifaceted goals and how to reach them, which running a marathon is. In this thesis, I will present an example of enabling change in universities, more explicitly enhancing education for sustainable development (ESD) with tools for quality assurance.

The global goal for ESD is to educate people that can contribute to sustainable development at all levels (UN DESD, 2011).This is not least relevant for universities, the graduates of which should obtain the competence to take economic, social and environmental costs and benefits into account when making decisions (Sibbel, 2009). Different ways to enhance ESD in universities already exist, but the progress has been shown to be challenging, and the examples are scare around the globe (Wals, 2013). The aim with this thesis is to open up new approaches for enhancing ESD in several universities, beyond the few forerunners. A joint global requirement for universities is quality assurance, with the aim to secure and improve teaching and learning (Pratasavitskaya and Stensaker, 2010). I have chosen to explore if the compulsory requirements for quality assurance could be benefitted for enhancing ESD and how tools for quality assurance such as management systems for quality and/or environment could be applied. Both developing management systems and enhancing ESD in a university are new fields of study, which made it reasonable to choose a practical approach for the research, for which action research was chosen. The theory applied is change management and organizational development. The research is an attempt to both design a new practical approach for how to promote ESD in universities and evaluate if simultaneously.

I have had the opportunity to work with applying managements systems for the last 15 years, first a quality management system at a company, then an environmental management system at a limited company that consisted of a university and a vocational institute and finally an integrated management system for quality, environment and safety at a university. During this journey I have learned how useful management systems can be, an insight I want to share. During this PhD process I have also finished eight marathons, which I recommend everyone to experience who want to exceed themselves. A management system can in its simplicity be applied for many things, for example for realizing to run a marathon; plan how to reach that, by choosing to do it and which race will be the goal and plan the training, do the training, modified according to the circumstances and finally run the race; check how it went by evaluating the race and; act, continue with setting a new goal according to the experiences from the training and the race. According to Lozano et al. (2013) sustainability aspects should be included throughout universities for ensuring ESD; in the framework, collaboration, on-campus, by educating the educators, and by fostering transdisciplinarity; why a

comparison to train for a marathon is not enough. It can rather be compared with preparing for an Ironman.

To take economic, social and environmental aspects into account in decision making is needed for sustainable development, which is why it could be expected that faculty in universities would prioritize including ESD in their education. The focus of this study is to explore how ESD could be enhanced as a part of the daily routines in universities, for getting more done, at several universities.

Read this and join the discussion.

I will start by giving a history about why I ended up writing this thesis, with this focus in chapter 1.1. and after that introduce the theoretical framework in chapter 1.2.

1.1. Prephase

I started working with management systems in the fall of 1999. I studied for my Master's degree in biology at Åbo Akademi University and graduated in 1998. At that time, I decided to give education a try. I worked as a senior lecturer in biology and geography at Lovisa gymnasium Senior School during a year, which I enjoyed. Next autumn, I attended a course that covered new strategic environmental tools, where I got familiar with environmental management systems. I also attended a course, in which quality management tools were presented, and ended up implementing a quality management system, according to ISO 9001, at a company. I also contacted different educational institutions and got the possibility to start planning an environmental management system for Ab Utbildning Sydväst in November 1999, which applied for funding for implementing one.

1.1.1. Ab Utbildning Sydväst

Ab Utbildning Sydväst was a private, limited company consisting of Sydväst University of Applied Sciences, Sydväst Vocational Institute and Central Administration, which had an environmental profile (Holm and Sahlstedt, 2008).

In January 2000 the application for funding implementation of an environmental management system was granted. I applied for the work as Environmental Coordinator, which I got, due to the fact that I had attended courses in management systems. That was something new at that time since ISO 14001 was published in 1996 (ISO, 2013). As Environmental Coordinator I was responsible for the environmental management system, first for implementation and later for maintenance. My work included education in environmental management systems for students at different degree programmes and training of the administrative staff and faculty in first environmental and environmental management systems issues, later sustainable development. During the first four

years I had more education than administration, which gradually changed. I was also responsible of the internal audits and the internal and external communication. Regional, national and international networks have been important sources of knowledge and support for development from the start (Holm and Sahlstedt, 2008).

The organization had special environmental groups at each of its units that worked with the implementation; and an environmental management group, which was the coordinating group for Ab Utbildning Sydväst. The amount of environmental groups was 18 in the beginning and 11 at the end, because of mergers (Holm and Sahlstedt, 2008).

Sydväst limited company was the first multidisciplinary education organization in Finland with a certified environmental management system, according to ISO 14001, covering all its operations: education, research and development, as well as other services. The environmental management system was certified in 2006 (Holm and Sahlstedt, 2008) and I started looking for new challenges, when my first serious plan to begin my PhD awoke.

1.1.2. Preliminary PhD plan

I explored in which universities this interdisciplinary study could fit, which universities were the pioneers and which Journals that published articles in this field. I made a list of innovative universities to visit for benchmarking, of which I have visited Mälardalen University, University of Gothenburg, Gotland University and University of Gävle in Sweden and the Hochschule Zittau/Görlitz in Germany.

I wrote a PhD plan and presented it at the researcher seminar of the Finnish environmental education days in October 2006 and on the Pedagogical days in November 2006. I wrote an abstract about the environmental management system at Sydväst University of Applied Sciences, which was accepted to the 13th annual International Sustainable Development Research Conference in 2007. After the presentation, I wrote a paper about it with my colleague Kristina Sahlstedt. It was published in the book: Learning for a sustainable future. Innovative solutions from the Baltic Sea region (Holm and Sahlstedt, 2008).

At the same time Ab Utbildning Sydväst was split and the different institutions merged with other institutions. It was decided that I would continue my work at Novia University of Applied Sciences. Novia University of Applied Sciences was the result of a merger between Sydväst University of Applied Sciences, which was certified according to ISO 14001 and Swedish Polytechnic, which was certified according to ISO 9001.

1.1.3. Novia University of Applied Sciences

At Novia University of Applied Sciences an integrated management system for quality, environment and safety was implemented (Holm, 2010).

The organization that worked with the implementation of the integrated management system was called the quality team, which consisted of the Head of Quality Assurance, five Quality Coordinators for each of the five educational units, the Environmental Coordinator and one representing the Student Union Novium, among which some had appointed responsibility to be Quality Coordinators for the Research and Development unit, the unit for Lifelong Learning and other functions (Holm, 2010; see also Paper IV).

In my work as Environmental Coordinator at Novia University of Applied Sciences, I worked with the integration of the requirements of the environmental management system into the quality management system. I was also responsible for promoting sustainable development and ESD with the integrated management system. My work also included working as a Quality Coordinator for the Unit of Research and Development and for the support functions, with the Head of Quality Assurance. The Quality Coordinators were responsible for the quality, environment and safety management questions at the units and the head of Quality Assurance for the management system of the university. The integrated management system was certified according to both ISO 9001 and 14001 at every unit of Novia University of Applied Sciences in August 2010. It was the first institution of higher education in Finland with a certified management system for both standards (Holm, 2010; see also Paper IV).

Based on my experience I consider that the main difference with implementing a quality management system and an environmental management systems is that the personnel wants to improve the quality of their work, but enhancing sustainability or environmental aspects are not that highly prioritized by most; which is why you have to be very patient if you want to integrate an environmental management system. The only exception I have faced is when I once visited the Finnish Deference Forces and one participant asked how they had managed to implement the environmental management system. After the presenter understood that it was a question, he answered “we gave an order of the day”. There might be organizations that are even more different than universities and the Deference Forces, but the leaders at universities do not succeed by giving orders of the day, but have to have many different approaches for managing the academia (teaching and researching staff, or faculty) that has much of the power. The academia is employed for its expertise and everyone will analyze each decision and would want to know why it has been taken and how it affects their work, after which they will consider if they will follow it and how. Because of this it is fascinating to do a study on management systems and ESD in universities.

1.1.4. Final PhD plan

Kaisu Sammalisto wrote here PhD in 2007, on environmental management systems, as a way towards sustainable development at universities (Sammalisto, 2007). I had a meeting with her in August 2010 at University of Gävle in Sweden, about a cooperation plan we had. The meeting resulted in her asking if I would like to write a PhD on my area of interest, which I did. I would say that I had waited for the right moment and supervisor to come along, why I could make this choice at that time. During the autumn I contacted a lot of different professors at several universities for finding out where my interdisciplinary study could fit, which appeared to be the hardest challenge during my PhD; it was considered to be an interesting theme, but did not fit the disciplines. I had met Timo Vuorisalo from University of Turku before, in a regional network for enhancing education for environmental education in higher education, which had successfully arranged a Studia Generalia in sustainable development in cooperation among five universities in the area of Turku, Finland, every autumn, since 2009. He saw a potential in my study and welcomed me to University of Turku, the section of Biodiversity and Environmental Science. I also considered starting my PhD studies at the Department of Industrial Economics and Management at the Royal Institute of Technology in Sweden where professor Staffan Laestadius welcomed me. I attended a course in evolutionary economics at the department in the spring 2011, which inspired me to one of my papers. The department would have suited my PhD studies as perfectly as the section of Biodiversity and Environmental Science, but due to logistical challenges I decided to continue my PhD studies at University of Turku in Finland.

The original title of my PhD thesis was “Introducing and developing integrated management systems in universities, especially as a way for promoting sustainable development and education for sustainable development (ESD) (in Finland, Sweden and Denmark), with the aim to investigate the critical issues, drivers and barriers of integrated management systems in universities, especially as a way for promoting sustainable development and ESD”.

1.1.5 The ESDAN project

Since cooperation has been identified as essential for ensuring ESD (Lozano, 2008; Lozano et al., 2013; Stephens et al., 2008) I wanted to realize this study in a network. In November 2010, it was possible to apply for funding from the Nordic Council of Ministers for cooperation projects regarding enhancing ESD for a maximum of two years, which rector Örjan Andersson of Novia University of Applied Sciences in Finland did in cooperation with Dean for Sustainable Development Kaisu Sammalisto from University of Gävle in Sweden and MSc. student Thomas Grindsted from Roskilde University in Denmark. I had met Thomas on a collaboration workshop regarding enhancing ESD in universities among the Baltic Sea Region and the Mediterranean in May 2010, where we noticed our

common interest in enhancing cooperation among universities in the Nordic countries. In March 2011 the Nordic Council of Ministers granted funding, for the project: Education for Sustainable Development in Academia in the Nordic countries, ESDAN, for the period March 1st 2011 to March 31st 2013. The project was partly financed by the Nordic Council of Ministers and partly by the participating pilot universities. The project plan included that the results would be published in scientific journals. The objectives for the project were:

- to develop a process, in cooperation among nine universities, by which knowledge for sustainable development could be included in curricula, which could be used in the quality assurance work, and
- as result identify and publish examples of relevant sustainability aspects in different degree programs, in universities, in the Nordic countries.

1.2. Theoretical framework

Biology is a natural science, the science of living things, including the mechanism and logic behind life processes, or the molecular, cellular and evolutionary working of life. One of the most important researchers in the history of biology is Charles Darwin, who presented a theory of evolution by natural selection in 1859. The theory of evolution gave an organizing framework for biology and was the starting point for modern biological science (Keeton and Gould, 1986).

Evolutionary theory has influenced many scientific disciplines, in addition to biology. Marshall thought that biological science could give a new content to economic theory and might especially help to explain the evolution of the industrial organizations (Laestadius, 1992). Herbert Spencer, a friend of Darwin, applied the evolutionary analogy to social science by claiming that human societies were also influenced by evolutionary forces (Hoefstadter, 1944). The Darwinian principles of variation, selection and inheritance provide a general framework that is essential for understanding complex population systems, which socio-economic systems are (Hodgson and Knudsen, 2008).

The concept of the meme was first presented by Dawkins in 1976, as an idea or a learnt element of culture that diffuses from brain to brain, which is analogous to genes, but not genetically inherited (Dawkins, 1976). In paper I have applied the memetic theory (see Figure 1).

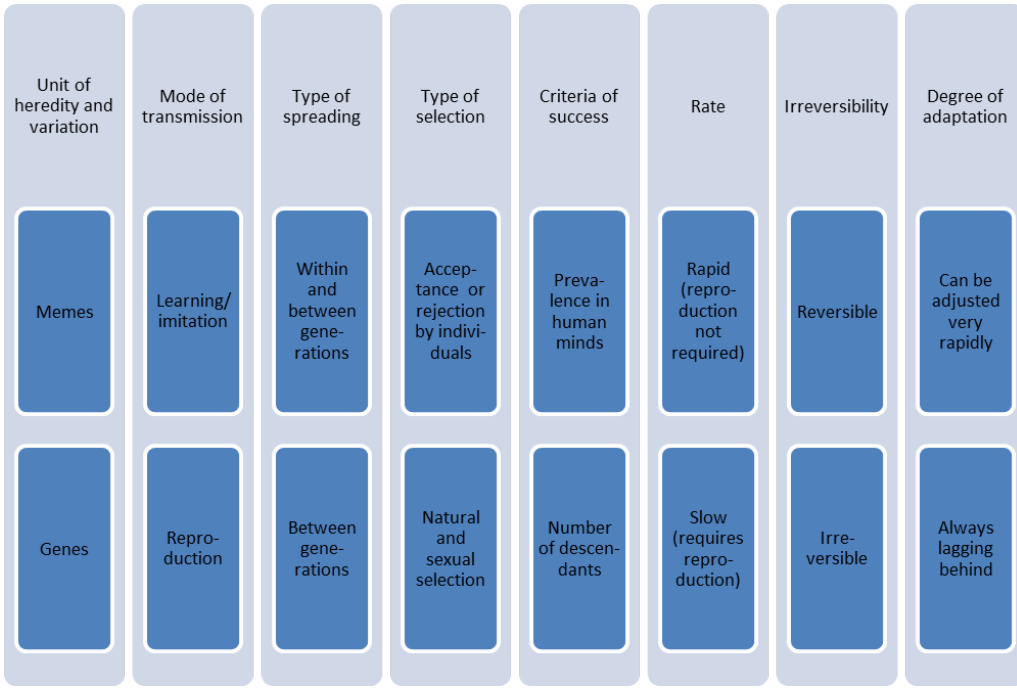

Figure 1. Basic differences between genes (bottom row) and memes (top row) (adapted from Blackmore, 1999; Elster, 1989; Guillo, 2012; Wilson, 1975). (Paper I)

Memetics deals with ways and means of effective communication within human communities. The approach was chosen because the memetic approach seemed suitable for this interdisciplinary study, even though the theory is criticized and not verified. The mechanism for copying and storing memes is not yet known despite the fact that the concept was introduced 36 years ago. As a comparison, it took almost a century for the humanity to understand the mechanism of heredity. Charles Darwin published his Origin of species in 1859 and in 1950 the structure of DNA was discovered (Blackmore, 1999).

According to biological science a population is a group of individuals that share a common gene pool (Keeton and Gould, 1986). This can be modified for this thesis, by considering that a discipline at a university could be considered a population, which shares the same meme pool.

1.2.1. Change management

Change management was developed as a result of change in business, from supplier´s market to buyer´s market, or from being predictable to being unpredictable and the managers needed to obtain the competence to be leaders of change (Arnold et al. 2005; Phillips, 1983; Senior and Swailes, 2010).

The difference between leadership and management is that leadership is establishing the direction and management the actions needed for the chosen direction (Senior and Swailes, 2010). It can be exemplified in universities by that leadership is the vision and strategies that the universities chooses, and declaration they commit to. Management is to plan, do and evaluate the goals and programmes for them. I consider that changes in universities do not happen suddenly, rather the opposite, in steps.

Hersey and Blanchard´s (Hersey and Blanchard, 1993) theory of situational leadership is divided in four categories: 1) specific instructions are needed; 2) the decision should be explained for providing opportunity for clarification; 3) ideas can be shared that facilitates decision making and 4) responsibility for decisions and implementation can be turned over.

According to Dunphy and Stace (1988) and Tushman et al. (1998) there are four categories for stepwise change: a) corporate transformation such as major changes across the organization, b) modular transformation such as major restructuring, c) incremental adjustment such as distinct changes and d) fine tuning. The success of the change initiative is dependent on the employees' reaction, which often is resistance (Senior and Swailes, 2010). Ford and Ford (2009) found five ways to benefit resistance to changes, which are to: 1) boost awareness, of how the change affects the work in practice, 2) return to purpose, by answering why and what, 3) change the change, be open-minded to development ideas, 4) build engagement by allowing reflection, 5) complete the past,

which means that people have good memories and resistance might have to do with past changes that needs to be acknowledged.

A usual way to group different factors that cause a change is the PEST abbreviation; 1) political factors such as international law, government legislation and ideology, and local regulations; 2) economic factors such as competitors, suppliers and government economic policies; 3) socio-cultural factors such as demographic trends, lifestyle changes, business ethics, skills availability, attitudes to work, employment, minority groups, gender issues, willingness and ability to move, concern for the environment ; and 4) technological factors such as information technology, internet and changes in transport technology (Senior and Swailes, 2010). These change factors are applied for universities in Table 1 (Paper IV).

Table 1. Change factors in universities, adapted from Arnold et al. (2005). (Paper IV)

	Political factors	Economic factors	Socio-cultural factors	Technological factors
Change factors in univers-ities	- higher education legislation and strategies, - regional, national and international strategies and regulations	- policy of financers, - need of education in society and companies, - changes in educational program selection in other universities - student enrollment	- demographic changes: an healthier older generation, which also needs innovative healthcare and biotechnology services, - education in relation to need of work force, - increased mobility, more multicultural campuses and need for language skills	- a global opening of internet, - virtual forms of working like e-meetings and e-learning, - competencies for new technologies

The main reason for development of the change management discipline was that market factors impacting on operations changed from being task-oriented to value oriented or from possibilities of suppliers to needs of buyers (Goodman, 1995). I think that applying change management at universities can be useful, since universities are facing both a focus shift from their own aims to the needs of the customers - the students - and a change in the required knowledge.

1.2.2. Education for sustainable development, ESD

The concept sustainable development became common after the publication of the so called Brundtland report in 1987 (WECD, 1987), but was first defined in the World Conservation Strategy. The basic definition for sustainable development is: “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Conservation Strategy, 1980). Sustainable development is dependent on economic and social development, and environmental protection (UN DESD, 2011).

The role of education soon became an apparent aspect of sustainability (UN DESD, 2011) and the concept Education in SD was introduced in 1992 (UNCED, 1992). The concept ESD was developed. It in not education about, or in sustainable development; neither education and sustainable development, seemed as different things; neither education as sustainable development (Sund, 2010). It is education for sustainable development, to provide students with the knowledge or competence: how they could make decisions for a sustainable future.

The first program in the world for promoting ESD in an regional international area was the Baltic 21 E, which the Ministries of Education around the Baltic Sea signed in 2002 (Baltic 21E, 2002). International, regional and national declarations and strategies have been set for enhancing ESD. They all share the same objective: to integrate ESD at all levels of education (Baltic 21 E, 2002; Grindsted and Holm, 2012; Nordic Council of Ministers, 2009, 2011; Renmin University of China UNDP, 2010; Paper II). From 1972 until 2010, at least 25 international declarations in English stressed ESD in universities (Grindsted and Holm, 2012). In 2005 the UN launched the UN Decade of Education for Sustainable Development, DESD, 2005-2014, with the objective to enable awareness, attitudes and competences for informed decisions, for the benefit for present and future (UN DESD, 2011). The latest declarations were prepared for Rio +20. They are the Higher Education Sustainability Initiative, HESI, which 272 universities had signed by end of 2012; and the Rio+20 Treaty on Higher Education, which was signed by 83 universities and/or networks by 2013. They differ from earlier declarations by that the rectors must state what their university will do to enhance ESD (Copernicus Alliance, 2013; UNCSD, 2012).

Universities have a central role in ESD because they produce graduates that influence all disciplines (see Figure 2). The graduates should be able to make sustainable decisions after having considered the social, environmental and economic costs and benefits of available alternatives (Sibbel, 2009). Knowledge outcomes for ESD in universities are improved systematic and holistic thinking, which requires involvement of all disciplines and stresses the role of interdisciplinary education. Essential sustainability competences, that graduates from universities are expected to have attained during their studies, are self-learning, problem-solving and critical as well as creative thinking. These are abilities connected to communication, teamwork and to be able to work as a change manager (Rieckmann, 2012; Sibbel, 2009; Svanström et al., 2008; van Dam-Mieras et al., 2008; Paper II). It can also be questioned if it is possible to enhance ESD at universities, which is interdisciplinary, since universities are based on disciplines.

Stephens et al. (2008) studied the potential for universities to be change agents for sustainability. They identified five critical issues that are 1) considering regional-specific challenges, 2) financing arrangement and independence, 3) institutional organization, 4) degree of democratic processes and

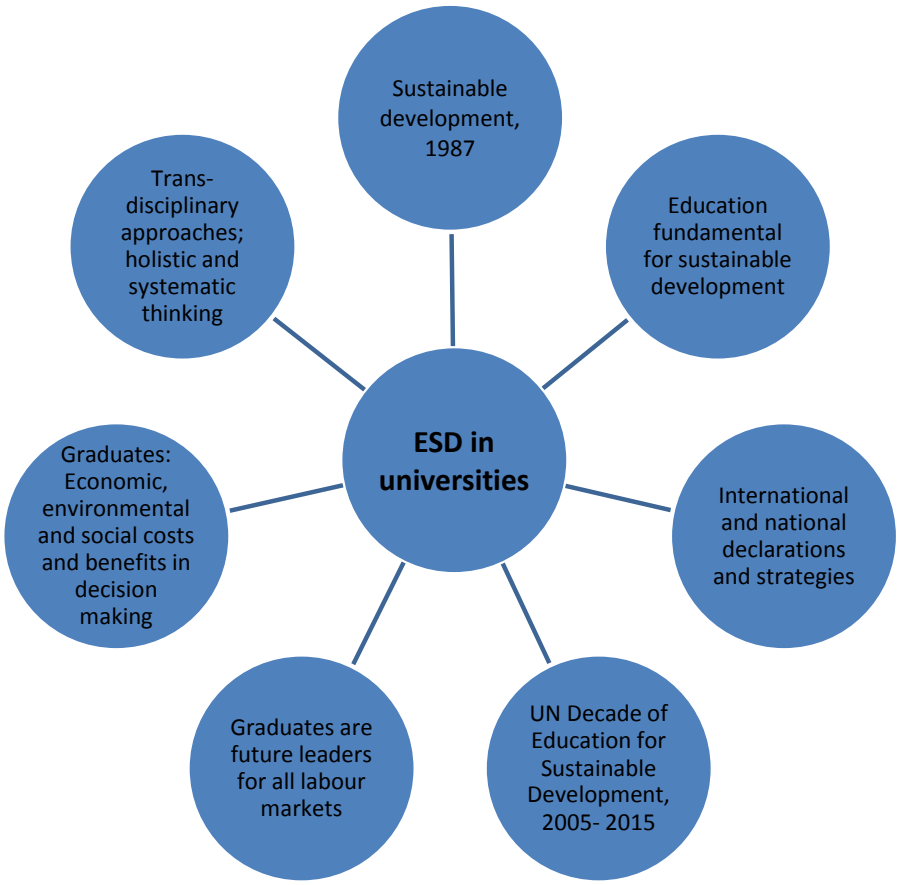

Figure 2. ESD in universities (adapted from Grindsted and Holm, 2012; Rieckmann, 2012; Sibbel, 2009; Svanström et al., 2008; UN DESD, 2011; van Dam-Mieras et al., 2008; WECD, 1987; World Conservation Strategy, 1980)

internally and 5) externally with stakeholders, global organizations and governments, are useful when organizations attempt to become more sustainable, because the staff notice that they are a part of a larger system. According to Holley (2009), the success for enhancing change strategies is in supporting specific focus areas that each campus has. Challenges for implementing sustainable development in universities identified by Leal Filho (2011) are that sustainability should be understood more broadly and that it should be explained to different stakeholders, that there is need to raise further support both on financial and commitment levels, and that there is need for practical projects, which demonstrates what can be done, how and why.

1.2.3. Quality assurance

National requirements for quality assurance in universities occur all over the world (Ewell, 2010; Harvey and Williams, 2010; Kliot and Bykovskaya, 2011; Yuan, 2010). The global aim for quality assurance in universities is to secure and improve teaching and learning (Pratasavitskaya and Stensaker 2010).

According to Ewell (2010), the Bologna process in Europe has most likely been the greatest noticeable multinational progress of quality assurance in universities in the world. The Bologna Declaration, in 1999, supported cooperation in quality assurance among universities in Europe, which advanced fast. In the early 1990s, less than half of the European countries had started quality assessment activities of universities, while in 2003; all countries but one had some kind of assessment. In 2005, the European Ministers of Education adopted the Standards and Guidelines for Quality Assurance in the European Higher Education Area, which the national requirements are based on (Amaral and Rosa, 2010).

1.2.4. Quality, environmental and integrated management system

Quality and environmental management is maintenance and continuous improvements of all everyday jobs with the goal to go beyond customer requirements (Molina-Azorín et al., 2009). Management systems are based on the so-called PDCA-cycle, plan- do- check- act; also called the Deming-cycle (Deming, 1982), see Figure 3.

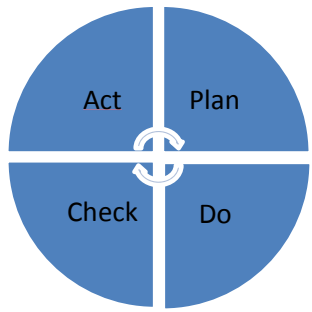

Figure 3. The PDCA-cycle (adapted from Deming, 1982).

The International Standardization Organization, ISO, has developed management system standards relevant to both production and service companies that can be certified, which have become popular globally (ISO, 2013; Zeng et al., 2007). The first one published was the standard for Quality Management Systems ISO 9001 in 1987 and after that ISO have among others published the standard for Environmental Management Systems ISO 14001 in 1996 and Occupational Health and

Safety Management Systems OHSAS 18001 in 1999 (Jørgensen et al. 2006; Kraus and Grosskopf, 2008). Most companies start by implementing a quality management system, into which they integrate an environmental management system (Bernardo et al. 2010; Karapetrovic and Casadesús, 2009), that becomes an integrated management system (see Figure 4). During the past years, ISO has eased integration of different standards (Jørgensen et al., 2006).

According to Disterheft et al. (2012), EMS can be used as a tool to enhance campus sustainability. Nawrocka and Parker (2009) however claimed that an environmental management system does not automatically improve environmental performance. The results depend, among other things, on the goals, culture, economy and legislation.

Quality, environmental and integrated management systems are used by some universities to master the quality assurance requirements (Federkeil, 2008; Pratasavitskaya and Stensaker, 2010). According to Brookes and Becket (2007), external demands have been the main driving force for developing quality management in universities. According to Fisher and Nair (2009), quality management has not developed at a similar speed in universities as in industry because faculty does not see the relevance of it, research cannot be managed and statistical thinking is only relevant for manufacturing. Tools for evaluating quality in universities are continuously improved (Pratasaviskaya and Stensaker, 2010), which could have a positive effect on the identified skepticism.

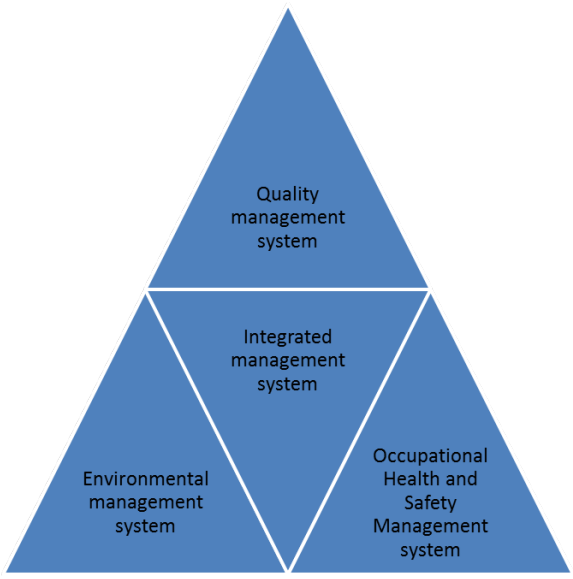

Figure 4. An integrated management system.

One found benefit of integrated management systems in industries is their contribution to sustainable development (Jørgensen et al., 2006; Kraus and Grosskopf, 2008). Stubbs and Schapper (2011) found that even though many universities support ESD, the initiatives are mainly driven by individuals and generally without using integrated management systems. I consider that an integrated management system that would cover several more aspects than a quality management system, such as sustainability aspects and further ESD, could be considered more relevant by a larger part of the faculty due to the fact that the faculty is from several disciplines (See Figure 5; Paper II).

Figure 5. Management systems in universities, as tools for quality assurance (adapted from Ewell, 2010; Fisher and Nair, 2009; Harvey and Williams, 2010; Kliot and Bykovskaya, 2011; Pratasavitskaya and Stensaker 2010; Swedish Standard Institute, 2004; Yuan, 2010).

A demand in an environmental management system is that personnel that have responsibility for tasks of significant environmental impacts should be competent for those tasks (Swedish Standard Institute, 2004). This means that if a university identifies ESD as a significant environmental aspect it should offer training in ESD for the teaching faculty, for all disciplines (see Figure 4; Paper II). It is of course challenging to get the faculty to participate in the training and further to be willing to teach ESD in their courses. The point is that the demands of an environmental management system can be used as a support for arranging training.

1.2.5. ESD and tools for quality assurance as change in universities

The characterization of changes on a scale from hard to soft is used for explaining differences. Hard changes are more limited problems concerning both amount of involved people and effect on the organization, generally with clear objectives and indicators, with a known cause of the problem and a solution that could be reached within a specific time. Soft changes are larger problems that affect the entire organization or even beyond it and concerns therefore a lot of people at different levels and the cause of the problem, the objectives and the solution are unknown (Senior and Swailes, 2010). A classification of a change to either hard or soft can help understanding the type of change that the organization is facing, which facilitated making a realistic plan (Paper IV). The TROPICS test, developed by Paton and Mc Calman (2000), can be used for locating if a change is more soft or hard In the fourth study (see Table 2), I have applied the TROPICS test for identifying which kind of change enhancing HESD and implementation of tools for quality assurance, such as management systems, at universities are (Paper IV).

Management systems could be used as tools for hard changes and support the soft change of enhancing ESD in universities with management systems (Paper IV).

OD, is an acronym for organizational development, which is a soft approach to organizational change and renewal. It is an approach that focuses on the organization as hole, its groups and its employees and considers that they are the drivers of change (Senior and Swailes, 2010). The OD approach suits universities, because all services and products which are produced: education, research and development are based on the knowledge and initiative of academia and administrative staff at the universities.

OD has two characteristics. The first is that a desired change can be divided into recognizable phases that should be taken for making the change possible and the second that OD can help to collect all phases for clarifying the relationship among the phases (Senior and Swailes, 2010). In the study a change management process model based on OD has been developed. According to Paton

and Mc Calman (2000) OD can also be considered an action based research model, which is why a reason to that action research was chosen as methodology for this thesis.

Table 2. The TROPICS test applied for enhancing ESD and implementation of tools for quality assurance, such as management systems, at universities, adapted from Paton and Mc Calman (2000). (Paper IV)

TROPICS test, the more clear these factors are, the harder is the change and vice versa	Enhancing HESD in universities	Implementation of tools for quality assurance, like management systems, in universities
Timescale	Future generations ought to have similar opportunities as previous	Includes objectives with timetables
Resources needed	Future generations ought to have similar opportunities as previous	The resource needs are identified for the objectives
Objectives	Graduates should hold the skill to choose best actions after considering social, economic and environmental expenses and benefits	Instructions to choose clear objectives for both the entire university and units, which are based on focus areas or strategies
Problem: reasons and solutions to it	Need of sustainability competencies; solution: HESD varies among disciplines and changes over time	Need to assure quality; solution: quality management system with instructions for appointing responsible ones for different tasks
Interest: limitations of interest and possibility to define	HESD "competes" with disciplinary focus among faculty; definition varies among disciplines and changes over time	A tool for management, which includes a definition of its target group/s and operation
Controlled: ability to be controlled by management	It can be monitored, but can not be controlled	A tool for management, can be controlled, is based on objectives and targets
Source: if it originates from inside the organization	The internal origin is often based on single individuals, the UN has chosen that ESD should be integrated at all levels of education, also universities	Internally a factor in competition among universities, global demands for quality assurance in universities

2. The structure of the thesis

In this chapter I will present what has been studied before; which is the aim of this study and why, which are the sub studies and why these were chosen.

2.1. Earlier studies

Many studies concerning ESD have been published during the last decades. Wright and Pullen (2007) studied journal articles in English related to ESD from 1990 to 2005. This is a representative time frame since ESD was introduced in 1992 (UNCED, 1992). They found that during this timeframe ESD related articles have grown in volume and the authors publishing in the area has increased. Still, in 2009, less than half of international experts on ESD, thought that the goals for the second half of the UN DESD will be realized adequately, until the end of the decade (Gross and Nakayama, 2010). UNESCO chose to support development of appropriate tools and research in ESD in Europe during the second half of the UN DESD (UN DESD, 2010), which indicated that there is need for more research in the field. According to Lozano et al. (2013), sustainability aspects should be included throughout universities, in the institutional framework, collaboration, on-campus experiences, by organizing training for educators, and by fostering transdisciplinarity for ensuring ESD.

Quality assurance and management systems in universities are also disciplines that have been explored a lot. Pratasavitskaya and Stensaker (2010) investigated quality management studies in universities that had been published in the journal Quality in Higher Education from 1995 to 2008. According to them, quality management is basically comparable in different universities, even though the vocabulary differs. They found that the research tends to be multidisciplinary and done from numerous perspectives, the published studies are often based on a single case and that scepticism for using more general quality management approaches in universities is usual. Studies on integrated management systems have been made in companies (Asif et al., in press; Bernardo et al., 2009, 2012; Zeng et al., 2007), but, to my knowledge, none in higher education. According to Federkeil (2008), management systems originating from the world of business are not yet usual in universities, but interest in them is rising.

One study examines ESD and quality assurance, which was done in the UK (Ryan and Tilbury, 2013). They suggest that connecting ESD and quality can change the importance of ESD.

Change management can be applied for any change and it has been applied for ESD, quality assurance and management systems in universities. In a search on Scopus, the following amount of published articles before 2011 were found: 21 223 on change management education for sustainable

development universities, 7862 on change management quality assurance universities and 561 241 on change management management systems universities. According to Lozano (2006), enhancing sustainable development in universities can be considered a change, because it requires a change in teaching methods. The identified change is that graduates have knowledge in their field, but little awareness of the consequences their actions may have in other fields, in both a short and long term perspective. Lozano identified different approaches and strategies to overcome different levels and aspects of barriers to change and argues that transdisciplinary and multi-stakeholder approaches should be used for enhancing sustainable development and that management on top-level must be engaged. Cortese (2003) argues that if a university only integrates sustainability aspects in its operational works and does not involve the faculty and students, it will lose 75 percent of the value, and cannot accomplish its role in society. Waas et al. (2010) proposed 22 characteristics of university research for sustainable development, of which one suggested way is action oriented and another environmental, safety and security management. They suggest that the in depth meaning of the proposed characteristics should be elaborated and how the characteristics should be handled operationally in a real university research context.

The only doctoral thesis that has been published on my subject in the Nordic countries is the one by Sammalisto in 2007 about environmental management systems, as a way towards sustainable development at universities. Sammalisto (2007) studied why universities work with environmental management systems in Sweden; how they work with them; if an environmental management system can be a way to institutionalize work for sustainable development, including ESD, and what industries and universities can learn from one another. According to Sammalisto, it would be useful to study how students develop their knowledge and awareness, ESD, and the drivers and barriers at different universities. Based on her suggestions for further research I have chosen to focus on enhancing ESD, since there is need for new ways for enhancing ESD in universities, beyond the forerunners. Sammalisto argues that the work with ESD usually follows the implementation phase of an environmental management system. This has been the case in both University of Gävle in Sweden and Novia University of Applied Sciences in Finland, which I have followed more closely, why the same development could be expected also in other universities. I have also studied drivers and barriers for enhancing ESD and developing management systems in universities. Since Sweden in the only Nordic country that has a requirement in the legislation for enhancing sustainable development and implementing an environmental management system in universities (Paper II), I have chosen to study how the compulsory quality assurance demands can be benefitted, since the demands are alike in the Nordic countries.

2.2. The core problems

It has been identified that top management should be committed to facilitate the change to enhance ESD in universities. Since quality assurance in universities has become compulsory and evaluated, globally, during the last 15 years, it can be expected to be prioritized by senior management. This is why I have chosen to explore if the quality assurance requirements could be used for enhancing ESD. Management systems are chosen because they are used as tools for quality assurance, and a suggested way for research for sustainable development.

Identified limitations for quality management studies are that they are often based on a single case and that scepticism for using more general quality management approaches in universities is usual. I have tackled the identified shortages by including concrete examples from several universities, and by focusing on the benefits of both ESD and management systems for universities.

Management systems are based on a cycle for continuous improvements. This is a process that will only work if all stakeholders accept the management system; top management, faculty, administrative staff and students. Involving faculty and students is also an identified core action for enhancing ESD in universities. In order to involve students, faculty and administrative staff action research was chosen as methodology, focusing on education, not enhancing sustainable development in all university activities. Another reason for choosing action research as methodology is because there are not already implemented approaches using quality management for promoting ESD why the only way to study this is to make it happen. Action oriented research is also a suggested identified way for research for sustainable development.

The aim of this study is to investigate how management systems could be used as tools for promoting ESD, in universities, by developing a process model. Since universities are based on disciplines, which ESD is not, there is a need for a process for bringing together faculty, administrative staff and students from different disciplines and departments. It can also be questioned if it is possible to enhance ESD at universities. The target group is faculty and management interested in enhancing ESD and developing tools for quality assurance, such as management systems, in universities. Since this study is written for a practical application in mind, it is an applied research and have practical examples included in all studies.

The thesis is an interdisciplinary study comprising of management, pedagogics, environmental science and sustainable development. This approach was chosen to increase validity.

The following studies I did in cooperation with my coauthors:

I Integrated management systems for enhancing education for sustainable development in universities: A memetic approach

II A model for enhancing education for sustainable development with management systems: experiences from the Nordic countries

III Education for sustainable development and quality assurance in universities in China and the Nordic countries: a comparative study

IV A change process for education for sustainable development in universities**.**

V Process model for integrating education for sustainable development and identifying sustainability aspects in university curricula

Table 3. The background or context and the research questions and aims of the original papers.

	I	II	III	IV	V
Back-ground/ context	- the global goals for ESD are not expected to be realized sufficiently - memetics deals with ways of effective communication within human communities - quality, environmental and safety management has been identified as a research characteristic for sustainable development in universities	- enhancing ESD in universities is a global challenge - most countries have national quality assurance demands to secure and improve teaching and learning, which could benefit ESD	- the Nordic countries strive to be among the regions that lead the way in enhancing ESD - it is interesting to compare the Nordic countries with China, in order to find possibilities for cooperation	- higher education changes when society changes - enhancing ESD and ensuring quality assurance are two global demands for universities, for which change management could be applied	- a decision to promote ESD more actively in the future was taken at the Rio + 20 UN Conference in 2012 - universities are required to have quality assurance - although quality assurance is compulsory, ESD has barely been examined or integrated in this context
Research questions and aims	- whether and how frameworks for processes and procedures for quality assurance, such as management systems, could be utilized to promote ESD in universities - an evolutionary perspective was chosen, considering ESD and management systems as memes, or basic units of cultural replication	- how different universities enhance ESD with quality, environmental and integrated management systems - introduce a model of how it could be done	- which are the differences and similarities in quality assurance and ESD in both regions, at both policy and implementation levels - for investigating the possibility to improve ESD in these regions by benefiting from the quality assurance requirements	- to explore characteristics for change management at universities, - for finding out what to consider when applying change management for enhancing ESD by making use of quality assurance, and - studying how the theory can be applied at a university	- to develop a process model for including ESD in management systems, which are applied for quality assurance, and - as a result, to identify and publish examples of relevant sustainability aspects in different degree programs in universities in the Nordic countries, by applying the model

In Table 3 the background or context and the research questions and aims of the original papers are summarized.

Unlike my PhD plan (see 1.1.4) I chose not to study integrated management systems in universities, or the differences between integrated management systems in universities and companies, because no studies about integrated management systems in universities have been made and integrated management systems are still unusual among universities. I have instead included results from studies about differences and similarities between implementing management systems in universities and companies in the first study (Paper I).

Since it has been identified that ESD should be explained to different stakeholders I have explored if there are ways to evaluate how relevant aspects of sustainable development, for the profession, have been included in curricula (Papers II, IV and V).

My interest in the memetic approach was aroused when I attended a course in evolutionary economics. Earlier, as lecturer, I have been teaching several courses in biological evolution, based on genes and I was thrilled when I found out that there is also a theory for cultural diffusion, based on memes. I chose the approach to see if considering management systems and ESD as memes may help to find ways for their further promotion in universities, for reaching a diversity of faculty (Paper I).

I chose to explore the differences and similarities between the Nordic countries and another, China, for exploring if the change depends on national culture or if it is global (Paper III).

I chose change management as an approach for the fourth study because both enhancing ESD and developing management systems in universities can be considered changes, which are demanded by stakeholders, for which change management can be applied (Paper IV).

The fifth study was the ultimate aim and the others were needed to get there. The development of the pilot process model is based on a study that includes earlier studies, a survey in academia and an analysis of the practice in 11 universities in the Nordic countries (Paper II). The final process model was compared with identified drivers and barriers for enhancing ESD and for implementing management systems. The process model was piloted and applied for identifying sustainability aspects in curricula (Paper V).

3. Action based research as methodology

Action research was chosen as methodology because there are not already implemented approaches using quality management for promoting ESD, why the only way to study this is to make it happen. Another reason for choosing action research is since it is essential to involve students and faculty for enhancing ESD. It is an approach in which the action researcher and other participants collaborate in diagnosing a problem and developing a solution. Action based research is mainly criticized for its lack for repeatability, lack of rigour and for concentrating too much on action at the expense of findings (Bryman and Bell, 2011). I have taken these risks into consideration by explaining each step (see 3.1. to 3.4 and Figure 6), by presenting the results on seminars (see Figure 6) and in papers (Papers I, II, III, IV and V). The aim was to do applied valid, reliable research, which could be applied by university management and faculty. Since the results are meant for action, it is also important that they are based on action, and not only theory. I have included both theoretical background and practical examples from universities, in all five studies.

I have also used my own experiences and reflected to that, which auto-ethnography is suitable for. Auto-ethnography has also been identified to be suitable for combining genres, which was another reason for its suitability for this study. I participated in the research as participant as observer, which means that I was a complete participant, and the other participants were aware of that I also attended as a researcher. The role carries the risk to develop an outside angle on the collection and analysis of data. On the other hand it offers an opportunity to get a deep insight in the study (Bryman and Bell, 2011). I have tackled this risk by presenting the results when they were ready, at the seminars, for the participants (see Figure 6). This way I made it possible to make corrections in the diagnoses, if I would have had problems with being objective.

A soft change management method was chosen to be applied, since the studied change, enhancing ESD in universities with management systems, can be considered soft (see 1.2.3; Paper IV). The soft change management method OD was chosen, because, according to Paton and Mc Calman (2000), it can also be considered an action based research model. The OD model consists of the following major phases: a) diagnosing, b) planning action, c) taking action and d) evaluating action (Coghlan and Brannick, 2007). Each phase can be further divided into four steps that are: 1) reflecting, 2) interpreting, 3) taking action and 4) experiencing. Between phase a) and b) the appointed change agent should develop a vision for change and gain commitment to the vision (Senior and Swailes, 2010). This research was made possible by a project called ESDAN (see 1.1.5), in which activities were divided in these four phases, see Figure 6. The fourth paper is a parallel study to this project that started before, and ended after the project.

In Table 4, the methodology used in the different articles is summarized. Both ESD, management systems and quality assurance requirements has been studied in all five papers. Documented and presented practice from the 11 pilot universities in the ESDAN project has been analyzed in Papers I, II and V and results from additionally 12 universities in the Nordic countries, that piloted the further developed final process model has been observed in Paper V. Beyond this result from a survey to academia in the Nordic countries has been studied in Papers II and III and results from a survey to academia in two provinces in China has been examined in Paper III. Paper IV is a single case study, based on change management.

Table 4. The methodologies used in the original papers.

	I	II	III	IV	V
Materials and methods	- the literature review was done using among others Scopus and Emerald, and benefitting by a literature list for a PhD course in evolutionary economics - the practical context was studied by looking into how 11 universities in the Nordic countries have enhanced ESD with management systems - the data used for the empirical study was collected from reports submitted by the universities and from seminar presentations on two seminars concerning how they are enhancing ESD especially with management systems	- published earlier research about curriculum development for ESD from 2009 until August 2011 of international Journal of Sustainability in Higher Educations dealing with selected keywords, concerning ESD, were studied - based on the results a model of a process for enhancing ESD, which can be used in the management systems, was developed - 27 universities from the Nordic countries answered a survey and eleven universities wrote reports of how they are enhancing ESD - the results from the research, survey and universities were presented at a seminar, where the model was further developed	- quality assurance and ESD in universities in China, Finland and to a lesser extent, the other Nordic countries, were compared - at policy level by a literature study, which was based on multiple resources like Scopus and Emerald, reports and books - at implementation level by conducting surveys in academia, in two provinces in China, and in the Nordic countries - the questions in the surveys focused on promoting ESD at the implementation level, especially with respect to management systems	- a change management process model based on a thematic literature review has been developed in order to enhance ESD in universities by making use of quality assurance - the process is built on a soft approach for change, based on organizational development, OD - the model has been applied at a university	- the research was grounded on action research - a process model for integrating ESD with management systems was developed based on identified drivers and barriers, and piloted at 11 Nordic universities - the process including planning, assessment, monitoring and implementation of ESD was used to identify relevant sustainability aspects in different disciplines

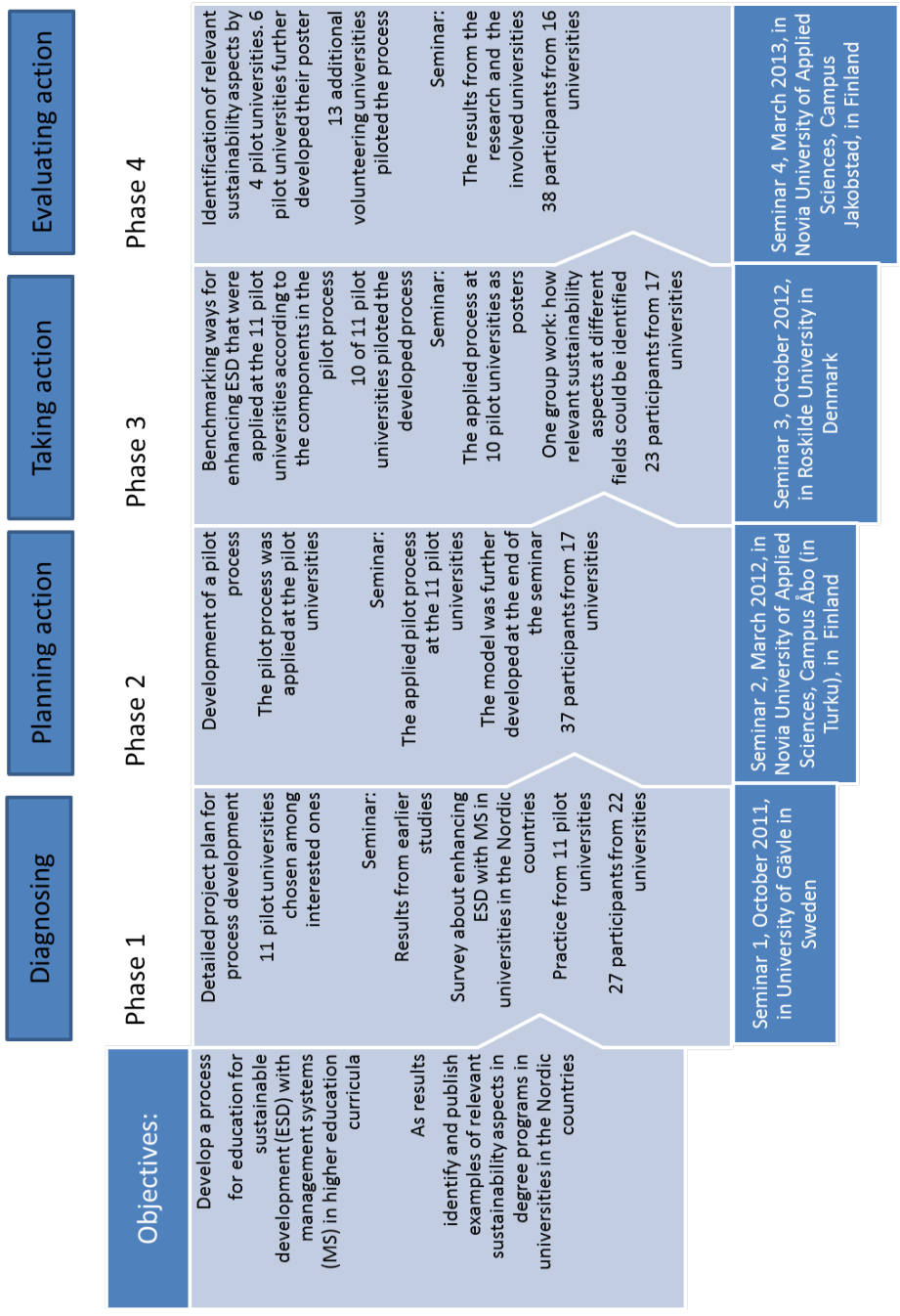

Figure 6. Developing a process model, for enhancing ESD with management systems, in the Nordic countries, within a two year project, according to the four phases in the OD model (adapted from Paper V).

3.1. Diagnosing

In phase one I diagnosed the current state by a literature study, by exploring the practice in 11 universities and by conducting a survey to academia, for validity (Hirsjärvi et al., 1997). A detailed project plan was set for the project.

One quality criterion for interdisciplinary research is reviewing and integrating literature across a broad range of disciplines (Gaziulusoy and Boyle, 2013) I collected earlier studies by using multiple resources for reliability, such as Scopus and Emerald, reports and books. The material for developing the pilot process (see Table 4; Paper II) I collected from a specific journal, to limit the amount of papers. Wright and Pullen (2007) found in a study in which they studied journal articles in English related to ESD from 1990 to 2005, that most articles were published in the Journal of Environmental Education and second most in the International Journal of Sustainability in Higher Education, which had published most articled related to ESD during the two last years of the study, why I chose to investigate published articles of that journal for this study. The change management model developed in the fourth study is also based on a thematic literature review (see table 4; Paper IV). In that the studies explored were from different journals. In addition to these, I have studied combining theory from the editors´ comments in the Journal Academy of Management Review, which an anonymous reviewer to one of my manuscripts recommended.

A survey to academia in the Nordic countries was conducted, on how ESD is enhanced in universities in the Nordic countries, especially by advantaging management systems (Paper II).

A comparative study on both policy and implementation level between the Nordic countries and China, was chosen for Paper III. I presented the preliminary results of the literature study of this Paper at the 2nd Sino-Finland Forum on Higher Education in University of Tampere, Finland, in September 2011. For reliability, I decided to expand the literature research, by conducting a survey in China (see Appendix A), administered to academia, about how ESD is enhanced, especially related to management systems, for investigating the implementation level (Paper III).

Pilot universities were recruited to the project. National higher education networks that enhance sustainable development in Sweden and Finland (Bup.fi, 2013; Hu2.se, 2013), a regional network in the Baltic Sea region called the Baltic University Programme (Kliucininkas et al., 2012) and partners in Finland, Sweden and Denmark among faculty were reached. In order to recruit universities, a summary of the project was written that included the objective, timetable and an explanation of the pilot universities tasks. The interested universities were invited to write an application that would include an answer to why their university should be chosen.

The following eleven universities were chosen as pilot universities to the project, listed in alphabetical order:

Denmark: - Copenhagen Business School
- Roskilde University
- University College Sealand

Finland: - Novia University of Applied Sciences
- University of Eastern Finland
- University of Tampere

Sweden: - Chalmers University of Technology
- Kristianstad University
- Umeå University
- University of Gothenburg
- University of Gävle

I selected the universities based on interest, so that a wide range of universities in the countries would be presented, both of different kind (research universities, universities of applied sciences, or colleges, and business and technical universities) and size but also of those in the forefront regarding ESD and/or management systems and of those who had just begun. Eleven were chosen, even though the plan was to involve nine, to ensure that I would have nine universities within the project until the end, because the time period was so long, but also because so many universities applied to participate.

3.1.1. Develop a vision for change

I examined the results from the literature and developed a pilot process model for enhancing ESD, which can be used in the management systems (Paper II). The fourth study is based on a developed OD model, which includes development of the vision, as chapter 4.4 (see Figure 9; Paper IV).

3.1.2. Gain commitment to the vision

Every pilot university signed a contract in which the responsibility, timetable and budget was documented, for committing the universities to the objectives of the project. The objectives of the project, the results from the research and survey and the practice in the 11 pilot universities were presented at the first seminar of the project, based on which the pilot process model was further developed (see Appendix B). The results from the survey were thoroughly analyzed and presented by Hokkanen (2012) (Paper II).

3.2. Planning action

In phase two a pilot process was developed, based on the results of phase one, which results are presented in Paper II. I presented the paper at the World Symposium on Sustainable development at Universities, WSSD-U-2012, which was a parallel event to the UN Conference on Sustainable Development, Rio+20, in Rio de Janeiro, Brazil, in June 2012.

The pilot process was applied at the pilot universities. The implementation was documented and presented by the participants from the pilot universities at the second seminar of the project.

The process model was further developed at the end of the seminar (presented in Figure 10), focusing on the challenges for enhancing sustainability aspects in universities identified by Leal Filho (2011; see 1.2.2).

In the fourth paper, the planning which included a joint understanding of vision, commitment, training and collaboration is explained in chapter 4.5 on the fourth paper (see Figure 9; Paper IV).

3.3. Taking action

In phase three methods for enhancing ESD, which were in use at the 11 pilot universities, with or without applying their management systems, were benchmarked. This was done by an analysis of the written reports and held presentations. I identified what was done at each university according to the components in the pilot process that are plan, do, check and act (see Appendix C). The identified actions were used for visualizing enhancing ESD with management systems in universities in the Nordic countries as memes (see Figure 7; Paper I). I chose a new perspective, the memetic approach for this study, for reaching a diversity of faculty.

Ten of the eleven pilot universities piloted the developed, final process (presented in Figure 10). The eleventh pilot university did not have enough time resources to stay in the project. The pilot universities presented how they had applied the process as a poster at the third seminar. The universities presentations were divided into four groups, which each focused on either: plan, do, check or act. Different methods were used at the universities for involving faculty, such as organizing seminars, training for academy, or by discussing it at meetings. At the third seminar one task at the group work session was how sustainability aspects can be, or methods how they could be, identified at different disciplines, in universities. The other group work tasks were additional development of the process and disseminating the process to several universities in the Nordic countries (Paper V).

In the fourth Paper chapter 4.5: empower and overcome barriers of change, establish a neutral organization, engage and involve individuals, corresponds with taking action (see Figure 9; Paper IV).

I presented the preliminary results of the fourth paper at the COPERNICUS Alliance Conference held at the University of Gloucestershire, UK, from 10-11 January 2014.

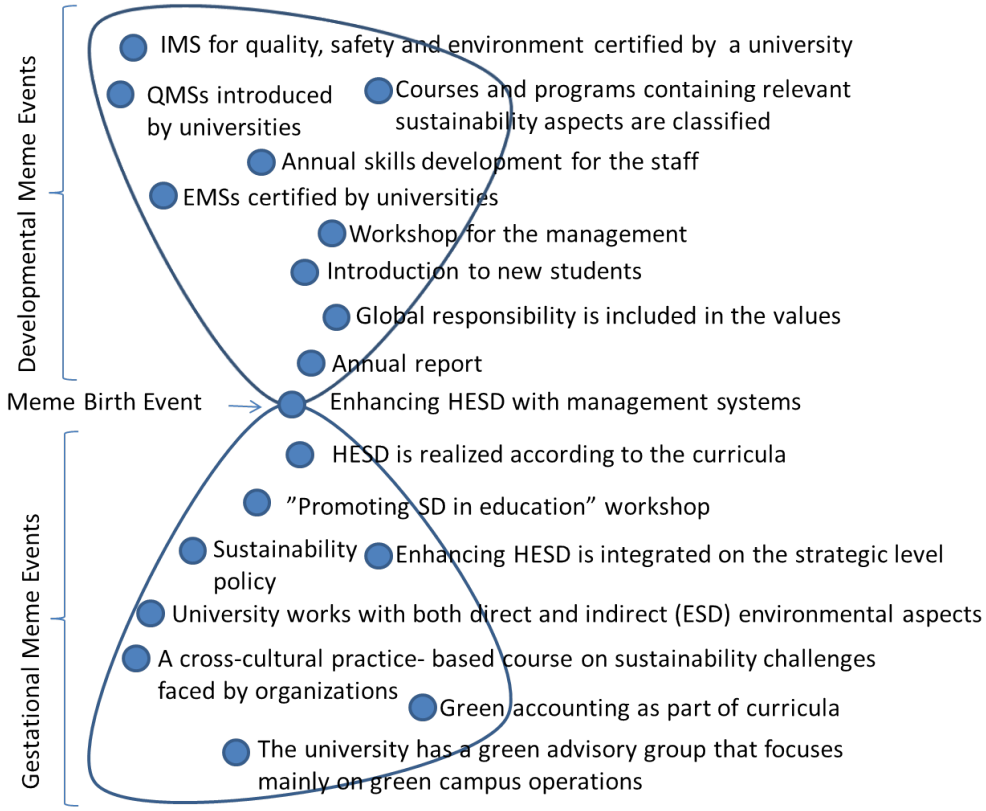

Figure 7. Meme map for enhancing HESD with MSs, based on examples from 11 universities in the Nordic countries, applied to the meme map tool by Paull (2009). (Paper I)

3.4. Evaluating action

In phase four the pilot universities were responsible for applying the process, by developing their poster further, with the aim to identify examples of relevant sustainability aspects in different disciplines at their university. The developed, final process was also further piloted by 13 volunteering universities in the Nordic countries that had not been taking part in the development, during November 2012 to January 2013. The final results were presented at the last seminar of the project and documented in Paper V. Each seminar was planned based on the evaluation of the former, which was done at the end of each seminar by the participants.

4. Results

The connection among biological science, ESD, quality assurance and management system in universities is exemplified in paper I, in which I have compared memes and genes (see Figure 1) and applied the memetic theory for enhancing ESD with management systems, as tools for quality assurance, in universities (see Figure 8). I consider that the most interesting result of my thesis is that the memetic approach can be applied for structuring and that both ESD and management systems in universities could be considered successful memes. When enhancing ESD in universities the characteristics of successful memes could be applied, such as to invest both time and effort for enhancing ESD among students and faculty; have a representative for the meme in top management and document it in routines that are followed, which gives good arguments for implementing ESD in the management system of the university (I).

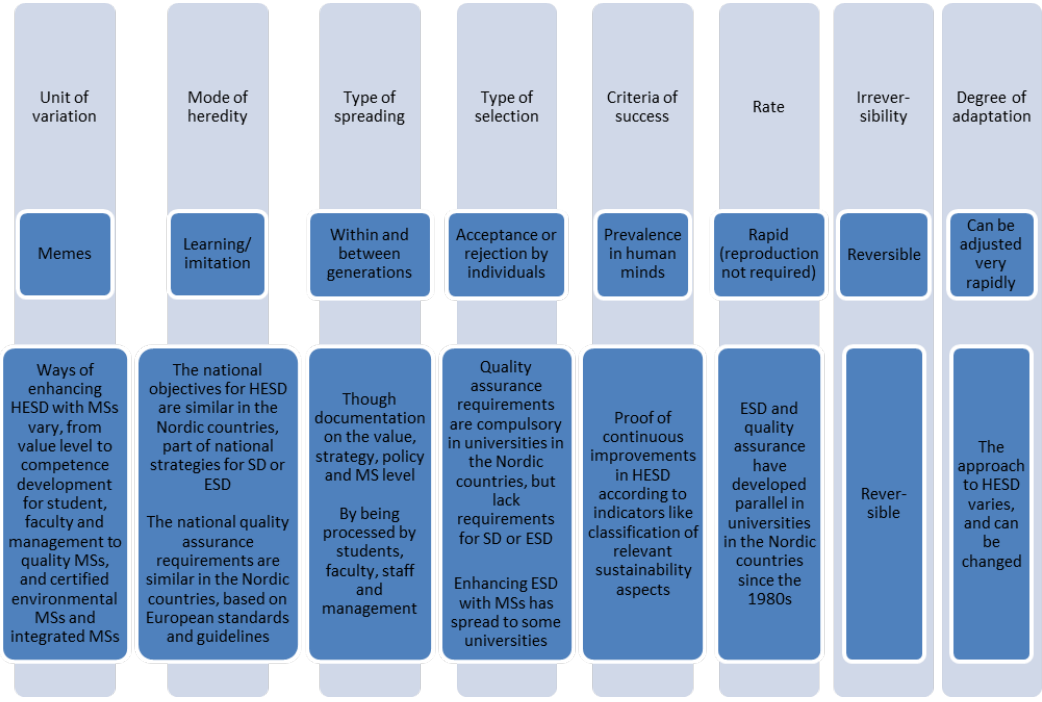

Figure 8. Enhancing HESD with MSs in the Nordic countries (bottom row), as memes (top row) applied to the framework presented in Figure 1 (based on Amaral and Rosa, 2010; Holm et al., 2012; Nordic Council of Ministers, 2009). (Paper I)

At the moment quality assurance requirements in none of the Nordic countries or China include sustainability aspects (Papers II and III). The most unexpected results were that the respondents in

China viewed quality assurance as sustainable development (Paper III). Sustainable development is a part of the quality assurance requirements of secondary schools in Finland (Ministry of Education and Culture in Finland, 2010), why I consider that this could be an expected change also in universities.

Table 5. The results of the original papers.

	I	II	III	IV	V
Results	- both ESD in universities and management systems could be considered successful memes - integrated management systems could be used as frameworks for promoting ESD in universities - characteristics of successful memes could be applied for spreading ESD in universities	- none of the Nordic countries have indicators for sustainable development included in the quality assurance demands, even though there are demands for enhancing ESD - the majority of the replies in the survey stated that the universities have a clear connection between ESD and quality assurance and it is implemented differently in many parts of the management systems	- both regions enhance ESD - the rather similar quality assurance requirements do not include ESD - In China, the respondents viewed quality assurance as sustainable development	- management systems could be used as tools for hard changes and support the soft change of enhancing ESD in universities with management systems - for this change it is important to: recognize the need of change, identify leadership competencies, involve all stakeholders, include vision, commitment, training and collaboration in the action plan, and institutionalize new approaches	- examples of relevant sustainability aspects in different disciplines in the Nordic countries are provided - sustainability aspects could be identified in many fields, which indicates that the process model could be used for enhancing ESD in in management systems of universities.

The most expected results were that both the Nordic countries and China follow the global goals for ESD at policy level and it is enhanced also in universities, and that the quality assurance requirements are alike (Paper III).

The results were equal in all studies concerning that management systems could be used for enhancing ESD in universities. The reason why I consider that especially integrated management systems could be suitable for enhancing ESD is because according to earlier studies some faculty have not felt that quality management is relevant for universities. I consider that by integrating other aspects, such as environmental and safety or sustainability aspects, into a quality management system, might back up the importance of the management system for academia. The faculty and students who are involved in the management system can learn systematic and holistic thinking, which management systems are based on, and is an important competence for ESD (Paper I).

In Paper IV can be seen which phases are important for the change to enhance ESD in universities by making use of quality assurance (see Figure 9; Paper IV)

Figure 9. The OD model applied for enhancing ESD by making use of quality assurance at universities, adapted from Azzone and Palermo, 2011; Battilana et al., 2010; Bouckenooghe, 2013; Brown, 2012; Exter et al., 2013; Farkas, 2013; Goldstein et al., 2012; Hase and Galt, 2011; Holmberg et al., 2012; Peccei et al., 2011; Peer and Stoeglehner, 2013; Ronnenberg et al., 2011; Senior and Swailes, 2010; Smith, 2011; Wals and Schwarzin, 2012. (Paper IV)

In Paper V the final results of the process model that can be applied for enhancing ESD with management systems are presented (see Figure 10), which was the final aim of this study.

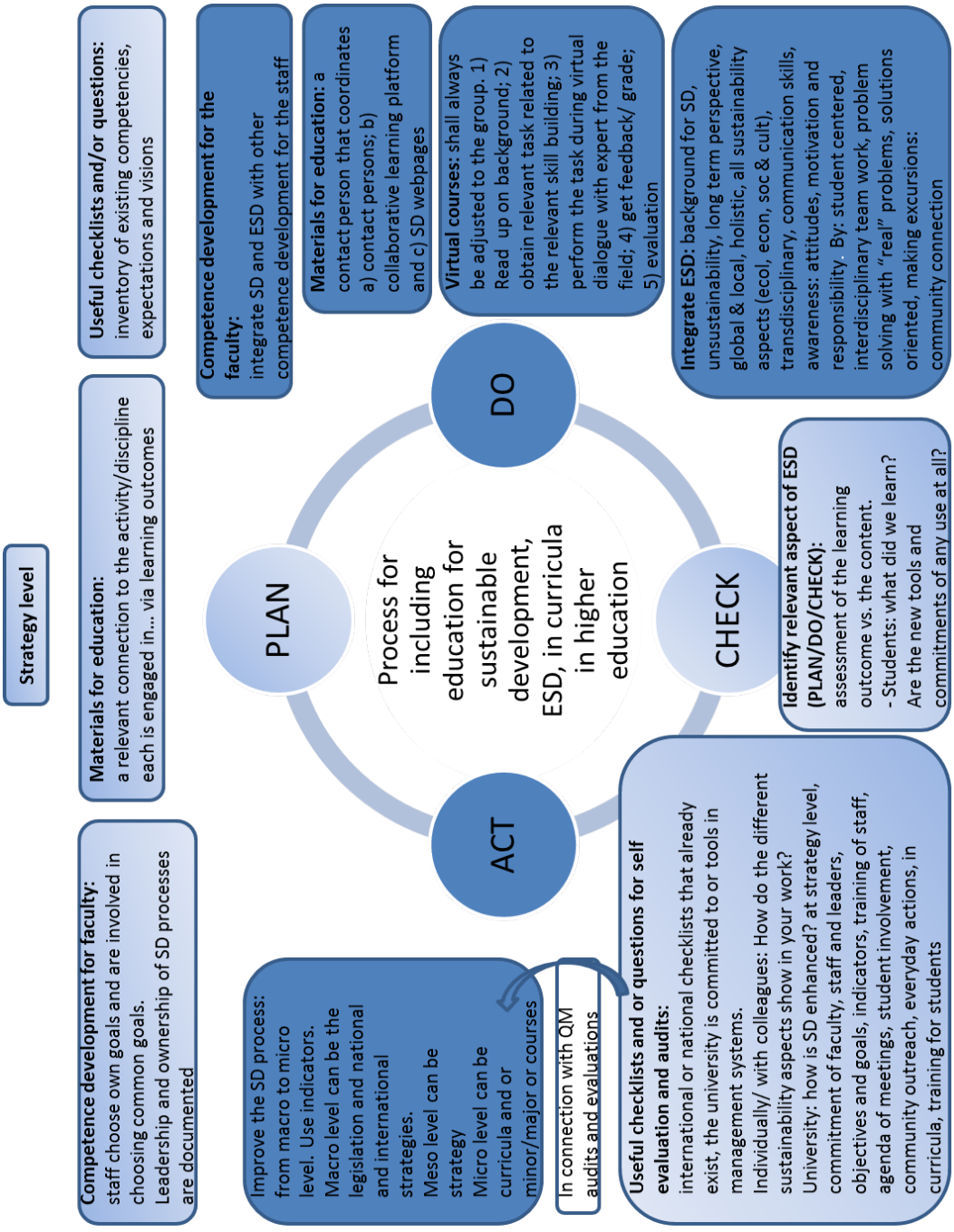

Figure 10. The process model for enhancing ESD with management systems in HE developed. Acronyms: SD: sustainable development; QA: quality assurance. (Paper V)

Examples of identified relevant sustainability aspects in universities, is summarized in Table 6. The results are from two research universities and from two that are not. Because examples of relevant sustainability aspects could be identified for many disciplines, I consider that the process model could be used as a tool in management systems at universities, for enhancing ESD (Paper V).

Table 6. Examples of relevant sustainability aspects in universities curricula in the Nordic countries, summarized from four universities. (Paper V)

Field of studies	Number of degree programmes (∑ four universities)	Number of Universities	Relevant sustainability aspects
Humanities and Education	2	2	Participation, multiculturalism, equality, experience teaching
Natural Sciences	2	2	Products and solutions that are sustainable, environmentally friendly, energy efficient and safe, GIS, environmental stress, sustainable societies.
Natural Resources and the Environment	4	1	Sustainable production of nature, agriculture and forestry. Ecosystem services. Bioenergy. Coastal areas.
Social Sciences, Business and Administration	4 (Business Administration)	3	Corporate environmental work and management, holistic economics, global requirements and intercultural communication, values, professional ethics, lifelong learning, risk management, knowledge of cultures, taxation.
Social Services, Health and Sports	13	2	Promote and maintain functional ability, health, safety and wellness. Global responsibility, ethics and attitude, clinical skills, multi-professional, leadership.
Technology, Communication and Transport	22	3	Sustainable technical solutions with regard to human resources, organizations, cultures, surroundings, natural resources and local environment, cradle to cradle, security, health, risks, energy-, material- and cost effectiveness.
Tourism, Catering and Domestic Services	1 (DP for Tourism Management)	1	Plan, produce and develop services in accordance with local and global requirements, and taking into account the sustainability aspects.
Culture	7	1	Cultural, social, artistic and substantive spiritual plane. Ethically, aesthetically, ecologically and socially responsible. Products that are qualitative in the long run.

5. Discussion

This is an applied research, written for a practical application in mind, with practical examples of how ESD could be enhanced with management systems included in all papers. The target group is faculty and management interested in enhancing ESD and developing tools for quality assurance, such as management systems, in universities (see table 7; Papers I, II, III, IV and V). In this chapter I will discuss the practical and theoretical implications, and an identified need of further research.

5.1. Practical and theoretical implications

The memetic approach can be applied for structuring, which may promote the understanding of management systems and ESD (see Figure 1, 6 and 7; Paper I). Another connection between the concepts of these studies is that they are all based on systematic thinking.

Table 7. The practical implications of the original papers.

	I	II	III	IV	V
Practical implications	- an evolutionary approach, based on memetics, may promote the understanding of management systems and ESD - the memetic approach can be applied for structuring	- the findings could be used by those responsible for developing ESD and/or management systems in different universities	- the results could be used by administrators, leaders and faculty responsible for the task of enhancing ESD and developing quality assurance - differences and similarities found between China and the Nordic countries can make mutual learning possible and be used for international benchmarking	- the results could be used by other universities for enhancing ESD - what to consider when applying change management at a university, and specifically for enhancing ESD by making use of quality assurance is presented	- we show a concrete model that can be applied for quality assurance, which is compulsory, and therefore a possible approach to advantage for enhancing ESD - the model is based on the Deming-cycle and can be used in or as a part of a management system - it could be used for benchmarking ESD enhancement among universities in a region, connected to the quality assurance demands - it could also be used for assessment and communication of multi-disciplinary courses and research on ESD, because the information can be gathered for visualization in one picture, which makes comparisons possible

Stephens et al. (2008) and Lozano (2008) found that it is important to consider regional-specific challenges, and that cooperation both internally and externally with stakeholders, global organizations and governments are useful when universities attempt to become more sustainable. The results from the study about differences among the Nordic countries and China (Paper III) could be applied by faculty in these regions. I consider that it is viable to make comparative studies between cultures, for getting insight in special characteristics of the own culture. Also for exploring management systems it is important to understand the difference between cultures when making comparative studies. A model that could be applied also in universities is for example the typology of management systems in Europe identified by Calori and De Woot (1994), which divides the European countries in different groups according to differences in management systems.

The process model (see Figure 10) could be applied for assessment, benchmarking and communication of ESD in universities. When applied, the information can be assembled in one picture, which facilitates comparison (see Table 7; Paper V). As a result of the UN Conference on Sustainable Development, Rio+20, in June 2012, the UN decided that ESD should be promoted more actively beyond the DESD (UN, 2012). I consider that the developed process model could be applied for tackling the challenges identified by Leal Filho (2011; see 1.2.2); by arranging training in sustainable development and ESD for faculty and integrating it in other competence development for the staff; by including ESD on both the strategy level and into the management system and by appointing responsibilities, for committing the top management; and by showing what can be done, how and why, by applying the process (see Figure 10; Paper V). The themes suggested by Lozano et al. (2013), i.e. collaboration, fostering transdisciplinarity, on-campus experiences, organizing training for educators and the institutional framework, are also addressed in the process model. The model overlap with some of the issues that are considered by Stephens et al. (2008) and Holley (2009) to be important for universities as change agents for sustainability (see 1.2.2), such as to take into consideration regional and campus specific challenges, institutional organization, degree of democratic processes and communication and collaboration with society. The model is lacking two issues that they found important, which are financing organization and freedom. The lack of these aspects might have to do with that the financing and freedom of universities in the Nordic countries do not differ between the countries.

The developed change management model presented in the fourth study could be used for planning which steps that ought to be considered for enhancing ESD, by making use of quality assurance. The difference between the models presented in the fourth and fifth study are that the process model (Figure 10) shows what to consider, and the OD model (Figure 9) the identified needed steps for the change (Papers IV and V). Due to the carefulness that is characteristic for the public sectors, resistance to change could be expected, which could be benefitted. It is viable

because all identified ways to benefit resistance to change by Ford and Ford (2009; see 1.2.1) could be benefitted in universities. The response ought to be seen as development ideas for making the change more suitable, for the different cultures at the units and departments that the resistance comes from, which ought to have a positive effect on commitment to the change.

I consider that one reason for succeeding with the research project was the use of project management (see Figure 6). A thorough research plan is essential in a research project like this, in which the universities are geographically separate, only meet a few times and start the cooperation before meeting (Paper V). I think that a solid experience in management is of advantage for this kind of project, in which the involved faculty is working at different universities, in different countries, with various cultures. I also consider that action based research is suitable for involving faculty and administrative staff, which, according to Cortese (2003) is important for enhancing ESD in a university.

An overall critical methodological point of my studies is that the practical examples are from a limited area, which means that I cannot argue that my conclusions are valid globally. I have neither investigated if quality assurance or management system actually improves education, only if it is possible. The results show that some faculties are interested in enhancing ESD, also with management systems, which means that it is a possible tool to apply (see Table 8). The results in the Nordic countries are based on results from 11- 27 universities, of 165 (Finnish National Board of Education, 2013; Higher Education in Iceland, 2013; Nokut, 2013; Swedish Higher Education Authority, 2013; Universities Denmark, 2013). However, I assume that the ones that are most interested (and) are among those who have the deepest knowledge and the ones that have participated. The survey in China is restricted to two provinces and 12 universities, of 2492 (Moe, 2012), but the provinces chosen to this study can be considered to be representative for China, because the universities are neither highly or poorly ranked (Hartog et al., 2010; Paper III).

The fourth paper is a single case study and I have been engaged in the change process, which is a reliability risk. By applying the model at the university I could identify which steps that ought to be considered for strengthening the change. This is why I consider it an advantage that I had insight in the process.

Table 8. The critical methodological points of the original papers.

	I	II	III	IV	V
Critical metho-dolo-gical points	- memetics is a widely criticized theory - still, it has been used for organizational culture and innovation strategies, and can be applied in interdisciplinary studies - a focus on the advantages of both ESD and management systems for universities is a hinder from drawing conclusions of the possible rate of diffusion, just about their potential - the practical examples are based on reports and presentations from 11 universities in the Nordic countries, which means that they are based on the participants` own reflections and restricted to this particular geographical area	- the findings from the survey and the pilot univer-sities are restricted to faculty involved in enhan-cing ESD in univer-sities in the Nordic countries	- the surveys had some differences and were not conducted at the same time, even though the investigated questions were the same - in China the survey was, based on limited contacts, restricted to a geographical area of two provinces, which however can be considered representative for China - only the most active universities in the field participated in cooperation by answering the questionnaire - the results do show that at least some universities are interested in developing their ESD work	- it is a single case study and one of the authors has been engaged in the change process at the case university, which could lead to unconscious biases and partial perspectives - this also means that the author has insight in the process	- only universities already interested in the topic participated, which means that the results do not reflect the overall situation in the Nordic countries, but rather that the model could be applied in some universities - quality assurance in universities aims at improving quality of education. In this study we have not investigated whether this really happens, we only show examples of how quality assurance can be used for enhancing ESD - the use of quality assurance in general can be questioned, since it is focused on chosen indicators that are measured

5.2. Further research

The pilot process model that was presented in Paper II has been piloted and further developed, which is presented in Paper I and V. This means that the further research need in Paper II and partly in III is done (see Table 9). The identified need for further research in the first study I have partly done in the fifth study, in which I have explored drivers and barriers for implementing management systems in universities (see Table 4 and 9)

In this thesis I have focused on enhancing ESD, not on making universities sustainable. This means that I have not studied promoting sustainable development at campus, in research and development, outreach and administration. Many examples from other areas than curricula are anyhow mentioned in the results, since it is usually the same person or collegial that work with all sustainability issues.

Therefore I think it would be interesting to continue with a study that would include all activities at a university, to investigate what makes a university sustainable.

The most interesting thing to continue with would be to apply the process model (Figure 10) and the change management model (Figure 9) in several universities in different geographical areas, by action based research for involving faculty, students, stakeholders and the responsible for quality assurance. It would also be of value to study if quality assurance and/or management system improve education, different management systems developed by and for universities and how management systems have been applied in universities, with focus on education, research and development, and outreach. It would also be interesting to develop the change management model (figure 9) for other changes in universities. For a deeper insight in how ESD is enhanced with management systems more universities should be explored, by conducting surveys and studying the universities´ strategies and practices. For completing the list of relevant sustainability aspects (see Table 6) for more disciplines the process could be applied in more universities. It would also be important to study which competences the students have received, as a result of enhancing ESD (see Table 9; Sammalisto, 2007).

Table 9. The identified need for further research of the original papers.

	I	II	III	IV	V
Further research	- there is a need for an extensive overview of recent developments in management systems, as scepticism of the relevance of management systems in universities was widespread - how ESD could be enhanced in universities by management systems and integrated management systems in particular	- future studies could focus on results from piloting the model for enhan-cing ESD with manage ment systems in different univer-sities	- possible partners for future research, about how to advantage quality assurance demands for enhancing ESD, could be found among the universities that have signed the latest higher education declarations for enhancing ESD, or the ones active in quality assurance - we will continue the research by developing a model for enhancing ESD with management systems	- future studies could be about applying the model at other universities, or to develop the model further for other changes, based on literature for that	- for further development and, for finding out the wider generalizability of the model and for completing the list of relevant sustainability aspects for more disciplines the model could be applied at more universities, also outside the Nordic countries - further research is needed to measure which competencies students have received and competence benefits acquired by students

6. Conclusions

The hypothesis was that quality, environmental and integrated management systems could be used as a way for promoting education for sustainable development (ESD) in universities. I consider that the hypothesis has been strengthened by the results from: practices in eleven universities (Papers I, II, IV, V); surveys for academia in the Nordic countries and two provinces in China (Papers I, III); developing a process model for enhancing ESD with management systems, in cooperation among eleven universities in the Nordic countries during a two year project (see Figure 6, 9; Papers II, V) and earlier research (Papers I, II, III, IV, V). The results, concerning enhancing ESD and quality assurance requirements in universities, were alike in the Nordic countries and China (Paper III). Relevant sustainability aspects have been identified in different fields of studies (see Table 6; Papers IV, V). Both ESD and management systems in universities could be considered successful memes, which can reflect an effective way of communication among individuals (Paper I).

The aim was to investigate the critical issues, drivers and barriers of management systems in universities, especially as a way for promoting ESD. The process model (presented in Figure 10) was compared with drivers and barriers for enhancing ESD and for implementing management systems in universities and with succeeding with management systems in industry. It corresponds with these, meaning that drivers are taken into account and barriers tackled (Paper V). The results also match with earlier research concerning succeeding with management systems in industry (Paper I).

I have identified that management systems could be used as tools for hard changes and support the soft change of enhancing ESD in universities with management system. Recommendations on what to consider, for enabling the studied change, are summarized in Figure 9 (Paper IV). The differences between the models presented are that the process model (Figure 10) shows what to consider, and the OD model (Figure 9) the identified needed steps for the change (Papers IV, V).

The main practical implications of the results are that the process model (Figure 10) could be applied for assessment, benchmarking and communication of ESD, connected to quality assurance, when applied (Paper V). The memetic approach can be applied for structuring (Paper I). It is viable to make comparative studies between cultures, for getting insight in special characteristics of the own culture (Paper III). Action based research was suitable for involving faculty, which is essential when enhancing ESD (Papers IV, V).

Based on my study I would recommend that a university would first define on the strategic level if it wants to include enhancing ESD and for what purposes it has a management system. Then the management could divide the strategic goals into objectives, with time targets, and responsible ones. Students, faculty and administrative staff should be involved for activities done, for reaching the objectives. Resistance to change is recommended to be benefitted from since it points out the focus for the change.

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I would first or all like to thank my supervisors PhD Kaisu Sammalisto and PhD Timo Vuorisalo for their open minded support. Without them I would not have started or finished this project. I want to thank them for their help and encouragement during my research. They have sensed each of my weak moments and been there to push me forward. Thanks to them my papers have reached the standard of scientific papers. I would also like to thank my co-author Thomas Grindsted, whose questioning reviews have taught me a lot about scientific research.

I have submitted my articles to Journals and have got valuable comments and suggestions from the anonymous reviewers, which I have used for making all the papers better. Thank you for them!

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D.Sc. Liisa Rohweder at HELIA University of Applied Sciences was the first that encouraged me to start with PhD studies in 2004, when we cooperated in many projects, like the Baltic Sea Sustainable Development Network that was a network among universities and in an interdisciplinary group at the Finnish Online University of Applied Sciences, in which virtual sustainability courses were developed in cooperation among several universities. Professor Mauri Åhlberg at Helsinki University was the second to invite me to start with PhD studies in 2006, who I got in contact with through the research and development days of the Finnish Association for Environmental Education. It took/was several years before I actually started, which I think was due to perfect timing considering both my professional and private situation, but anyhow these encouragements has supported me both consciously and unconsciously.

As I mentioned in the introduction it was challenging to find a department where my PhD thesis would fit. Finally I had a choice between the section of Biodiversity and Environmental Science at University of Turku in Finland and the Department of Industrial Economics and Management at the Royal Institute of Technology in Sweden, which both where suitable for my studies, in different ways.

I am thankful for the opportunity that professor Staffan Laestadius gave me at the Department of Industrial Economics and Management and that I could participate in the PhD course in evolutionary economics.

When implementing a management system as many as possible of the personnel ought to be involved and external partners from other organizations are important to be in contact with, for both experience and support. This is why I have hundreds of colleagues at my current and former workplace and external contacts to thank, for their interest, support and the knowledge they have shared, which all have influenced the deepening of my competence.

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At every seminar I have attended the commitment of the management is emphasized, which I agree with. The implementation of an integrated management system at Novia University of Applied Sciences is no exception and I would like to thank the management for their commitment and support for this work, and especially rector Örjan Andersson and vice rector Birgitta Forsström.

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Appendix A - Survey about ESD at universities

Survey about education for sustainable development at universities

Please participate in this survey which is conducted in different Chinese Universities during February – April 2012.

The purpose of this survey is to investigate how education for sustainable development is considered at present time in Chinese universities, especially with the quality assurance work, and to make suggestions for improvement of the topic.

The objective for the UN Decade of Education for Sustainable development, DESD, 2005- 2014 is to integrate education for sustainable development in all education from pre-school to higher education. Education for sustainable development in higher education requires cross-discipline teaching because the graduates should be educated to make decisions promoting sustainability after having considered the social, environmental and economic costs and benefits of available alternatives.

Tell it like it is. Make a difference by giving your views. By answering the questions you are making an important contribution.

The objectives for the project are to development a process for how knowledge for sustainable development can be included in curricula, and as result identify and publish examples of relevant sustainability issues in different degree programs in Institutions of higher education. The results will be published.

Lanny Zhang on behalf of Novia University of Applied Sciences (http://www.novia.fi/english/).

Thank you!

Information

University:
Name:
E-mail:
You may be in contact for potential further questions: YES NO

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1. Shortly describe how education for sustainable development is taken into account in your university´s strategies?

2. Shortly describe your university's connection between education for sustainable development and the quality assurance work.

3. Shortly describe how education for sustainable development overall is taken into account in the curriculum or in your education programmes at your university. Indicate if you answered for your education programme.

4. Does your university have a management system? For example a quality management system, an environmental management system or an integrated management system.

If yes, shortly describe your university's management system. Is it connected to education for sustainable development, if yes, how?

5. To what extent do international and national directives and laws (e.g. UNESCO) affect education for sustainable development at your university?

Not at all Little Quite a lot Much Very Much I don't know

6. Does your university provide guidance in developing competence about education for sustainable development for teaching staff? If yes, describe shortly!

7. Does your university use checklists and questions for self-evaluation and audits about education for sustainable development, if yes, what information/points do they contain? Describe shortly!

8. Shortly describe what your university considers as relevant aspects for education for sustainable development.

9. Does your university use virtual courses for education for sustainable development? If yes, describe shortly.

10. List useful keywords on sustainability and education for sustainable development for your university.

Appendix B - Development of the pilot process

Development of the pilot process was done based on the results from the research and survey and the practice in the 11 pilot universities, which were presented at the first seminar of the project. The findings were collected and analyzed according to the following tables, based on which the final process was developed

1. Reports used for conclusions from the written reports and held presentations:

University	**Competence development for the faculty**	**Identified relevant aspects of ESD, or methods for**	**Checklists and questions for self-evaluation and audits**	**Virtual courses and other related material**
Chalmers University of Technology (SWE)				
Copenhagen Business School (DNK)				
Kristianstad University (SWE)				
Novia University of Applied Sciences (FIN)				
Roskilde University (DNK)				
Umeå University (SWE)				
University College Sealand (DNK)				
University of Eastern Finland (FIN)				
University of Gothenburg (SWE)				
University of Gävle (SWE)				
University of Tampere (FIN)				

2. Reports used for conclusions from the survey: (% of 27 respondents)

Competence development for the faculty	**Identified relevant aspects of ESD, or methods for**	**Checklists and questions for self-evaluation and audits**	**Virtual courses and other related material**
∑:	*∑:*	*∑:*	*∑:*

3. Reports used for conclusions about the connection between ESD and quality management

University	
Chalmers University of Technology (SWE)	
Copenhagen Business School (DNK)	
Kristianstad University (SWE)	
Novia University of Applied Sciences (FIN)	
Roskilde University (DNK)	
Umeå University (SWE)	
University College Sealand (DNK)	
University of Eastern Finland (FIN)	
University of Gothenburg (SWE)	
University of Gävle (SWE)	
University of Tampere (FIN)	
Conclusions from the survey:	

4. Reports used for conclusions from the the further development of the pilot process in the workshop at the seminar

Competence development for the faculty	**Identified relevant aspects of ESD, or methods for**	**Checklists and questions for self-evaluation and audits**	**Virtual courses and other related material**

Appendix C - Benchmarking methods for enhancing ESD, which were in use at the 11 pilot universities

In phase three methods for enhancing ESD, which were in use at the 11 pilot universities, with or without applying their management systems, were benchmarked.

This was done by an analysis of the written reports and held presentations during the third phase of the project. What was done at each university was identified according to the components in the pilot process that are plan, do, check and act.

University	Plan	Do	Check	Act
Chalmers University of Technology (SWE)				
Copenhagen Business School (DNK)				
Kristianstad University (SWE)				
Novia University of Applied Sciences (FIN)				
Roskilde University (DNK)				
Umeå University (SWE)				
University College Sealand (DNK)				
University of Eastern Finland (FIN)				
University of Gothenburg (SWE)				
University of Gävle (SWE)				
University of Tampere (FIN)				

Original papers

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Integrated management systems for enhancing education for sustainable development in universities: A memetic approach

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by

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Integrated management systems for enhancing education for sustainable development in universities: A memetic approach

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Abstract

There is a need for new approaches for enhancing education for sustainable development in universities. Memetics, which is about effective pathways of communication, could be such a new, promising approach. Quality assurance is required in universities to secure and improve education, which could be another approach. The aim of this study is to look into whether and how frameworks for processes and procedures for quality assurance, such as management systems, could be utilized to promote higher education for sustainable development. The study approaches this from both a theoretical and a practical standpoint. An evolutionary perspective was chosen, considering higher education for sustainable development and management systems as memes, or basic units of cultural replication. The practical context was studied by looking into how 11 universities in the Nordic countries have enhanced ESD with management systems. We found that both higher education for sustainable development and management systems could be considered successful memes and that management systems could be applied to enhance higher education for sustainable development.

KEY WORDS: Higher education for sustainable development; Integrated management systems; Meme; The Nordic countries; Quality assurance; Universities

List of acronyms: DESD – Decade of Education for Sustainable Development; EMS – environmental management system; ESD – education for sustainable development; HESD – higher education for sustainable development; IMS – integrated management system; ISO – International Organization for Standardization; MS – management system ; QMS – quality management system; SD – sustainable development; TQM – total quality management

1. Introduction

The aim of the UN Decade of Education for Sustainable Development (DESD) 2005-2014 has been to integrate education for sustainable development (ESD) into all levels of education (UN DESD, 2011). Acquired skills by graduates from higher education (collectively referred to in this paper as "universities") should, thereby, include the ability to choose the best actions after considering the social, economic and environmental benefits and drawbacks. Although higher education for sustainable development (HESD) necessarily involves cross-disciplinary approaches, and should therefore interest representatives of a multitude of disciplines (Lozano et al., 2013; Rieckmann, 2012; Svanström et al., 2008), faculty are unsure if the DESD objectives will be achieved. A survey revealed that less than half of international ESD experts believed that the action goals for the second half of the DESD will be realized at a satisfactory level (Gross and Nakayama, 2010). Should this be true, either the goals set have been too ambitious, the efforts to enhance ESD have been too weak, or the methods to promote ESD insufficient.

Leal Filho (2011) identified four critical challenges for enhancing sustainable development (SD) in universities. Firstly, SD should be interpreted more broadly so that each individual understands the role of SD. Secondly, SD should be made an understandable goal for a high diversity of interested parties, such as various professions and nations. Thirdly, tangible projects are needed in order to help understanding reasons and results of achievements. Fourthly, there is a need to increase support for SD promotion, both in terms of financial support and commitment.

Lozano (2006) identified methods by which to overcome barriers to change, and argues that transdisciplinary and multi-stakeholder approaches could be used to enhance SD and engaging top-level management is essential. Waas et al. (2010) identified 22 content with process related characteristics of university research for SD, which can be applied as a frame of reference by various university stakeholders interested in (re)orienting their research towards SD. Environmental, safety and security management is one of the identified research characteristics or methods. They also propose that the in-depth meaning of these characteristics and the way they could be handled in a real university research context should be studied.

In this study we investigate whether memetics (refer to Dawkins, 1976), applied here as the study of effective communication within human communities, may prove useful for ESD promotion in universities. Following the suggestion of Waas et al. (2010), we also analyse the situation in a real context at 11 universities by looking into how they have enhanced ESD with management systems (MSs).

Quality assurance requirements range from national to international standards and guidelines (Ewell, 2010; Kliot and Bykovskaya, 2011; Yuan, 2010). Quality, environmental and integrated MSs have been developed by some universities as a response to quality expectations (Federkeil, 2008; Pratasavitskaya and Stensaker, 2010). Pratasavitskaya and Stensaker (2010) observed that, although terminologies may differ, quality management is basically similar in different universities. They found at least three explanations for the observed variance: 1) the research tends to be performed from multiple perspectives; 2) the published studies often focus on a single case; and 3) a general scepticism towards the use of more general quality management approaches prevails, because they are not seen as suitable for universities. In this study we have tackled these shortcomings by including practical examples from several universities, and by focusing on the advantages of both ESD and MSs for universities. As HESD is an interdisciplinary field of study, we approach the topic from multiple perspectives.

2. A memetic approach to enhancing higher education for sustainable development using management systems

ESD has already been adopted by many universities worldwide (UNCSD, 2012). The same is true for MSs, which are frameworks of processes and procedures used by management to ensure tasks required for quality assurance (Federkeil, 2008; Pratasavitskaya and Stensaker, 2010). This section examines some possibilities for considering HESD itself and different MSs as memes.

The literature review was done using among others Scopus and Emerald, and benefiting by a

literature list for a PhD course in evolutionary economics.

2.1. The basics and relevance of memetics

Since the end of the 19th century, the evolutionary theory has had a great and continuing impact on many scientific disciplines. In economics, evolutionary ideas have been used to explain the evolution of human societies and industrial organizations (Hoefstadter, 1944; Nelson, 1995). Early pioneers of the evolutionary theory included Darwin, who introduced the concept of natural selection, and Spencer, who applied Darwin´s approach to human societies (Currie and Mace, 2011). A century later, in the 1970s, there was a rebirth in the popularity of biological approaches in the social sciences, largely due to the rise of sociobiology (Wilson, 1975). The Darwinian principles were considered providers of an essential general framework for understanding population systems (Hodgson and Knudsen, 2008).

The concept of "meme" was introduced by evolutionary biologist Richard Dawkins (Dawkins, 1976). Predecessors of the concept can be found around the turn of both the 19th and 20th centuries, in various analyses of cultural evolution; Thorndike was possibly the first to define "cultural imitation" in 1898, and Baldwin used the term "social heredity" in the beginning of the 20th century (Blackmore, 1999). According to the memetic theory, humans are packs of neurons and memes; genes are instructions coded in molecules of DNA, and memes are defined as elements of culture that are imitated, self-replicating ideas, or views, or instructions coded in human brains or artefacts like books or pictures (Gill, 2012; see Figure 1). For something to count as a replicator, it must express the characteristics of variation, selection and heredity. Memes express variation (children´s stories, for example, have many variations), selection (the best stories will be passed on) and heredity (the stories are transmitted essentially unchanged) (Dawkins, 1976).

The memetic theory has been applied primarily in the fields of organizational culture, innovation strategy, and mergers (Gill, 2012). Although many researchers have welcomed the new concept (Blackmore, 1999), there is no lack of criticism against it. According to Elster (1989), the difference is that, while populations in nature adapt slowly to their environment over time, companies must be constantly in tune with their economic environment, which requires the ability to adapt quickly and even return to an earlier state, a fact that is not possible in an essentially irreversible biological evolution. According to Constant (2000), however, it is not clear what evolves in technological and scientific change, or on what grounds or at which particular level selection might be said to occur. Neither is it properly defined what counts as a useful adaptation. Gabora (2011) criticized the emphasis on competition in the theory of memetics, and presented cultural evolution instead as a process based on cooperation between individuals. Nelson (1995) noted that the biological analogy by itself is not sufficient, since, in companies, other processes such as individual learning and organizational adaptation take place at the same time. Whitmeyer (1998) claimed that memes are not independent from our genes and that morals are independent from both genes and memes. According to John (2003), the role of imitation has been exaggerated in memetics; for example, in politics many decisions are not a result of imitation but of power.

In this paper we accept that the meme is a controversial concept, but at the same time consider that there is much to be learned from memetics in its emphasis on factors that promote the effective diffusion of ideas and other innovations in human societies, especially in universities that have to adapt to changes in society. Figure 1 depicts the main differences between memes and genes based on the theory of Dawkins (1976), and Blackmore (1999) and the identified criticism.

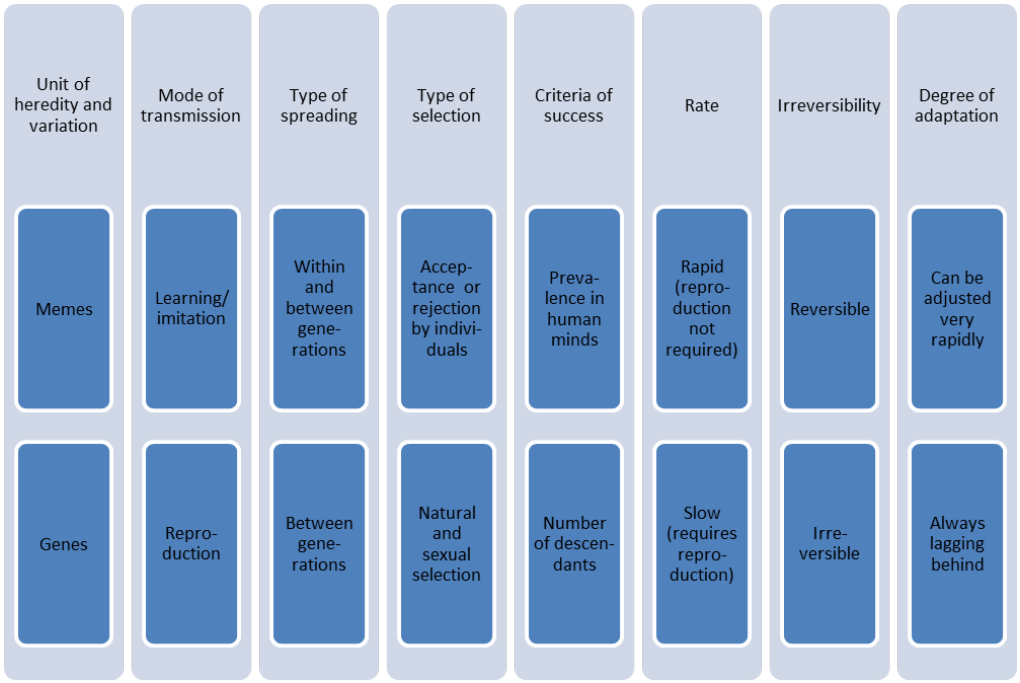

Figure 1. Basic differences between genes (bottom row) and memes (top row) (adapted from Blackmore, 1999; Elster, 1989; Guillo, 2012; Wilson, 1975).

The choice of categories in Figure 1 was compared with earlier studies. We conducted a search on Scopus (on June 28th, 2013) with the keywords “meme and gene”, for which 27 articles were found; and the keyword “memetics”, for which 36 articles were found. Of the articles, four (Guillo, 2012; Kvasnička, 2003; Tanaka, 2002; Wilkins, 1988) explored genes and memes, and three of them included the categories in Figure 1. Six (Brand, 2010; Brooks, 2008; Bryson, 2008, 2009; Paull, 2009; Whitty, 2005) presented a theory for memetics. All six articled included the categories in Figure 1.

In the current study, we have adopted the widely accepted view that “prevalence in human minds” is the basic criterion for a meme´s success, even though Kvasnička (2003) and Brand (2010) presented that there might be a coevolution between genes and memes. We have also adopted the meme map tool proposed by Paull (2009). According to Paull´s model, the life span of a meme consists of a meme gestation zone, a meme birth point and a meme development zone.

The rate of diffusion of a meme is dependent on its content (variation), frequency of acceptance (selection), and persistence of content from source to recipient (heredity) (Blackmore, 1999). Typical examples of successful memes are altruistic, cooperative and generous ways of behaviour. For example, a professor who generally invests his/her time and provides guidance to his/her students is likely to be very successful in transmitting his/her views (i.e., memes) to even more students. Another characteristically successful meme is the promotion of cooperative behaviour (Blackmore, 1999). HESD, as any other idea, can undoubtedly be considered what Dawkins (1976) defined as “an element of cultural transmission”. To effectively promote the diffusion of the “ESD meme” in universities, we suggest that, like any other meme, this concept needs to have a structure or content that is clear enough to be effectively transmitted among universities. Next, the possibility of considering HESD and different types of MSs as memes will be studied.

2.2. Education for sustainable development as a meme

Sustainable development (SD) first became widely known in the World Conservation Strategy (1980), and evolved into one of the cornerstones of global environmental policy in the Report of the World Commission on Environment and Development (1987). SD is dependent on economic and social development, and environmental awareness and protection (UN DESD, 2011). The role of education soon became an obvious aspect of sustainability. In 1992 issues related to sustainability in education were explicitly listed in UN‟s Agenda 21 (Wright, 2002).

The objective of the UN DESD 2005-2014 is to develop students attitudes, skills, and knowledge, so that they can make informed decisions that benefits themselves and others, in the present and future (UN DESD, 2011). At least 24 declarations for enhancing HESD, which universities can commit to, have been adopted from 1990 to 2010. The predecessors of HESD date back to the 1970s, including the Stockholm and Tbilisi declarations, which differed in that they focused solely on environmental education (Grindsted and Holm, 2012). During the UN decade different institutions, regions and nations have developed rather similar strategies for enhancing ESD. The Nordic countries, for example, have ESD strategies or have set goals for ESD in their SD strategies, published from 2002 to 2008 (Holm et al., 2012). These are based on the regional strategies of Agenda 21 for Education in the Baltic Sea Region (Baltic 21 E, 2002) and the Nordic strategy for SD (Nordic Council of Ministers, 2009). The objective for universities, as stated in the DESD, is to incorporate all aspects of SD into education programmes, practices and policies (UN DESD, 2011), although the ways this is pursued varies among institutions, disciplines and regions. The often mentioned learning outcomes for HESD include improved systematic and holistic thinking, which requires the participation of many disciplines and emphasizes the role of interdisciplinary education. Central sustainability skills and knowledge that graduates are expected to have acquired by the end of their studies are self-learning, problemsolving, and critical- as well as creative thinking. These are skills related to

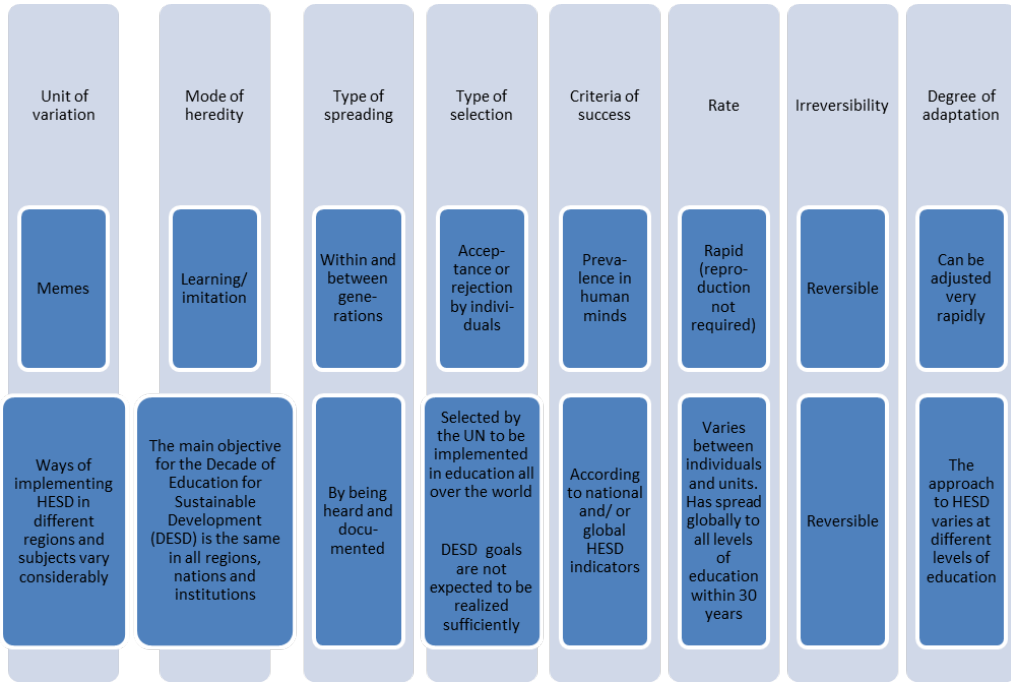

Figure 2. HESD (bottom row) as a meme (top row) applied to the framework presented in Figure 1 (based on Gross and Nakayama, 2010; Holm et al., 2012; UN DESD, 2011).

communication, teamwork, and the need to develop as an effective change agent (Lozano et al., 2013; Rieckmann, 2012; Svanström et al., 2008).

In this paper, we suggest that ESD could be seen as a meme that transfers within and between universities (see Figures 2 and 3). Since the ways vary of implementing HESD in different regions and in a diversity of subjects, the condition of variation is fulfilled, which should in turn motivate successful diffusion of HESD, as it brings together specialists from different disciplines. We posit that the condition of selection is fulfilled since HESD has been selected by the UN to be implemented globally after having competed with traditional education and other competencies in the curricula, and, for which international and national strategies have been conducted. The concept itself includes the aspect of heredity. The main objective for the DESD is to implement ESD throughout the education system, from preschools to universities, an aim that is consistent across different regions.

The diffusion of any meme needs to be monitored to measure its success, a requirement which is considered to be lacking in HESD according to recent studies. In four HESD declarations between 1997 and 2009, the development of monitoring tools has been recommended (Grindsted and Holm, 2012). Saadatian et al. (2013) identified 48 indicators that can be applied to measure sustainability on Malaysian campuses, and worldwide. We think that the most recent sustainability declarations for universities, the Rio+20 Treaty on Higher Education and the Higher Education Sustainability Initiative for Rio+20 (Copernicus Alliance 2013; UNCSD, 2012), have importance for the future diffusion of the HESD meme. These declarations differ from earlier declarations in that they require that institutions also disclose their specific strategies to enhance HESD. A follow-up of taken actions could be used as an indicator. By the end of 2012, a total of 272 universities, 12 of which were from the Nordic countries, had signed the Higher Education Sustainability Initiative for Rio+20 (UNCSD, 2012). The Rio+20 Treaty on Higher Education was signed by 83 universities and/or networks by 2013 (Copernicus Alliance, 2013).

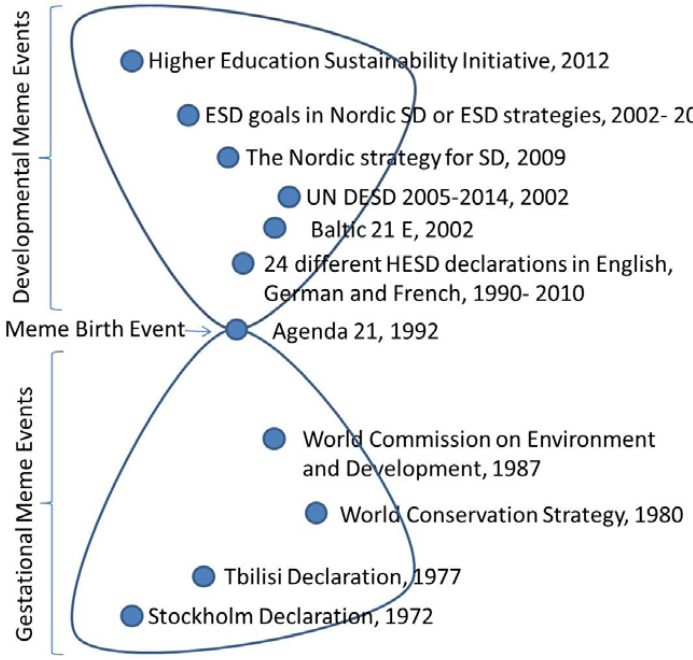

Figure 3. Meme map for HESD in the Nordic countries applied to the meme map tool by Paull (2009).

2.3. Management systems and organizational routines as memes

Assessment of product and service quality was historically developed by the end of the 13th century (Fisher and Nair, 2009). The modern theory for quality management evolved during the 1980s inspired by quality gurus such as Deming and Juran. Formal assessment processes such as those of the European excellence awards and quality management measurement and indicator studies, that include mechanisms for measuring quality were introduced (Molina-Azorín et al., 2009). Quality is defined as the "degree to which a set of inherent characteristics fulfils requirements" and quality management as "coordinated activities to direct and control an organization with regard to quality" (Finnish Standards Association, 2005, p. 7 and 9).

A standard, in turn, is a published document, which consists of a set of regulations to be used repeatedly (ISO, 2012). This is clearly a memetic criterion. A management system standard includes guidelines that people follow with the aim to develop and manage materials, products, services, technologies, processes and systems, including training. The International Organization for Standardization (ISO) has developed and published the most widely used international standards for MS in the world (ISO, 2012). The first administrative standard that ISO published for quality management systems (QMS) was ISO 9001 in 1987, a standard that can be applied at both production and service companies. Since then, ISO has published standards for environmental management systems (EMS) ISO 14001 in 1996, and OHSAS 18001, an occupational health and safety MS standard in 1999 (Jørgensen et al., 2006). Both implementation and certification according to the ISO 9001, ISO 14001 and OHSAS 18001 schemes have become popular around the globe and are regarded as symbols of success at the company level (Zeng et al., 2007). Standards for MSs are based on the so-called PDCA (plan-do-check-act) cycle, which also forms the basis for total quality management (TQM) (Deming, 1982).

The TQM approach describes all major aspects for continuous improvement of product and process quality, involving all employees, customers and stakeholders, with the aim to meet and, if possible, exceed customer expectations (Jørgensen et al., 2006). Various studies, on different types of businesses, show the positive effects of the TQM approach, in particular in innovation capacity and performance (Perdomo-Ortiz et al., 2009). The TQM principle has also been applied for developing at least one standard. For example, Balzarova and Castka (2012) found, that during development one of the latest ISO standards, ISO 26000:2010 Guidance on Social Responsibility, comments were as usually accepted irrespective of the stakeholders" identity or branch of activity.

A memetic approach can be applied to the study of the diffusion of MSs (Figure 4). Based on earlier studies routines are considered the foundation of a management system in this study. According to Nelson (1995), routines are analogous to memes and, according to Nelson and Winter (1982), all regular and predictable behaviours are routines and, in organizations, routines play the same role as genes do in biological evolution. An organization´s growth rate can be considered an outcome of its routines, combined with its capacity to adapt them to external changes when necessary (which means replacing one meme by another and by having a capacity to evolve future memes). Constant (2000) indicated that information evolves through technology, and that technological and scientific change should thus be understood in terms of combinations, recombination, and radical mutation of memes.

Successful memes have a better chance of being replicated and transmitted to other similar organizations, but also to other sectors. As an example, Gustafsson (1994) suggests that cooperative economic thinking such as standards for MSs may be one such successful meme structure. The procedures of MSs do not produce the same outcomes in different organizations, a circumstance which fulfils the condition of variation. The condition of selection is also fulfilled as the recipients choose the systems most suitable for them. Different MSs, such as the ISO standards for MSs, are applied worldwide in all sectors, even in universities (Brookes and Becket, 2007; Disterheft et al., 2012; Fisher and Nair, 2009). The transfer of the most up-to-date technology also follows the memetic rules. In today´s computerized world, it is increasingly the instructions rather than the products, which are copied (Blackmore, 1999).

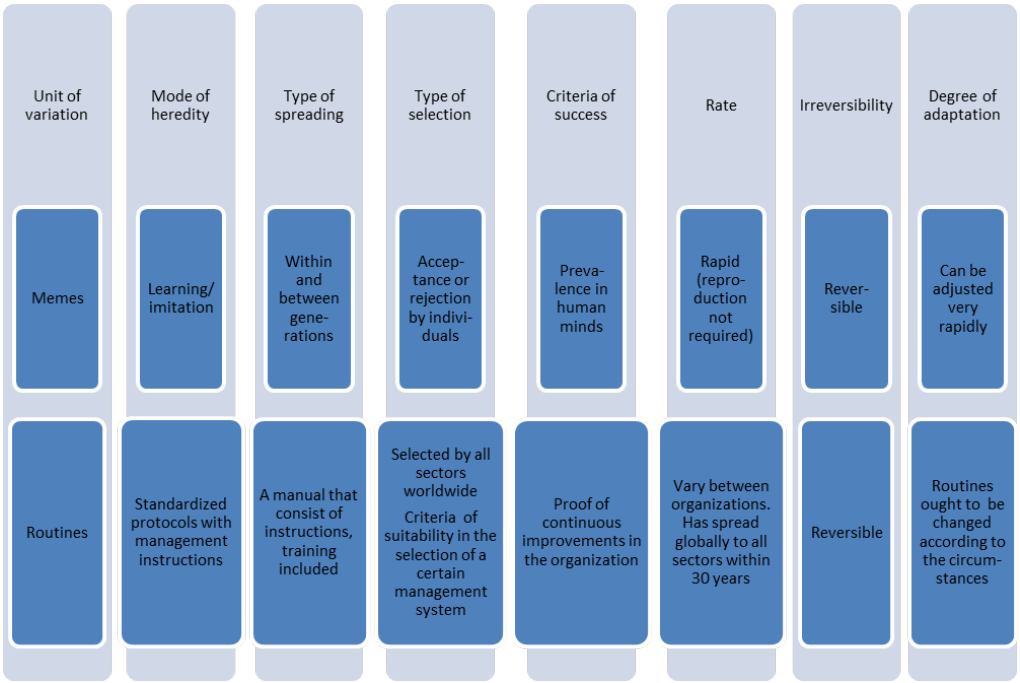

Figure 4. Management systems (bottom row) as memes (top row) applied to the framework presented in Figure 1 (based on ISO, 2012; Nelson, 1995; Zeng et al., 2007).

New memes are needed when conditions change. Change management is a discipline within management that has evolved due to business attitudes having changed from being predictable to being largely unpredictable (Arnold et al., 2005; Senior and Swailes, 2010). Higher education also changes as society changes (Barnett, 2003). A common way to group various factors that influence organizations is according to PEST categorization: 1) political factors (legislation and strategies); 2) economic factors (stakeholders, suppliers and economic policies); 3) socio-cultural factors (demographic changes, availability of skills, employment, concern for the environment, and business ethics); and 4) technological factors (information technology, internet and transportation) (Senior and Swailes, 2010). We consider that this categorization fits universities which change as a response to changing legislation, requests of stakeholders, educational needs within different disciplines, demographic changes and development of internet. These change factors affect the choice of goals and changes at a university, as well as the name and type of MS that can be considered most suitable.

Federkeil (2008) and Pratasavitskaya and Stensaker (2010) found that several universities throughout the world have developed or are developing quality management systems, like TQM and specifically ISO 9001, with the objective of continuous improvement of the quality of education. Barnett (2003), identified as one benefit of quality assessment that faculty and staff worked together and got more engaged in academic practices. The advancement of quality assurance in universities varies geographically (Harvey and Williams, 2010; Pratasavitskaya and Stensaker, 2010). According to Ewell (2010), the Bologna Process is probably the most visible multinational progress of quality assurance in universities in the world. The Bologna Declaration of 1999 supported European cooperation in quality assurance in universities, which has since developed rapidly. In the early 1990s, fewer than 50% of the European countries had initiated quality assessment activities in universities. In 2003, all countries except Greece were using some kind of evaluation.

In 2005 the European Ministers of Education adopted the Standards and Guidelines for Quality Assurance in the European Higher Education Area, and in 2007 the European Quality Assurance Register for Higher Education was established by the European Association for Quality Assurance in Higher Education (ENQA) (Amaral and Rosa, 2010). Networks comparable to ENQA have also been established in Asia and in Central and South America (Ewell, 2010). In China and the US, development of quality assurance in universities started in the mid-1980s and is today compulsory (Ewell, 2010; Yuan, 2010). In Russia, many universities have developed QMSs according to the recommendations of the Russian Standard for Quality Management, but there are so far no legal requirements (Kliot and Bykovskaya, 2011).

In the Nordic countries, the quality assurance requirements at universities are fairly similar to one another (Franke, 2002; Saarinen, 2005; Thune, 2001), and we present the development in Finland as an example (see Figure 5). According to Saarinen (2005), quality assurance began to develop in Finnish universities at the end of the 1970s. In Finland, the Universities Act and Polytechnic Act stipulate that universities participate in external evaluations of their quality assurance systems (Parliament of Finland, 2003, 2009). Since 2005, quality assurance has been audited (FINHEEC, 2010; Saarinen, 2005). The Finnish audit model for a second round of evaluation was renewed in 2010 to focus more on the quality management of degree education (FINHEEC, 2010).

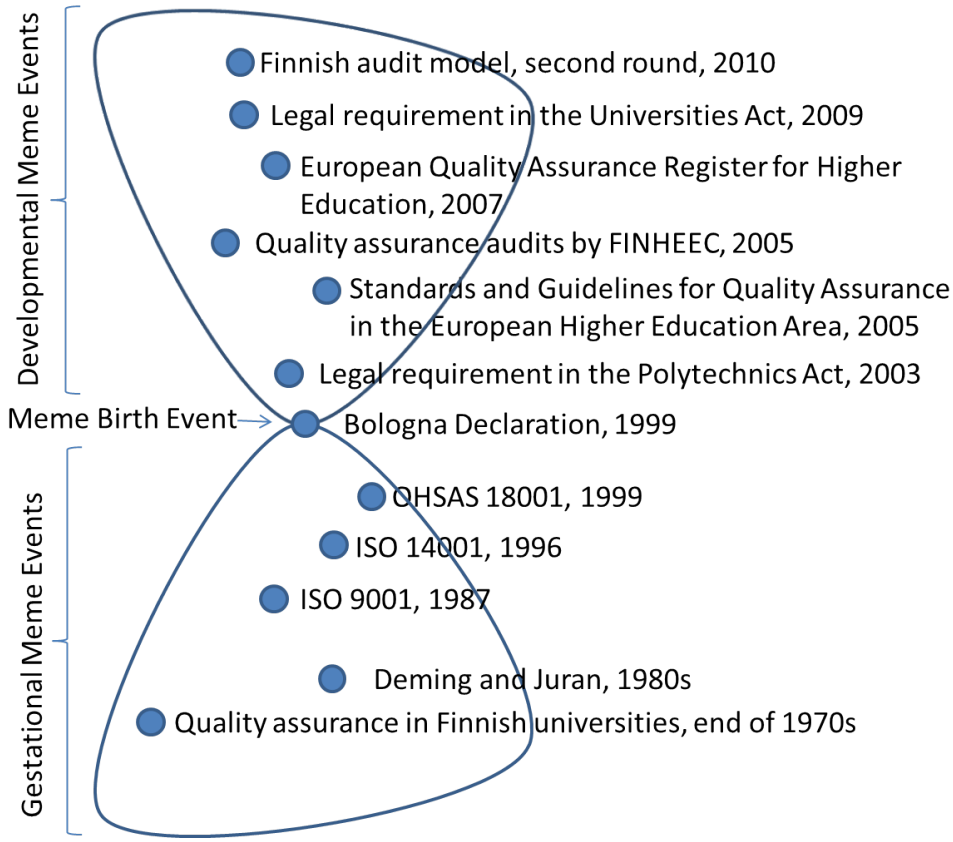

Figure 5. Meme map for development of quality assurance in universities in Finland applied to the meme map tool by Paull (2009).

In a study of quality management at universities in 34 countries, based predominantly on papers published in educational journals from 1996 to 2006, Brookes and Becket (2007) found that external demands have been the main driving force for developing quality management in universities. Quality management models, tools or systems mentioned are TQM, EFQM, Balanced Scorecard, the Malcolm Baldrige National Quality Award, ISO 9001, Business Process Reengineering, and a modified service quality model (SERVQUAL). According to Fisher and Nair (2009), universities have not developed QMSs at the same pace as companies. Typical explanations provided for this include claims such as: "Quality Management isn´t relevant to universities," "You can´t manage research," and "„Variation" and "statistical thinking" are only relevant to manufacturing and have no place in service delivery" (Fisher and Nair, 2009, p. 19). Wiklund et al. (2003) found that the vagueness of the concept is one reason for the difficulties in accepting TQM in universities. In memetic terms, we consider that vagueness may be seen as an obstacle to transmission. According to Methuku and Hussein (2011), TQM could be applied in universities, provided that education is seen as a service industry, with no material products.

According to Federkeil (2008), ranking lists, which often gain a lot of publicity, could also be used as a framework for quality assessment in universities. Lukman et al. (2010) argue that highly ranked universities are also on the frontline of environmental and sustainability performance. At present, however, the European quality assurance guidelines lack requirements for SD (Holm et al., 2012). Barth and Rieckmann (2012) claim that enhancing sustainability aspects in universities can be an important step for organizational change, because the faculty and staff are usually involved in the progress.

Disterheft et al. (2012) maintain that an EMS could be used for enhancing SD in universities and could be a powerful supportive framework in combination with the participation of students, faculty and staff. Nawrocka and Parker (2009), however, claimed that an EMS does not automatically improve environmental performance. The results depend, among other things, on the goals, culture, economy and legislation. According to Clarke and Kouri (2009), different EMSs are suited for different purposes, and ISO 14001 is the only option available for universities to globally certify their EMSs. In European universities, EMAS (the Eco management and Audit Scheme developed by the European Union) and ISO 14001 are equally common alternatives for registering EMSs (Disterheft et al., 2012). In this study, we have focused on MSs that can be applied to all universities, which means that specific accreditation systems as well as national and regional standards are not included.

According to Zeng et al. (2007), it is difficult to manage separate management systems. We will next look into integrated management systems (IMSs) for the study of possible MS meme in universities. Studies on IMSs in companies have been conducted (Asif et al., 2013; Bernardo et al., 2009, 2012; Zeng et al., 2007), but, to our knowledge, none on IMSs in universities, even though we consider that the same benefits of IMSs ought to be valid because both QMSs and EMSs have been applied at universities.

Over the past decade, ISO has made it easier for companies to integrate different standards. There are three levels of integration: 1) to have parallel systems and use the similarities in the standards with the help of cross-reference tables; 2) to combine different MSs in one handbook with a focus on the PDCA cycle; and 3) to achieve a full integration with a TQM approach (Jørgensen et al., 2006). Bernardo et al. (2012) studied integration difficulties in a sample of 362 Spanish organizations. They found that companies that integrated two MSs succeeded, but that companies that attempted to integrate three MSs have faced difficulties that affect the level of integration. "Internal difficulties" and "difficulties with standards" are the factors that were considered the main challenges. The difficulties concern specific fundamentals of the MSs, such as the objectives, internal audits and management reviews, and overlap with difficulties noted in other studies (Bernardo et al., 2012).

A continuous learning process through cross-functional groups, teamwork and knowledge management needs to be supported for securing the benefit of an IMS throughout an organization (Jørgensen et al., 2006). Quality, environmental, health and safety issues ought to be provided

equally important status on the agenda (Bernardo et al., 2012; Jørgensen et al., 2006). Zeng et al. (2007) suggested a multi-level synergy for efficient implementation of an IMS, consisting of the following levels: 1) the strategic level; 2) the structural, resource and cultural levels; and 3) documentation. According to Jørgensen et al. (2006), it is also important to understand the PDCA cycle and the potential benefits of a successful integration, or in the authors‟ words: "integration is more about culture, learning and employees than about common system elements and generic processes" (Jørgensen et al., 2006, p. 718).

There are many benefits for companies that successfully integrate their MSs into one. For instance, the focus on production processes that is typical in QMSs can be changed to a focus on continuous improvements and innovations (Jørgensen et al., 2006; Oskarsson and von Malmborg, 2005). According to Jørgensen (2008), an integration of MSs promotes sustainable management. According to Asif et al. (2013), an IMS can be used as a framework for implementing corporate social responsibility. According to Pojasek (2011), might ISO 26000 be used as a tool for organizations to convert their EMSs into truly integrated sustainability MSs. Other benefits of IMSs are increased levels of efficiency and avoidance of duplication in documentation, routines, audits and management reviews, reduction of expenses for audits, improved internal communication, as well as the possibility to arrange training for the personnel that includes several aspects, like quality and sustainability aspects (Molina-Azorín et al., 2009). Based on this we consider that IMSs may act as successful memes in organizations because they can support improvements.

3. Case study: Enhancing education for sustainable development with management systems in Nordic universities

In the Nordic sustainability strategy, the Nordic countries set the goal of being among the states that lead the way in the DESD (Nordic Council of Ministers, 2009), and innovative examples of HESD enhancement could therefore be expected in this region.

The Nordic countries consist of Denmark, Finland, Iceland, Norway and Sweden. The selected universities for the case study participated in a project that focused on using MSs to enhance ESD in universities in the Nordic countries. The participating universities were: three from Denmark (Copenhagen Business School, Roskilde University, University College Sjælland), three from Finland (Novia University of Applied Sciences, University of Eastern Finland, University of Tampere) and five from Sweden (Chalmers University of Technology, Kristianstad University, Umeå University, University of Gothenburg, University of Gävle).

The number of participants in the initial part of the project had to be limited due to budget constraints. Instead of choosing universities from all of the Nordic countries, universities from three countries were chosen, with the aim that a variety of universities of different sizes and focus would be represented, as well as a mix of universities that were leaders in the development of ESD and/or MSs, and of universities that were lagging behind in this field (Holm et al., 2012). In a later part of the project, universities from Norway and Iceland also participated. The data used for this study was collected from reports submitted by the pilot universities from September 2011 to February 2012, and from seminar presentations that took place in October 2011 and March 2012. The qualitative reports were produced internally by the contact persons and their colleagues from each university.

The examples provided in Figure 6 in the gestational phase are from five universities that did not enhance ESD with MSs and the examples in the developmental phase from six universities that did.

Different ways for enhancing HESD are applied, which either are, or at least could be, parts of the MS. The examples in the gestational phase can be seen as pre-conditions for succeeding. We consider that this case demonstrates that enhancing HESD with MSs has the characteristic of adaptation, because the examples differ from one university to another.

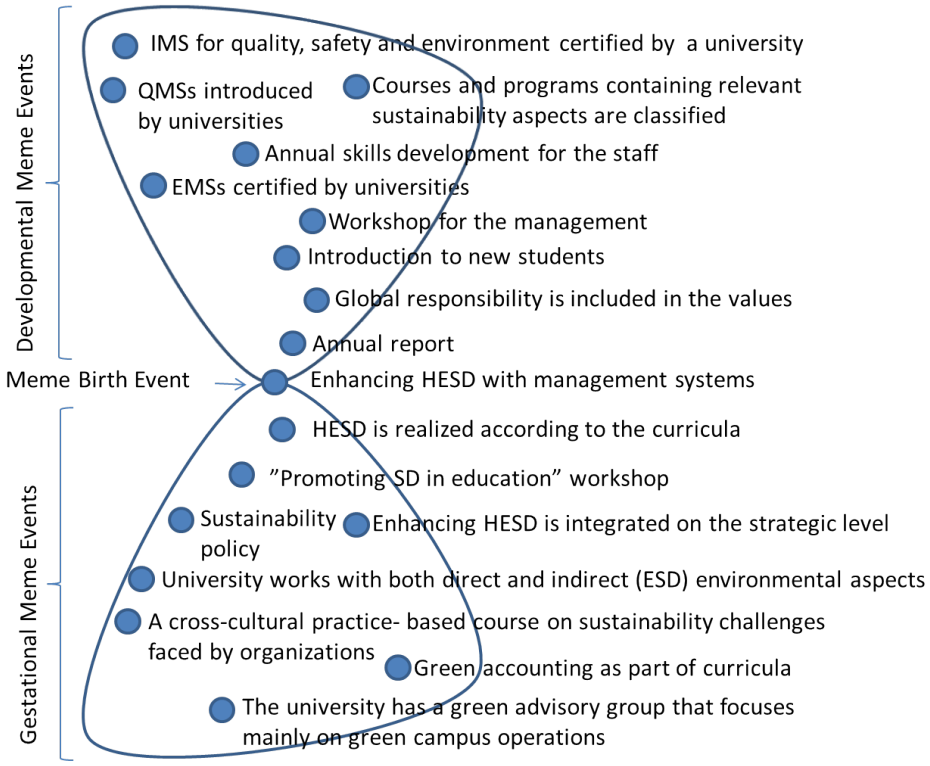

Figure 6. Meme map for enhancing HESD with MSs, based on examples from 11 universities in the Nordic countries, applied to the meme map tool by Paull (2009).

Enhancing HESD with MSs in the Nordic countries as memes (see Figure 7) is based on the case (see Figure 6) and the memetic approach applied to HESD and MSs (see Figures 2 and 4). Since no specific requirement for SD or HESD is included in the quality assurance guidelines we consider that a criterion of success, a proof of continuous improvements, is crucial for transferring the meme. Which MS is applied may be important but its examination goes beyond the scope of this paper.

5. Discussion, conclusions and future perspectives

The originality of this paper is the research question; to study whether a memetic approach might be applied in the promotion of ESD and MSs in universities.

We found that both HESD and MSs could be considered successful memes. They express selection, heredity and variation. The UN chose HESD to be enhanced globally and the HESD objectives are the same for all regions, nations and institutions. Ways of implementing HESD, however, vary. In 2012, over 300 universities or networks, that had signed the latest higher education sustainability declarations, published a variety of goals for enhancing HESD. MSs can be used in different kinds of organizations and have managed to spread all over the world, to all sectors, including universities, as frameworks for quality assurance. The requirements for quality assurance in universities, or the standards for MSs, do not lead to the same outcomes at different institutions. Universities are nor stuck with their routines, but rather have the ability to adapt them according to circumstances. All of these features fit well with a memetic approach.

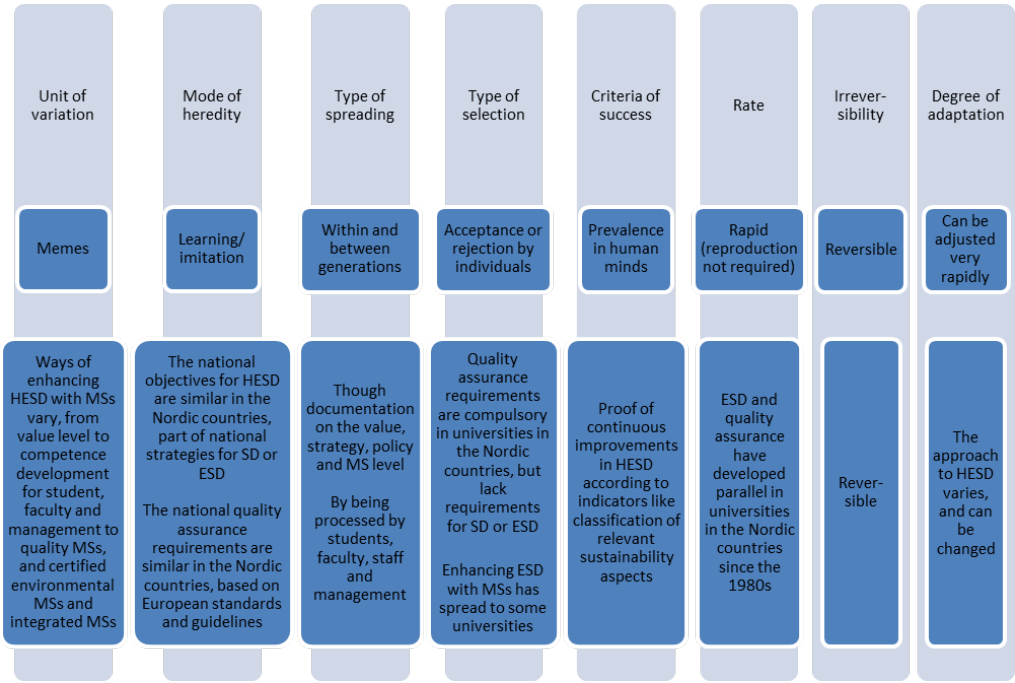

Figure 7. Enhancing HESD with MSs in the Nordic countries (bottom row), as memes (top row) applied to the framework presented in Figure 1 (based on Amaral and Rosa, 2010; Holm et al., 2012; Nordic Council of Ministers, 2009).

When applying memetics, it is important to be aware of the critique of using the evolutionary approach. There are constraints to improvements, and many decisions are a matter of power and morals. Various aspects of successful memes could be paid attention to for effective transfer of ESD in universities: by being generous with one´s time and efforts with the students and faculty; by having a representative for the meme in management and/or the board; and by replicating the meme by documenting it in routines that are followed; all of which are good arguments for implementing ESD in the MS of a university.

The proposition of this study was that MSs can be applied to enhance ESD in universities. In earlier studies it has been found that EMSs can be utilized to promote SD, especially when combined with the involvement of students, faculty and staff, which is also supported by quality assessments. Since quality assurance requirement are compulsory, we consider that integrating other aspects, like environmental and safety or sustainability aspects, into QMSs might support ESD promotion in universities. In the case study, which included a selection of universities in the Nordic countries, we found that different approaches to enhance HESD with MSs already exist, with EMSs, QMSs and an IMS. Based on this, we argue that MSs and especially IMSs could be used as frameworks for promoting ESD in universities.

In companies, the benefits of integrating the MSs into one system consist of among other things improvement of efficiency and sustainability performance. The findings of our study include examples of implementation efforts that parallel experiences of successful IMSs in industry. It is important to support teamwork, a continuous learning process, and environmental health and safety. Quality issues should, however, receive equal attention in the agenda. According to earlier research, efficient implementation of an IMS should consist of involvement of the strategic, structural, resource and cultural levels, as well as documentation.

According to earlier studies, the success of an EMS implementation depends on the goals,

culture, economy and legislation. It is therefore important to be aware of that quality assurance requirements fail to address HESD. This means that it is up to the university leaders to implement HESD in the MSs, if they want to benefit from compulsory quality assurance demands, for enhancing HESD. Evidence of improvement, both for enhancing HESD and as follow-up in a MS, is a criterion of success for diffusing the meme enhancing HESD with MSs.

This study is not without limitations. Memetics is a widely criticized theory. Still, it has been used for organizational cultures and innovation strategies, and can be applied in interdisciplinary studies. We have focused on the advantages of both ESD and MSs for universities, which hinder us from drawing conclusions of the possible rate of diffusion of these memes, leaving us only with conclusions about their potential. The practical examples provided are based on reports and presentations from 11 universities in the Nordic countries, which mean that they are based on the participants‟ own reflections and restricted to this particular geographical area.

The insight about enhancing ESD with MSs in universities can be used by university leaders, administrators and faculty, in the Nordic countries, and applied by academia in other regions.

In this paper we have shown a need for an extensive overview of recent developments in MSs, as scepticism of the relevance of MSs in universities was widespread. Further research is needed on how HESD could be enhanced by MSs, and IMSs in particular. We consider the memetic approach as one promising avenue that leads in this direction.

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II

A model for enhancing education for sustainable development with management systems: experiences from the Nordic countries.

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by

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A model for enhancing education for sustainable development with management systems: experiences from the Nordic countries.

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Abstract

Enhancing education for sustainable development (ESD) in higher education is a global challenge. Most countries have national quality assurance demands for higher education that could benefit ESD. This innovative way to develop ESD has not been investigated before. The authors studied how different higher education institutions enhance ESD, in particular with quality, environmental and integrated management systems. The research was done as an exploratory comparative study. Results from earlier research on ESD curriculum development in recent years were studied. Based on the results, a model of a process for enhancing ESD was developed that can be used in management systems. 27 higher education institutions from the Nordic countries answered a survey and 11 institutions wrote reports of how they are enhancing ESD. The results from the research, survey and institutions were presented at a seminar, where the model was further developed. The authors found that in none of the Nordic countries are indicators for SD included in the quality assurance models of higher education, even though there are demands for enhancing ESD. The majority of the replies stated that the institutions have a clear connection between ESD and quality assurance and it is implemented differently in many parts of the management systems. The findings from the survey and the pilot institutions are restricted to faculty involved in enhancing ESD in higher education the Nordic countries. The findings can be used by those responsible for developing ESD and/or management systems in different higher education institutions.

Introduction

The objective for the UN Decade of Education for Sustainable development, DESD, 2005- 2014 is to integrate education for sustainable development, ESD, in all education from pre-school to higher education (UN DESD 2011). Higher education has a central role for ESD because future leaders for all labour markets are usually graduates from higher education. ESD in higher education requires cross-disciplinary teaching, because the graduates should be educated to make decisions promoting sustainability after having considered the social, environmental and economic costs and benefits of available alternatives (Sibbel 2009). In Europe UNESCO supports ESD-related research and innovation in higher education, following the strategy for the second half of the UN DESD (UN DESD 2010).

European countries have national demands for quality assurance in higher education, based on European standards and guidelines (Amaral and Rosa 2010). Companies usually start by applying a quality management system according to the standard ISO 9001 into which they later integrate an environmental management system according to the standard ISO 14001 (Bernardo et al. 2009). Researchers have found that one of the benefits of integrated management systems is their contribution to sustainable development (Jørgensen et al. 2006; Kraus and Grosskopf 2008). Several studies examine integrated management systems for quality, environment and/ or safety in companies (Bernardo et al. 2009), but as far as is known only one that deals with higher education (Holm et al. 2011). Stubbs and Schapper (2011) found that though many higher education institutions support ESD, initiatives on curriculum greening is mainly driven by individuals, and generally in absence of integrated management systems. A typical explanation for the fact that higher education lags behind companies in developing quality management seems to be that the benefits of the management are not known, or that management is only considered to be relevant to manufacturing (Holm et al. 2011). It seems likely that an integrated management system, that encompasses a wider array of aspects than a quality management system, sustainability possibly included, could be considered more relevant by a larger part of the faculty due to the fact that university faculties represent many different fields. The global aim for quality management in higher education is to secure and improve teaching and learning (Pratasavitskaya and Stensaker 2010), which means that ESD can be enhanced with the management system as far as sustainability aspects are a part of it. An environmental management system requires that personnel having responsibility for tasks that have significant environmental impacts should be competent (Swedish Standard Institute 2004). This means that if the institution identifies ESD as a significant environmental aspect it should offer training in ESD for the entire staff, irrespective of their background.

The aim of this study is to investigate how different higher education institutions enhance ESD with quality, environmental and integrated management systems - which as far as the authors know, has not been investigated before. The authors argue that integrated managements systems can have great potential for enhancing ESD in higher education, and introduce a model of how this can be further developed. Thus it is argued that enhancing ESD with integrated management systems is an innovative way of promoting SD, because everything that is a part of the quality management system of the institution is evaluated, for national demands, and further developed. If the quality management system is further developed to an integrated management system, more aspects, for example ESD, are followed up regularly by being included in the measuring routines of the institution and prioritized by the top management.

Methodology

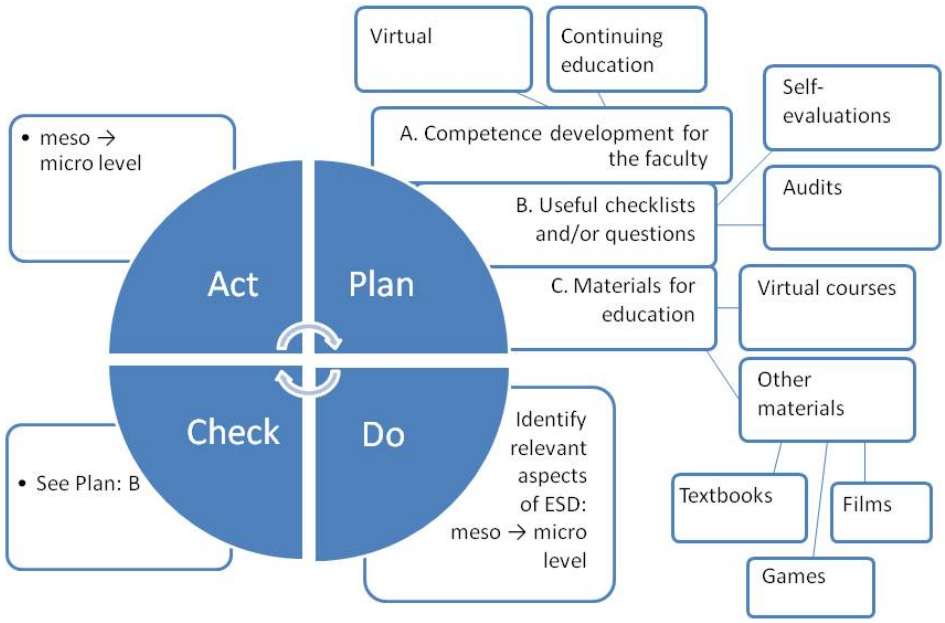
The objective is to conduct innovative research for ESD and its use in practice. The research was done in a project called “ESD in Academia in the Nordic Countries”, in which one objective has been to develop a process for including ESD in the curricula in higher education so that it can be used in the quality assurance work.

Published earlier research on curriculum development for ESD from 2009 onwards was collected. This time period was chosen because 2009 was the halfway-point of the DESD and the authors thought that innovative ways to enhance ESD could possibly be found in research from that

time. The majority of relevant studies turned out to have been published in the International Journal of Sustainability in Higher Education. All issues of that journal from 2009 until August 2011 were therefore analyzed and from them studies dealing with selected keywords were chosen for study. The keywords were: behavior change, competences, curricula, curriculum, curriculum development, education, environmental management, knowledge creation, learning, learning outcomes, student and teaching. Those papers dealing with sustainability in higher education in a wider area or discipline, which were assumed to include curriculum development, were also chosen. Papers on greening campuses were not included in this study. A model of a pilot process was developed for including ESD in curricula in higher education (Fig. 1) for use in the management systems. The literature research was summarized according to what was found in each study according to the elements in the model.

A survey about how ESD is enhanced in higher education institutions in the Nordic countries, especially with the help of their management systems, was carried out by three of the authors (Grindsted, Holm and Sammalisto) and a MSc student. A link to the web-based survey was sent via email to contact persons at higher education institutions in the Nordic countries in June 2011. 27 higher education institutions in Finland, Sweden, Denmark and Norway answered the survey. Only the institutions interested in these matters are assumed to have answered the survey, which means that the results may overestimate the popularity of ESD in higher education in the Nordic countries. The results therefore apparently describe the situation in institutions that have already done something to promote ESD.

Fig. 1. The model for including ESD in curricula in higher education



After having categorized the universities according to degree programmes, nine institutions of higher education from Finland, Sweden and Denmark were invited to participate as pilot universities in the project during spring 2011. 11 institutions were selected based on interest expressed in answers by post and/or conversation, so that a wide range of institutions in the countries would be presented, of different kinds and sizes but also including those institutions at the forefront regarding ESD and/or management systems as well as those who have just begun working in these areas. In September 2011 the pilot universities sent reports of how they were enhancing ESD.

The results from the literature research, survey and work in the pilot universities were presented at the first seminar of the project in October 2011 at the University of Gävle in Sweden, where 27 representatives from 22 different higher education institutions participated. Based on the presentations and audience response the model (Fig. 1) was further developed in a workshop at the seminar. The results of the further development of the model were summarized according to the elements in the model.

Table 1. Demands for ESD and quality assurance in higher education in the Nordic countries

	National strategies for implementing the DESD	**Legislation for SD or ESD that relates to higher education**	**Indicators for SD in quality assurance for higher education**
Denmark	Education for Sustainable Development -strategy for the UN Decade 2005 – 2014, published 2008	A demand for all public buildings to reduce their $C0_2$ emissions	-
Finland	Implementation of Baltic 21E programme and Finnish Strategy for the Decade of Education for Sustainable Development (2005–2014), published 2006	-	SD can be an optional subject for the audits in Finland, according to the new model, published 2011
Iceland	Environmental education as part of Iceland's National Strategy for Sustainable Development 2002–2020, published 2002	-	-
Norway	ESD as part of Norway's strategy for sustainable development, published 2007	-	-
Sweden	ESD as part of Sweden's strategy for sustainable development, published 2006	The Swedish Higher Education Act include a statement that universities shall work for SD in all their activities, 2006	-

ESD and quality assurance in higher education in the Nordic countries

The Nordic countries either have national strategies for implementing the DESD or then it is mentioned as a part of the strategy for SD (see Table 1) (The Ministry for the Environment in Iceland 2002; Ministry of Education in Finland 2006; Government of Norway 2007; Ministry of Education in Denmark 2008; Lindberg 2010). The regional strategies for ESD in the Nordic countries are the Agenda 21 for Education in the Baltic Sea Region (Baltic 21 E 2002) and the Nordic strategy for SD in which it is stated that the Nordic countries want to be leaders in enhancing the UN DESD (The Nordic Council of Ministers 2009).

The Swedish Government gave a directive in 1996 to all public authorities in Sweden to implement an environmental management system. In 2006 the Swedish Higher Education Act was revised to include a statement that universities should work for SD in all their activities (Lindberg 2010). None of the other Nordic countries have any legal requirements for higher education to enhance ESD (The Nordic Council of Ministers 2011), although in Denmark there is a requirement for all public buildings to reduce their $C0_2$ emissions (The Danish Parliament 2005), see Table 1.

Higher education institutions have been required to have national quality assurance demands in the Nordic countries since the mid-1990s (Amaral and Rosa 2010). The formulations of the criteria in the Nordic countries have been developed by national agencies in cooperation with stakeholders (Thune 2001; Franke 2002; Saarinen 2005) and can be seen as broad and soft. Some kind of self-assessment is a part of the accreditation in all countries. So far, the potential benefits of accreditation have been utilized only modestly (Danø and Stensaker 2007).

Connection between ESD and quality assurance

The European standards and guidelines have so far not addressed sustainability (EUA 2011), although it has been discussed in the Nordic Quality Assurance Network in Higher Education (Omar and Liuhanen 2005). Indicators for SD are not yet included in the audits for quality assurance in any Nordic country. However, in Finland they can be an optional subject for the audits in Finland according to the new demands, which will be applied from 2012 (see Table 1) (Universitetet i Bergen 2010; FINHEEC 2011; Magnússon 2011; Swedish National Agency for Higher Education 2011; Danish Accreditation Institution,2011; Danish Evaluation Institute 2011).

In the survey 63 % answered that the institutions have a clear connection between ESD and the quality assurance system. ESD was handled in environmental management systems, some certified according to ISO 14001 and in faculties and departments, where ESD was a part of the vision, policy, objectives, goals and routines. 22 % answered that the SD work is ongoing but not yet connected to the management system.

In the reports from the 11 universities one stated that they had a certified integrated management system for quality and environment according to both ISO 9001 and 14001, by which ESD is enhanced. Two other institutions had a certified environmental management system according to ISO 14001, and a third was striving for it. One would include work environment and quality in the environmental management system, and another thought this would be the natural next step. At one university, the responsibility and SD promotion process was described as one of the sub-processes in the quality manual. In one institution ESD was incorporated in the quality assurance policy, and in another the monitoring of the environment and the sustainability goals comprised part of the quality work. Two answered that there was no connection between ESD and the quality assurance in their institution.

Including ESD in curricula in higher education

The model for including ESD in curricula in higher education consisted of: 1) guidance for competence development for the faculty; 2) guidance for identifying relevant aspects of ESD; 3) useful checklists and questions for self-evaluation and audits; and 4) a list of virtual courses and other related material (Fig. 1).

Previous research indicated that promoting sustainability competence of teachers requires cooperation within the university, between disciplines, between faculty and students, and with the local communities and society at large, along with competence to integrate multiple ways to look at the world as a multi-lingual and multi-

cultural entity (Anderberg et al. 2009; Loranzo-García et al. 2009; Sibbel 2009; Wals 2010; Clark and Button 2011). Brundiers et al. (2010) demonstrated that real world learning is an effective way to introduce interdisciplinary issues and Hansmann et al. (2009) that group processes are essential. Online communication technology can be used to facilitate interdisciplinary research (Dale et al. 2010). There is a need for connectors or coordinating bodies (Bacon et al. 2010). The research of Podger et al. (2010) showed that people are usually more willing to learn when they can relate their own characteristics of identity, morality or work-oriented, to the subject. It is important to take into consideration regional and local values and cultures (Thaman 2010). Savelyeva and McKenna (2010) presented a system for academia to address sustainability through curricula, and Cotgrave and Kokkarinen (2011) a structure for sustainable curriculum design. Loranzo-García *et al*. (2009) demonstrated interconnections for promoting SD.

In the survey less than half of the respondents stated that they provide uncomplicated education and guidance in SD for the faculty. During further development of the model a need for annual planning for competence development of SD for the faculty emerged. This should include information for new personnel, annual training for both faculty and staff about ESD and SD, preferably a day with presentations that would include examples for/of ESD and discussions about integrating SD in education. ESD should also be integrated in the curriculum planning process, and SD should be a part of the goals of the courses, which should be monitored. The work should have a budget and the improvement could be based on innovations. Networks of teachers interested in ESD should be established. Information about ESD should form part of regular meetings in which the employees discuss their daily life. Attitudes towards SD should be investigated before inclusion of SD among organization goals.

According to Mochizuki and Fadeeva (2010) academia should first identify competences and then document them into curricula. Rusinko (2010) has developed a general matrix to integrate ESD. In many different studies relevant aspects for ESD in different disciplines have been identified, such as in operations management courses (Fredriksson and Persson 2011), in business administration (Palma et al. 2011; Stubbs and Schapper 2011), and in science, technology, engineering and mathematics (Hopkinson and James 2010; Desha et al. 2009). An integrated sustainability curriculum for environmental studies, engineering, sociology, education and politics department has also been identified (Bacon et al. 2001), and it has been noted that sustainability is a core competence for environmental programs (Vincent and Focht 2009). Competencies to work in teams, in different knowledge communities and to link knowledge and action for SD are important (Brundiers et al. 2010). In the survey most institutions mentioned many relevant aspects for ESD, for example systematic and critical thinking and attitudes. During the further development of the model the participants highlighted that ESD is interdisciplinary, cross-disciplinary and non-disciplinary activity that focuses on long term holistic thinking. The demands for ESD are discipline-specific. At one institution the Dean´s support ensured that the programmes integrate SD.

Many examples of checklists and questions for self-evaluation and audits were found. The STAUNCH model consists of criteria to identify sustainability aspects in the curricula, within the economic, environmental, social and cross-cutting sectors (Glover et al. 2010). Another method is to identify courses named with the key words for sustainability competences in the curricula (Palma, et al. 2011). A compass that can be used for identifying sustainability aspects within curricula is described by Miller et al. (2011). Desha et al. (2009) demonstrated a method for a systematic review of the extent of sustainability content within courses. Cotgrave and Kokkarinen (2011) had asked students to answer a questionnaire about awareness, skills and attitudes for SD before, during and after SD was included in the curricula. Mitchell (2011) showed a method that consists of questions for key stakeholder interviews. The Balance Act is a Nordic campaign that enhances the DESD, and includes a newly developed checklist for identifying different sustainability aspects (Nordic Council of Ministers 2011). In the survey, a third of the respondents answered that they already use checklists, usually as a part of their management system, which was also mentioned at the seminar. During the further

development of the model it was also mentioned that SD should be a part of the curricula development and course evaluation, which could be done by the study boards, and as a part of the pedagogical training for teachers.

No studies that included results about virtual courses in SD were found, although there are several networks that enhance ESD in the Nordic countries. These include the Baltic University Programme, which is a network of 220 higher education institutions in the region; Idébanken, an organization which publishes a newsletter about SD in the Nordic countries; a website for ESD in both Sweden and Denmark; and in Finland a website for the national SD network for higher education. In the survey half of the institutions answered that they use virtual courses in many different fields.

Table 2 presents examples of enhancing ESD in three of the eleven pilot universities in the project "ESD in Academia in the Nordic Countries". The table is based on reports from September 2011 that were complemented by the authors for this table. The selected universities addresses sustainability as one strategic area and one objective is to enhance sustainability in the educational programs. The universities or parts of them, are based on problem-oriented project work and teaching, sometimes referred as the Aalborg model (Brundiers et al. 2010). Thus the academic culture requires students to have a multidisciplinary and multi-methodological approach, which maintains interaction with ESD (Hansmann et al. 2009). Hence the following methods are very common: problem-based learning, critical thinking, reflective accounts, group discussion, fieldwork, lectures, case studies etc.

Conclusions

All Nordic countries have requirements for enhancing ESD in higher education, mentioned in both international and national strategies, and in Sweden higher education institutions are required to include SD amongst their objectives. In none of the countries are indicators for SD included in quality assurance of higher education. In the survey, two thirds of 27 respondents answered that their institutions have established a clear connection between ESD and quality assurance. The reports from the eleven institutions showed that one institution had an integrated management system and another is going to integrate quality and work environments into their environmental management systems. ESD is generally enhanced as a component of the vision, policy, processes, objectives, goals, monitoring or routines of a particular institute. The results of the study and parallel earlier studies emphasize that ESD is an interdisciplinary or cross-disciplinary activity. Earlier studies that have included guidance for competence development for the faculty show examples of how it can be accomplished, and this study that there is a need for such inclusion. In some earlier studies relevant aspects of ESD have been have identified in different disciplines. A lot of different checklists already exist and in the survey a third answered that they already use checklists, usually as a part of their management systems.

The authors think that it is just a matter of time before standards for management systems will be a widespread tool for quality assurance because higher education usually follows the development in society. The authors argue that the presented model of the process for enhancing ESD can be used in management systems, because it is based on earlier research results and practical experience of faculty working with these matters. The model can be used by the personnel responsible for developing ESD and/or quality or integrated management systems in different higher education institutions and is being tested at the eleven pilot universities. Future studies could focus on results from piloting the model for enhancing ESD with management systems in different higher education institutions.

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Table 2. ESD promotion in three of the eleven pilot universities in the project ESD in Academia in the Nordic countries, according to the elements in the model

University	Novia University of Applied Sciences (FIN)	Roskilde University (DNK)	University of Gävle (SWE)
Competence development for the faculty	**Identified relevant aspects of ESD, or methods for**	**Checklists and questions for self-evaluation and audits**	**Virtual courses and other related material**
Twice a year for the staff. It´s voluntary to participate. SD tip of the week on the intranet.	Indicators for ESD: relevant aspects of SD for the profession in the curricula at every degree programme, which is revised every year, and the classification of courses that University of Gävle uses. Questions about how well SD is integrated in surveys to students and personnel. Course descriptions: sustainability aspects. Practice placement: students observe SD aspects in their work environment. Study modules worth 3 or 5 ECTS.	No internal, but the external auditors (of the management system certified according to ISO 9001 and 14001) positive and developing reflections of how ESD is implemented motivates the personnel. See left and University of Gävle	Some degree programmes uses
Training for new personal, voluntary courses	Create a sustainable awareness towards less energy consumption. ¾ of all enrolled students have mandatory courses in sustainability issues.	No, this in being developed as part of the participation at sustainable university partnership.	*Nothing mentionable*
Annual training for new personnel. In regular meetings. Loose network of teachers interested in ESD. Days of inspiration for both students and teachers.	Classification of courses into following categories: A. The main part of the course contains SD B. The course contains some SD C. The course does not yet have moments of SD, but it is possible to include it. D. SD is not relevant for the course E. The course has not been checked for SD content. Also thesis works have been checked in some departments. The aim of the classification is to challenge teachers to think of ESD.	Questionnaire to first and third year students about what they know, how aware they are and how they act regarding ESD in a comparative study with Novia University of Applied Sciences. Survey among personnel every two years about SD including also SD applied in education and research. See column to the left.	*Nothing mentionable*

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III

Education for sustainable development and quality assurance in universities in China and the Nordic countries: a comparative study.

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Education for sustainable development and quality assurance in universities in China and the Nordic countries: a comparative study.

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Abstract

The global goal for education for sustainable development (ESD) is to integrate it at all levels of education. For ensuring it the change has to be put in practice, by transforming universities. The Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) strive to be among the regions that lead the way in enhancing ESD, and want to increase cooperation with China. It is therefore interesting to compare the region with China. We compared ESD and quality assurance between these areas at both policy and implementation levels. The former was based on literature, and the latter was studied with specific surveys in academia in both regions; in two provinces in China and in the Nordic countries. We investigated the possibilities to improve ESD in these regions by benefiting from quality assurance requirements. We found that both regions enhance ESD. The rather similar quality assurance requirements do not include ESD. In China, the respondents viewed quality assurance as sustainable development.

KEY WORDS: China; Education for sustainable development; Finland; Higher education; Quality assurance; The Nordic countries

1. Introduction

Competition among higher education institutions, which we call universities hereafter, is increasing globally. At the same time universities have a greater autonomy, which makes different evaluation methods and ranking lists even more important (Federkeil, 2008). Such rankings are important in regions where competition for study places is high, such as in China (Li, 2010). Lukman et al. (2010) evaluated the research, educational and environmental performance of universities and noted that highly ranked universities are also in the forefront from environmental and sustainability perspective.

All policies for enhancing education for sustainable development, ESD, share the objective of integrating ESD into all levels of education (Baltic 21 E, 2002; Grindsted and Holm, 2012; Holm et al., 2012; Nordic Council of Ministers, 2009, 2011; Renmin University of China UNDP, 2010; UN DESD, 2011). The aim for ESD in universities is that graduates in their later professional life could take social, environmental and economic costs and benefits into consideration in a balanced way in their decision-making (Lozano et al., 2013; Svanström et al., 2008). Mader et al. (2013) identified that there is a need to ensure the change, or in other words to put in practice what should change. This means that university management is expected to presume a response from faculty in universities concerning their actions for daily routines for sustainable development in education, research and collaboration. According to Mader (2013) these actions drive transformation.

The global aim of quality assurance in universities is to secure and develop quality of education (Pratasavitskaya and Stensaker, 2010). Research concerning quality assurance in universities has been reported and evaluated for a wide range of countries with varying economic status by Harvey and Williams (2010) and Pratasavitskaya and Stensaker (2010). Certifiable quality, environmental and integrated management systems, used in industry can be applied for quality assurance in universities even though it is not yet very common (Disterheft et al., 2012; Federkeil, 2008). Quality management can be viewed as a link connecting management theory and environmental sustainability (Rusinko, 2005). According to Fadeeva and Galkute (2012) ESD could bring a new insight to development of quality assurance. So far, no certifiable tools exist for sustainable management that could help environmental managements to provide solutions for consideration of environmental aspects. It is thus up to the universities to modify the existing tools for enhancing ESD.

China is increasingly competing globally for education and high-skilled employees. China maintains the highest enrolment in universities, when it passed USA with over 20 million students in 2007 (Brown et al., 2008). The number is still small (about 1.5 per cent) compared to the total population in China. The Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) share a common of history, values and knowledge (Nordic Council of Ministers, 2010), and are therefore regarded as one region in this study. According to the Nordic Council of Ministers (2010) the Nordic countries are an innovative and competitive region and well placed for cooperation with China, particularly in the field of climate change and energy. This results in a need for new models for cooperation at both national and university level. Since government policies in the Nordic countries strive to enhance the UN Decade of Education for Sustainable Development, DESD, 2005-2014 (Nordic Council of Ministers, 2009, 2011), it is interesting to compare the region with China, in order to find possibilities for cooperation.

Here, we aim at 1) studying differences and similarities in quality assurance and ESD in universities in China, Finland and to a lesser extent, the other Nordic countries, and 2) investigating the possibility to improve ESD in these regions by benefiting from the quality assurance requirements. The research was conducted both at policy level by a literature study and at the implementation level by comparative surveys in academia in two provinces in China and in the Nordic countries with focus on ESD and not campus management.

2. Theoretical framework

We introduce the theoretical framework for ESD in universities and quality, environmental and integrated management systems, as tools for quality assurance.

2.1. Education for sustainable development, ESD, in universities

Since the 1970s, at least 26 different declarations have been prepared for enhancing sustainability in universities until 2010, all of them emphasizing ESD (Grindsted and Holm, 2012). The UN launched the UN DESD, 2005- 2014 in 2002 (UN DESD, 2011). The objective for the DESD is for all levels of education to "help people to develop the attitudes, skills and knowledge to make informed decisions for the benefit of themselves and others, now and in the future, and to act upon these decisions" (UN DESD, 2011, para.1). In 2009 Gross and Nakayama (2010) conducted a questionnaire to international experts with a focus on drivers and barriers for UNESCO's action goals for the second half of the DESD. The situation was classified as satisfactory for less than half of the action goals. In 2012 UN decided that ESD should be promoted more actively beyond the DESD (UN, 2012). A concrete need for transformation has also been identified by Mader et al. (2013).

Universities have an essential function in local, regional and national development in education of future experts and leaders. ESD works to strengthen this essential function (Svanström et al., 2008). Systematic and critical thinking and understanding of complexity are vital competences for ESD in universities, according to experts in both Europe and Latin America (Rieckmann, 2012).

The Higher Education Sustainability Initiative and the Rio+20 Treaty on Higher Education which was prepared for the Rio +20 Conference, are the latest declarations universities can commit themselves to. They differ from the earlier declarations because the signatory party of these initiatives is committed to actions for ESD. By November 2012, 272 universities had signed the Higher Education Sustainability initiative, including five universities from China and 12 universities from the Nordic countries. The Rio+20 Treaty on Higher Education had 83 signatories by 2013, among others The China Green University Network and several International and European networks (Copernicus Alliance, 2013; UNCSD, 2012). It emphasizes strengthening of cooperation with communities and development of tools for quality assurance needs (Dlouhá et al., 2013). Yarime and Tanaka (2012) concluded, after having reviewed 16 assessment tools for sustainability in universities, such as the Global Reporting Initiative (GRI) and the Auditing Instrument for Sustainability in Higher Education (AISHE), that very few indicators exist that take into account which competencies graduates achieve. However, some universities have developed tools for monitoring the prevalence of sustainability aspects in their curricula and courses. These universities include University of Gävle in Sweden, certified according to ISO 14001, and Novia University of Applied Sciences in Finland, certified according to both ISO 9001 and 14001 (Holm et al., 2012).

2.2. Quality, environmental and integrated management systems in universities

Quality and environmental management is maintenance and constant improvement of all tasks with the goal to exceed customer requirements (Molina-Azorín et al., 2009). A management system can be certified according to a management system standard. The standards that the International Standardization Organization, ISO, publishes are applicable for both production and service companies. The most popular standards globally are those for quality management systems, ISO 9001 and for environmental management systems ISO 14001 (Jørgensen et al., 2006). These standards have a total quality management approach, defined by ISO as a "management approach of an organization, centered on quality, based on participation of all its members and aiming at long term success through customer satisfaction and benefits to all members of the organization and to society" (Finnish Standard Association, 1995, p. 25). The definition indicates that the responsibility for relations to stakeholders is taken into account.

By December 2008 ISO 9001 certificates had been issued in 176 and ISO 14001 certificates in 155 countries. Certified management systems are uncommon for the educational sector. During the period from 2004 to 2008, the amount of certifications in the Nordic countries had not changed much, but in China the amount of ISO 9001 certifications almost doubled during the period, and the amount of ISO 14001 certificates increased over three-fold. In 2008, China had more ISO 9001 and ISO 14001 certificates than any other country in the world, about a fifth of the global total. However, adjusted to population sizes, certified management systems are still three times

more common in the Nordic countries than in China (ISO, 2011).

According to Fisher and Nair (2009) tools for measuring quality in universities are continuously improved. A reason to that quality management has not developed at the same pace in universities as in industry is because faculty has not seen the relevance of it (Pratasaviskaya and Stensaker, 2010). According to Bagaoutdinova et al. (2012) and Rabee (2012) quality management that is based on total quality management can improve the educational process.

Some universities are trying to follow society trends and companies as regards to sustainability (Lozano et al., 2013). According to Crawford and Shutler (1999), applying total quality management in universities helps students to be involved in problem solving training and co-operative work, which can further develop critical and creative thinking among graduates, undoubtedly an important aim for ESD in universities. Clarke and Kouri (2009) studied which environmental management system is best suited for the needs of universities by studying both international and national frameworks. They found that different management systems are best suited for individual drivers and that ISO 14001 is the only globally available and certifiable system suitable for universities. One reason for an increase in the amount of ISO 14001 certificates in China is because cleaner production is compulsory. China was the first country in the world to enforce legislation for cleaner production promotion, in 2002 (Hicks and Dietmar, 2007). Although the laws themselves are often strict, there are often problems with implementation of environmental legislation in China, (Liu and Diamond, 2005). According to Geng et al. (2009) cleaner production legislation tends to promote understanding of sustainable and efficient use of resources among graduate students in China. In Europe, universities certify their environmental management systems equally frequently with ISO 14001 and with EMAS, the Eco-management and Audit Scheme developed by the European Union (Disterheft et al., 2012). The goals and their indicators in an environmental management system are based on identified environmental aspects, which can be either positive or negative (SIS, 2004). We argue that the most significant environmental aspect a university can have is effective enhancement of ESD with focus on education, research and training of faculty and staff. Improving ESD can simultaneously reduce negative impacts, like consumption of electricity, paper and other resources.

Recently there have been attempts to make it easier to integrate different management system standards, like environment and quality, which would probably benefit sustainable development (Jørgensen et al., 2006). Although there are numerous studies concerning integrated management systems in companies (Asif et al., 2013; Bernardo et al., 2009, 2012; Zeng et al., 2007), there are to our knowledge none for universities. We see a gap in research in whether integrating sustainability aspects into the quality system at a university could be a way to ensure ESD enhancement.

3. Literature study

The literature study was based on multiple resources like Scopus and Emerald, reports and books. Main results are summarized in Table 1.

Of the Nordic countries, Finland was chosen as a primary case country based on the work done by the Finnish Higher Education Evaluation Council, FINHEEC. It conducts the audits in Finland and is one of the first evaluation bodies in the Nordic countries that belong to the European Quality Assurance Register for Higher education, a register of reliable audit operators (EQAR, 2012).

3.1. Education for sustainable development in China

In the Agenda 21 declaration of China from 1994 universities were urged to take an important role in enhancing ESD (Lijun, 1995). According to the Medium and Long-term Education Reform and Development Plan, 2010-2020 (China Central Government, 2010, p. 8), one of the major tasks during the 21st century will be to enhance education quality and the capacity for sustainable development. The report for a sustainable future in China (Renmin University of China UNDP, 2010, p. 86), states that education should play a greater role in efforts to conserve energy and to reduce emissions.

ESD has been defined as “a kind of education introduced to meet the needs of sustainable development with cultivation of a value of sustainable development as the core” (Shi and Wang, 2010, p. 58). According to Niu et al. (2010), almost all specific ESD activities that were mentioned in the Agenda 21 have been achieved in China. According to them about half of the

universities had general courses in sustainable development by 2009 and the need to add ESD into the curricula has been widely acknowledged. The main appointed driver for ESD in China has been the Tongji University, in which the UNEP-Tongji Institute of Environment for Sustainable Development has acted since 2002, as a base for research, education and information exchange associated to sustainable development. The DESD was launched at the Tongji University in 2005. The United Nations University Regional Centre of Expertise in ESD was established at the Beijing Normal University in 2006. It has produced a series of seven books on the implementation of the DESD in China (Niu et al., 2010).

According to the strategy for the second half of the DESD, the Asia-Pacific region is at a point where countries are beginning to develop clear strategies for ESD (UN DESD, 2010). China has prepared her ESD plans, as well as regulations and legislation for ESD (Shi and Wang, 2010). In both the working paper for the Asia –Pacific regional strategy for ESD by UNESCO in 2005 and in the results of an Asia-Pacific DESD indicator project that was carried out during the same period, the importance of reaching both government and corporate stakeholders was emphasized (Ryan et al., 2010). Two Chinese universities (Chinese Academy of Sciences and Tongji University) cooperate with other universities in Asia and the Pacific in the network for the Promotion of Sustainability in Postgraduate Education and Research, ProSPER.Net, which consisted of 28 universities by July 2012 (Naeem and Peach, 2011; ProSPER.Net, 2012).

The major challenges for enhancing ESD in China are the vast geographical size of the country and the noticeable regional cultural and provincial differences. Reasons for why the practice should differ among these local regions and the possible conflicts between ESD and the social needs due to economic growth should be carefully considered. Government policies and priority programs that are mediated through regional centers, and appropriate funding decisions are important determinants to overcome these challenges. ESD is still relatively new in China and for this reason educators need training in Chinese to communicate effectively. The most important activity for enhancing ESD in universities, at the moment, is to keep existing activities alive and to support continuous improvements. The objective is to improve the quality of universities with the aim that sustainable development will be integrated in all research and education (Choi et al., 2009; Niu et al., 2010).

3.2. Education for sustainable development in the Nordic countries

The Nordic countries follow the Nordic strategy for sustainable development (Nordic Council of Ministers, 2009) and the Agenda 21 for education in the Baltic Sea region. In addition to the Nordic countries, the Baltic Sea region consists of Germany, Poland, Russia, Lithuania, Latvia and Estonia (Baltic 21 E, 2002). In the Nordic sustainability strategy, the Nordic countries have set up as a goal to lead the way in the UN DESD (Nordic Council of Ministers, 2009). The countries have either national strategy for the DESD, or ESD is referred to in their national sustainability strategies (Holm et al., 2012).

The Ministry of Education in Finland has published a national strategy for implementing the DESD in 2006 (Ministry of Education in Finland, 2006), in which there are specific goals for Polytechnics and Universities, respectively, because the Finnish higher education is arranged according to this dichotomy. Finland follows the definition for ESD of Baltic 21 E, according to which "the individual learner should have skills and competence relevant to their future professions and future roles as decision-makers. Higher education should also play an active role locally, nationally and internationally in enhancing knowledge and action competence regarding sustainable development through research and education in co-operation with surrounding society" (Ministry of Education in Finland, 2006, p. 30). In 2010, the Ministry of Education and Culture in Finland made a questionnaire to find out how universities have enhanced sustainable development. 74 % of the Finnish universities replied. 75% of them replied and summarized the content, meaning and objectives of sustainable development very broadly. Sustainable development was defined as the development of activities, interaction with the society, enhancing internationalization, responsibility, developing local strengths and branding (Vainonen, 2010).

Of the Nordic countries, only Sweden has a national directive to include sustainable development in all university activities, including education (Nordic Council of Ministers; 2011; SFS, 1992, chapter 1 § 5).

Universities cooperate nationally for enhancing ESD in the Nordic countries, for example in the Finnish sustainability forum for higher education, with appointed contact persons from the universities (Bup.fi, 2012). Universities also cooperate regionally within the Nordic countries. In countries in the Baltic Sea region, universities cooperate in enhancing ESD within the Baltic University Programme, which in 2012 consisted of

about 225 universities (Kliucininkas, 2012). UNESCO has chosen to strengthen existing networks working on ESD as a key action for the second half of the UN DESD in Europe (UN DESD, 2010).

3.3. Quality assurance in universities in China

The development of quality assurance in Chinese universities started in the 1980s when about 500 institutions were chosen as pilots for quality evaluation. In 1990, the first regulation that defined the principles of evaluation was published and in 1994 the principles were first applied. In 2003, a five-year action plan for the evaluation of the undergraduate education was published. After the first, five-year round of education evaluation, the Ministry of Education and Higher Education Evaluation Centre have developed the evaluation system in 2008 (Li, 2010).

Since 2008, the universities are required by the Ministry of Education to develop their own quality assurance systems (Li, 2010). In 2010, a national network to evaluate quality of China's universities was launched (Chinese Government, 2010). Quality evaluation is operated by the Higher Education Evaluation Centre, HEEC, an agency affiliated to the Ministry of Education. The evaluation focuses on how the education meets the requirements defined by the government, the objectives defined by the university, and to what extent the students achieve them. It is based on evaluation of teaching, annual report on student feedback, feedback from a teaching supervision group and a peer review that is done by the evaluated institutions. In addition to HEEC, most provincial governments have established their own agencies that are responsible for the education quality evaluation (Li, 2010).

The evaluation starts with a self-evaluation report and is followed by an on-site visit by the evaluation panel, which publishes the evaluation report. The Ministry of Education maintains a pool of evaluators which is composed mainly of senior managers of universities. The scores are based on the evaluation results and categorized into excellent, good, pass and fail. The main policy of the government was to establish 100 key universities in China that would be granted extra funds. Also non-governmental agencies in China publish their results of university rankings, which are followed with interest both by parents and potential students (Li, 2010).

According to the Medium and Long Term Education Reform and Development Plan, 2010-2020, one aim of the educational system reform is to improve the assessment of quality, including evaluation, examination and employment, teaching contents, methods and approaches (China Central Government, 2010). One goal for universities is to be globally more competitive.

No connection to sustainable development or ESD was found in the quality assurance requirements of universities in China.

3.4. Quality assurance in universities in the Nordic countries

Quality assurance requirements in universities are similar in the Nordic countries (Danø and Stensaker, 2007; Saarinen, 2005). According to Saarinen (2005), quality assurance did not exist in Finnish universities until the end of the 1970s. The New Universities Act and the Polytechnics Act in Finland stipulates that the universities shall participate in external evaluation of their quality assurance system on a regular basis and publish the findings (Parliament of Finland, 2003, 2009). In the beginning of the 2000s, quality assurance concentrated on the development of teaching and the identification of centers of excellence in Finland (Saarinen, 2005). Since 2005, quality assurance in Finnish universities has been audited (FINHEEC, 2010; Saarinen, 2005). The Finnish audit model for the second round of evaluation for the quality management audits was renewed in 2010 and focuses now more on the quality management of degree education. Universities make first a self-evaluation report that is followed by an on-site visit by the auditors and the results are published in a report. The universities that pass the audit will be quality labeled for six years (FINHEEC, 2010).

The standards for quality assurance in the Nordic countries are set by national agencies in cooperation with stakeholders. The standards have been developed based on the requirements of the governments and the needs of the universities (Danø and Stensaker, 2007). Evaluation of quality assurance became a legal obligation in universities in the mid-1990s in all Nordic countries. In Europe, the countries have national quality assurance requirements, which since 2005 have been based on European standards and guidelines (Amaral and Rosa, 2010; Huisman and Westerheijden, 2010). The aim is to create a common European university region by improving the quality assurance of the study programmes (Federkeil, 2008).

None of the audit principles of the Nordic countries deals with sustainability aspects (Holm et al., 2012), but the evaluations are flexible, and the universities can choose what the evaluations should focus on (Danø and Stensaker, 2007).

Table 1. Comparison of ESD and quality assurance, QA, in universities in China and in the Nordic countries.

	ESD in China	ESD in the Nordic countries	QA in China	QA in the Nordic countries
Overall	Enhancing education quality and the capacity for sustainable development is chosen as one of the focus areas. Higher education has had an important role in enhancement of the Decade for ESD.	The Nordic countries follow the Nordic strategy for sustainable development in which a goal is set to lead the way in the UN Decade for ESD. The countries have either national strategies for the Decade of ESD or then ESD is referred to in their national SD strategies. Higher education has an important role, see below.	The QA evaluation starts with a self-evaluation report, which is followed by an on-site visit by the evaluation panel, which publishes the results in a report. The university scores are based on the results from the evaluation and categorized into excellent, good, pass and fail.	The QA evaluations are comparable to the Chinese, apart from as comprehensive assessment of teaching. The institutions that pass the audits are quality labeled for six years.
Definition	"a kind of education introduced to meet the needs of sustainable development with cultivation of a value of sustainable development as the core"	"the individual learner should have skills and competence relevant to their future professions and future roles as decision-makers. Higher education should also play an active role locally, nationally, and internationally in enhancing knowledge and action competence regarding sustainable development through research and education in co-operation with surrounding society"	One aim of the educational system reform is to improve the assessment of quality, with the goal that higher education would be globally more competitive.	The aim in Europe is to create a common higher education area by improving the QA of study programmes.
Legislation	Plans, regulations and legislation for ESD are planned. Countries in the Asia-Pacific region are beginning to develop clear strategies for ESD.	One country, Sweden, has a national directive to train higher education students in sustainable development. In another, Denmark, all public buildings are demanded to reduce their CO_2 emissions.	Universities are required by the Ministry of Education to develop their own QA systems, since 2008. Quality evaluation is operated by the national: Higher Education Evaluation Centre. Additionally, most provincial governments have own agencies.	It became a legal obligation in the mid 1990s, and is based on European standards and guidelines, since 2005. The demands are given by national agencies in cooperation with stakeholders.
QA vs ESD	The major challenges for ESD are the vast geographical size, the noticeable regional cultural and provincial differences, and the gap between ESD and the social needs due to economic growth.	The institutions cooperate both nationally and internationally among the Nordic countries, and within the Baltic Sea region, also regarding enhancing ESD with management systems.	QA demands do not include sustainable development or ESD.	QA demands do not include sustainable development or ESD.

4. Implementation study

We made a comparative analysis on promotion of ESD at the implementation level, especially with respect to management systems. Surveys were conducted in China and the Nordic countries by taking into account regional dissimilarities.

The survey in the Nordic countries was conducted in 2011 (see Table 3). The universities were contacted by e-mail via national networks that enhance ESD and sustainable development (Holm et al., 2012).

The survey was professionally translated into Mandarin Chinese by a native speaking consultant. It was given personally by the consultant to universities and separately sent by e-mail to additional universities in 2012. We see it as strength that native contact persons were engaged for distributing the survey, because the questions they asked helped us to clarify introductions and apply them to the Chinese context. The provinces chosen for this study can be considered to be representative, because the universities in these provinces are ranked as average in China (Hartog et al., 2010). Most answers were provided in English and those provided in mandarin Chinese were translated back to English by the consultant. Google translate was used for double translation.

The survey consisted of ten questions that focused on five subjects (see Table 3). Four questions, one of them quantitative, concentrated on how the faculty saw the connection between ESD and quality assurance at their universities. Three questions were created to find out relevant aspects of ESD at the universities and/or the degree programmes or courses. The questionnaire also asked (i) if the universities provided guidance in developing competence about ESD for the teaching staff, (ii) if virtual courses for ESD were used, and (iii) if the universities used checklists and questions for self-evaluation and audits about ESD. The chi-square test was used for testing statistical significance in distribution of answers.

14 universities in China and 91 in the Nordic countries received the survey. The surveys were answered anonymously by faculty to provide answers from those who work as teachers and researchers at the universities and who are expected to implement the university strategies in practice. 46 representatives from 12 different universities in the provinces of Sichuan and Shaanxi in China responded, mostly representing educators. 27 universities in the Nordic countries provided answers; all of them representing educators and developers (see Table 2). In both regions it is very likely that we received answers mainly from the universities which have been active in the field.

Table 2. A list of the respondent universities.

	China, responses from 12 universities in Sichuan and Shaanxi province	The Nordic countries, responses from 27 higher education institutions in Denmark (DNK), Finland (FIN), Norway (NOR) and Sweden (SWE)	
Universities in alphabetical order	Chengdu, Chengdu Institute; Chengdu University, School of Medicine; Nanyang Institute of Technology; Shaanxi Normal University; Sichuan Academy of Social Sciences; Sichuan Normal University; Sichuan University; Xi'an Foreign Studies University; Xi'an Jiao Tong University; Xi'an Petroleum University; Xi'an Technological University; Xi'an University of A&T	Chalmers University of Technology (SWE); Copenhagen Business School (DNK); Gotland University (SWE); Hanken School of Economics (FIN); Häme University of Applied Sciences (FIN); Karolinska institutet (SWE); Kristianstad University (SWE); Kunstakademiets Arkitektskole (DNK); Kymenlaakso University of Applied Sciences (FIN); Malmö University (SWE); North Karelia University of Applied Sciences (FIN); Novia University of Applied Sciences (FIN); Oulu University of Applied Sciences (FIN)	Roskilde Universitet (DNK); Satakunta University of Applied Sciences (FIN); Tampere University of Applied Sciences (FIN); Turku University of Applied Sciences (FIN); Umeå University (SWE); University College of Telemark (NOR); University of Borås (SWE); University of Eastern Finland (FIN); University of Gothenburg (SWE); University of Gävle (SWE); University of Jyväskylä (FIN); University of Tampere (FIN); University of Turku (FIN); Åbo Akademi University (FIN)

The main difference in the answers was that in the Nordic countries, only one answer from each university was received, whereas in the Chinese provinces, between one and 12 answers were received from each university. The answers from the Nordic countries were analyzed and summarized for a project by Hokkanen (2012) and have partly been studied in a research about a model for enhancing ESD with management systems by Holm et al. (2012). The results from the answers in the survey in China were analyzed in steps according to the chosen subjects. All answers from one university were compiled and these compiled answers were then compared. All answers were not complete. For instance some respondents wrote "not clear" as their response to some questions. We interpreted the answers "no" to not clear, if their colleagues in the same university had provided complete answers to that particular question. The results are indicative, not statistically significant.

The results concerning the connection between ESD and quality assurance show similarities among the regions. In the Nordic countries, the majority of the respondents saw a clear connection. In half of the universities in China, the respondents answered that ESD and quality assurance were complementary to each other while the other half of the respondents answered that connections were unclear or did not exist. This was the case even though the faculty in two of these universities answered that sustainable development was an important part of the strategy and in replies from two other universities examples of sustainable development work had been mentioned. The results indicate that it would be possible to use quality assurance for enhancing ESD, because a majority of the respondent faculty in these regions considered that ESD and quality assurance are or at least could be connected.

A majority mentioned examples of some relevant aspect of ESD, 92 % in China and 74 % in the Nordic countries. The mentioned relevant aspects for ESD differed between the answers from China and the Nordic countries. In the Nordic countries most answers were related to ecology and no answer included aspects related to quality assurance. In China, half of the respondents' answers were related to quality assurance. The answers indicate that ESD is viewed as a part of quality assurance in the provinces in China, while it is regarded as broader sustainability education in the Nordic countries. Here it is also important to notice that the respondents in the Nordic countries were contacted through networks that enhance ESD, which means that the broad vision of sustainability aspects was expected to be mentioned.

In both regions half of the respondents mentioned that their university provides education and guidance for sustainable development for the faculty. The difference between the regions was that most examples in China were related to quality assurance. The answers to this question strengthen the observed difference in ESD between these regions.

Virtual courses were more commonly in use in the Nordic countries, where half of the respondents answered that they are in use. In China, most universities did not have virtual courses, or at least the respondent was not aware of any such courses. Two universities mentioned that they had a platform on internet with instructions for students and teachers who were abroad. In the Nordic countries, a third of the respondents answered that checklists and questions for self-evaluation and audits for ESD are used at their universities, usually as part of their management system. Also in China, a third of the faculty that answered wrote that they used checklists, of which two of four mentioned that it was a part of the evaluation of teaching. The answers show that in some universities tools for quality assurance for ESD are already in use.

Many of the Chinese answers included information about degree programmes their universities provide and awards that their universities had achieved, even though we did not ask about those, which gives a glimpse of the cultural differences between the regions and the competitive environment in China. The possible competitiveness of the Nordic countries did not show in their answers.

Table 3. The results from the surveys answered by faculty in universities.

Questions concerning	Sichuan and Shaanxi province in China, 46 respondents			The Nordic countries, 27 respondents		
The connection between ESD and quality assurance	Clear connection	Unclear	Not connected	Clear connection	Unclear	Not connected
	50 %	33 %	17 %	63 %	15 %	22 %
	$\chi2 = 2$, $p > 0.05$ not statistically significant			$\chi2 = 10.89$, $p < 0.05$ statistically significant		
Examples from the answers	Various kinds of management systems, for quality, office, information, administration, logistical support, foreign affairs, financial management, education, graduate, research , staff, students, human resources, employment			Different kinds of management systems, like environmental management systems, EMS, ISO 14001 & 9001,internal audits, the teachers are obliged to participate in administration education every second year, development of curricula		
Relevant aspects of ESD	Examples mentioned in the answers	Related to quality assurance	Related to environmental aspects	Examples mentioned in the answers	Related to quality assurance	Related to environmental aspects (not clear)
	92 %	50 %	25 %	74 %	0 %	78 % (22 %)
	$\chi2 = 8.33$, $p < 0.05$ stat.sign.			$\chi2 = 8.33$, $p < 0.05$ stat.sign.		
Examples from the answers	Quality, evaluation, education, teaching, research, discipline construction and international exchange and cooperation		Recourse saving and ecological civilization context	Ecological, economic, social, cultural sustainable development, ecotoxicology, renewable energy, recycling, sustainable business, CSR, global responsibility, social responsibility, reflection, problem based learning, trans disciplinary		
Competence development in ESD for the teaching staff	Provided (not provided)	Related to quality assurance	Related to sustainable development	Provided (not provided)	Related to quality assurance	Related to sustainable development
	50 % (50 %)	25 %	17 %	44 % (56 %)	Not answered	Not answered
	$\chi2 = 0$, $p > 0.05$ not stat.sign.			$\chi2 = 0.33$, $p > 0.05$ not stat.sign.		
Examples from the answers	Introduction training for teachers and international exchange for teachers and academics			Shorter information opportunities or courses, links to documents, books and research on the web, projects		
Virtual courses in ESD	In use	Not in use (or unclear)	Network on internet, for oversea students and teachers	In use	Not in use (or unclear)	Network on internet, for oversea students and teachers
	0 %	83 % (17 %)	17 %	52 %	22 % (26 %)	Not answered
	$\chi2 = 8.67$, $p > 0.05$ statistically significant			$\chi2 = 0.04$, $p > 0.05$ not statistically significant		
Examples from the answers	For ESD, virtual company example to explain the production process and cost, a course to evaluate the students´ teaching ability to create strong basis for future work			Adobe Connect Pro, Optima, UniPID, BUP and social media alternatives like Skype, distance courses, education of the personnel through internet, different meetings		
Checklists and questions for self-evaluation and audits about ESD	In use	Not in use, or unclear	Part of quality assurance of teaching	In use	Not in use (or unclear)	Part of quality assurance of teaching
	33 %	66 %	33 %	33 %	56 % (11 %)	Not answered
	$\chi2 = 1.33$, $p > 0.05$ not statistically significant			$\chi2 = 3$, $p > 0.05$ not statistically significant		
Examples from the answers	Evaluation and audit for sustainable development which include evaluation of teaching; research, teaching quality, evaluation of different functional department, student´s social activity, moral development and future employment			As a part of the management systems or in the internal audits		

5. ESD and quality assurance among universities in China and the Nordic countries

Both China and the Nordic countries identified the important role universities have for enhancing ESD, and both regions are cooperating internationally for developing ESD, although so far mostly in regional networks (see Table 1).

According to Niu et al. (2010) the strengths in China are that almost all goals for Agenda 21 concerning ESD have been realized, half of the universities have general courses in sustainable development and the need to add ESD into the curricula has been widely acknowledged. This is much better than the global situation; it has been estimated that less than half of the action goals for the second half of the DESD were expected to be realized by 2014 (Gross and Nakayama, 2010). It can be questioned if the implementation of the DESD has really been more successful in China than globally, or do the results merely indicate that reporting in China differs from the global practice. According to the UN (2012) new ways for enhancing ESD in universities are needed for implementing the goals for ESD globally in more universities. According to Mader (2013) this transformation can be strengthened by education and research. One recent development are the latest declarations, the Higher Education Sustainability Initiative and the Rio+20 Treaty on Higher Education, which also require action plans (Copernicus Alliance, 2013; Dlouhá et al., 2013; UNCSD, 2012). Progress monitoring is possible based on reports related to these initiatives. Identified challenges in China are the vast geographical size of the country and the noticeable regional differences with many ethnic groups, which means that ESD ought to be enhanced according to the regional conditions. Another challenge in China is the gap between ESD and the social needs due to economic growth, which ESD could ease. Most frequently mentioned answers in the surveys for relevant aspects for ESD in the Nordic countries were related to ecology, while in China, they were related to quality assurance, even though the definitions for ESD are similar. Both China and the Nordic countries emphasize that the competence of sustainable development is the core and the aim is to meet the needs of sustainable development in society (see Tables 1 and 3).

The quality assurance evaluations are similar and the universities are encouraged to develop their own quality assurance systems. The evaluations start with a self-evaluation report that is followed by an on-site visit by the evaluators who also write the reports. The universities can pass or fail the evaluation, and in China the universities that pass are categorized into pass, good or excellent (see Table 1). The main difference is that in China teachers are both peer-reviewed and evaluated by a teaching supervision group (Li, 2010), for which there is no equivalent in the Nordic countries.

Even though in both China and the Nordic countries quality assurance of universities is compulsory, so far, ESD is absent in the requirements for quality assurance and in the legislation in both regions (with the exception of Sweden), which is a gap that could be an area of cooperation between these countries. A majority of the respondents in the surveys saw a clear connection between ESD and quality assurance (see Table 3), which indicates that at least some of the faculty see this opportunity to enhance ESD in these regions by benefiting from the quality assurance requirements. The respondents in our study in China viewed quality assurance as sustainable development.

The application of management system standards ISO 9001 for quality and ISO 14001 for environment doubled in Chinese companies from 2004 to 2008. China is also the first country in the world with cleaner production legislation (ISO, 2011; Jørgensen et al., 2006), even though it is known that in China the legislation is not always implemented in practice (Liu and Diamond, 2005). Because some universities are following the development in companies and society with regard to sustainability (Lozano et al., 2013), standards for management systems, which are based on total quality management, might be a useful tool for enhancing ESD in universities. Bagaoutdinova et al. (2012) and Rabee (2012) found that total quality management can improve the educational process,

which contradicts with the earlier findings by Fisher and Nair (2009), who found that faculty does not see the relevance of quality management.

We consider that the reason for this contradiction is that the significance and application of quality management has not been explained for and/or understood clearly by faculty. One identified benefit for companies that have integrated their management systems, for example ISO 14001 and 9001, is the contribution to sustainable development (Jørgensen et al., 2006). Because no certifiable sustainability standard exists yet, ISO 14001 could be used as a tool for enhancing ESD in a university, as a complement to quality assurance. Lukman et al. (2010) found that universities that are highly ranked are in the forefront of the sustainability work. Would it be possible that inclusion of sustainability in their activities is one of their success factors? Also, a certified management system might be an advantage in marketing a university globally, especially in China where placement on ranking lists, awards and other distinctions are important. A certified management system could provide a proof of the quality of the university.

6. Conclusions and future perspectives

Our aim was to compare ESD and quality assurance in universities between China and the Nordic countries both at the policy level (see Table 1) and at the practical level (see Table 3), in order to investigate the possibility to improve ESD in these regions by benefiting from the quality assurance requirements.

Based on the comparison we argue that because quality assurance is compulsory in both regions and focuses on developing education we see a potential for enhancing ESD as part of quality assurance, as far as its positive contribution to quality of education is appreciated. ISO standards for management systems, which are based on total quality management, could be applied in striving towards this goal.

The limitations in this study are that the surveys had some differences and were not conducted at the same time, even though the investigated questions were the same. In China the survey was, based on our limited contacts, restricted to a geographical area of two provinces, which however can be considered representative for China. There are also considerable differences between the North European and the Chinese universities for example in focus and size. A possible limitation that can cause bias in our results is the fact that only the most active universities in the field participated in cooperation by answering the questionnaire. The results do show that at least some universities are interested in developing their ESD work.

The results could be used by national and regional administrators, leaders and faculty in universities responsible for the task of enhancing ESD and developing quality assurance. Differences and similarities found between China and the Nordic countries can make mutual learning possible and be used for international benchmarking. Possible partners for future research, about how to advantage quality assurance demands for enhancing ESD, could be found among the universities that have signed the latest higher education declarations for enhancing ESD, or the ones active in quality assurance. We will continue the research by developing a model for enhancing ESD with management systems.

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IV

A change process for education for sustainable development in universities

Manuscript

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by

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A change process for education for sustainable development in universities

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Abstract

Higher education changes when society changes. Enhancing education for sustainable development and ensuring quality assurance are two global demands for universities, for which change management could be applied. Changes can be classified on a scale from soft to hard. Soft are broader changes that affect the entire organization while hard changes are more limited. Management systems could be used as tools for hard changes and support the soft change of enhancing higher education for sustainable development with management systems. A change management process model based on a thematic literature review has been developed in order to enhance ESD in universities by making use of quality assurance. The process is built on a soft approach for change, based on organizational development, OD. The developed OD model has been applied at a university. Steps for strengthening the change could be identified by applying the model. We found that for this change it is important to: recognize the need of change, identify leadership competencies, involve all stakeholders, include vision, commitment, training and collaboration in the action plan, and institutionalize new approaches.

KEY WORDS: Change management; Higher Education for Sustainable Development (HESD); Management system; Organizational development (OD); Quality assurance; Thematic review

1. Introduction

Change management is a discipline that has evolved as business environment has changed from being predictable to unpredictable (Arnold et al. 2005; Phillips, 1983; Senior and Swailes, 2010). Higher education changes with changes in the society.

Enhancing education for sustainable development (ESD) and ensuring quality assurance are two global demands for universities (Ewell, 2010; Kliot and Bykovskaya, 2011; UN DESD, 2011; Yuan, 2010), for which change management could be applied. The central difference is that the identified main driver for quality assurance is compulsory external demands (Brookes and Becket, 2007) and for ESD that the UN has chosen to focus on enhancing ESD during 2005-2014 (UN DESD, 2011), for which both national and international strategies have been made (Holm et al., 2012), but it is not compulsory. Enhancing ESD at universities can be considered a change, because it requires a change in teaching methods (Lozano, 2006). The goal for higher education for sustainable development (HESD) is to ensure that graduates can take economic, social and ecological aspects into consideration in their future careers (Sibbel, 2009). As the global goals for ESD are not expected to be reached to a satisfactory level (Gross and Nakayama, 2010), new and different methods should be explored. For ensuring HESD sustainability aspects should be included throughout universities, in the institutional framework, collaboration, on-campus experiences, by organizing training for educators, and by fostering transdisciplinarity (Lozano et al., 2013). The global aim for quality assurance at universities is to secure and improve teaching and learning (Pratasaviskaya and Stensaker, 2010), which is why we aim to fill the gap in research about whether quality assurance requirements could support ESD by applying change management.

Lozano (2006) identified approaches to overcome barriers to change for enhancing sustainability aspects at universities. He considers that transdisciplinary and multi-stakeholder approaches could be benefitted and that top-level management should be engaged. This is considered in this study, which is transdisciplinary and focuses on tools for quality assurance, which management applies, for enhancing ESD. Cortese (2003) argues that if a university only enhances sustainability aspects in its operative work, such as energy and material optimization, and consequently does not involve students and faculty, it will lose three fourths of its value, and cannot accomplish its role in society. We have taken this into account by looking into how faculty has integrated sustainability aspects in the curricula and courses. Waas et al. (2010) suggest 22 characteristics of university research for sustainable development. One suggested characteristic or method is to apply environmental, safety and security management, which could be a part of quality assurance. Waas et al. (2010) propose also exploration of how the suggested research characteristics could be handled operationally in a real university research context, which has been done in this study for a case university.

The aim of this study is to explore a) characteristics of change management at universities b) to identify factors that influence HESD enhancement by making use of quality assurance from a change management perspective and c) how the theory of change management can be applied at a university.

2. Materials and methods

The theory was elaborated based on a thematic literature review on organizational change. It was based on the book Senior and Swailes (2010), which was expanded with recent studies. For finding recent studies we made a search on Scopus (June 7th, 2013) on the words relevant for this study. From validity we chose the most relevant for our study by choosing the ones that have change (agent/s or management) as keywords. The first search was on “change management education for sustainable development quality assurance university”, for which two conference proceedings were found, which were not relevant for this study. On the search “change management quality management university” 1541 articles were found, of which none had change (agent/s or management) as a keyword. On “change management quality assurance university” 210 articles were found, of which none had change (agent/s or management) as a keyword. Three articles had organizational change as a keyword, but none of them were relevant for this study. Of

Table I. Thematic review.

Article	Keywords (relevant for this study)	Chosen because	Key findings (relevant for this study)
Azzone and Palermo, 2011. Adopting performance appraisal and reward systems: A qualitative analysis of public sector organisational change.	Change management; Organizational change; Public sector organizations	An investigation of which factors inhibit and which facilitate change in a public organization .	It is essential that key organizational actors understand the purpose and usefulness of a change management method; or in other words it can succeed if the managers understand and can communicate the relevance of the method, put into practice the results and overcome resistance.
Battilana et al., 2010. Leadership competencies for implementing planned organizational change.	Change agent; Change process; Organizational change	The heading: leadership competencies for implementing planned organizational change.	Leaders who are more effective at task oriented changes focus on mobilizing and evaluating activities, and leaders that are more effective on person-oriented are more likely to focus on communication.
Bouckenooghe, 2013. Positioning change recipients´ attitudes toward change in the organizational change literature.	Attitudes towards change; Change management	This article reviews the literature on attitudes toward change.	Attitudes are individual-level concepts, but can also be at collective levels.
Brown, 2012. Leading complex change with post-conventional consciousness.	Change management; Organizational change; Sustainability	A study about how leaders design and engage in sustainability issues.	15 leadership competences for three dimensions of leadership were identified.
Exter et al., 2013. Facilitating organizational change for embedding sustainability into academia: A case study.	Change management, Corporate responsibility; Organizational change; Sustainability	This study describes a change management process to embed corporate responsibility and sustainability at a business school.	Recognize that you are implementing a change; look into management theory; accept that it can be a messy and iterative process; be prepared to make mistakes and learn from them; understand the organizational context and processes, and enablers and barriers; achieve organizational commitment; enable a two way dialogue at all levels.
Farkas, 2013. Building and sustaining a culture of assessment: best practices for change leadership.	Change leadership; Change management	A change leadership methodology is tested at a unit (library) at a university.	Structures and policies ought to be changed for a change process to be successful over time. Kotter´s model for change provides a pragmatic structure.
Goldstein et al., 2012. Creating pathways for positive change.	Change; Environment; Management	This study examines emerging, successful trends is communication and its links to change management, concerning sustainability.	For succeeding with engaging and communication with stakeholders: their interests, constraints and the processes by which the different sectors work should be understood.
Hase and Galt, 2011. Records management myopia: a case study.	Change management; Knowledge management	It is a study about implementing a (records) management system in a vocational educational institution.	Implementation needs to be driven from the uppermost level and built from the bottom; training and support are vital; development is continuing; and external know-how should be advantaged when needed.
Holmberg et al., 2012. The university and transformation towards sustainability. The strategy used at Chalmers University of Technology.	Change; Change management; Education for sustainable development; Sustainable development; Universities	It is a study about change management towards sustainability at a university.	Success factors towards sustainability at a university: to create a neutral arena/organization for enhancing ESD; to engage and involve individuals; that the management team communicates a clear commitment.
Peccei et al., 2011. The role of organisational commitment in the analysis of resistance to change. Co-predictor and moderator effects.	Change management; Organizational Change	The study aims at contributing to a better understanding of resistance to change.	For succeeding with a change organizational commitment is essential, but change processes might also create new opportunities to enhance commitment, and committed employees should be involved.
Ronnenberg et al., 2011. The important role of change management in environmental management system implementation.	Change management; Environmental management	The focus: if change management improve the perceived success of EMS implementation.	Change management appears to enhance implementation and institutionalization of an environmental management system.
Smith, 2011. Organisational quality and organisational change. Interconnecting paths to effectiveness.	Change management; Organizational change; Quality management; Universities	The focus on quality; the argument that managing organizational change and managing organizational quality go hand-in-hand.	Two models for change, Kotter and Doppelt have in common the following: establish a sense of urgency about the need to change; create a vision; communicate the change vision at all levels; empower and overcome barriers of change; enable feedback loops; institutionalize new approaches.
Verena and Stoeglehner, 2013. Universities as change agents for sustainability- framing the role of knowledge transfer and generation in regional development processes.	Change agent; Sustainable development process; University	The title; Universities as change agents for sustainability.	Customized education programmes, and /or co-researches could be established, so that knowledge demand/transfer can be jointly determined among local/regional societies and universities.
Wals and Schwarzin, 2012. Fostering organizational sustainability through dialogical interaction.	Change management; Sustainability competence; Sustainable development	It investigates a transition towards sustainability in people.	Dialogue and dialogic interaction are key mechanisms for facilitating sustainability competence.

these 80 had the keywords organization and management, but the articles were about health care management and not about higher education or universities. For a search on "change management education for sustainable development university" 63 articles was found, of which three had change (agent/s or management) as a keyword, of which two were relevant for this study.

We continued by looking into the related articles to these two, and chose the ones that had change (agent/s or management) as a keyword, and found 96 articles. Of these we chose to look into 52 articles, which were published in 2010-2013. We read through the abstracts and chose to explore 14 articles from 13 different journals that presented change management models, which had been used for enhancing sustainability aspects or environmental or quality management, in universities or public sector organizations (see Table I).

Based on the literature review a change management process model has been developed for universities. The model has been applied at a university, which is presented in section 4.

Higher education follows a dual model in Finland. The model contains Universities that offer bachelor´s, master´s, licentiate and doctoral degrees and Universities of Applied Sciences (former called Polytechnics) that offer bachelor´s and master´s degrees (Välimaa, 2012).

For reliability Novia University of Applied Sciences in Finland was chosen as research site because it enhances HESD by making use of quality assurance (FINHEEC, 2012). Novia University of Applied Sciences (Novia) is the largest Swedish speaking university of applied sciences in Finland with 4000 students and 380 employees (Svartsjö, 2013). It is amedium-sized university in Finland (Ministry of Education and Culture in Finland, 2011). It offers education within all, eight educational fields of the universities of applied sciences in Finland. There are 27 Bachelor´s and 4 Master´s Degree Programmes in Swedish, and 4 Degree Programmes in English, one of them as adult education. It is a multipoint university of applied sciences located along the Swedish-speaking coast at five campuses (Svartsjö, 2013). As the first higher education institution in Finland, Novia applies an integrated management system for quality, environment and safety that is certified according to ISO 9001 and 14001 (Holm, 2010).

Auto-ethnography was applied (Bryman and Bell, 2011) because one of the authors has been engaged in the process at the university. The methodology carries the risk to develop an outside angle on the collection and analysis of data. On the other hand it offers an opportunity to get a deep insight in the study (Bryman and Bell, 2011). For validity another author from Novia was involved in this paper, who has not been engaged in the change.

3. Change management

The difference between management and leadership is that leadership is forming the path and management the required activities for the chosen direction (Senior and Swailes, 2010). It could be exemplified by that leadership or strategic management is the vision and strategies that management selects, and the declaration it commits to. Management is to plan, to do and to assess the objectives, goals and programs for the chosen way.

Incremental changes can be divided into four categories: 1) corporate transformation such as great changes of the entire organization, 2) modular transformation such as major rearrangements, 3) incremental adjustment such as separate changes, and 4) fine tuning (Dunphy and Stace, 1988; Tushman et al., 1998). We consider that enhancing HESD by making use of quality assurance in universities could be classified as stepwise modification because it is often done in steps, by including HESD throughout the university for ensuring the change, as found by Lozano et al. (2013).

3.1 Change factors at universities

One way to group various factors influencing organizations for change is the PEST abbreviation that stands for 1) political factors such as local regulations, national and international legislation and strategies, 2) economic factors such as economic interest of stakeholders, competitors, suppliers and economic policies, 3) socio-cultural factors such as demographic changes, lifestyles, availability of skills, attitudes to work, un/employment, minority groups, gender matters, willingness and capacity to move, concern for the environment and business ethics, and 4)

technological factors such as information technology, internet and transportation (Senior and Swailes, 2010).
In Table II we have applied these factors.

Table II. Change factors in higher education, adapted from Arnold et al. (2005).

	Political factors	Economic factors	Socio-cultural factors	Technological factors
Change factors in univers-sities	- higher education legislation and strategies, - regional, national and international strategies and regulations	- policy of financers, - need of education in society and companies, - changes in educational program selection in other universities - student enrollment	- academic culture - demographic changes: an healthier older generation, which also needs innovative healthcare and biotechnology services, - education in relation to need of work force, - increased mobility, more multicultural campuses and need for language skills	- a global opening of internet, - virtual forms of working like e-meetings and e-learning, - competencies for new technologies

3.2 Success factors for changes at universities

When the need of change that the organization is facing has been identified there are a number of things to consider for succeeding with the change, above all the culture at the organization that can be explained by a cultural web (Johnson et al., 2008). A cultural web can be divided into: routinized ways to work, which are valuable for the competence, but demanding to change; rituals, signaling what is essential and respected, for example advancement ways; stories told, which highlight happenings and characters; symbolic features such as logos, titles and rewards; the control system, or measuring and monitoring routines; power structures, which mean that power is associated with the group that knows what is significant; and the formal organization (Johnson et al., 2008). The formal organization is the documented and the informal consist of the values, attitudes and opinions of staff and management, or all the informal routines (French and Bell, 1990).

In an organization, for example a university, the culture influences which procedures are suitable to choose for a change. There are different approaches to identify what kind of culture an organization has. An insight in the culture can be used for understanding the approaches that could be successful for a change. One theory of organizational culture and change that we consider to be suitable for universities is explained by Senior and Swailes (2010). It consists of different aspects that affect capacity to change, such as approaches to information sharing, conflicts, critic and experimentation in processes; degree of willingness to give people independence and backing them up in their activities and to discuss sensitive matters openly; degree to which the organizations' construction enables change and degree of management´s openness to new ideas – especially from below. The success of a change initiative is also reliant on the personnel's reaction, which is often resistance (Senior and Swailes, 2010). Resistance to change can be benefitted for increasing awareness, by discussing what practical effects the change has on every ones work. Resistance might also be a signal of unclear communication which can be solved by going back to the aim of the change, by answering why and what. It is also an opportunity to change the change, by being open to ideas for improvement, which might construct commitment. Resistance also gives the opportunity to carry out the past, by acknowledging that resistance might have to do with past changes (Ford and Ford, 2009).

One way to characterize leadership is Hersey and Blanchard´s theory of situational leadership which consists of four categories: 1) precise directives are required; 2) decision should be explained for clarification; 3) ideas are shared that enables decision making and 4) responsibility for decisions and implementation are turned over. Which leadership category that fits to different situations depends on people's capacity, or

knowledge and skills; and willingness, or confidence and commitment (Hersey and Blanchard, 1993). University faculty is highly educated and has the capability to find information about different subjects. In the fourth category, responsibility can be turned over and applied to individuals who should be capable and willing for the task, which fits a part of the faculty. Then again, evolving quality management is not developing at the same pace at universities as in companies, and enhancing HESD is not expected to develop successfully according to the global goals (Fisher and Nair, 2009; Gross and Nakayama, 2010). Either the objectives have been too ambitious, the efforts too weak, or the methods insufficient. This implies that quality assurance and HESD are questioned by the faculty, so they could be classified in the second category, the capable, but not willing. This overlaps with one of the challenges identified by Leal Filho (2011) for implementation of ESD at universities that sustainability should be clarified to different stakeholders.

3.3. Classification of changes at universities

Changes can be classified on a scale from soft to hard. Soft are broader changes that affect the entire organization or even beyond it while hard are more limited changes that have clear objectives and indicators with a known cause (Senior and Swailes, 2010).

Paton and Mc Calman (2000) developed the TROPICS test that can be applied for locating a change on a continuum from soft to hard. The test includes the factors timescale, needed resources, objectives, the cause of and solution to the problem, limitation of interest and possibility to define, ability to be controlled by management and if the source for the need of the change originates from within the organization. The clearer these factors are, the harder is the change and vice versa. We have applied the test for identifying which kind of change enhancing HESD and implementation of tools for quality assurance, such as management systems, at universities are (see Table III).

Table III. The TROPICS test applied for enhancing HESD and implementation of tools for quality assurance, such as management systems, at universities, adapted from Paton and Mc Calman (2000).

TROPICS test, the more clear these factors are, the harder is the change and vice versa	Enhancing HESD in universities	Implementation of tools for quality assurance, like management systems, in universities
Timescale	Future generations ought to have similar opportunities as previous	Includes objectives with timetables
Resources needed	Future generations ought to have similar opportunities as previous	The resource needs are identified for the objectives
Objectives	Graduates should hold the skill to choose best actions after considering social, economic and environmental expenses and benefits	Instructions to choose clear objectives for both the entire university and units, which are based on focus areas or strategies
Problem: reasons and solutions to it	Need of sustainability competencies; solution: HESD varies among disciplines and changes over time	Need to assure quality; solution: quality management system with instructions for appointing responsible ones for different tasks
Interest: limitations of interest and possibility to define	HESD "competes" with disciplinary focus among faculty; definition varies among disciplines and changes over time	A tool for management, which includes a definition of its target group/s and operation
Controlled: ability to be controlled by management	It can be monitored, but can not be controlled	A tool for management, can be controlled, is based on objectives and targets
Source: if it originates from inside the organization	The internal origin is often based on single individuals, the UN has chosen that ESD should be integrated at all levels of education, also universities	Internally a factor in competition among universities, global demands for quality assurance in universities

Based on this we argue that management systems could be used as tools for hard changes and support the soft change of enhancing HESD with management systems. Next section examines therefore a soft change approach for change for enhancing HESD by making use of quality assurance.

3.3.1 Organizational development at universities

Organizational development, OD, is a soft change approach. It focuses on the entire organization, its groups and employees and considers that the staff is the driver of the change (Senior and Swailes, 2010). We think that this approach could be applied at universities, because we consider that the services and products of universities: education, research and development and regional development are based on knowledge and creativity of faculty and administrative staff.

According to OD a change can be divided into seven identifiable steps to make the change possible and to clarify the connection between them. Senior and Swailes (2010) define the steps as: 1) insight in the problem by management and staff; 2) gathering of data which is diagnosed by the change agent/s; 3) feedback to those involved in the change, management and possible client/s; 4) a joint understanding of the problem/s; 5) joint action planning; 6) implementation; and 7) strengthening and evaluation of the change.

According to Senior and Swailes (2010) the OD model is more challenging to apply in the public sector compared to the private sector. The difference between private and public sector is that the private sector functions to make a profit and the public sector to keep within a budget. Profit oriented private universities exist globally, but not, yet, in all countries. Mc Conkie (1993) recognized the following problems that the public sector might face when applying OD. The bureaucratic manners do not fit the OD model. It is challenging to gain commitment to a vision because within the organizations there are many levels of management and beyond this many stakeholders, which all should be taken into account. It is difficult to get financial support granted for an OD process because funding possibilities for consultants are difficult to get and, again, so many levels of management needs to be committed. OD is more possible to realize within smaller parts of an organization, such as units, departments or work groups, because the cultural web is multilayered and the praxis varies between different units. The “habit background”, such as focus on legislation, carefulness and the view of what type of leadership is considered professional. Decisions are made in the top management, but it is not clear where it is, because public sector also has to consider stakeholders at both local and national level.

3.3.2 A modified OD model for enhancing HESD by making use of quality assurance at universities

Based on the thematic literature review it seems that the following aspects should be considered for succeeding with a change at a university, adapted to the OD model of Senior and Swailes (2010). Firstly recognize that you are implementing a change (Exter et al., 2013) and establish a sense of urgency about the need to change (Peccei et al., 2011; Smith, 2011);. Secondly look into the theory (Exter et al., 2013) and needed leadership competencies (Battilana et al., 2010; Brown, 2012). Thirdly enable feedback loops (Smith, 2011) and a two way dialogue (Exter et al., 2013; Wals and Schwarzin, 2012), by understanding stakeholders interest constraints and work processes (Goldstein et al., 2012). Fourthly create a vision (Smith, 2011). Fifthly communicate a clear commitment to the change vision at all levels (Azzone and Palermo, 2011; Exter et al., 2013; Hase and Galt, 2011; Holmberg et al., 2012; Smith, 2011). For this training and support are vital (Hase and Galt, 2011), by developing customized education programmes, and /or co-researches among local/regional societies and universities (Peer and Stoeglehner, 2013). External know-how should be used when needed (Hase and Galt, 2011). Sixhtly empower and overcome barriers of change by establishing a neutral organization and by engaging and involving individuals, accept that it can be a messy and iterative process. Be prepared to make mistakes and learn from them and by understanding the organizational context and processes. Identify enablers such as to involve committed employees. Identify barriers that can be both on individual and group level (Azzone and Palermo, 2011; Bouckenooghe, 2013; Exter et al., 2013; Holmberg et al., 2012; Peccei et al., 2011; Smith, 2011). Sevenhly institutionalize new approaches (Smith,

2011), for example by an environmental management system (Farkas, 2013; Ronnenberg et al., 2011).

The change process according to the OD model (Senior and Swailes, 2010), is revised according to the literature review for enhancing HESD by making use of quality assurance at universities (see Figure I).

Figure I. The OD model applied for enhancing HESD by making use of quality assurance at universities, adapted from Azzone and Palermo, 2011; Battilana et al., 2010; Bouckenooghe, 2013; Brown, 2012; Exter et al., 2013; Farkas, 2013; Goldstein et al., 2012; Hase and Galt, 2011; Holmberg et al., 2012; Peccei et al., 2011; Peer and Stoeglehner, 2013; Ronnenberg et al., 2011; Senior and Swailes, 2010; Smith, 2011; Wals and Schwarzin, 2012.

4. Change at Novia University of Applied Sciences

The developed change process according to the OD model has been applied for enhancing HESD by making use of quality assurance at Novia.

4.1 Insight in the problem and recognition of need of change by management and staff

Novia is a result of a merger in 2008 between Sydväst University of Applied Sciences, which was certified according to ISO 14001 and Swedish Polytechnic, which was certified according to ISO 9001. At the merger the vision of the new university of applied sciences, Novia, was to provide high quality education, regional presence and sustainable development - ecological, economic, social and cultural. This meant that the new merged university of applied sciences was committed, among other changes, to enhance sustainable development in in all activities and to develop the quality management system into an integrated management system. The

documentation of the management system follows the structure of the quality management standard ISO 9001, in which the demands from the environmental management system, EMS, standard ISO 14001 and the safety management system standard OHSAS 18001 has been implemented, according to the correspondence table between the standards. At this step the barrier for change was that the decision that the entire university will be certified according to ISO 9001 was taken before the merger in 2008, but the decision to certify the university according to ISO 14001 was taken in September 2009.

The main aim of the integrated management system at Novia was to support the students' development into quality- and environmentally conscious skilled citizens who can take sustainability aspects into consideration in their future roles. In the overall strategy, "Novia 2015" and the strategy for research and development the sustainability aspects were integrated among the focus areas (Holm, 2010).

In the pedagogical strategy of Novia ESD was chosen as one of 15 focus areas. In the pedagogical strategy ESD, and what it meant both for students and teachers were explained (Holm, 2010). The pedagogy at Novia is based on problem oriented project work and teaching (Svartsjö, 2013), sometimes referred as the Aalborg model (Brundiers et al. 2010). Thus the academic culture requires students to have a multidisciplinary and multi methodological approach which strongly supports HESD (Hansmann et al. 2009).

4.2 Study of theory and gathering data which is diagnosed by change agent/s; identify needed leadership competencies

An organization that follows ISO 14001 has to identify environmental aspects, choose significant environmental aspects and plan objectives for these (SIS, 2004). The environmental aspects for Novia were chosen by the faculty and administrative staff for each unit and degree programme. This was done during training sessions arranged internally for the whole faculty and staff during the first academic year of Novia (2008-2009). The chosen significant environmental aspects of each campus and unit were presented by the head of each of them to the management. Based on this the most significant environmental aspect for Novia, to integrate sustainability aspects in education, research and development, was chosen. Another demand in the ISO 14001 standard is that faculty and staff that performs tasks that could have a significant environmental impact should have the competence for that (SIS, 2004). As a consequence the faculty at Novia should have current knowledge in sustainable development and master the key sustainability aspects in their subject area.

In 2010 all degree programmes at Novia were required to revise their curricula. The head of every degree programme was to identify the relevant aspects of sustainable development for the profession in the curricula, which 36 of 38 of them managed to do. According to results of a survey to the faculty and staff in the spring 2010 many were motivated to implement and teach sustainability. Some saw sustainability quite narrowly, for example as saving papers, which meant that the need for training and information was identified for ensuring that all teachers could teach relevant sustainability aspects in their courses.

4.3 Enable feedback loops among those involved in the change, including management and stakeholders

At Novia a quality team is responsible for the integrated management system and for enhancing HESD with it. The team consists of a head of quality assurance, an environmental coordinator and five quality coordinators for each educational unit. The head of quality assurance and the environmental coordinator are also quality coordinators for the unit of research and development, the center for lifelong learning and the support functions or units. The environmental coordinator is responsible for enhancing sustainable development throughout Novia and the quality coordinators for ensuring the management system work at their unit, concerning all demands, meaning also the sustainability work. Due to the reason that the two universities were merged three educational units have quality coordinators and two have separate appointed ones for the environmental work, in addition to quality coordinators, which leads to that the faculty and staff involved in the work differs between the units. The quality team has representatives in each management team and coordinating group at Novia.

Novia has external audits of the certified management system, according to ISO 9001 and 14001 every nine months. The positive and developing reflections of the external auditors, of how HESD is implemented, motivate and give new ideas for development. Internal audits of all functions and units in a three year cycle are also a part of the management system. Another feedback loop is the customer satisfaction surveys, in which questions about how well sustainable development is integrated are included. With a customer is meant someone who receives a product of Novia, such as students, faculty and staff, society and, the Finnish Ministry of Education and Culture and other financers. The surveys are held annually for students, at graduation, and a year after graduation; and to faculty and staff every second/third year.

During the second academic year, 2009- 2010, the quality team decided that annual further training in sustainable development and HESD would be organized for the staff twice a year; once a year for the entire staff and once a year particularly for the faculty, in education and research. The competence development is planned by the environmental coordinator, and it is based on theory on recent studies in the field. A barrier to change is that it is optional to participate, which means that the faculty and staff that are interested join the training, but the ones that should be reached do not.

For newly employed staff the introduction about sustainable development and HESD is integrated in the overall introduction for new staff to the management system.

Also the student affairs office and the janitorial guide for students, support the work for HESD. In 2011 all other functions beyond education answered how they are enhancing sustainable development within their units, which was summarized in a report.

4.4 Create a vision

The overall objective for Novia was to implement sustainable development in the curricula of all degree programmes, during the academic years 2010- 2014.

The definition of HESD used at Novia was based on the text about HESD in the pedagogical strategy from 2009. The text was seven sentences long and the core message was that graduates can take both economic, environmental and social costs and benefits into account in their decision-making. Central to HESD is interdisciplinary, holistic, systematic, and critical thinking (Lozano, 2006; Sibbel, 2009).

A barrier to the change was that the pedagogical strategy was shortened in 2012, when a definition for HESD was excluded.

4.5 Joint understanding of vision, commitment, training, collaboration

One requirement in the EMS standard ISO 14001 is to document an environmental program for each environmental objective (SIS, 2004). At Novia a program for the documented objective to integrate HESD in education included: the follow up of degree programmes on how they have implemented sustainability aspects as defined within their degree programme, and the responsibility of updating the document that specifies the relevant sustainability aspects in the curricula; investigating the need of creation of a routine for HESD or integrating it in existing routines; arranging competence development in HESD and; conducting a survey among new students that will be repeated at graduation in some degree programmes.

For training and support an external HESD expert was used for the annual continuing education, which was organized at each campus in 2010.

In March 2011 Novia received funding for a two year cooperation project called Education for Sustainable Development in Academia in the Nordic countries, ESDAN. During the project a process for enhancing HESD was developed in cooperation with partners from 10 other universities within the Nordic countries. This project was partly financed by the Nordic Council of Ministers, and partly by the participating universities. As part of the project Novia organized four international seminars in enhancing HESD in the Nordic countries during 2011- 2013 (Holm et al., 2012), at which the participating universities presented and further developed their HESD work together with external experts. The project was followed up in the quality team, instead of a management team, which we see as a barrier, which reduced the commitment and further the participation of faculty and staff in the organized seminars.

Table IV. Participating universities in the ESDAN project

Country	University
Denmark	Copenhagen Business School
	Roskilde University
	University College Sjælland
Finland	Novia University of Applied Sciences
	University of Eastern Finland
	University of Tampere
Sweden	Kristianstad University
	Umeå University
	University of Gothenburg in cooperation with Chalmers University of Technology
	University of Gävle

4.6 Empower and overcome barriers of change, establish a neutral organization, engage and involve individuals

The annual internal training in sustainable development and HESD was organized by the environmental coordinator as a common seminar for the faculty and staff on two campuses in Vaasa, one in Jakobstad/Nykarleby, one in Raseborg and one in Turku for the faculty and staff in Turku and Helsinki during December 2011 – March 2012. During this training the entire faculty and staff was involved in choosing sustainability goals, which are to be revised every third year, for their unit. Again only the ones interested participated, but it ought to be the same ones that are the change agents at each unit.

In 2012 the head of every degree programme updated the document from 2010 about relevant aspects of sustainable development for the profession in the curricula. It was also decided that is was time to start a follow up of how the identified sustainability aspects were realized in courses. A classification of courses that University of Gävle in Sweden used (Sammalisto and Lindhqvist, 2008) was modified into the following categories: a) the main part of the course contains ESD; b) the course contains some ESD; c) the course does not yet have moments of ESD, but it is possible to include it; d) ESD is not relevant for the course; e) the course has not been checked for ESD content. A document for the follow up was made and sent to the head of every degree programme by the rector, for pointing out the commitment of top management, in January 2012. The document included information about the follow up, the ESDAN project and a description of HESD.

The Finnish Higher Education Evaluation Council conducted a quality assurance audit during 2012 and awarded Novia a quality label that is valid for six years. Sustainable development was chosen as an optional audit object. According to the audit team, one of three key strengths of the quality system is that “functional mechanisms to comprehensively integrate sustainable development are established, particularly its environmental aspects, in a majority of its operations. The various actors are engaged and actively involved in the development of sustainable development through systematic quality assurance work” (FINHEEC, 2012, p. 79). This audit had an empowering effect on the work, because each of the 80 persons interviewed during the audit answered when the auditors asked the faculty, personnel and students how they are enhancing sustainable development or which sustainability aspects they think are relevant.

In the autumn 2012 the internal training for faculty and staff included a presentation of the developed ESDAN process, applied at Novia and other universities. The identified relevant sustainability aspects were translated into English. The translated concepts were further developed by the faculty and staff that participated. The continuing education was organized separately in Vaasa, Raseborg and Turku. Although participation

was voluntary, about 80 of a total of 400 staff participated in the whole education.

In March 2012 and 2013 external ESDAN seminars were organized at Novia. At least one of the staff from each five campuses participated in both these seminars. The head of the degree program of Design in Turku presented how they are enhancing HESD in their education at the seminar in 2012. In 2013 the head of the degree programmes in Biomedical Laboratory Science, Environmental Engineering and Integrated Coastal Zone management presented together with students their HESD work. A pedagogical team was during the project responsible for pedagogical development, quality in education and education needs at Novia. The team reviewed all tasks of Novia for the project. The process for enhancing HESD by making use of quality assurance at Novia has been documented in scientific papers among the final results of the ESDAN project. A student group studying tourism organized the external ESDAN seminars at Novia, taking sustainability aspects into account, and presented their work in a poster. The unit of information and marketing helped with a press release in June 2012 and in June 2013. The first one was about Novia signing the Higher Education Sustainability Initiative (UNCSD, 2012), in which also the ESDAN project was mentioned and the other about presenting the final process that was developed in the ESDAN project.

4.7 Strengthening and evaluation of the change; institutionalizing new approaches

In 2012 the internal survey from 2010 to the faculty and staff was repeated and revealed a need for a clearer definition of sustainable development. Also in the quality assurance audit of 2012 the auditors recommended that Novia could problematize and define sustainable development according to its activities, and systemize its cooperation with external stakeholders (FINHEEC, 2012).

We identified that needed management competencies had not been identified, which we developed in November 2013. In 2014 the internal training for faculty and staff was organized at each of the five campuses. It was based on the United Nations competencies in ESD (UNECE, 2012), which were translated into Swedish and modified according to the terminology applied. The evaluation of relevant sustainability aspects in curricula and a follow up of how ESD was realized in courses was done a third time, in 2014, in the same way as in 2012. The final results are presented in table V.

For strengthening the change Novia is cooperating with other Nordic universities, within projects and by writing applications for further research for the work.

5. Discussion

According to Brookes and Becket (2007) the main driving force for developing quality management at universities has been external demands. The main driver for enhancing HESD is the UN focus on enhancing ESD during 2005-2014 (UN DESD, 2011), for which both national and international strategies have been made (Holm et al., 2012). These are both political factors (see Table II) whereas the socio-cultural and technical factors highlight the need of HESD.

We have identified that each step in the developed model (see Figure I) has been followed in Novia. In this case the quality assurance demands have been successfully used for enhancing HESD.

We consider that all actions were important for succeeding with the change. The change gained power when the change was recognized. The leadership competencies were identified to be missing at the last step, which was done for teachers, and identified to strengthen the change. All stakeholders, faculty and staff, students and management have been included, which we consider a factor that has had a positive effect on the change. In the action plan the vision, commitment, training and collaboration within the university was included, but not with stakeholders outside the university. This is why a collaboration project in cooperation with other universities was included at a later step, which had an improving effect on the results. In addition to Novia, ten 10 other universities (see Table IV) have applied a process, which was developed for enhancing HESD with management systems, which can be used for quality assurance. This correlated with the findings by Lozano et al. (2013), which is that for ensuring HESD sustainability aspects should be included throughout universities.

Table V. Keywords for relevant sustainability aspects and evaluation of realization at course level.

A. The main part of the course contains ESD. B. The course contains some ESD. C. The course does not yet have moments of ESD, but it is possible to include it. D. ESD is not relevant for the course E. The course has not been checked for ESD content.

Degree programmes (DP)	Relevant aspects of sustainable development for the profession in the curricula, keywords	Realization, in courses				
Bachelor = BSc		A %	B %	C %	D %	E %
Degree in Beauty and Cosmetics		14	79	4,5	2,5	0
DP in Beauty and Cosmetics (BSc)	health, well-being, entrepreneurship, ethical principles	14	79	4,5	2,5	0
Degree in Business Administration		18	27,5	6	42	6,5
DP in Business Administration (BSc), Turku	environmental strategy, environmental management systems, sustainable use of resources, intercultural leadership, integrated view of economics in business, lifelong learning, professional ethical principles	36	52	12	0	0
DP in Business Administration (BSc), Vaasa	corporate social responsibility, quality, economics	New education in 2013				
DP in Business Information Technology (BSc)	acquisition processes, energy saving modes, re-use, video conferencing, teleworking	0	3	0	84	13
DP in Leadership and Service Design (Master)	problem solving, intercultural, responsibility, service design thinking	New education in 2014				
Degree in Culture		3,5	57,5	16,5	16,5	6
DP in Design (BSc), Pietarsaari	user-oriented design, problem-solving, quality, entrepreneurship	0	52	40,5	7,5	0
DP in Design (BSc), Turku	user-oriented design, lifecycle, ethic and aesthetic responsibility	9	79,5	11,5	0	0
DP in Fine Arts (BSc)	culture, society, communication, sensitivity	13	69,5	17,5	0	0
DP in Leadership and Service Design (Master)	problem solving, intercultural, responsibility, service design thinking	New education in 2014				
DP in Music (BSc)	ergonomy, good physical and social environment, respect and understanding for both tradition, genres and developments, well-being among both audience / fellow musicians and himself	0	100	0	0	0
DP in Performing Arts (BSc)	social and cultural sustainability, wellness, voice also for "hidden voices", forums for increased self-awareness of audience, participants and leaders, forum for the individual discussion with the society and the world...	0	35	0	31	34
DP in Photography (BSc)	cultural knowledge	0	8	25	58	9
Degree in Humanities		35	26	0	0	38
DP for Community Educators (BSc)	participation, tolerance, equality, environmental responsibility	35	26	0	0	38
Maritime Management		9,5	44	5	40,5	1
DP in Maritime Studies, Maritime Management (BSc),	safe navigation, effective leadership on board and ashore, effective teamwork on board, safe cargo handling incl. oil and marine pollutants	9,5	44	5	40,5	1
Degree in Natural Resources		42	55	0	1	2
DP in Natural Resources and the Environment (BSc)	sustainable natural resource production, recirculating nutrient management, pest management, ecosystem	15	85	0	0	0
Agriculture, Horticultural Production	services	26	58	0	5	11
DP in Natural Res. and the Environm. (BSc), Forestry	natural and well integrated part (of forestry education)	34,5	65,5	0	0	0
DP in Natural Resources and the Environment (BSc), Environmental Planning	coastal management, ecosystem services, climate change, environmental impact assessment, environmental protection, water management, management plans, sustainability science	69	31	0	0	0
DP in Sustainable Coastal Management (BSc)	multidisciplinary education, holistic and critical thinking, envisions change and flexibility, cooperation, understands complex relations, understand that they can make a change, humility	63,5	36,5	0	0	0
DP in Natural Resource Management (Master)		New education in 2014				
Degree in Social Services and Health		8	82	1	3,5	5,5
DP in Social Services and Health Care (Master), Vasa	health promotion, evidence based practice, development of practice	0	100	0	0	0
DP for Biomedical Laboratory Scientists	ethical awareness, occupational health and safety, co-operation, ergonomics, economical awareness, quality	2,5	74	2,5	18,5	2,5
DP in Social Services and Health Care (Master), Development and Leadership within Social Services and Health Care	work life psychosocial factors, the impact of globalization on social service and healthcare development, global responsibility, cultural differences, ethical leadership, multi professional leadership, reinforcing resource leadership, future oriented critical and conscious thought, strength based leadership, ...	0	100	0	0	0
DP in Nursing (BSc) English, Vaasa	ethical values, responsibility for own activities, adopted in the daily activities	17	83	0	0	0
DP in Nursing, Public Health Nursing, (BSc), Turku	ethical values, interpersonal encounters, inter-professional work, responsibility, strengths-based nursing, security factors (ecological, economical and psychological), health promotion, life long learning	0	93	0	0	7
DP in Nursing, Public Health Nursing, Midwifery (BSc), Vaasa	ecological, economical, technical, social, cultural , environmental health, awareness of the importance of sustainable development	4	62,5	0	0	33,5
DP in Radiography and Radiotherapy (BSc)	radiation safety in medical use, economical aspects, social competence	14	86	0	0	0
DP in Social Services (BSc), Turku	interprofessional work, resource promoting socio-pedagogical work, development-oriented, ethical values, client-centric, adaptivity, service coordination, social anchoring	10	84	0	1,5	4,5
DP in Social Services (BSc), Vaasa	social sustainability, prevent, utilize, support, generate (resources)	26	56,5	4,5	13	0
Degree in Technology		10,5	61	14	12	2,5
DP in Civil and Construction Engin., Engineer (BSc), R	durable structural solutions, suitability for aimed purpose, energy efficiency, lifecycle	17,5	54,5	28	0	0
DP in Civil and Construction Engin., Engineer (BSc), V	energy efficiency, life cycle costs, profitability, durability	0	50	50	0	0
DP in Civil and ..., Engineer (BSc), Land Surveying	urban planning, geographic information systems, remote sensing	0	60	0	40	0
DP in Construction Management, Construction Manager (BSc)	durable structural solutions, suitability for aimed purpose, energy efficiency, lifecycle	16	51	0	33	0
DP in Electrical Engineering and Automation (BSc)	sustainable coastal management, lean production, economical sustainability, environmental impact	28,5	32	0	30	9,5
DP in Electrical Engineering (Bachelor)	electrical safety, renewable energy, energy efficiency	8,5	54	4	14	19,5
DP in Energy and Environmental Engineering (BSc)	sustainability, comprehensive view, work load, working methods, respect	47	41	0	12	0
DP in Industrial Management and Engineering (BSc)	insight, realism, global responsibility, learn to learn, combined efforts, a good environment in a broad spectrum	0	75	25	0	0
Information Technology	lifecycle, context, platform	0	50	45	5	0
DP in Mechanical and Production Engineering (BSc)	technical and energy efficient construction unities by taking into account social and technical sustainability	0	100	0	0	0
DP in Technology Based Management (Master)	insight, leadership through dialogue, measurability, value-based business knowledge, technology as driver, sustainable profitability and strong together	0	100	0	0	0
Degree in Tourism		7	57	36	0	0
DP in Tourism Management (BSc)	sustainable tourism, socially sustainable tourism, economic. sustainable tourism, culturally sustainable tourism	7	57	36	0	0

6. Conclusions and future perspectives

The aim of this study is to explore characteristics of change management at universities, to identify factors that influence HESD enhancement by making use of quality assurance from a change management perspective and studying how the theory can be applied at a university.

Universities will change, on many levels, for which we argue that HESD will play an important part, because socio-cultural and technical change factors as well as political and economic factors have a great impact on them.

Factors that should be considered at a university for a change are the variety of individuals that the faculty and administrative staff consist of, which should be involved by for example getting insight in the change, being involved in decision making and granted freedom to progress the change in accordance with the culture.

We argue that management systems could be used as tools for hard changes and support the soft change of enhancing HESD with management systems (see Table II). For succeeding with a soft change in public sector, which we have applied for universities, it is important to take into consideration the cultural web and especially the informal organization with their disciplinary loyalty and academic hierarchies. Based on this we consider that a university would first define how it wants to enhance HESD and for what purposes it has a management system, on the strategic level. After that the management could divide the strategic goals into objectives with time targets and appoint those responsible among the faculty and staff. For phases in the implementation of a management system involving faculty and administrative staff in the goal setting is recommended, where possible. For phases that are compulsory, for example following the legislation, it is necessary to find out what has to be done and document needed routines.

Resistance to change could be benefitted for further development of the change in creating discussion within different disciplines. It is also important to realize that the culture at a university is bureaucratic, several levels of management need to be reached for commitment both within and outside a university and that the culture differs among the units, which means that successful methods used might differ between the departments. One way to get an insight into different cultures at different units in a university could be to ask faculty and administrative staff to give their view of the capacity of change at the university.

A soft approach for change, the OD model, was further developed for enhancing HESD by making use of quality assurance at universities. Compared to the OD model by Senior and Swailes (2010) the differences in the developed model are a need to: recognize the need of change, identify leadership competencies, involve all stakeholders, include vision, commitment, training and collaboration in the action plan, and institutionalize new approaches.

The model was applied at a university for enhancing HESD with an integrated management system for quality and environment. Steps for strengthening the change could be identified by applying the model.

This study is not without limitation, it is a single case study and one of the authors has been engaged in the change-management process at Novia, which could lead to unconscious biases and partial perspectives. This also means that the author has insight in the process.

We consider that the results could be used by other universities for enhancing HESD. Future studies could be about applying the model at other universities, or to develop the model further for other changes, based on literature for that.

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V

Process model for integrating education for sustainable development and identifying sustainability aspects in university curricula

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Process model for integrating education for sustainable development and identifying sustainability aspects in university curricula

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Abstract

The decision to promote education for sustainable development more actively in the future was taken at the Rio + 20 UN Conference on Sustainable Development in 2012. Universities are globally required to have quality assurance to secure and improve teaching and learning, and they use management systems to this aim. A common feature in education for sustainable development and management systems is that they are based on continuous improvement and systematic thinking and involve all stakeholders. Although quality assurance is compulsory, education for sustainable development has barely been examined or integrated in this context. In this article, it has been examined whether a voluntary integration of education for sustainable development into management systems at universities could facilitate to overcome challenges identified in previous research. Action research was chosen as methodology because there are not already implemented approaches using quality management for promoting education for sustainable development, why the only way to study this is to make it happen. A process model for integrating education for sustainable development with management systems was developed based on identified drivers and barriers, and piloted at 11 Nordic universities. This process including planning, assessment, monitoring and implementation of education for sustainable development was used to identify relevant sustainability aspects in different disciplines. We found that the process model could be applied as concrete model for enhancing education for sustainable development in management systems of universities. Sustainability aspects could be identified in many fields.

KEY WORDS: Higher education; Management systems; Process model; Quality assurance; Relevant sustainability aspects; The Nordic countries

List of acronyms: DESD: Decade of Education for Sustainable Development; ESD: Education for Sustainable Development; HE: higher education; ISO: International Standardization Organization; QA: Quality Assurance; TQM: Total quality management

1. Introduction

The World Symposium on Sustainable Development at Universities, in June 2012, was a parallel seminar to Rio +20 United Nations Conference on Sustainable Development. At the symposium, ideas and experiences relating to education for sustainable development (ESD) at university level, were presented, documented and disseminated (Leal Filho, 2012). Many initiatives have been taken, for implementing ESD in the curricula, university activities, research and outreach. The overall impression was that there is still much to do for promoting ESD. According to Lozano et al. (2013), sustainability aspects should be included throughout universities, in all tasks, for ensuring ESD. One conclusion of Rio + 20 was that integration of sustainability aspects into education will be promoted more actively beyond the UN Decade of Education for Sustainable Development (DESD) (UN, 2012). Examples and best practices were presented also at the European Roundtable on Sustainable Production and Consumption and the Environmental Management for Sustainable Universities (ERSCP-EMSU) conference in Istanbul in June 2013, , yet none of the conferences dealt with quality assurance.

Leal Filho (2011) identified four challenges that are crucial for implementation of sustainable development or ESD in HE. Two challenges have to do with communication; to interpret sustainability in a wider meaning inclusive terms, as well as translating it directly to different stakeholders. The third challenge states need to raise further financial support and commitment from management and various stakeholders. The fourth challenge claims need for concrete projects that would demonstrate what can be achieved, how and why.

Based on a literature review of articles on ESD in HE in the period 2003- 2011, Karatzoglou (2013) found that there is need of research based on the entire Deming cycle; planning, feedback, measurement and corrective actions processes. Management systems are used for administration of quality assurance in universities. Management systems are based on the Deming-cycle (Deming, 1982). ESD and management systems are both based on total quality management (TQM), which means continuous improvements and systematic thinking involving all stakeholders. Quality assurance is compulsory in HE globally, and aims to secure and improve teaching and learning (Ewell, 2010; Kliot and Bykovskaya, 2011; Yuan, 2010). It is owned by, and therefore, prioritized by management, but to our knowledge only one article examines ESD and quality assurance, which was done in the UK (Ryan and Tilbury, 2013). Ryan and Tilbury (2013) suggest that connecting of ESD and quality can change the importance of ESD. Yet, it remains to be studied whether voluntarily management systems help to overcome the identified challenges. With ESD it is important to recognize that you are implementing a change, with enablers and barriers (Exter et al., 2013) and an organizational change needs to overcome the barriers and institutionalize new approaches (Smith, 2011).

In this applied interdisciplinary study our aim is to fill the gap in research about whether compulsory quality assurance demands could support ESD. Drivers and barriers for enhancing ESD and for implementing management systems has been examined. Results from a developed and piloted TQM process model are presented. The challenges identified by Leal Filho (2011) are taken into account, by showing examples of sustainability aspects that are considered relevant in different disciplines. The aim is to open up the concept for faculty, and to raise further support for enhancing ESD in different disciplines and management. The sustainability aspects have been identified by applying the developed process model at several Nordic universities. The Nordic countries, which consist of Denmark, Finland, Iceland, Norway and Sweden, have a long standing tradition for quality assurance based on values compatible with education for sustainable development, yet not integrated so far. According to the Nordic Council of Ministers and national strategies the region aims at becoming one of the leaders on education for sustainable development (Nordic Council of Ministers, 2009, 2011). This requires both resources as well as discussion about whether existing quality assurance systems are compatible with education for sustainable development. The model includes planning, assessment, monitoring and implementation of ESD, and could be used in quality assurance work.

2. Methods

No studies with implemented approaches using quality management for promoting ESD were found. Because of this we identified that to study this there is a need to make it happen, for which action research was chosen as methodology. Another reason for choosing this approach is because action based research is suitable for involving faculty and administrative staff, which, according to Cortese (2003) is important for enhancing ESD in a university. It is a methodology in which the action researcher and other participants collaborate in diagnosing a problem and developing a solution. Action based research is mainly criticized for its lack for repeatability, lack of severity and for concentrating too much on action at the expense of findings (Bryman and Bell, 2011). We have taken these risks into consideration by explaining each step and by presenting the results on seminars (see Figure 1). The aim was to do applied valid, reliable research, which could be applied by university faculty and management. Since the results are meant for action, we think it is important that the results are based on action, and not only theory.

The objectives are (a) to develop a process model for including ESD in management systems, which are applied for quality assurance, in HE; and (b) as a result, to identify and publish examples of relevant sustainability aspects in different degree programs in all kinds of institutions of HE (collectively referred to in this paper as "universities") in the Nordic countries, by applying the model.

A detailed project plan was prepared, based on action research. The model consists of the following phases: a) diagnosing, b) planning action, c) taking action and d) evaluating action (Coghlan and Brannick, 2007; see Figure 1). The research was made in a project called Education for Sustainable Development in Academia in the Nordic countries (ESDAN).

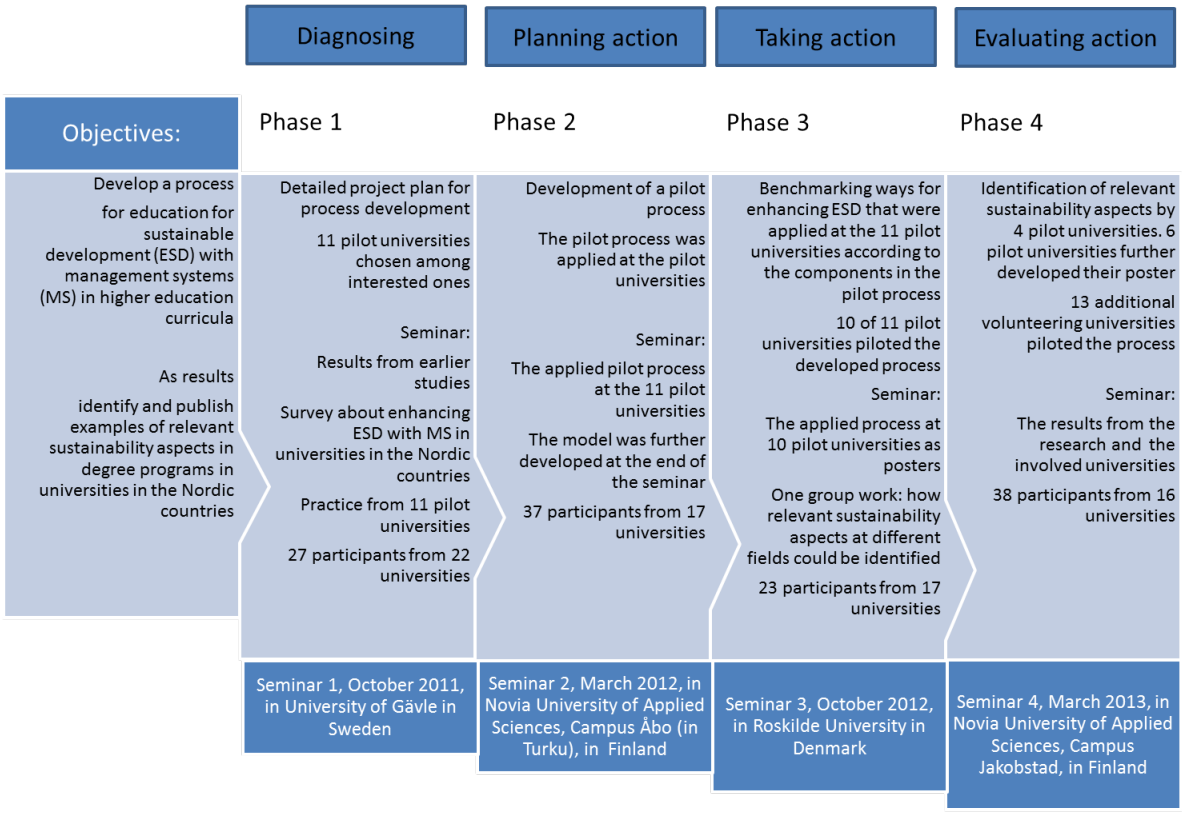

Figure 1. Developing a process model for enhancing ESD with management systems in the Nordic countries.

In phase 1 the theory was elaborated. Results from earlier studies about enhancing ESD and how compulsory quality assurance demands could be used for enhancing ESD in HE were explored, which is presented in chapter 3.

The research sites, respondents and measurement methods were chosen, and data collection began. A variety of methods were chosen for validity.

The aim was to involve as many universities as possible in the model development, for reaching the goals that by applying the model a university would overcome the identified challenges, which would be put in practice, and be disseminated. To serve the purpose, four open seminars were organized at different universities in different countries, to make it possible for any interested faculty to join a seminar, study the results and participate in the study. The marketing of each seminar was started four months in advance through national and regional networks to allow early scheduling. A survey about enhancing ESD with management systems in universities in the Nordic countries was conducted, which 27 universities answered. The results are presented in Holm et al. (2012; In Press). The number of participating pilot universities had to be limited to 11 due to budget reasons. Universities from three of the five Nordic countries were chosen, with the aim to choose a broad sample of universities of different sizes and foci. To examine the potential of TQM in various contexts, a mix of universities that were leaders in the development of ESD and/or MSs, and those that were not, was chosen. The additional 13 volunteering universities that piloted the model in phase 4 were recruited by showing how the model could be applied, at national network meetings and by e-mail.

Practices in the 11 pilot universities (see Table 1) were documented, according to instructions that were presented and discussed in the end of each seminar. Results were triangulated and verified by presentations and discussion with the stakeholders at four seminars (see Appendix B, on page 62). The themes suggested by Lozano et al. (2013), i.e. collaboration, fostering transdisciplinarity, on-campus experiences, organizing training for educators and the institutional framework, were addressed in the four phases for validity.

In phase 2 the development of the process model was planned. An initial pilot process model was developed as group work among the participants of the first seminar, based on the results of phase 1. The results are presented in Holm et al. (2012).The pilot process model was applied at the pilot universities, documented and presented at the second seminar. The model was further developed as group work focusing on the challenges identified by Leal Filho (2011).

Table 1. Participating pilot universities.

Country	University
Denmark	Copenhagen Business School
	Roskilde University
	University College Sjælland
Finland	Novia University of Applied Sciences
	University of Eastern Finland
	University of Tampere
Sweden	Kristianstad University
	Umeå University
	University of Gothenburg in cooperation with Chalmers University of Technology
	University of Gävle

In phase 3 the final process was applied. Ways for enhancing ESD applied at the 11 universities were benchmarked, based on the individual components in the model (see Appendix C, on page 64). Ten of the eleven pilot universities tested the developed model, by applying it at their university. The results were presented as posters, which showed how the model was applied including organizing seminars, training for faculty and staff, and discussions on this topic at meetings. At the third seminar one group worked with methods of identifying sustainability aspects in different disciplines in universities. Another group worked with further development of the model and its dissemination to several universities in the Nordic countries.

In phase 4 the actions taken were evaluated. The pilot universities were responsible for applying the process model, with the aim to identify examples of relevant sustainability aspects in their universities. During November 2012- January 2013 the model was further piloted by 13 volunteering Nordic universities, which had not been taking part in the development.

The theoretical findings are presented in section 3.1, the process model in section 3.2 and the findings from applying the model and discussion in section 4.

3. Results

3.1. Compulsory quality assurance demands as a means for enhancing ESD in HE

In this section the challenges identified by Leal Filho (2011) are discussed in more detail. Drivers and barriers, identified internationally and in the Nordic countries, for enhancing ESD are followed by those identified for implementing management systems in HE.

3.1.1. Drivers and barriers for enhancing ESD in HE

The objective for ESD in HE is to ensure that graduates are able to take economic, ecological and social aspects into account when making decisions (Sibbel, 2009). Identified aspects for ESD are systematic and critical thinking and attitudes (Rieckmann, 2012).

The main driver for ESD has been that UN chose the decade 2005-2014 to enhance it globally (UN DESD, 2011), for which regional and national strategies have been developed. All the Nordic countries have either ESD strategies, or enhancement of ESD belongs to their overall national sustainability strategy (Holm et al., 2012). Another driver are the voluntary declarations that universities can commit themselves to. From 1972 until 2010, at least 25 different international declarations stressed ESD in HE (Grindsted and Holm, 2012). The latest declarations are the Higher Education Sustainability Initiative, and the Rio+20 Treaty on Higher Education which were prepared for Rio +20. These differ from earlier declarations, in that by signing these, rectors must also state what their university will do to enhance ESD (Copernicus Alliance 2013; UNCSD, 2012). The rectors could be expected to work for carrying out the changes to which they have publicly committed themselves. Identified benefits for successful implementation of environmental initiatives in HE were evolution and development of education and research, specialization of graduates and diffusion of knowledge to society (Evangelinos and Jones, 2009).

In many countries around the world sustainability aspects have been included in the HE curricula, but not without difficulties (Læssøe et al., 2009; Stephens et al., 2008). Limited teacher qualifications, existing disciplinary boundaries or subject separations and an overcrowded curriculum are identified as the main barriers to overcome mainstreaming of ESD in the Nordic countries (Læssøe et al., 2009). These resemble two of the challenges identified by Leal Filho (2011) regarding ESD interpretation and wider communication. Christensen et al. (2009) identified three reasons for why sustainability work declined after a promising start at Aalborg University in Denmark, one of the first universities in Northern Europe to enhance sustainability. These were lack of commitment from top management, rejection by technical staff and a narrow definition of the environmental impact of the university. It focused on administration but should have included also the impact from the main tasks: education, research and outreach. Christensen et al. (2009) estimated that only 5 % of educational programmes delt with sustainability issues at Aalborg University. Similar results were obtained by Lozano (2010) at Cardiff University in England, where he found that linking ESD in and among different disciplines could facilitate the capability of graduates to take sustainability aspects into consideration in the future. Holley (2009) studied how 21 research universities in the United States succeeded in

meeting the increasing demands for interdisciplinary knowledge. The results showed that the success for enhancing interdisciplinary studies is gained by supporting other priorities, like specific characteristics and priorities that each campus has. According to Stephens et al. (2008) one successful way to enhance ESD in HE is by transdisciplinary case studies, which enhance ESD both for involved faculty and participating practitioners, and can further result in co-authored studies. Also Barth et al. (2007) found that combining formal and informal learning settings are relevant for developing competencies for ESD in HE.

The situation in the Nordic countries concerning the third challenge identified by Leal Filho (2011), the need of further support, is that ESD indicators are lacking from the quality assurance demands in all countries and a demand to enhance ESD is missing in the HE legislation in all countries but Sweden (Holm et al., 2012). We consider that the absence of ESD demands cannot directly be seen as a barrier, but rather that a driver is missing. An exception of this is the Swedish legislation, which still does not include any legal sanctions if not followed, and can so be seen to have only a symbolic value (Sammalisto, 2007). Evangelinos and Jones (2009) observed that a high staff and faculty turnover and lack of targets for completed work at each function are obstacles for successful implementation of environmental initiatives in HE. Dahl (2012) studied indicators of progress towards sustainability and noticed that they are not sufficient. According to him, there is need for indicators for change, for national sustainability targets that could be measured, for global indicators and indicators for individuals that would reflect progress and provide positive encouragements, as well as for value-based indicators.

Choosing the change leader team, motivational methods, communication and assessing are keys to success for a change (Exter et al., 2013; Mento, et al., 2002). According to Sol et al. (in press) social learning is more likely to create a change. Trust, commitment and reframing are relevant aspects for social learning. According to Lozano (2008), collaboration is the fastest way to an optimal results and it is useful when striving for more sustainability oriented organizations, because through collaboration individuals understand that they are a part of a larger system. It is important to collaborate both internally and externally with stakeholders, global organizations and governments. The greater the social capital is, the higher the probability that collaborators will act in a joint way for the common good (Lozano, 2008), which indicates that sustainability aspects would be easier to enhance at a university that in a company.

According to Nicolaides (2006) and Sammalisto (2007) an environmental management system could be implemented at a university for enhancing sustainability aspects. According to Leal Filho (2011) one identified barrier for enhancing ESD in HE was poor commitment of management. In the next section the possibility to integrate ESD into quality management systems is discussed.

3.1.2. Drivers and barriers for implementing quality management systems in HE

Quality assurance in HE aims at continuous improvement of quality of education (Federkeil, 2008; Pratasavitskaya and Stensaker, 2010).

Brookes and Becket (2007) conducted a study concerning quality management in HE in 34 countries, which also included studies from some Nordic countries. According to them, the foremost driving forces for developing quality management are external demands. National demands for quality assurance exist all over the world (Ewell, 2010; Kliot and Bykovskaya, 2011; Yuan, 2010). In Europe, the national demands are based upon the Standards and Guidelines for Quality Assurance in the European Higher Education Area, which were adopted in 2005, and followed by the European Quality Assurance Registry for Higher Education, ENQA, established in 2007 (Amaral and Rosa, 2010). In the Nordic countries, the demands for quality assurance in HE are similar, determined by national agencies in collaboration with stakeholders (Franke, 2002; Saarinen, 2005; Thune, 2001). Neither the European nor the Nordic demands include ESD.

The most popular tools for quality assurance in HE are quality management models developed for industry (Brookes and Becket, 2007). These are based on the so-called Deming-cycle that consists of the following parts: plan, do, check and act, and which is the basis for TQM (Deming, 1982). The TQM approach means that all major aspects of continuous improvement are taken into account among personnel, customers and stakeholders, with the overall aim of exceeding the expectations of customers (Jørgensen et al., 2006). We do not claim that a management system based on TQM model is

the only possibility, but have used it to provide structure for our study.

Identified benefits of adopting quality management models in HE are that strategic approaches to quality measurements are chosen, that problems are identified and resolved, and that quality improvements are selected (Bagaoutdinova et al., 2012; Brookes and Becket, 2007; Rabee, 2012). According to Rabee (2012) application of TQM can improve education through improvement of the students' satisfaction. It proves that the university ensures training to guarantee that employees are capable of performing their tasks to meet the needs of quality and that management focuses on improved internal communication. Since TQM is based on the fact that things measured can be improved, it is up to the university if ESD enhancement is assessed or not.

Development of quality management in HE has not followed the path of industry (Fisher and Nair, 2009; Wiklund et al., 2003). Quality management does not seem relevant for universities, it is considered to be appropriate only for manufacturing and the concept of TQM is considered vague. There are also some problems when comparing HE and companies, as the processes are different; education research and development versus production of goods or services. Then again, both learning outcomes and results from research and development can be seen as services, as processes of universities. Brookes and Becket (2007) noted that there are limitations in applying standards developed for industry to HE, especially concerning quality management. According to Rosa et al. (2012) ISO standards do not have a full potential to cover the demands established by ENQA, but they allow universities to go beyond quality assurance into quality enhancement. It is up to the universities to decide how they implement the demands in the standards and to focus on the main tasks.

Graduates development into critical and creative thinkers is an objective for ESD in HE (Rieckmann, 2012). Students can be involved in problem based training and co-operative work by applying the Deming model at an educational institute (Crawford and Shutler, 1999). According to Isaksson (2006) system based process models can be used to describe synergies between sustainable development and TQM. Sabet et al. (2012) found that two key elements in TQM implementation are commitment and teamwork. Another aspect to take into consideration is the relationship between rewards and recognition, or motivation and high performance. They also found that for succeeding with TQM it is vital to offer training for the personnel about TQM (see also Crawford and Shutler, 1999). They found that implementing the Deming model in HE is dependent on training for teachers. Such training should include goal-setting, efficient education and evaluation of the quality of education. In another study in HE, six critical factors were identified for implementing TQM (Asif et al., 2011). These were leadership, vision, measurement and evaluation, process control and evaluation, program design, and stakeholder focused approach.

Drivers and barriers for enhancing ESD and for implementing management systems in HE are summarized in Table 2.

Table 2. Summary of drivers and barriers for enhancing ESD and for implementing management systems in HE, identified internationally and in the Nordic countries.

	Drivers	Barriers
Enhancing education for sustainable development (ESD) in higher education (HE)	UN DESD 2005- 2014 International and national ESD strategies HE declarations for ESD Management commitment Linking ESD within and among disciplines Combining formal and informal learning Supporting campus priorities/ projects Goals and indicators Collaboration, internally and externally	Limited teacher qualifications Disciplinary boundaries Subject separations Overcrowded curricula Narrow definition of environmental impact at some universities, focus on administration, which should also include impact from the main tasks: education, research and development and outreach.
Implementing management systems in higher education (HE)	International and national quality assurance demands Management systems, based on TQM, encourages identifying and solving problems, which improves education, human resources and management Go beyond quality assurance into quality enhancement	Does not seem relevant It is considered to be appropriate only for manufacturing Limitations to cover quality assurance demands for HE

3.2. The process model for enhancing ESD with management systems.

The process model, presented in Figure 2, for enhancing ESD with management systems in HE was developed during the second phase of the project (see Figure 1).

The Deming cycle was chosen as framework because according to Crawford and Shutler (1999) and Isaksson (2006) it can be applied for enhancing ESD in HE, and according to Karatzoglou (2013) there is need for ESD research based on the Deming cycle. The Deming cycle is based on the four phases plan, do, check and act (Deming, 1982).

The main identified driver for implementation of management systems in HE was external demands (Brookes and Becket, 2007). Both the legislation in all Nordic countries but Sweden and the quality assurance demands in all these countries so far lack a demand for enhancing ESD (Holm et al., 2012), which indicates that the only external demands in the Nordic countries for implementing management systems are the compulsory quality assurance demands. According to Rosa et al. (2012) quality models developed for industry, that are based on TQM, do allow universities to go a step further than if they only considered the quality assurance demands for HE, as long as they choose to focus on their main tasks, education, research and regional development. Identified benefits of following TQM in HE are: improved education, human resources and management, and strategic approaches to quality measurements and management (Bagaoutdinova et al., 2012; Brookes and Becket, 2007; Rabee, 2012). According to Lozano et al. (2013), ESD can be ensured in HE if sustainable aspects are integrated throughout. This is one of the reasons why a TQM approach was chosen to the model.

Identified factors for succeeding with TQM in HE are vision, leadership or commitment, teamwork, a correlation between motivation and high performance, training in TQM, process control and evaluation, measurement and evaluation, program

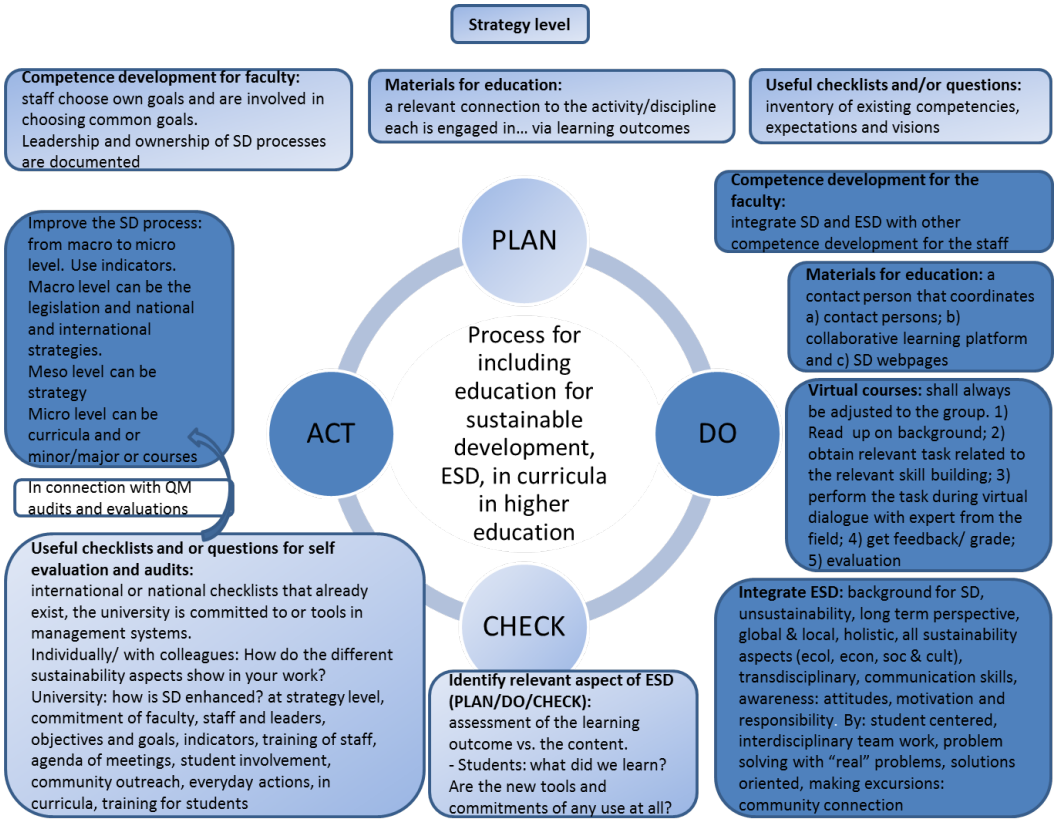

Figure 2. The developed process model for enhancing ESD with management systems in HE.

design and stakeholder focus (Asif et al., 2011; Crawford and Shutler, 1999; Sabet et al., 2012). The model is based on these aspects, with the exception of a correlation between motivation and high performance as can be seen in Figure 2.

In next sections the different parts of the process model in Figure 2 are presented, and how the identified drivers and barriers, summarized in Table 2, have been taken into account.

3.2.1. Plan

Certain features were recognized as important for enhancing ESD which ought to be taken into account during planning. The first of them is commitment of management (Christensen et al., 2009; Leal Filho, 2011), which is supported in the model by including ESD on the strategy level. Another important feature is linking ESD within and among different disciplines (Lozano, 2010), which is considered in the model by organizing training for faculty and by planning materials for education. These ought to have a relevant connection to the activity or discipline each faculty member is engaged in. This is supported via learning outcomes and useful checklists and/or questions for inventory of existing competences, expectations and visions. According to Evangelinos and Jones (2009), it is significant to choose goals for each unit. This is considered in the model by involving staff to choose both common goals and its own goals; in order to enhance ESD and document leadership and ownership of sustainability processes. The national strategies for ESD in the Nordic countries include targets (Holm et al., 2012). In the targets for Rio + 20 no global goals for ESD are mentioned for HE, even though ESD was chosen to be enhanced beyond the DESD (UN, 2012). Based on a study by Dahl (2012), the model takes into account the possibility that universities could have their own goals, and even separate goals for faculty, staff and students, and even for individuals.

3.2.2. Do

The next step after decision and plans are made to enhance ESD is fulfillment of the plans. The reasons for not understanding ESD broadly enough included teachers' limited qualifications, disciplinary boundaries, subject separations, overcrowded curriculum and a high percentage of turnover of staff and faculty (Christensen et al. 2009; Evangelinos and Jones, 2009; Læssøe et al., 2009; Leal Filho, 2011; Stephens et al., 2008). Identified solutions for the mentioned barriers in earlier studies are: communicating ESD to different stakeholders, concrete projects that show what can be achieved and why, linking ESD with subjects and disciplines, implementing an EMS by which ESD could be enhanced, and collaboration both internally, externally with stakeholders and governments, and globally (Leal Filho, 2011; Lozano, 2008; Nicolaides, 2006).

These factors have been taken into account in the process model by: 1) including planning and training for faculty in ESD, preferably integrated with other matters; 2) managing materials for education, by appointing a contact person who coordinates contact persons, a collaborative learning platform and webpages; 3) developing virtual courses in ESD adjusted to the group that consist of the following parts: background, relevant task, performing the task, feedback / grade, and evaluation; 4) integrating ESD by focusing on background for sustainable development, unsustainability, long term perspective, both global and local perspective, holistic view considering all sustainability aspects: ecological, economic, social and cultural, transdisciplinarity, communication skills, and awareness by focusing on attitudes, motivation and responsibility. This could be reached by choosing student centered, solutions oriented interdisciplinary team works, with "real" problems and by making excursions for community connection.

3.2.3. Check

Development of measurement and evaluation are important for succeeding with TQM (Asif et al., 2011). In the model this is taken into consideration by both identifying relevant aspects of ESD and applying useful checklists and/or questions for self-evaluations and audits. They can be connected with quality management audits and evaluations. When relevant ESD aspects have been identified the learning outcomes could be assessed in relation to the course content. Students could be asked what they have learned and if the new tools and commitments have been useful. It is recommendable to use already existing international and national checklists the university is committed to or tools in management systems. Observed sustainability aspects in different functions could be

discussed individually or with colleagues. At the university level focus areas are the status of ESD at the strategy level, commitment of faculty, staff and leaders, objectives and goals, indicators, training of faculty and staff, agenda on meetings, student involvement, community outreach, everyday actions, in curricula, and training for students, which all could be checked.

3.2.4. Act

Finally, based on results from evaluations different kinds of practices are considered for implementation. In the model improvements are divided from macro to micro level, in which indicators are helpful. The macro level corresponds to legislation as well as national and international strategies. According to earlier studies by Lozano (2008), Sol et al. (in press) and Stephens et al. (2008) university faculty could cooperate more with governments, NGO's and businesses to foster partnerships at local, regional, national and global levels for enhancing more sustainable societies. The meso level could be the strategy level of universities. The micro level could be curricula and minors' or majors' courses. Since the main drivers for enhancing ESD according to earlier studies were international and national strategies and declarations (Grindsted and Holm, 2012; UN DESD, 2011; UNCSD, 2012), these could be used in the development of ESD.

In the next section examples of application of the model, at the pilot universities, is presented. The results were recognized during the four phases presented in Figure 1.

4. Discussion, application of the model in the universities

The process model presented in Figure 2 was applied at 10 of the 11 pilot universities during the third phase of the project, in order to make identification of examples of relevant sustainability aspects possible for the fourth phase of the project.

4.1. Results from applying the model

The universities applied the model by documenting the actions for enhancing ESD at their university in a poster. The posters differed from each other but all could apply the process in one picture around the cycle. One example is provided in Figure 3, which is chosen because Novia University of Applied Sciences has worked with enhancing ESD with management systems for a decade, and was the only pilot university that had an integrated management system for quality and environment.

In one pilot university workshops were organized in which themes and learning objectives for ESD were compared with objectives of different disciplines. Based on the discussion, courses labeled to promote ESD in curricula were listed and a 25-credit optional study module in sustainable development was put together. At one university discussions were going on in faculty and department meetings about what ESD could mean in various disciplines. In one university, a group of teachers interested in ESD held meetings. Several universities mentioned that they had arranged inspiration days dealing with various sustainability aspects for students, faculty and staff. One pilot university had created a webpage with ESD tools and a web based course in sustainable development.

Two pilot universities that applied an ISO management system had integrated the audits. Integration would encourage their prioritization equally, since quality assurance is compulsory, while taking sustainability aspects into account is not. Different assessment methods that enhance ESD were also identified. For instance, at two universities the first year students answered a survey about their knowledge, awareness and actions for sustainable development, and the same survey was repeated during their final year. Another university sent a questionnaire to alumni, in this case four years after graduation, in which they were asked which competencies they considered most important in their work with sustainability issues. Three universities classified their courses according to how sustainability aspects are taken into account. Several universities had secured support for ESD in their quality management system. One university had formulated a list of sustainability aspects based on the national degree ordinance and their perception of the competence of systems thinking for ESD. The list was used to analyze the intended learning outcomes; in teaching, by looking into texts in lecture handouts and exercise instructions in the teaching process; and in assessment, by looking into questions in written exams and tasks in compulsory hand-ins and projects. At one university all researchers applying for internal funding were asked, among other things, to reflect and indicate the degree of contribution their project had to social, economic and ecological dimensions of

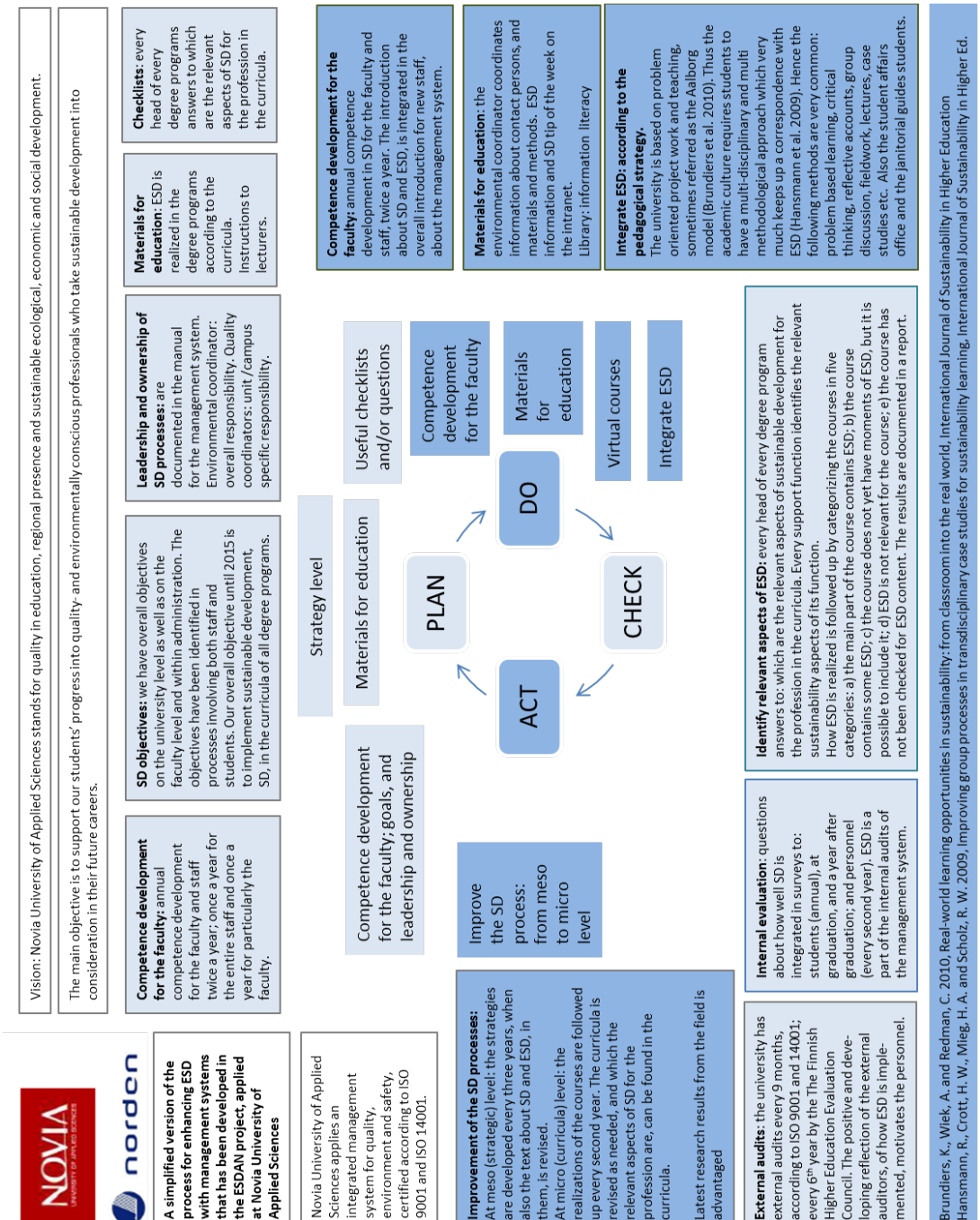

Figure 3. A simplified version of the process model for enhancing ESD with management systems, applied at Novia University of Applied Sciences. Acronyms used: DESD: Decade of Education for Sustainable Development; ESD: Education for Sustainable Development; SD: Sustainable development; QA: Quality Assurance.

Table 3. Examples of relevant sustainability aspects in HE curricula in the Nordic countries, based on reports from four universities.

Field of studies	Number of degree programmes (∑ four universities)	Number of Universities	Relevant sustainability aspects
Humanities and Education	2	2	Participation, multiculturalism, equality, experience teaching
Natural Sciences	2	2	Products and solutions that are sustainable, environmentally friendly, energy efficient and safe, GIS, environmental stress, sustainable societies.
Natural Resources and the Environment	4	1	Sustainable production of nature, agriculture and forestry. Ecosystem services. Bioenergy. Coastal areas.
Social Sciences, Business and Administration	4 (Business Administration)	3	Corporate environmental work and management, holistic economics, global requirements and intercultural communication, values, professional ethics, lifelong learning, risk management, knowledge of cultures, taxation.
Social Services, Health and Sports	13	2	Promote and maintain functional ability, health, safety and wellness. Global responsibility, ethics and attitude, clinical skills, multi-professional, leadership.
Technology, Communication and Transport	22	3	Sustainable technical solutions with regard to human resources, organizations, cultures, surroundings, natural resources and local environment, cradle to cradle, security, health, risks, energy-, material- and cost effectiveness.
Tourism, Catering and Domestic Services	1 (DP for Tourism Management)	1	Plan, produce and develop services in accordance with local and global requirements, and taking into account the sustainability aspects.
Culture	7	1	Cultural, social, artistic and substantive spiritual plane. Ethically, aesthetically, ecologically and socially responsible. Products that are qualitative in the long run.

sustainability and/or to holistic thinking. One university mentioned that internal sustainability audits and –seminars help keeping ESD issues in mind and in action agendas.

Characteristics that may influence possibilities for change in HE are climate for change, level of alignment, regional-specific sustainability aspects, financing and aims of financers, institutional organization, communication and interaction with society (Holley, 2009; Stephens et al., 2008). Aspects to consider are choice of the change leader team, motivation methods, communication and measurement, and importance of social learning (Exter et al., 2013; Mento, et al., 2002; Sol et al., in

press). Successful methods for enhancing interdisciplinary studies, including ESD, are supporting different priorities that each campus has and by combining formal and informal learning (Barth et al., 2007; Holley, 2009; Stephens et al., 2008).

In the final evaluation of the ESDAN project the participants answered that the following aspects were important for them as change leaders for ESD at their universities: being a specialist and pushing the work in the chain of command; spreading instructions; noticing possibilities; positive thinking; being able to discuss with people from different disciplines; being part of senior faculty when discussing ESD; using the connection between ESD and MSs; and networking with community and other universities, also regionally. Difficult issues or experiences included the following: taking two steps forward and one or several back; being patient and humble when having to explain things once more; engaging more teachers, program leaders, senior management and also those already interested, by empowerment and participation. These aspects are the same as contributors to a successful change identified in earlier studies in section 3, which indicates that our results correlate with them.

4.2. Identified sustainability aspects

The examples of identified sustainability aspects are summarized in Table 3 in fields of studies, according to the categories in Finland. The summary is based on results from four universities because the universities that participated were in different stages of enhancing ESD. For identifying sustainability aspects in different disciplines faculty has to be involved, which takes time. For the other six universities the schedule was too tight for documenting sustainability aspects for different disciplines. In the final evaluation of the ESDAN project five pilot universities answered that the development of their ESD work would not have taken place without the project, and four answered that it would have, or had already, but not to the same extent and with same speed. Many answered that it had helped to structure the work. In addition to the 10 pilot universities 13 other universities in the Nordic countries piloted the process model during November 2012 - January 2013. Of these two answered that they had applied the process model to some extent, and three that they might apply it in the future.

Ways of identifying relevant sustainability aspects in HE are summarized in Figure 4, a result of a group work during phase 3 in the project. The aim is to create awareness of ESD by a systematic view or perspectives. It was mentioned that central things to consider were a long time perspective and future orientation, like trends and scenarios. Questions for

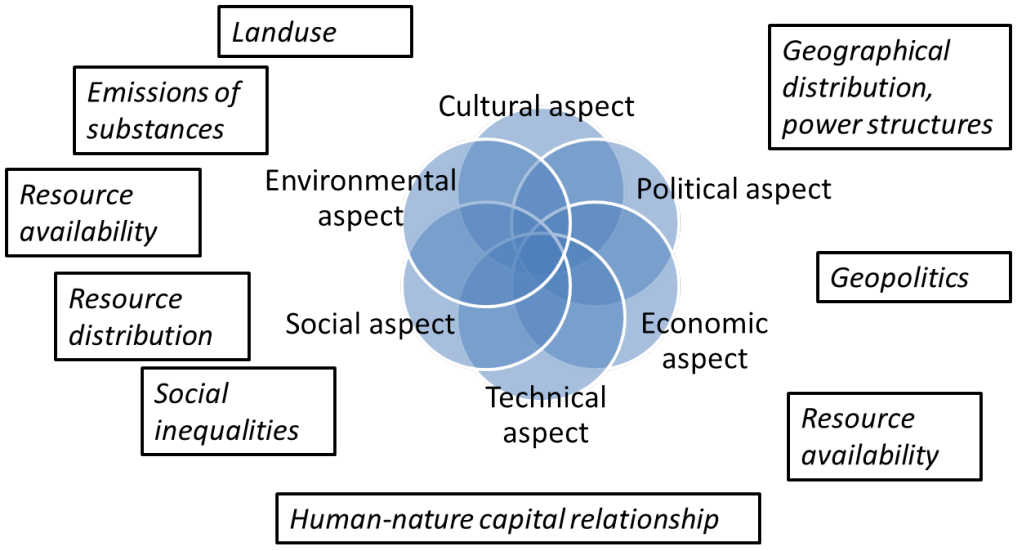

Figure 4. Identification of relevant sustainability aspects at different HE disciplines.

group works included the following: what is the carbon footprint of the food we eat; what is the water footprint for products or the food we eat; and how to cope with the complexity of ESD issues- how to combine calculations made from different perspectives?

The results supplement each other. Figure 4 stresses that all sustainability aspects should be considered, while Table 3 shows that relevant sustainability aspects differ among disciplines.

4.3 Conclusions about the process model

Compared to the challenges identified by Leal Filho (2011) we argue that the main advantage of including ESD into a management system, which is applied for quality assurance, at a university is that the actions will be monitored and the entire process developed further based on experience. Decision-making and clear documentation of leadership and ownership of ESD processes, and inclusion of ESD in the strategy level, could enhance commitment and strengthen the financial base of the ESD activities. By organizing training for faculty and staff by integrating it with other training could facilitate communication of ESD to different target groups. The process model could be applied at 11 different universities, by using it to demonstrate how ESD is enhanced in one picture. The examples could be interpreted by looking into what is done and how, and which parts of the model that are lacking at different universities.

Based on the results from a group work in the third phase of the project, the model could be further used for the following identified features: by producing results that could be monitored to assess progress and for disseminating more applied methods of teaching, like problem based learning (PBL), or Conceiving — Designing — Implementing — Operating real-world systems and products (CDIO). Students, alumni's, teachers, researchers, companies and staff could be mobilized in interdisciplinary ESD. The process could be owned by several persons in different units of the university and integrated in already existing processes, for example change processes, rather than being dependent on individuals. This cannot be avoided, but a shared ownership might support those responsible.

The model is more focused on students and teachers and less focused on external cooperation and a link to other university functions. These aspects could be applied in the model, which indicates that it is up to the ones who apply the model what they will include.

5. Conclusions and future perspectives

The aim of this study was firstly to develop a process model for including ESD in management systems, which are applied for quality assurance, in HE; and secondly as a result, to identify and publish examples of relevant sustainability aspects in different degree programs in universities in the Nordic countries, by applying the model.

A process model (see Figure 2), based on TQM, was developed in cooperation with 11 Nordic universities based on identified drivers and barriers for enhancing ESD and for implementing management systems in HE (see Table 2), and the experiences of the participating universities. All levels and stakeholders are taken into account in the model, which includes planning, assessment, monitoring and implementation of ESD. 10 universities applied the model, and four of these identified relevant sustainability aspects in different disciplines (see Table 3), which according to an earlier study could help the ability of graduates to take sustainability aspects into consideration. The implication of this study is that the model can be used for enhancing ESD in universities.

The study is unique because a concrete model is presented, that can be applied (see an example in Figure 3) for quality assurance, which is compulsory, and therefore a possible approach to advantage for enhancing ESD. The model is based on the Deming-cycle and can be used in or as a part of a management system. It could be used for benchmarking ESD enhancement among universities in a region, connected to the quality assurance demands. It could also be used for assessment, benchmarking and communication of multi-disciplinary courses and research on ESD, because the information can be gathered for visualization in one picture, which makes comparisons possible. By applying the model challenges that are critical for enhancing sustainability aspects in HE could be overcome.

Based on the experience from this applied research we also consider that project management (see Figure 1) is vitally important for

cooperation in research projects, where the project partners are geographically apart without possibility to frequent meetings and start the cooperation before meeting physically.

A limitation in this study is that only universities already interested in the topic participated, which means that the results do not reflect the overall situation in the Nordic countries, but rather that the model could be applied in some universities. Quality assurance in HE aims at improving quality of education. In this study we have not investigated whether this really happens, we only show examples of how quality assurance could be used for enhancing ESD. In earlier studies skepticism for quality assurance in HE has been identified, why the use of quality assurance in general can be questioned, since it is focused on chosen indicators that are measured.

For further development and for finding out the wider generalizability of the model and for completing the list of relevant sustainability aspects for more disciplines the model could be applied at more universities, also outside the Nordic countries. Further research is needed to measure which competencies students have received and competence benefits acquired by students.

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