Master's Thesis

Achieving Sustainable Education

The "ecoworks" initiative, a practical case study to enhance second order change in learning in sustainability for higher education.

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TABLE OF CONTENTS

Acknowledgments

"We do not inherit the land from our ancestors, we borrow it from our children."
Native American Proverb

Since, the beginning of my studies I was always interested in the issues related to sustainability and had always been active in many projects. Through this master thesis, I can share a part of my practical experience, and especially show a step forward in understanding the achievement of sustainable education. Albert Einstein says "Look deep into nature, and then you will understand everything better". Humanity needs to change its values and set new priorities regarding its surrounding environment, maybe it is time for us to look again more deeply into nature and in our relation with it.

I would like to express my deep and sincere gratitude to my supervisor, Professor Dr. Didier Sornette responsible for the chair Entrepreneurial Risks of the Management, Technology and Economics Department at the Swiss Federal Institute of Technology in Zurich. Without him, I would not have been able to achieve this work. His support was more than beneficial and his wide knowledge and his availability a big help for my work.

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1 Introduction

"The world began without man and will end without him."
(Levi Strauss, 1955)

In less than two hundred years humankind depleted the earth's natural resources in a way that it is now facing the biggest environmental crisis of its evolution. Therefore, something has to change in the way we behave with our surrounding environment. This transformation is closely related to our education and will be the main topic of this master thesis.

This master contains two parts. The first part explores the theory behind the concepts of sustainable development and sustainability, and the shift we must do in our academic system to achieve sustainable education. In chapter 2, I shortly describe the problems we are facing in the future. Then, in chapter 3, I describe the emergence of the concepts, the evolution of the several declarations related to sustainability for higher education, the limits of the concepts, the theory of transformative learning behind the achievement of sustainable education and some assessment tools to measure this transformation. And finally, in chapter 4, I present a new model based on the three pillars of sustainable development, which shows since our emergence the detachment that occur with our natural surrounding environment and the steps to take to achieve sustainable education.

The second part shows a more practical vision to understand the implementation of a process to enhance second order change of learning in a university system with a concrete case study. In chapter 5, I explain the methodology behind the process. In chapter 6, I show how we implemented the practical case, which is an initiative of the ETH Zurich called ecoworks. In chapter 7, I present the results coming out from the implementation of ecoworks inside the campus of the ETH Zurich. And finally, in chapter 8, I draw the conclusion between the model, the case study and its results.

2 The biggest crisis of our time

Since the 1970s, a new wave of consciousness in society has emerged. The Club of Rome [1], which wrote the book "The Limit of Growth" (1972), highlighted the need to rationalize our consumption of natural resources to avoid a global disaster. Moreover, this new perception increased with various pollution incidents, as some local populations suffered terrible effects (e.g. Bhopal in India, 1984). The members of the club elaborated models on the consequences of a rapidly growing world population and finite resource supplies. With their models they predicted that economic growth could not continue indefinitely because of the limited availability of natural resources, particularly oil. Our current socio-ecological regime and its set of interconnected worldviews, institutions, and technologies all support the goal of unlimited growth of material production and consumption as a proxy for quality of life. However, abundant evidence shows that, beyond a certain threshold, further material growth no longer significantly contributes to improvement in quality of life (Woodward, 2009). In fact, humanity is facing its biggest crisis in its history, the extinction of its natural environment.

The WWF (World Wide Fond for Nature) in the "Living Planet Report 2008" tells us that we are consuming these resources much faster than they can be replenished. In figure 1, The Living Planet Index[2] of global biodiversity, as measured by populations of 1'686 vertebrate species across all regions of the world, shows that over the past 35 years alone, has declined by nearly 30 percent. Moreover, Humanity's demand on the planet's living resources, its Ecological Footprint[3] now exceeds the world's capacity to regenerate by about 30 per cent (see figure 2). If we continue to solicit our planet and its resources at the same rate, by the mid-2030s we will need the equivalent of two planets to maintain our modern lifestyles.

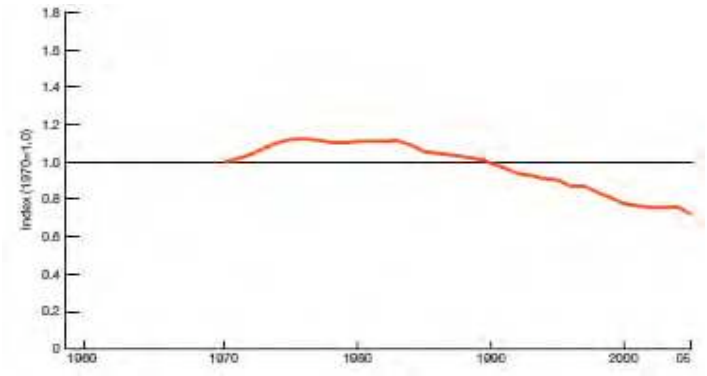


Figure 1: The Living Planet Index since 1970 to 2005

[1] The Club of Rome was founded in April 1968. It is composed of "scientists, economists, businessmen, international high civil servants, heads of state and former heads of state from all five continents who are convinced that the future of humankind is not determined once and for all and that each human being can contribute to the improvement of our societies."

[2] The Living Planet Index is an indicator designed to monitor the state of the world's biodiversity.

[3] The Ecological or Global Footprint is one way of measuring how our lifestyles impact not only on the planet, but also on other people. It calculates how much productive land, freshwater and sea is needed to feed us and provide all the energy, water and materials we use in our everyday lives. It also calculates the emissions generated from the oil, coal and gas we burn at ever-increasing rates, and it determines how much land is required to absorb our waste.

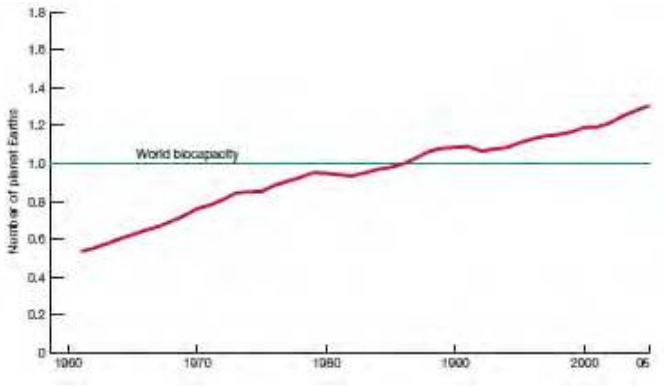


Figure 2: Humanity's Ecological Footprint since 1961 to 2005

The challenge for future generations and us will be our capability to adapt ourselves to this environmental crisis. For example, the earth's climate has gone through natural and often abrupt variations, creating new conditions, persistent for decades and centuries that were unfamiliar to the inhabitants of the time; this has led to dramatic effects and societal decline. Besides, when socio-ecological systems have become brittle and unable to adapt due to other causes, including deforestation and habitat destruction, soil degradation (erosion, salinization, and soil fertility losses), water management problems, overhunting, overfishing, effects of invasive alien species, etc… Some ancient civilizations were not able to adapt to environmental change, leading to their demise like the population of the Easter Island (Woodward and al, 2009).

At present time, because of our exponential population growth and our inability to manage the environment, we are over consuming the natural resources available, our " Earth Carrying Capacity[4]". We are now globally approaching a tipping point, in which irreversible consequences for nature and humanity can occur. Figure 3 shows two possible scenarios for the future, a non-adaptation case (1) and an adaptation case (2).

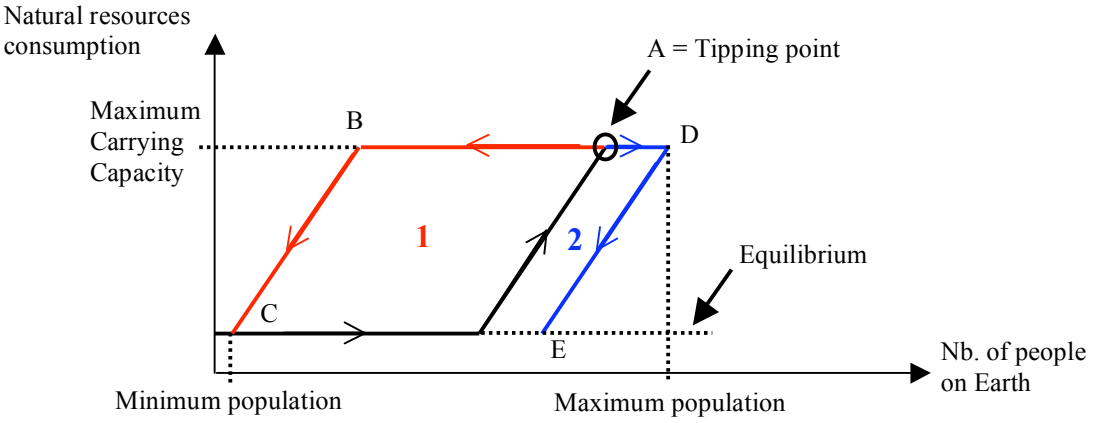


Figure 3: Possible scenarios for the future of humanity.

[4] The carrying capacity is conventionally defined as the maximum population size of a given species that an area can support without reducing its ability to support the same species in the future. In the human context, William Catton defines it as the maximum "load" (population x per capita impact) that can safely and persistently be imposed on the environment by people (Wackernagel and Rees, 1996).

The non-adaptation case scenario (1)

Presently we are consuming much more than the planet is able to provide; looking at figure 3 we are approaching point A. If we continue like this, we are going to achieve an "overshoot", which means according to William Catton that: "growth beyond an area's carrying capacity, leads to crash". If we do not change our behaviour, a decrease of environmental resources will lead to a huge decrease of world population, until point B. This shift from A to B shows that even the population decrease, the biosphere doesn't have the capacity to regenerate itself until a certain point (B). Because the population continues to decrease, the biosphere is less stressed and has more space to regenerate itself until a minimum population on the planet (point C) is reached.

The adaptation case scenario (2)

Humanity is conscious about the problem of environmental changes and drastically adapts itself and changes its behaviour with nature. This leads to a rationalisation of the consumption of natural resources until point D. Due to the limited area of this earth there will be not enough surface available to respond to the all population needs (point D). Therefore the growth of population should be regulated with a continuous improvement of the way we consume the natural resources, which helps the biosphere to regenerate itself to achieve an equilibrium at point E.

Of course those two scenarios are biased, because many other changes can occur. For example, if the earth is kicked by a meteorite and projected towards the sun, there is no chance of survival for life on earth at all.

These two scenarios are only here to make the reader aware of the challenge we are facing for the twenty first century. But behind this, there is a fundamental question, how do we have to change our behaviour regarding the use of natural resources to sustain humanity existence?

This question is currently crucial, because our well-being depends mostly in the ecosystem we are living in and with the way we interact with it. The idea of sustainable development or sustainability is no longer a theoretical concept, but a guideline for our common vision of living to an infinite future. Thus first, we should have a common understanding of the concept, and second, spread it as quickly as possible to be able to adapt ourselves to the future crisis that we will face for the next generations, and finally act in the way that it occurs. Our adaptation to potential collapse requires a thorough realignment of the way we view and interact with our surroundings—what has been called a socio-ecological ''regime shift[5]'' (Woodward and al., 2009).

As symbol for knowledge and guidance for our society, universities have a major responsibility to play and have to be the role model to achieve this challenge. To better understand this role, I introduce in the next chapter the concepts of sustainable development and sustainability of and its evolution.

[5] A socio-ecological regime is a culture embedded in, and co-evolving with, its ecological context. ''Regime'' suggests a complete, interacting set of cultural and environmental factors that operate as a whole. When the ecological context changes so that the existing regime is no longer adaptive, societies must either identify and surmount the roadblocks confronting a regime shift or else become unsustainable and decline.

3 Sustainable Development and Sustainability

The rise of a collapse of our natural environment has brought about a new consciousness in human society. The concept of living in harmony in our surrounding environment for an infinite time has lead to the definitions of sustainable development and sustainability. To guide society to this new paradigm some world pioneers in this field have defined the principles of this harmony and have set recommendations to involve universities in order to form competent students who will respond to this challenge. In the next section, I introduce the birth of the concept and its evolution until our present time.

3.1 Conceptual development

In 1972, the United Nations Conference on the Human Environment was held in Stockholm with the purpose of defining an action plan for the human environment. This was the first major world conference that considered the need for a common outlook and for common principles to inspire and guide the people of the world in the preservation and enhancement of the human environment (UN - CHE, 1972). Through this conference, a set of recommendations was made to guide the world society to a better understanding of the issues of interdependency between the natural environment and the human welfare. The outcome, unfortunately, was more anthropocentric in the sense that little was mentioned about the rights of nature (Wright, 2002b). This conference was not specifically focused on university initiatives on sustainability, but it is often referred to as the starting point for the first declaration of sustainability in higher education. The rationale offered was that education would "broaden the basis for enlightened opinions and responsible conduct by individuals, enterprises and communities in protecting and improving the environment in its full human dimension" (UNESCO, 1972, Principle 19).

In 1987, the United Nations World Commission on Environment and Development led by chairperson Mrs Gro Harlem Bruntland, Prime Minister of Norway, published the report "Our Common Future" in which the commission defined officially the concept of *sustainable development*, as follow:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."
(Bruntland, 1987)

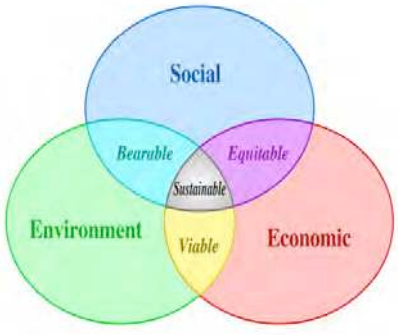


Figure 4: Represents the three pillars of sustainable development

In Figure 4, the three pillars environment, economic and social represent the common model used to represent the vision of sustainable development. For many organizations this definition is used worldwide as a reference to kick-off thinking to involve society in a change of perception of our use of natural resources. The concept of sustainable development's concept is not only related to the way we should manage and preserve our scarce resources, it also refreshes a new paradigm, in which respect for the environment mixed with social equity leads to new economic development (UN-WCED, 1987). This was the first time that the term sustainable development was defined at a world level.

To improve the definition, in 1991, the IUCN (International Union for Conservation of Nature) WWF (World Wild Fund) and the UNEP (United Nations environment program) based on the work of the Bruntland commission, presented the document "Caring for the earth" in which sustainability is defined as **"a characteristic of process or state that can be maintained indefinitely"**. They then go on to redefine sustainable development as **"Improving the quality of human life while living within the carrying capacity of supporting ecosystems"** (Trzyna, 1995).

In 1992 "The Earth Summit" in Rio de Janeiro organized by the UN invited governments to rethink economic development and find ways to halt the destruction of irreplaceable natural resources and pollution of the planet. At this event, an agenda for the 21-century was implemented for defining concrete action plans regarding sustainability. It was the first time in the history where decision leaders coming from several organisations and country of the world met to define the foundation for common principles for the good of the earth. Because of the fresh definition of the concept and its difficulty to be implemented in every country, and because of the troubles linked to the agreement on all principles, the second "Earth Summit" was organized in 2002, in Johannesburg. The Agenda 21 became Action 21, in which every country defined their enrolment to implement sustainable development. In the same year the UN conference held in New York, approved a new resolution, which points out the fact that: the Plan of Implementation of the World Summit on Sustainable Development ("Johannesburg Plan of Implementation") confirmed the importance of education for sustainable development and recommended that the General Assembly consider adopting a decade of education for sustainable development starting in 2005 (UN, New York, 2002). The United Nations Decade of Education for Sustainable Development for 2005-2014 was launched in January 2005 in New York, for which UNESCO is the lead responsible for integrating the principles, values, and practices of sustainable development into all aspects of education and learning.

This last event is of great significance. It sets the priority that sustainable development must be a day-to-day priority in education and pushes educational institutions to integrate the concept in their functional and organisational activities. In the next chapter, I explain the evolution of several declarations to enhance sustainable development and sustainability concept in educational institutions, which give a roadmap of the development of the principles related to *sustainability for higher education* (SHE) and its state at present time.

3.2 Declarations and Policies for Sustainability in Higher Education (SHE)

The changes needed for society to achieve sustainability have to be driven by policy makers. Those policies are a framework to be followed and implemented for guiding society to behave more sustainably. Already at the beginning of the sustainable development concept revolution, government and non-government organizations (NGOs) have repeatedly pointed to education as a key policy instrument for bringing around a transition to sustainable development (Huckle and Sterling, 1996).

"Universities, as centers for research, teaching and training of qualified personnel for the nation, must be increasingly available to undertake research concerning environmental education and to train experts in formal and non-formal education. Environmental education…is necessary for students in all fields, not only natural and technical sciences, but also social sciences and arts, because the relationship between nature, technology and society mark and determine the development of a society (UNESCO-UNEP, 1977, p. 33)."

3.2.1 Development of the declarations

In 1977, the "Tbilisi Declaration" developed by the UNESCO/UNEP Intergovernmental Conference on Environmental Education was the first declaration to take an international and holistic approach to the environment within a higher educational context. It recognizes the requirements for the development of sustainability initiatives within the university amongst faculty, students and support staff (Wright, 2002b). This declaration has a high degree of importance, not only by creating initiatives, but because it sees sustainability as a whole, which implies all stakeholders within the educational system without distinction.

During the last twenty years many other declarations have been made, based on the principle of the "Tbilisi Declaration". Each of them has brought either a new statement or an improvement on the global frame for universities to become sustainable institutions. Regarding the analysis of Wright (2002b), those statements can be summarize as followed:

The Talloires Declaration (1990)

Through this declaration, statements were made by university administrators of a commitment to sustainability in higher education. It explains that "university heads must provide leadership and support to mobilize internal and external resources so that their institutions respond to this urgent challenge" (UNESCO, 1990, p. 2). University signatories of the declaration were asked to work together towards environmental sustainability, encouraging other universities which hadn't signed the declaration to do it, and join administrators in their efforts. This declaration goes a step further. Sustainability is not seen as a requirement anymore but as an obligation to be implemented in higher education institutions.

The Halifax Declaration (1991)

Mostly established for universities in Canada, this declaration recognized the leadership role that such establishments could play in a world at serious risk of irreparable environmental damage and asserted that the university community must be challenged to re-think and re-construct their environmental policies and practices in order to contribute to sustainable development on local, national and international levels. This declaration point out a new dimension for sustainability the geographic scale, in which the solutions can be dissociated at different level, even if there are all linked together.

The Kyoto Declaration (1993)

This declaration was closely tied to Agenda 21 and the United Nations Commission on Environment and Development Conference in Rio de Janeiro. Its main contribution was focused on the framework for sustainability as a call for a clearer vision of how to achieve sustainability within universities. Moreover, it also stressed the ethical obligation of universities to the environment and to sustainable development principles, not only to promote sustainability through environmental education, but also through the physical operations of a university. Through this declaration, sustainable development is not anymore a theoretical concept, it is linked directly with practical implications, which define a clear target that universities have to achieve.

The Swansea Declaration (1993)

This Declaration added an interesting dimension to the discussion of sustainability in higher education. It stressed equality amongst countries as an important factor in achieving sustainability. The recognition that environmental sustainability was an immediate priority for less developed nations, universities of richer countries were called upon to aid in the evolution of university environmental sustainability programs in less wealthy nations worldwide. Through this declaration, a new social parameter occurs, which is the recognition of different social statute, which is related to degree of priority for survival. In fact, it was difficult to tell an African to not to destroy the biodiversity of his environment, when his first priority is to research basic food.

The CRE-Copernicus Charter (1994)

This charter explicitly stated that universities must not only provide opportunities for students, but for university employees as well so that all individuals within the university can work in an environmentally responsible manner. Additionally, it emphasized the need for networking amongst universities.

The Thessaloniki Declaration (1997)

This declaration can be seen as the follow-up to the “Tbilisi Declaration”. Twenty years later, the Thessaloniki Declaration pointed out that radical social change must

occur before environmental change can appear. It's also recognized that sustainability initiatives must take place at all levels of society and must be interdisciplinary in nature. The declaration argued that the concept of environmental sustainability must be clearly linked with poverty, population, food security, democracy, human rights, peace and health and a respect for traditional cultural and ecological knowledge. This declaration is a revolution, because it defines sustainable education as a whole, and that environmental education is clearly linked with cultural social issues.

The Lüneburg Declaration (2001)

The conference, in which this declaration was made, was considered as a preparatory event in the higher education sector for the Rio+10 Summit in Johannesburg 2002. The objective was to ensure that higher education was given priority in the international works program to follow the Rio+10 Summit. . It is a unique declaration in that it recognizes the problems encountered with the implementation of sustainability declarations in the past and calls for the development of a "toolkit" for universities to use in order to translate their written commitment to sustainability to action. Further, it lists priorities for working toward SHE in education institutions, NGOs, governments, and the United Nations. The declaration also calls for the empowerment of all people to work towards sustainability. The declaration does not ask for signatories, but promotes the endorsement and implementation of previous declarations (Wright, 2004).

In the same register, the Thessaloniki, the Kyoto and the Swansea Declarations are no formal individual signatory institutions. They are more a reminder for educational institutions to the commitments they had already made in signing past declarations of environmental sustainability or an improvement of the concept of sustainable development for education, which wasn't underline in the past declarations.

Regarding the analysis of Wright (table 1) indicates to us the key themes that are common to all declarations for becoming sustainable institutions:

Declaration	*Moral obligation*	*Public outreach*	*Sustainable physical operations*	*Ecological literacy*	*Develop interdisciplinary curriculum*	*Encourage sustainable research*	*Partnership with government, NGOs and industry*	*Interuniversity cooperation*
Tbilisi	x	x		x		x	x	
Talloires	x	x	x	x	x	x	x	x
Halifax	x	x		x			x	x
Kyoto	x	x	x	x		x	x	x
Swansea	x	x	x	x		x		x
CRE-COPERNICUS	x	x		x		x	x	
Thessaloniki	x	x		x	x		x	
Lüneburg	x	x			½(x)	x	x	x

*modified from Wright, 2002b

*Table 1. Common principles of Sustainability in Higher Education Declarations**

Through Table 1, we see two themes that are not mentioned as a priority for the majority of the declarations: sustainable physical operations and development of interdisciplinary curriculum. In this context, sustainable physical operations are seen as physical actions to reflect best sustainable development practices and establishing "institutional ecology policies and practices of resource conservation, recycling, waste reduction, and environmentally sound operations" (University Leaders for a Sustainable Future, 1990). The development of interdisciplinary curriculum is seen as the inclusion of environmental concepts and principles into all curricula, this principle is often linked with ecological literacy (Wright, 2002b). Moreover, the university cooperation was removed in the "Swansea and CRE-COPERNIUS Declarations" and lately mentioned in the "Lüneburg Declaration.

Surprisingly, if we observe the complete table elaborated by Wright (appendix 10.1), many universities have in the same period elaborated their policy taking into account seriously sustainable physical operations and more or less interdisciplinary curriculum. Unexpectedly, those policies are not promoting inter-university cooperation and partnership with government, NGOs and Industry. In this case, we have to be aware that the study of Wright deals only with policies elaborated by American and Canadian University and do not represent the worldwide University community. Moreover some policies could have been modified after the last article of Wright.

The Ubuntu declaration (2002)

The Ubuntu Declaration, which was elaborated in September 2002 is the latest official declaration related to education for sustainable development and is not included in Wright research. It focuses on three main points: the need for a greater global emphasis on education; the essential role of education in the continued and effective application of science and technology; and the importance of partnerships. It brings together for the first time science, technology and education of sustainable development. This last declaration fulfils the gap from the previous declaration and most of the University policies mentioned above.

Despite all these evolutions of the models, and what they deal with, several points remain unaddressed, such as the cooperation between Universities or the development of environmental education in all scientific fields or research. In the following chapter, I discuss the limits of the current concepts of sustainable development and sustainability, and show how the concepts can be misinterpreted.

*3.3 **Limit of the concepts***

Because sustainable development is seen as a concept, there are many divergences about the way we must conduct our society to behave more sustainable. In his book "*A sustainable world*", Thaddeus C. Trzyna mentioned that one of his Canadian colleagues was convinced that the term "sustainable development" is "as ambiguous, unhelpful, and ill-defined as ever, that it is not supported by concrete body of theory, and means all things to all people"(Tryzna, 2005). Dobson shows that in the mid-nineties, three hundred definitions for sustainability and sustainable development were available, up from just a few in the late eighties (Dobson, 1996). Also, David A. Munro confirms this divergence by explaining the misunderstanding between development and sustainability used as a fashionable word, and often misused to gain advantages for narrow and special interests of misinformed people (Munro, 1995). Besides, the value of natural capital is masked by the financial system that gives us improper information (Hwaken, 1997). Onisto (Onisto, 1999) argues that these measures are clearly evident in many corporate environmental reports. Sustainable development quickly became a key element to increase companies' image value. Companies fill their reports with indicators and indices of sustainability, while none of them directly measure the natural capital that business consumes in order to provide their goods and services. Furthermore, corporate environmental literature is filled with a mixture of vague principles that allude to the Bruntland definition and make broad statements in their corporate policies regarding their commitment to sustainability. Besides, case studies in sustainability in higher education rarely included any information on the theoretical approach to the methodology or on the methods used to gather the data. Instead, stories of successes were reported and the data supporting these successes are not readily available for public critique (Corcoran et al., 2004).

In fact, environmental impact assessment does not measure the impact to provide goods and services, it calculates the functionality of a need or a service, which could be compared with other. An example of functionality could be "I want to drink". From this action, we analyse the impact of the overall system product, which respond to the functionality. In this case, we can compare the environmental impact between a coke, a beer, a mineral water, etc… It is not the company, which is creating the impact, it is the functionality of the customer, which has to be fulfilled and for that he needs an infrastructure to respond to his need. Most of the companies' leaders are not aware of this distinction, which is why most of those reports are not relevant and are simply nice marketing studies.

As a matter of fact, when we analyse the Bruntland definition itself, used by many private and public organisations to promote their sustainable strategy, it is clearly observable that the concept of sustainable development can be misunderstood. The needs mentioned in it are related to society's needs, but do not express the environmental needs of nature, which are vital for the regeneration of ecosystems and conservation of biodiversity. Besides, sustainability calls for limits on consumption and resource use (Elgin, 1981; Pirages 1977; Rifkin 1980). That's why in the report "Carrying the Earth" this lack has been completed for a better understanding of the concept and the environmental issues behind it. So should the word sustainable still be adequate with development?

As the economists Paul Elkins (1992) observes:

There is literally no experience of an environmentally sustainable industrial economy, anywhere in the world, where such sustainability refers to a non-depleting stock of environmental capital. It is therefore not immediately apparent that, on the basis of past experience only, the term sustainable development is any more than an oxymoron. (p.412)

The biggest problem with our understanding of the concept is connected to our own value, education and opinion of reality. We have different perception of our surrounding environment. Each individual assigns different weights and priorities to the three pillars regarding the model of sustainability. Those are depending on the social, economic, geographic and political context we are in. Additionally, we have to deal with culture, science, knowledge and skills diversity. And finally, our perception of long-term issues is not inherent in our way of thinking. The whole reveals the difficulty to understand the link between development and sustainable, which at the end defines a common well-being for our natural environment, our society, and the same for our next generations. In the next chapter, I focus on the models, which explain the shift that our education has to make to understand sustainability and sustainable development and the role that university must play to achieve it.

3.4 Change in Education

“The crisis of the biosphere is symptomatic of a prior crisis of mind, perception, and heart. It is not so much a problem *in* education, but a problem *of* education (Orr, 1994).”

The challenge of sustainability is to create a new approach to social and economic development in adequacy with our surrounding nature. The purpose is to give our next generations and the global natural environment a security for their own development in an indefinite time. For this, education plays a key role of transition to sustainable development in our society. Specifically, “Higher Education” is vested by society with the mission of discerning truth, imparting knowledge, skills and values and preparing responsible citizens and competent workers who will contribute to an improving world (Clugston, 2004). Moreover, Thomas Berry, an elder scholar exploring the wounds in human and Earth relationships, tells us that "the university has a special role to fill as the institution with the critical capacity, the influence over the professions and societal activities, and the contact with the younger generation needed to reorient the human community toward a greater awareness that we exist within a single great interconnected community of the planet Earth" (Berry, 1996).

Sustainability does not simply require an ‘add-on’ to existing structures and curricula, but implies a change of fundamental epistemology in our culture and hence also in our educational thinking and practice (Sterling, 2004). The failure in our system is that our education is always focused on economic values, because capitalism has pushed our learning systems to profit through productivity with exponential use of natural resources. The outcome of education is mostly related to a reward with money, which lead for jobs in society, which gives revenue to fulfil our basic needs. The effect of neo-liberal educational has massively reformed the foundational values of educational institutions worldwide. Aronowitz and Giroux in ‘Education under Siege’ give us a good taste on the implication of this reform of thought and its effects:

During these years, the meaning and purpose of schooling at all levels of education was refashioned around the principles of the marketplace and the logic of rampant individualism. Ideologically, this meant abstracting schools from the language of democracy and equity while simultaneously organizing educational reform around the discourse of choice, reprivatization, and individual competition (Aronowitz & Giroux, 1993, p. 1).

According to Brown of the Worldwatch Institute the biggest issue for achieving sustainability is whether *we can see the economy as part of the environment, rather than the environment as part of the economy*. The purpose of figure 5 shows the transformation that vision of education has to achieve.

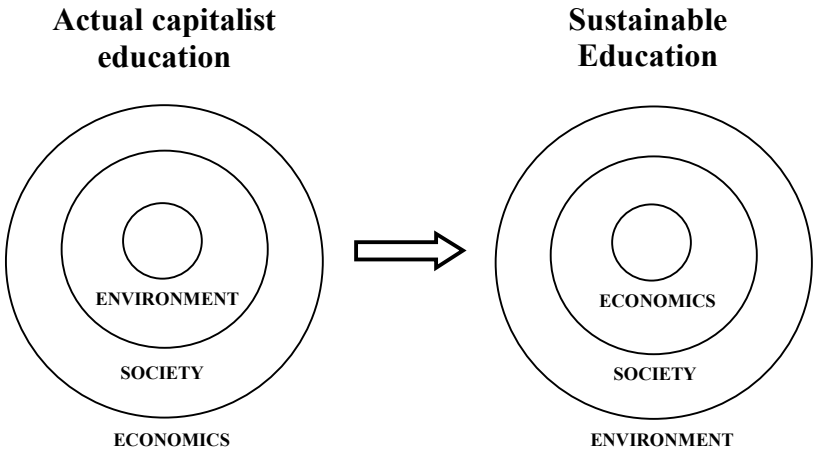


Figure 5: The three pillars of sustainable development representing the shift of consciousness to achieve sustainability.

This transformation represents the change of behaviour from the vision of neo liberalism economic to a new paradigm, which is sustainable education and focus environment as the main element we have to be aware of. This move is also nicely illustrated in the UICN program 2005-2008 report "Many Voices, One Earth" (IUCN, 2004). The figure 6 reflects the worldwide changes needed for the future from now to achieve the theoretical model of sustainable development. But in this case, economics, society and environment are pondered in the same way.

Figure 6: The three pillars of sustainable development, from left to right, the theory, the reality and the change needed to better balance the model

But even through this change there are contradictions to the way we perceive it. Some argue that sustainable development requires only improvements in eco-efficiency and freer global markets. Others argue for a profound shift in worldviews in which the intrinsic worth of nature and the spiritual meaning of life should guide development

(Clugston, 2004). According to the World Business Council for Sustainable Development (WBCSD) definition, eco-efficiency is achieved through the delivery of "competitively priced goods and services that satisfy human needs and bring quality of life while progressively reducing environmental impacts of goods and resource intensity throughout the entire life-cycle to a level at least in line with the Earth's estimated carrying capacity" (WBSCD, 2000). This concept describes a vision for the production of economically valuable goods and services while reducing the ecological impacts of production. In other words eco-efficiency means producing more with less. But eco-efficiency does not solve the problem on its own. It is mostly used as an indicator to improve the environmental performance and efficiency of material use. Furthermore, their implementation is promoted entirely on the basis of efficiency gains, cost reduction, pollution control, increased earnings, avoiding costs on present or future non-compliance and brand equity (Onisto, 1999). But none of these factors have a relevant meaning to define how sustainable development in the business should be. It is clear that the win-win business situation is possible if production processes use less natural raw material and virgin energy inputs and produce less waste and emissions outputs. But, if we replace the energy consumption to create ten same products instead of one this product, we just push the problem further and there is a risk that the use of the concepts of eco-efficiency and win-win can hinder true contribution of business to ecological sustainability (Korhonen, 2003).

Meanwhile, when we discuss environmental issues and education, we often neglect the social side of the concept of sustainable development. In fact, if we act more environmentally, that does not mean for example that women and men rights are equally applied, or that child labour is abolished. Those social issues are defined by the WBCSD under the concept of Corporate Social Responsibility (CSR) as the commitment of business to contribute to sustainable economic development, working with employees, their families, the local community and society at large to improve their quality of life. Thus environmental concerns are part of a companies' CSR (WBCSD, 2000). But, improving quality of life does not reduce environmental impact insofar. In contrary, improving quality of life can extend the problem of consumption of natural resources.

As mentioned above, the problem of our society is depending on the value that we give to the three pillar of sustainable development. Through the concept of eco-efficiency and corporate social responsibility there are two simultaneous way to promote sustainable development in our society. But is it really the case? If we take the company Nestlé as an example, their annual report explain the way they promote CSR as a fundamental key activity in the company. On the other hand a journalist recently wrote an article on the production of coffee held by Nestlé involving very young workers.

As a matter of fact, there are few people, who understand deeply the change of consciousness regarding our relationship with natural resources and social equity. At present time, economics stays always as the main argument for prosperity. To better understand this transformation in our modern education, the next chapter goes deeper into the shift to a sustainable education. The main point concerns the successive level of change that is required in educational systems to achieve this purpose.

3.5 Transformative educational vision

The fundamental educational task of our times is to make the choice for a sustainable planetary habitat of interdependent life forms over and against the pathos of the global competitive marketplace (O'Sullivan, 1999; O'Sullivan, Morrell & O'Connor, 2002). As mentioned above, the behaviour of society needs a complete transformation to achieve "Sustainability". The transition to a new spiritual interaction with our natural environment will be possible only through a change in our education, which is the key element to accomplish this task. Through the signatures of the miscellaneous declarations for higher education, university's institutions had to reorganize their educational system (a system of related components including policies, institutions, curricula, actors etc.) to respond to this new principles and recommendations. In figure 7, starting at the center, educational system can be seen as subsystem of wider society: it is organized by, financed by, and mandated by this society. It is shaped and oriented by the needs, policies, values and norms of the social context, which it serves (Sterling, 2004).

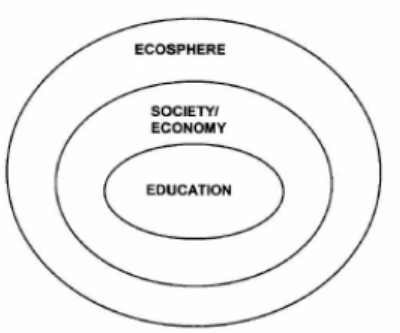


Figure 7. Education, society/economy, and ecosphere as nesting systems.

But where does our failure of understanding the ecosphere come from? If we study books of economics, we often find this definition: economics is the study of how society manages its scarce resources, or economics is the social science that studies the production, distribution, and consumption of goods and services. In this context economics is directly related to the notion of use of scarce resources, so it denotes explicitly the environment as a part of the economy. But why did a big part of the world population enter a capitalist society and did not continue to behave in a sustainable way like the Kogis[6] Indian? Why did this population change its mind-spirit regarding the use and management of natural resources?

[6] The Kogi or Kogui or Kaggabba, translated "jaguar" in the Kogi language are a Native American ethnic group that lives in the Sierra Nevada de Santa Marta in Colombia. They are one of the few surviving indigenous peoples of Pre-Columbian South America. They based their lifestyles on their belief in "The Great Mother," their creator figure, whom they believe is the force behind nature, providing guidance. The Kogui's understand the Earth to be a living being, and see the colonizers' mining, building, pollution and other activities damaging the Great Mother. Their wisdom goes upper the perception of modern society regarding the consumption of natural resources. For them, every molecules made in our body is coming from "Great Mother", which has to be respected and venerated.

"**You learn where you are**", or more precisely our perception of the reality is based on the system we live in. Our learning system tends to adapt itself in the social system where we evolved and tries to respond to societal needs in the environment we are living in. Dickens (1996) mentioned "the crisis of sustainability is both a crisis of the ways in which modern capitalist societies combine with nature and a crisis of understanding whereby the citizens of those societies fail to understand their relations with nature". The rise of modernity and new forms of industrial production separated people from nature with new kinds of knowledge contributing to this alienation. People were separated from the land, from the products of their labor, from one another, and from their own inner nature, by new social, technical and spatial divisions of labor that also separated them from knowledge that enabled them to make sense of the world. This disaffection from nature led us to transform criticism to change the culture's vision for development, which need to be "formatively appropriate" with our ecosphere. This will be discussed in the next section.

3.5.1 Transformative criticism in education

"Transformative criticism" suggests a radical restructuring of the dominant culture and a fundamental rupture with the past (O'Sullivan, 2004). More precisely, the change needed to transform our culture has to be done in our learning system. Bateson (1972) distinguished three orders of learning and change, corresponding with increases in learning capacity. Learning (by an individual, or a group or an organization) can be seen as having two aspects – *self-correction* and *meaning making* in response to a change in the system's environment. Such learning can serve either to keep a system stable, or enable it to change to a new state in relation to its environment (Sterling, 2004). These two types of learning are described also as 'first order' and 'second order' change (Ison & Russel, 2000) or 'basic learning' and 'meta-learning' (Badwen, 1997a). First order change is change within the system and second order change is change that is so fundamental that the system itself is changed. The third level is described as transformative learning or epistemic learning, which is the key to the realization of a more sustainable cultural paradigm – in individuals, in education systems, and in society as a whole. In learning theory terms, transformative learning signifies a move from first-order learning, to a second-order learning where values, beliefs and paradigm are critically realized and examined, and further stage where a new paradigm emerges (Sterling, 2004). Table 3 shows the three learning summarized.

Learning I: basic learning	learning	thinking	knowing
Learning II: meta-learning	learning *about* learning	thinking *about* thinking	knowing *about* knowing
Learning III: epistemic learning	learning *about* learning *about* learning	thinking *about* thinking *about* thinking	knowing *about* knowing *about* knowing

Table 3: the three learning levels for "transformative criticism".

To understand table 3, Sterling define the three levels as following:
Learning level I – 'doing things better'
Learning level II – 'doing better things'
Learning level III – 'seeing thinks differently'

The main difficulty in changing the educational system is that educational institutions are the role model for education, thus very reluctant to change. Moreover, a distinction has to be made between 'learning *through* higher education' (relating *to provision*) which is the usual subject of discourse, and 'learning *within* higher education' (relating to the guiding *paradigm*) (Sterling, 2004). To understand this transformation of learning, a practical example is presented in the next section.

3.5.2 Transformative learning: an example in architecture

Twenty years ago, sustainable development was not a topic in the curriculum of an architect. It was concretely recognized 10 years ago by some pioneers, but not adopted by all the architects; it was rarely mentioned as a priority. Architects were aware of the thematic, and were partially implementing this concept. However, most of them continued to build their construction with active technologies like air conditioner mixed with a heating system, which regulate temperature in the building and consume a huge among of energy. This can be seen as *learning level I* or a first 'order change', in which architects are aware *to do things better*. But with a first order change, the dominant paradigm maintains its stability. That's why some architects continue at our present time to construct inefficient buildings.

Now-a-days, the concept of sustainability is more known by the architect community and integrated through the conception of 'Green Buildings[7]'. For many universities it became a trend that every student had to be aware of, and they are educated to diverse standards they have to apply for sustainable construction. This change can be seen as *learning level II* as or second 'order change', in which architects are trained *to do better things*.

In their book "Cradle to cradle", William McDonough and Michael Braungart (2002) suggest a new approach to the conception of constructing buildings. They argue that, since we are educated to build buildings with an optic of consumption of resources, we will develop them in the same way. So why don't we change this optic and create buildings, which generate resources? For an architect, this means that his or her building will not consume energy or natural resources, but will enhance biodiversity, provide energy, for the same comfort, and living will be seen as a whole. The move from the first-order learning to the second-order learning in learning theory term engages and involves the architect in a process of re-perception and re-cognition of his or her values, beliefs and paradigm, which can be critically realized and examined, and lead he or she in a further stage the *learning level III*, which can be see as *seeing the things differently*. In the next section, we introduce the same reasoning, but to a wider society.

[7] Green buildings is an outcome of a design which focuses on increasing the efficiency of resource use — energy, water, and materials — while reducing building impacts on human health and the environment during the building's lifecycle, through better sitting, design, construction, operation, maintenance, and removal (Frej, 2005).

3.5.3 Learning responses in wider society

During the first "Earth Summit" in Rio de Janeiro in 1992, two conceptions on sustainability emerged, the strong one and the weak one. "Weak Sustainability" allows the substitution of equivalent human-made capital for depleted natural capital. From this perspective, the loss of the income-earning potential of a former forest is no problem if part of the proceeds of liquidation have been invested in factories of equivalent income-earning potential. By contrast, "Strong Sustainability" recognizes the unaccounted ecological services and life-support functions performed by many forms of natural capital and the considerable risk associated with their irreversible loss. Strong sustainability therefore requires that natural capital stocks held constant independently of human-made capital (Wackernagel & Rees, 1996).

To understand the 'sustainability transition' from weak sustainability to strong sustainability, the authors of *The Politics of Agenda 21 in Europe* (1998) suggest that four-stage shift is necessary (see table 4).

Sustainability transition	*Response*	*State of sustainability*	*State of education*
1 Very weak	Denial, rejection or minimum	No change (or token)	No change (or token)
2 Weak	'Bolt-on'	Cosmetic reform	Education *about* sustainability
3 Strong	'Build-in'	Serious greening	Education *for* sustainability
4 Very strong	Rebuild or redesign	Wholly integrative	Sustainable education

Table 4: Comparing staged social and educational responses to sustainability.

The first stage 'response' means that there is no response, or a minimum awareness of the challenge of sustainability.

The second stage is accommodation: from the educational system, there is a minimal effect on the institution, and the values and behavior of teachers and students, for example sustainability concepts such as biodiversity or carrying capacity may be added into some parts of the curriculum and some subjects, which in other respects carries messages supporting unsustainability.

The third stage is reformation: the educational system becomes more coherent in the coverage of the content of sustainability. An attempt to teach values and skills perceived to be associated with sustainability with the aim to 'green' the operation of the institution. This is described by 'education for sustainability'.

The fourth stage is transformation: this is a deep, conscious reordering of assumptions which leads to a paradigm change, so to sustainable education.

The implementation of these four stages is not just an ideal view on how we can transform the society as a whole; it is a coherent roadmap to understand the different level of change that has to be fulfilling in order to achieve the new paradigm.

If we look at the declaration during the two "Earth Summits" we can summarize that the first level (second stage) of learning is the establishment of the Agenda 21, in which the decision makers are aware about the issues of sustainability. The second level of learning (third stage) is the involvement of all society in implementing this agenda through Action 21, in which theoretical recommendations becomes concrete practice. But, is it really the case? Unfortunately not, some efforts are made but politics had to put much effort to encourage society to achieve those actions. Moreover, because sustainability is not in everyone's mind and because of it complexity, many countries are playing with the weak and the strong sustainability principles. For example, if we take the "Swiss Sustainable Development Strategy: Guidelines and Action Plan 2008–2011" defines by the Swiss federal council, we find that "based on the legal content of the sustainability provisions in the Federal Constitution (specifically Articles 2 and 73,13) the Federal Council has taken the middle road between strong and weak sustainability. This is referred to within expert circles as "sensible sustainability" in English-speaking countries, and as "weak sustainability plus" in Switzerland. This sentence explicitly shows the difficulty for decision makers to take clear decisions to achieve sustainability. In the next section, I introduce shortly a Swiss initiative related to buildings construction and renovation in Switzerland. This can be seen as a third stage transition of learning in wider society.

3.5.4 A practical case in Switzerland, the MINERGIE® Standard

In Switzlerand in 1994 Heinz Uebersax and Ruedi Kriesi elaborated the Minergie[8] idea. The idea was at this time a revolution in the way that buildings had to be constructed in Switzerland. In 1998 the Minergie Association was founded, and its first standard, the Minergie label for low-energy-consumption buildings, was published. At the end of 2001, a further, more stringent standard for so-called passive housing was introduced, Minergie-P. Since then, further applications of the label have been defined, such as those for specific building components. At present around 13% of new buildings and 2% of refurbishment projects are Minergie certified. These are mostly residential buildings. The goals of the Swiss national SwissEnergy Infrastructure and environment program calls for 20% of new construction and 5-10% of refurbishment projects to be Minergie certified. This is a practical example of a first order change. A second order change would be that Swiss construction policies apply this standard for all new construction or renovation of buildings. Thus, it won't be a thing to do, only because it is a trend, but instead a concrete framework that all architects we have to implement in their day to day work.

[8] MINERGIE® is a sustainability brand for new and refurbished buildings. It is mutually supported by the Swiss Confederation, the Swiss Cantons along with Trade and Industry. Specific energy consumption is used as the main indicator to quantify the required building quality. In this way, a reliable assessment can be assured. Only the final energy consumed is relevant.

In the all chapter 3.5, we have seen that transformation in education is linked to a learned response from society. Both follow the same principles, which are an accommodation to a reformation for finally a complete transformation of our education. In fact there is no surprise that the parallel is so narrow. In one side society pushes for a change in educational systems, which respond through a new adaptive training for future workers. Active in the market, those will perform in a better matter and will ask from education more performed students (workers) and so one…

The next chapter underlines the distinction of provision and paradigm in higher education, which help to better identify the system change as a whole.

3.6 Whole system change in higher education

The main problem is that the exact goal of the transformation to sustainable education is not entirely clear, and the incentives of the individuals involved are not aligned, this can be seen in the resilience of the system to adapt itself to the change. In this case "resilience" is defined as the capacity of a system to undergo disturbance and maintain its functions and controls (Gunderson and Holding, 2001). Many educational institutions are often characterized by systematic management and organization including top-down control, explicit rules, defined structures and areas of responsibility, and a degree of rigidity. Moreover, Banathy says that; "Our inquiry is still dominated by reductionism, 'objectivity' and determinism. This approach cannot, 'possibly cope with the complexity, mutual causality, purpose, intention, uncertainty, ambiguity, and ever accelerating dynamic changes that characterize our systems and larger society environment' (1991, p. 10). The challenge that we are facing here is the speed at which an educational system can adapt itself to the change at the operational and functional level.

In this sense, Ison says that we have to re-establish universities as communities of learners, [lecturers] must become involved in learning about learning, facilitating the development of learners, and in exploring new ways of understanding their own and others' realities' (Ison, 1990, p. 9). Elsewhere, there is evidence of growing recognition that sustainability necessarily requires a change of ethos, epistemology and practice in higher education, and that it is for each institution to grapple with the difficult transition this implies (Sterling, 2004). Sterling summarized the need for and the possibility of a 'whole system shift' simply as four 'P's:

Paradigm instead of higher education reflecting a paradigm founded on a mechanistic root metaphor and embracing reductionism, positivism, and objectivism, it begins to reflect a paradigm founded on a living systems or ecological metaphor and view of the world, embracing holism, systemisism and critical subjectivity. This gives rise to a change of ethos and purpose…

Purpose instead of higher education being mostly or only as preparation for economic life, it becomes: a broader education for a sustainable society/communities; sustainable economy; sustainable ecology. This expanded sense of purpose gives rise to a shift in policy…

Policy instead of higher education being viewed solely in terms of product (courses/materials/qualifications/educated people) it becomes: much more seen as a process of developing potential and capacity through life, at individual and community levels through continuous learning. This requires a change in methodology and practice…

Practice instead of higher education being largely confined to instruction and transmission, it becomes: much more a participative, dynamic, active learning process based more on generating knowledge and meaning in context, and on real-world/situated problem solving.

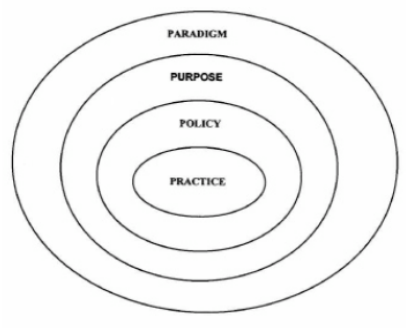


Figure 8. The four 'P' as nesting systems.

The representation of these 'P's' in a systemic perspective (figure 8) is relevant to understanding the vision of the paradigm shift and the system responds, at a national level, institutional level and even at the departmental level within the institution. It suggests that what an institution does (provision) is ultimately informed by its dominant view of reality and its epistemology (paradigm). Sterling summarizes some key points that increase the possibility of deep change in higher education as a sufficient response to the challenge and opportunity of sustainability:

- the importance of conscious intent and leadership
- the importance of second order learning as a precursor to epistemic change
- the need for epistemological change towards a more participative or ecological paradigm
- the importance of attention to context
- the need for systemic rather than piecemeal change
- the importance of a co-evolutionary rather than linear view of the relationship between education and society.

The achievement of the paradigm in higher education follows a continuous change in which everybody should participate without creating distortions in the learning system seen as a whole. In most practical cases, because we still are in a capitalist model of education, those distortions are related to a main factor; the trade off between the expenses to sustain the change, which is the transformation to sustainable education and the return of investment that this change created. For example if we launch an initiative in a university to create students projects to reduce the energy consumption in a building already constructed, we first have to analyze where the potential reductions are, and then define the different possible projects to achieve it. The feasibility of those projects will depend on diverse variables like the state of technology, the norms required, the functionality of the buildings and so on… In the end, the results should be that the costs created by the analysis, the establishment of the projects, their implementation and the proof of the success is less expensive than the costs spared by the reduction of energy consumption. Thus, the speed of the change is related to two regimes; the socio-ecological regime, which set the priorities based on the environmental behavior related to the paradigm; and the socio-economics regime, which set the priorities on the return of investment to sustain the achievement of the paradigm. The resilience of the system will depend on the adequacy of those two regimes, and are key parameters to control for the success of the change. The two challenges here are to match those two regimes and be capable to measure concretely the progress of achieving sustainable education in a concrete way. In the next chapter, I introduce the diverse set of specific tools to assess sustainability in higher education systems.

3.7 Assessing sustainability in SHE

Defining and assessing sustainability across campuses has proven to be difficult, due in large part to the ambiguities involving in operationalizing and standardizing environmental and social principles (Schriberg, 2004). The implementation of cross–institutional assessment tools can be powerful force for organizational change, but they are impeded by the different views of the internal stakeholders to accept a framework measuring sustainability. Especially in higher education systems, where the level of spirit for criticism is very high, the vision of sustainable development becomes a permanent debate between the diverse specialists. Montheith and Sabbatini (1997, p.56-57) found that "people were supportive of the sustainability mantra, but when the implications became more clearly defined, disparities in approach and implementation became apparent."

A good example to understand the difficulty to create concrete indicators to assess sustainability can be seen between the sharing of knowledge versus the environmental impact of mobility due to it. In higher education systems like universities most of the teachers travel around the world to participate in meetings, congresses or business events. The purpose of these travels is to share their results and their knowledge with other specialists. In the case of environmental sciences, how do we measure the trade off between the sharing of knowledge to reduce environmental impact versus the impact created by the teacher's mobility? Or, how can we compare the same trade off between diverse scientific fields? Another point is that without travelling teachers have fewer opportunities to present their work, so less possibilities to increase their reputation. Indirectly this raises for them the difficulties to prove to the institutions they are working in that their research is beneficial and needs to be economically sustained.

Through this example, we see the difficulty and the complexity to create indicators, which are relevant to the community and can be used as guidelines for achieving sustainability. To identify levers for organizational change, assessment tools must ask "why" and "how" campuses pursue sustainability in addition to "what" they are currently doing. In other words, assessment tools must analyze processes and motivations in addition to outcomes (Shrieberg, 2004). For this Shrieberg have created a table (appendix 10.2), which evaluates all assessment tools to measure sustainability on campuses. The most important thing, he pointed out, is that sustainability assessment tools must be comprehensible to a broad range of stakeholders. Without this accessibility and communicability, assessment will have little impact. Therefore ecological footprint (Wackernagel & Rees, 1996) is one of the best positive examples of this principle. It translates complex calculations into an understandable and demonstrable geographic area. The power of this indicator comes from the way it sensitizes the relationship between our consumption and soil productivity, when this ratio is bigger than one; it means our footprint is bigger than the carrying capacity that the soil is able to provide. Moreover, Onisto (1999, p. 37) outlines: "Without a measure and value attached for the rates at which an economy consumes nature, there is no possibility for the market to act in any other interest than economic". In this way, ecological footprint can be seen as one of the most useful tool to assess sustainability. But, unfortunately this indicator does not reflect social motivation or environmental management processes, which are needed to implement assessment tools and enhance sustainability. Ideally, we could use the ecological

footprint with the functionality “getting knowledge through university”, which could be compared between the miscellaneous possibility to acquire knowledge into a university. But the development of such assessment tools is a research in itself and is not the purpose of this master thesis.

The emergence of assessment tools is a relatively new field of management for sustainability in higher education. Through the analysis of Shrieberg we have the possibility of using different tools, which vary greatly in scope, scale and phase. But, without comparing campus efforts against other institutions (national/international), due to the fear of sustainability rankings and the lack of incentives in policies to exchange experience with other institutions, most assessments do not address the rationale for “why” initiatives began and are maintained (i.e. motivations), thus failing to provide input into effective advocacy Strategies (Shrieberg, 2004).

Moreover, assessing sustainability comes back to the way we do personally understand the vision of sustainable education. Through my many talks with people involved in this field, it seem that their a few people, who are able to make the distinction between education about sustainability, for sustainability and sustainable education. In fact, there is no model explaining the steps that we have to do to achieve sustainable education from our actual learning model. In the next chapter, I introduce a new model, which help to understand and visualize those steps until a complete transformation to sustainable education.

4 A model to understand the achievement of sustainable education

In chapter 3, we saw that to combat the environmental threat we are facing in the next century, humanity's response must find its origin in the concepts of sustainable development and sustainability. The development of this new paradigm took several years until it was recognized to be a priority in our education. Moreover, the complexity of this vision, the comprehension and participation of many stakeholders increases the challenge to implement sustainable development principles in all stage of our society. Our understanding of the shift is biased by the way we understand our surrounding environment and by the priorities we set in the three pillars in the model of sustainable development. This transformation follows three level of learning to achieve sustainable education. Those are visible in society as a learning response function, in which education and society are indivisible. The state of the educational system in which the paradigm emerges can be seen as 4 P's, which give us the state of involvement of the system has as a whole. The measurement of sustainable education can be done through diverse assessment tools, which are a complement to see and manage the change within the educational systems, but we still need to define indicators, which have to be comprehensive for a broader range of stakeholders. The resilience of the system to adapt itself to the shift is driven by its socio-environmental regime and its socio-economic regime, collapse will occurs if they are not in alignment

The main questions are; why did a socio-environmental and a socio-economics regime occur in our society? How did we get into a capitalist society? And besides, what are the steps that we have to accomplish to get out of it in order to achieve sustainable education? This next section presents the foundation of a new model, which helps to understand the evolution of our relationship with nature. It helps to understand the emergence from Homo Genus (genus = gorilla) to Homo Economicus, our detachment regarding the value of natural resources, and the steps that we have to take to return to a spirit in complete harmony with nature, so transforming humankind into Homo Sustenabilis.

4.1 Two paths to achieve sustainability

In order to understand sustainability, we have to focus on the vision of what sustainable education can or could be. As mentioned above in chapter 3.4, figure 5 shows us the shift that we have to reach from a capitalist education to a new paradigm; in figure 6 the UICN shows us the actual state of concern related to the theoretical model of sustainable development and the direction to take to achieve the it. Figure 9 shows us a new model based on the assumption of UICN, which explains the two paths that arise and must arise to attain sustainability. The model that I found makes important extensions of the previous models in the sense that it gives us a big picture on the change of priorities of the three pillars of sustainable development that occur since the beginning of humankind, and the change of priorities we have to do in the future to achieve sustainable education. Moreover, these changes of priorities are linked with two different regimes, a socio-ecological and a socio-economical, which both are always in the development of the model bonded together. The letters N (Nature replace Environment in the model of SD), E (Economics) and S (Social) are represented in three orders of priority, in which the highest priority is at the top.

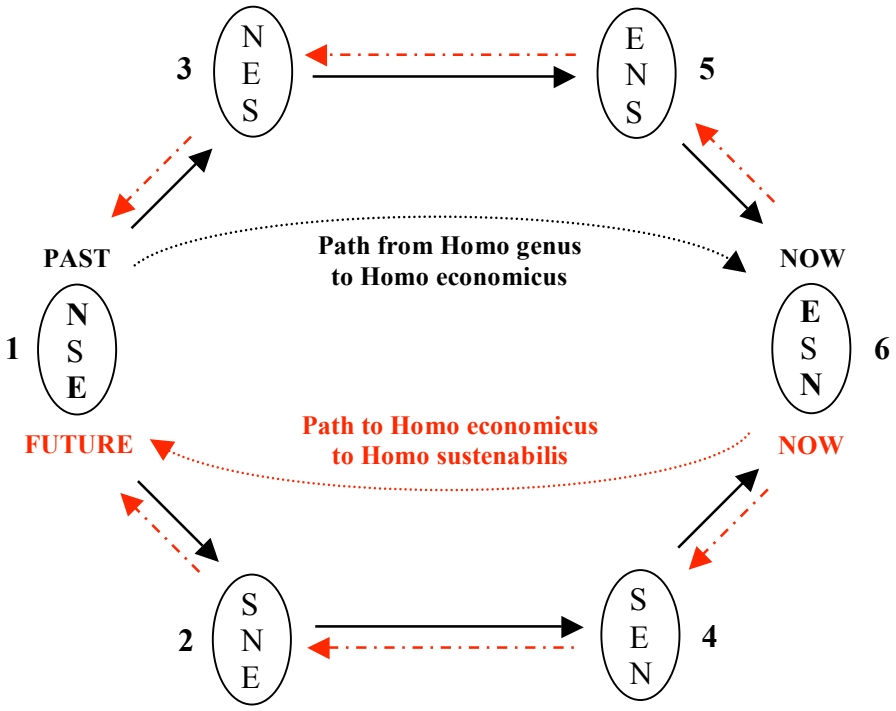


Figure 9. The model of the two paths to sustainability.

With this model, we see two major transformations in humankind evolution. As a matter of fact, the first path from Homo genus to Homo economicus (1 → 6) has already occurred and is quietly visible in our present time, which is considered here to be the system 6. This transformation has drastically altered our behaviour with our natural environment. Besides, this shift follows also a third order of transformation of learning (chapter 3.5) during human evolution. The second path represents the transformation from our modern capitalism economic society to sustainable education (6 → 1), which follows also a third order of transformation of learning. To better understand these transformations I explain in the next section the first shift that takes place in humankind.

4.2 From Homo genus to Home economicus

In millions of years from hunters we became capitalist. But how did this occur? In fact, we change our behaviour with natural resources in three distinct steps. The first step can be seen as the entrance of humankind in prehistory (Palaeolithic, Mesolithic, Neolithic) until the protohistory (Chalcolitic, Bronze Age, Iron Age) represented by the move from **system 1** to **system 2** and **3**. The second step starts with the beginning of the protohistory until the end of Antiquity, this move represents the move from **system 2** to **system 4** and from **system 3** to **system 5**. And the last step starts at the end of the Antiquity until our modern time represented by the move from **system 4** and **5** to **system 6**. The purpose of the next paragraphs is to explain the complete transformation (third order change), which occurs during humankind evolution and understand our detachment regarding the value of natural resources.

Since the ancestors of modern humans diverged from the ancestors of the living great apes, around 7 million year ago, all humans on Earth fed themselves exclusively by hunting wild animals and gathering wild plants (Diamond, 1997). This time is called the Pliocene[9] epoch and is represented by **system number 1** in the model**.** Then humankind entered the first step of evolution the Palaeolithic Period (c. 2.6 Ma – 10 ka BC) (genus Homo) or called also the "Stone Age"; this period ended at the same time as the Pleistocene[10] epoch. From subsistence by gathering plants and hunting or scavenging wild animals, he developed stone tools (2.6 – 1.8 Ma BC), controlled fire (1.7 – 0.1 Ma BC). Then arrives the Middle Palaeolithic (300 – 30 ka BC) (Homo sapiens); in this period it shows the first sign of behavioural modernity (art and intentional burials) and the earliest evidence of cooking food migration. Then enters the Upper Palaeolithic (50 – 10 ka BC) in which it achieves an abundant artwork and a fully developed language (Miller and Barbra, 2006).

During this period human population density was very low, approximately only one person per square mile (McClellan, 2006). Humans hunted wild animals for meat and gathered food, firewood, and materials for their tools, clothes and shelter (Leften, 1991; Rowland, 2008). The economy of a typical Paleolithic society was a hunter-gatherer economy (Leften, 1991). Much evidence exists that humans took part in long-distance trade between bands for rare commodities (such as ochre, which was often used for religious purposes such as ritual) (Henahan, 2008; Fernandez 2003) and raw materials, as early as 120,000 years ago in Middle Paleolithic. Inter-band trade may have appeared during the Middle Paleolithic because it would have helped ensure their survival by allowing them to exchange resources and commodities such as raw materials during times of relative scarcity (i.e. famine, drought) (Mayell, 2008). After 50'000 BC; what Jared Diamond and other anthropologists characterize as a "Great Leap Forward," human culture apparently began to change much faster: humans started to bury their dead with more elaborate burials, made clothing out of hides, developed sophisticated hunting techniques (such as pitfall traps, or driving animals to fall off cliffs), made cave paintings (Ambrose, 2001). This change allowed man to explore less hospitable geographical areas and engage in more extensive barter trade networks, thus expanding his territory on earth. With this change, the economy

[9] The Pliocene epoch is the period in the geologic timescale that extends from 5.332 million to 1.806 million years before present.
[10] The Pleistocene is the epoch from 1.8 million to 10,000 years before present covering the world's recent period of repeated glaciations.

took a step ahead in the connection between humans and natural resources, which was not only seen as fulfilling basic needs, but as medium of exchange for specific needs. This can be seen as the beginning of barter. With the entrance of the humans in the Mesolithic/ Epipaleolithic Period (10 ka – 8 or 3 ka BP, depending of the geographical area) or also called the "Middle Stone Age", we see a gradual transition from a food-collecting to a food-producing culture. This gradual transition of behaviour is represented in the model by the moves from the **system number 1** to **system number 2 and 3** (figure 10). Alternatively human society entered two regimes: a socio-ecological with **system 2** and a socio-economics with **system 3**. Those two regimes evolved together as a whole.

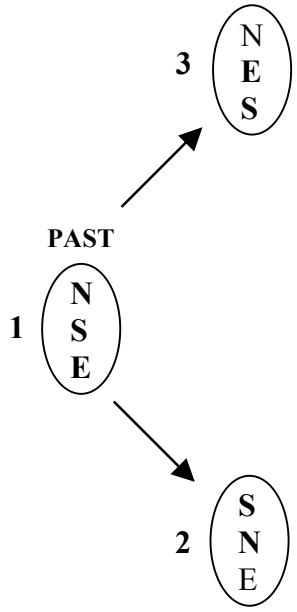


Figure 10. First transition of behaviour or first order change.

Through our development from the Paleolithic period to the end of the Mesolithic period, from being hunters-gatherers to early farmers, we changed our priority regarding the use of natural resources. In **system 2**, a shift occurred in our socio-ecological regime between **nature** and **society**. With the appearance of agriculture we converted our behaviour in a way that made it possible for us to control partially wild plants and animals species with the aim of fulfilling our needs. We were able to domesticate our surrounding environment and this effect changed our spirit regarding natural resources.

Moreover, the availability of more consumable calories meant more people. Mesolithic adaptations are cited as of relevant to the question of the transition of agriculture, including sedentism, population size and plant foods (Price, 2000). The existence of settlement permits us store food surplus, since storage would be pointless if one didn't remain nearby to guard the stored food. Stored food was essential here to feed the rest of the community, which were non-food-producing specialists. On contrary, nomadic hunter-gatherers may occasionally bag more foods than they may consume in a few days, but are mostly occupied with acquiring their food (Diamond, 1997). The appearance of non-food-producing specialists developed new economic

activities around food production, which was not the case with the hunters and increased the value of natural resource. This shift can bee seen in our socio-economic regime in the **system 3** between **society** and **economics**, in which economics increase it value to sustain local population. Both the shift from **system 1** to **system 2** and **3** are clearly apparent when we enter the Neolithic Period or also called the "New Stone Age".

The transition from a hunter society to a farmer society can be seen as our first change in our learning system. We accommodated ourselves to our proximate environment in "*doing things better*" in the way that we better manage natural resources to fulfil more than our basic needs.

The move from **system number 2** to **system number 4** and from **system number 3** to **system number 5** (figure 11) begins during the Neolithic Period, which ended prehistory to enter protohistory. This period starts with the rise of farming, which produced the "Neolithic Revolution" and ended when metal tools became widespread in the Copper Age (chalcolithic).

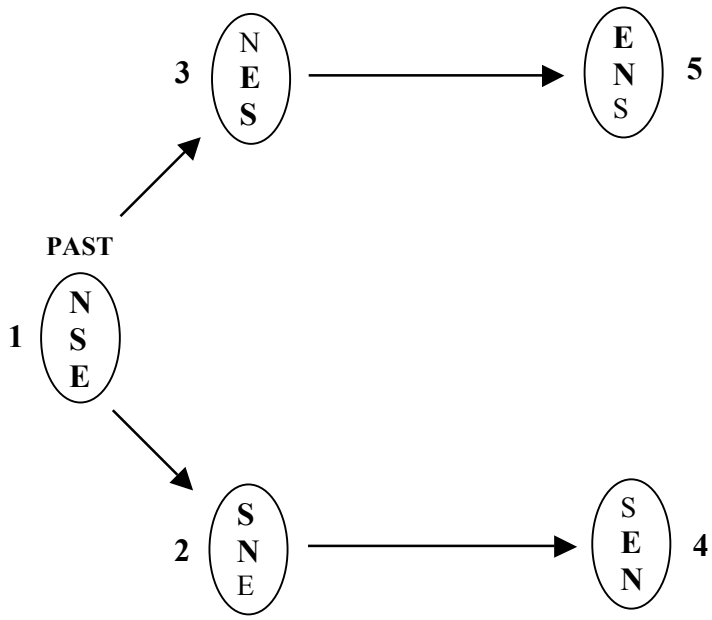


Figure 11. Second transition of behaviour or second order change.

The Neolithic period began in about 9500 BC in the Middle East with the development of human technology. It is not a specific chronological period, but rather a suite of behavioural and cultural characteristics, including the use of wild and domestic crops and the use of domesticated animals. Neolithic cultures made more useful stone tools by grinding and polishing relatively hard rocks, rather than merely chipping softer ones down to the desired shape. The cultivation of cereal grains enabled Neolithic peoples to build permanent dwellings and congregate in villages, and the release from nomadism and a hunting-gathering economy gave them the time to pursue specialized crafts (Encyclopedia Britannica, 2009). Furthermore, the invention of pottery increased the possibility for them to store grains, to protect it from humidity and from animals or insects and to transport it. The termination of the

Neolithic period is marked by such innovations as the rise of urban civilization or the introduction of metal tools or writing. The transition from the Neolithic to the Chalcolithic phase of cultural evolution is thought to have taken place gradually in the late 7th millennium BC (Encyclopedia Britannica, 2009). The emergence of metallurgy occurred in the 4th millennium BC with the discovery of Copper and thus ended the Chalcolithic Period, then we entered the Bronze Age (3300 – 1200 BC) followed by the Iron Age (1200 – 100 BC), which ended the Protohistory epoch.

During this epoch, as a result of evolution of food production and settlement, human community continued to grow. Small bands gave rise to larger communities, in which the augmentation of population and the increase of technology innovation accelerated the division of labour. Thus new activities occurred. The development of work diversity and political organisation in society marks the beginning of the gap of our spiritual relationship with our natural environment. More precisely, the creation of a political structure or hierarchical structure reduced our direct contact with soil labour to fulfil non-food producing community basic needs. To sustain this community an equity system developed itself, in which the exchange of resources is seen as economic reward in proportion for the work done. This shift of relationship in our socio-ecological regime can be seen in the model in **system number 4**, in which our behaviour with **natural resources** become a lower priority than **economics**.

Besides, as a result of the growth of technology and the boost of world population, we increased the intercommunity contacts, which leaded us to amplify trade activities. Most of the exchanges were done at the beginning with natural commodities such as cowry shells (used in Africa and Asia) for the acquisition of spices, animal skins and so one… It was the beginning of primitive forms of money. With the invention of metallurgy our economic behaviour took a step ahead, in which metal became a parallel medium of exchange for natural commodities. In Egypt the centralization of harvests in state warehouses also led to the development of a system of banking. Written orders for the withdrawal of separate lots of grain by owners whose crops had been deposited there for safety and convenience, or which had been compulsorily deposited to the credit of the king, soon became used as a more general method of payment of debts to other persons including tax gatherers, priests and traders (Davies, 2002). With the invention of the first real coins, which were probably minted some time in the period 650 - 600 BC, according to Herodotus and most modern scholars, the Lydians were the first people to introduce the use of gold and silver coins (Goldsborough, 2004). In fact, after bartering, we used natural resource commodities as primitive forms of money for specific trade, to finish with the invention of money, which became the main medium of economic transaction to satisfy market needs. Money is anything that is generally accepted as payment for goods and services and repayment of debts (Mishkin, 2007). The main uses of money are as a medium of exchange, a unit of account, and a store of value (Mankiw, 2007). This shift in our socio-economic regime can be seen in **system 5** between **nature** and **economics**. We switch from food-production to a market economy.

The move from farmers' societies to market consumption can be seen as the second change in our learning system. We reform our proximate natural environment through technological improvements in "*doing better thinks*" to fulfil society needs.

The last transition from **system 4** and **5** to **system 6** (figure 12) began at the end of Antiquity (2000 BC – 500 AD).

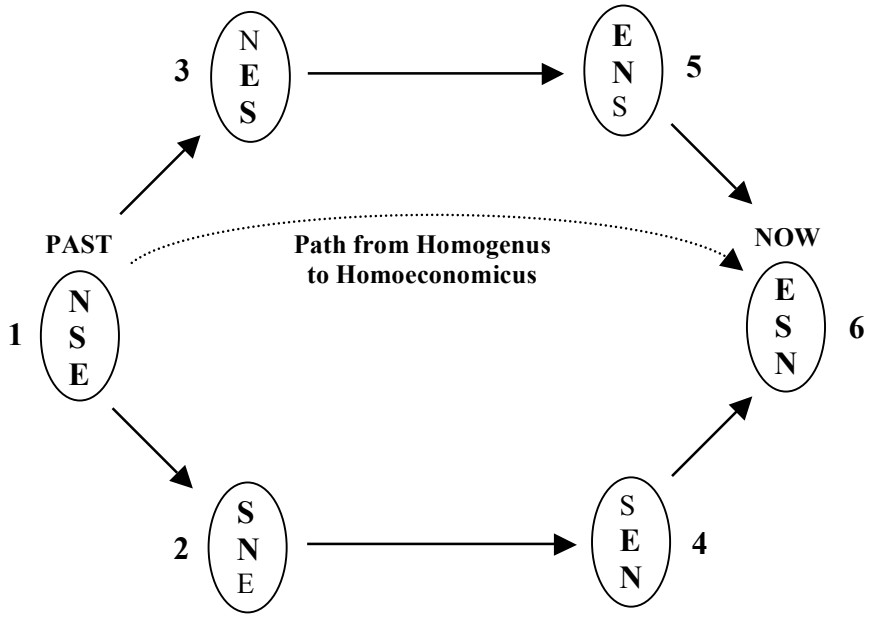


Figure 12. Third transition of behaviour or third order change.

In premodern China, the need for credit and for circulating a medium that was less of a burden than exchanging thousands of copper coins led to the introduction of paper money or more precisely banknotes in (700 – 1000 AD) (Davies, 2007). At around the same time in the medieval Islamic world, a vigorous monetary economy was created during the 7th–12th centuries on the basis of the expanding levels of circulation of a stable high-value currency (the dinar). Innovations introduced by Muslim economists, traders and merchants include the earliest uses of credit (Banaji, 2007), cheques, promissory notes (Lopez and al, 2001) savings accounts, transactional accounts, loaning, trusts, exchange rates, the transfer of credit and debt (Labib, 1969) and banking institutions for loans and deposits (Labib, 1969). It marked the emergence of the banking system.

The introduction of paper money (note) led to many advantages, like the replacement of coins (heavy weight) in transactions or enabling company to sell stocks. But since a note has no intrinsic value, there was nothing to stop issuing authorities from printing more of it than they had to back it with. Moreover, with the industrial revolution we increased goods production, and with the emergence of financial market systems we increased the value economics services. The improvement of services enhanced the trade between communities, without integrating any tangible assets like natural resources. This shift in the system view can be seen as a transition from **system 5** to **system 6** between **society** and **nature**. Society became more economically valuable as natural resources. At the same time, our vision of profit resulted in a more selfish and individualist attitude, and changed our relationship in the way that everything we do has a market price. This shift can bee seen in the transition from **system 4** to **system 6** between **society** and **economics**. We enter the learning education of high consumption.

The move from basic economic consumption to financial market can be seen as the third change in our learning system. We transform the value of our natural resources through intangible assets in "*seeing thinks differently*". This gap is actually due to our ignorance of limited resources and to our detachment to environmental relationship.

In fact, until 40 years ago the world was seen as an "empty" world, in which natural resources were abundant, social settlements were sparser, and inadequate access to infrastructure and consumer goods represented the main limit on improvements to human well-being (Costanza, 2008). But since the Stockholm conference and the publication of the report a limit to growth from the "Club of Rome" in 1972, the view of an empty world has changed, in the way that world resources are going to be depleted, if nothing is quickly done.

Since, humankind became aware of the limitation of natural resources, it developed the concepts of sustainable development and sustainability. In the next section, I explain the steps of the second transformation that we have to do to lead our society to sustainable education.

4.3 The transformation to achieve the new Paradigm of Sustainable Education

Mostly, when people talk about sustainable development or sustainability, they have many perceptions on how the concepts could be (see chapter 3.3), try to integrate it in following the principles and recommendations coming from the many summits or conferences established since today (see chapter 3.1 and 3.2), but still behaving into an economic vision. To enhance this transformation the IUCN has developed models (see chapter 3.4) to define what sustainable education is and how we should improve our environmental education to achieve the theoretical model of sustainable development, but it does not explicitly shows how we should reach it.

In fact, nobody has really an idea about how to achieve this new paradigm, this is only because they do not understand the change of comportment they have to follow in order to behave more sustainable. The model that I have developed in chapter 4.1 helps us understand the diverse transitions we have to take in order to transform our education (or our society) to achieve the new paradigm. Those steps are related to the three orders change of learning level (see chapter 3.6.1) in our educational system. The big issue that we are now facing is to switch our perception of our economical value to environmental value to 180°.

The first step is to leave **system 6** and move to **system 4** and **system 5** (figure 13). Actually this move is already visible at present in several types of public and private organizations. For business companies, for example as mentioned above in the chapter 3.4, the WBSCD already has distinct those moves with the concept of Corporate Social Responsibility (CRS) and *eco-efficiency*.

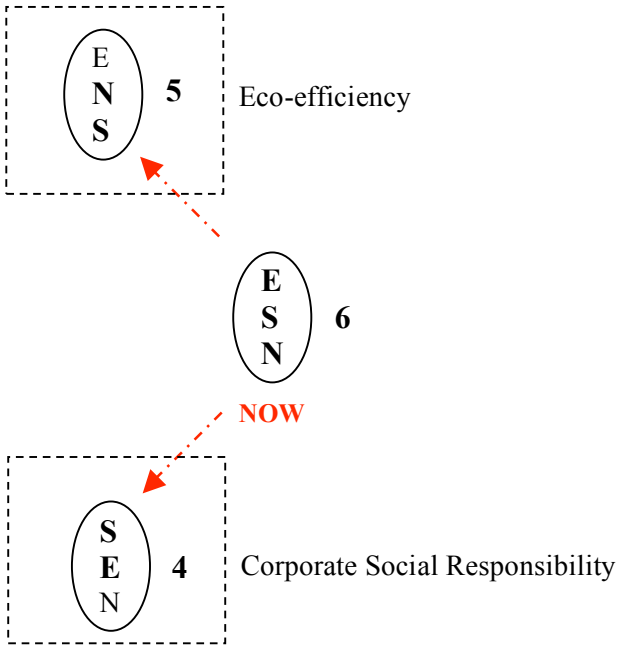


Figure 13. First transition of behaviour or first order change.

The WBCSD defines under the concept CSR the commitment of business to contribute to sustainable economic development, working with employees, their families, the local community and society at large to improve their quality of life. Thus environmental concerns are part of a companies' CSR (WBCSD, 2000). And the concept of eco-efficiency as the delivery of "competitively priced goods and services that satisfy human needs and bring quality of life while progressively reducing environmental impacts of goods and resource intensity throughout the entire life-cycle to a level at least in line with the Earth's estimated carrying capacity" (WBSCD, 2000). CRS shows the shift between economy and society through the move from **system 6** to **system 4** and eco-efficiency shows the shift between society and nature through the move from **system 6** to **system 5**. This can be seen as the first order change as "*doing things better*". These concepts are a first step for change, but there still exist negative feedback loops as mentioned in the chapter 3.6.1. Even if companies publish those commitments in their annual report, it does not mean that they implement it in their day-to-day business activities.

To achieve the second order change (figure 14), public and private organizations should not only sell themselves in the way that they increase their image value, but also really constantly implement those principles in their business model and business activities.

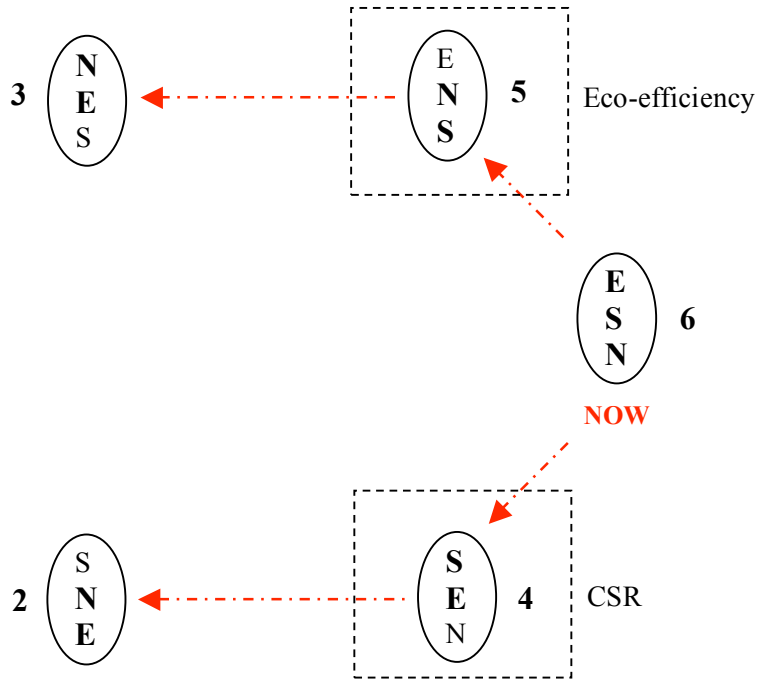


Figure 14. Second transition of behaviour or second order change.

Besides, those concepts need to be improved. For CRS, the problem of the definition comes from the perspective of quality of life, which is implicitly related to the growth of GDP, which is not anymore a subject of maintaining a high and sustainable quality of life (Woodward and al, 2009). The definition should argue that life quality must be seen as an equal share of natural resources for sustaining common living, this argumentation is visible in the model through the transition from **system 4** to **system**

2 and the shift between **economy** and **nature**. On the other side, the concept of eco-efficiency has a problem too. It should sustain the estimated Earth's carrying capacity and therefore continue to lead us to consumption, which push the risk further. The definition should argue that eco-efficiency should sustain less than the carrying capacity in order to give the possibility to biodiversity to regenerate itself. This represents the transition from **system 5** to **system 3** and the shift between **economy** and **nature**. Both changes in the definitions could be seen as "*doing better things*".

The last move to reach the new paradigm can be seen as following (figure 15). In the chapter 3.6.2, I have given an example about how sustainable education for architecture could be.

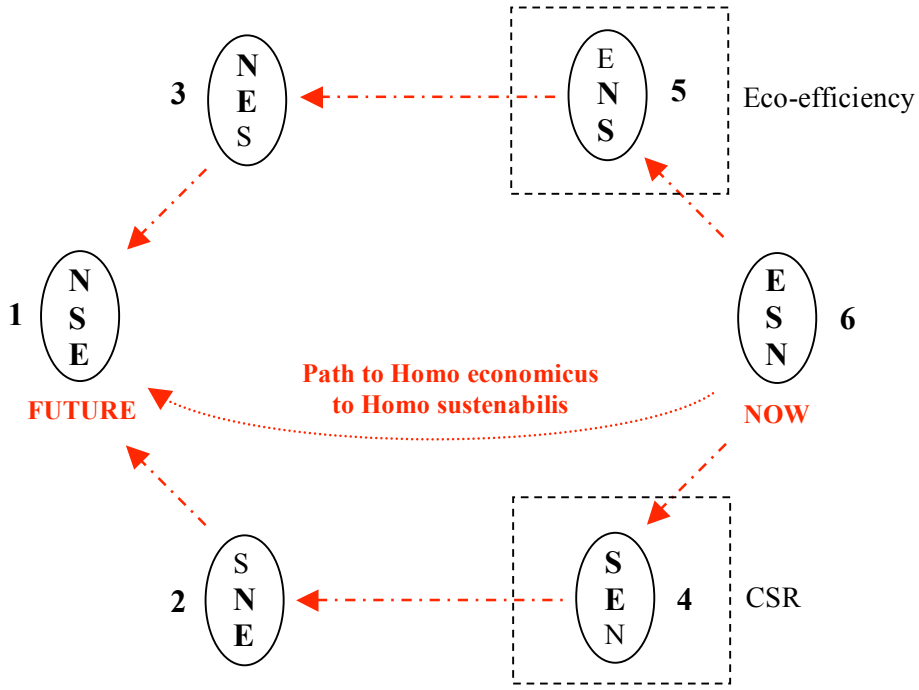


Figure 15. Third transition of behaviour or third order change.

As a matter of fact, our society since the beginning of it evolution has always consumed natural resources to sustain on this planet. But, could we not imagine changing our lifestyle in a way that we do not consume resources, but in contrary enhance natural resources through it. This would represent the transition from **system 2** and **3** to **system 1** or "*seeing things differently*". This last step will be the achievement of the new paradigm and a complete transformation of our society as a whole.

4.4 Achieving sustainable education

With the use of this model, we are able to visualize the steps that need to be completed in order to change our priorities to achieve the new paradigm. In altering our connection with our surrounding environment, we have lost a vital reference, which is actually the main key factor for our survival. In this sense, the model can be used as a guideline for educational leaders to understand the direction to take for achieving sustainable education.

As role model, universities have a major responsibility to lead our society into a change of perception of our surrounding environment. They have to be transformed in a way that they do themselves understand there own impact on our natural surrounding environment, integrating in every day activities the notion of environmental carrying capacity and respect of social equity, which is not the case actually. At present time, they still act in a first order change (system 6 → 4 and 5), event if they are making some progress. The educational model which behaves actually, continues to be economic oriented and will not end the problem. If students were learning in a system in which everything is thought to maintain the community to behave more environmentally friendly and socially fair, they will themselves be able to spread this behaviour outside university and be ready to face the environmental crisis. If this one occurs the costs coming from it will be bigger, than the costs to achieve the change, take as example the economic crisis in which we are now.

Recently, universities have become more aware of the problematic and try to increase this awareness in their community with more or less success. In the next part of this master thesis, I propose a holistic approach to increase a second change in order in a university system with a practical case study.

Part II
Practice in education for sustainability

5 Holistic approach to enhance second order change for SHE.

Since the establishment of the several declarations for sustainability for higher education, many educational institutions pushed by the trend of sustainable development and their commitment through the underwriting declarations have integrated education for sustainability with more or less success. In fact, many incentives were elaborated to enhance projects, which were mostly cancelled after a few years, because of financial problems, change of vision from the management board, departure or resignation from key people, etc… We see clearly that universities have difficulties in implementing education for sustainability (second order change) in their learning system (Sterling chap 3.5.1). If we use the model in chapter 4.1, we see that those systems are staying in the first order change, or staying in a negative feedback loop, and do not take the step to achieve the second order change.

With the analysis of Wright in chapter 3.2.1 developing interdisciplinary curriculum inside university does not seem to be a priority in the declarations and in the policy of some universities. As a matter of fact, those universities' policies do not push for cooperation neither with external partners like NGO's and industry partners and nor for collaboration with other universities. This disaffection can be seen inside the educational system too. Students will learn economics or social sciences or natural sciences, but will not study all of them in their university curriculum. Besides, interdisciplinary projects are rarely developed in those fields, which is a big mistake, because of the fact that in everyday life we are always confronted to technical, economical and environmental issues and with the people behind them, which have diverse educational background. The earlier the students will be confronted with others coming from diverse background, the better they will be prepared for the real life needs. In fact, this lack of collaboration is one of the main reasons for the unsuccessful implementation of sustainable development. Because of the complexity of the thematic, students should not only learn the purpose of the concept of sustainable development, but should integrate it in real case study by using their theoretical knowledge in practical situations. A second main reason for the unsuccessful implementation of sustainable development is the lack of collaboration between the diverse stakeholders participating in the university system dynamic. Many projects do not succeed because there is no common shared vision to achieve education for sustainability and therefore no motivation and financial support to work on this issue.

To respond to those problems, I am describing in the next sections a global framework to implement a sustainable change in a university system. The main idea is to connect every stakeholders of the system to a common action, which can be integrated through a participative process and connected with an epidemic model. The mix of both helps to understand the key elements to enhance the chance of success for achieving second order change within a university system.

5.1 Participative processes mixed with an epidemic model

How do we work towards transformative learning in a system that is itself intended to be a prime agency for learning? This is a difficult question and shows the complexity of introducing change in a learning system, especially in a university, where knowledge is at the highest level of society with a high degree of criticism. In this sense participative processes are a key issue to involve all the stakeholders of the learning system to joint a common action to lead to sustainable change. "Participative Processes" is based on the vision that bottom up participation of stakeholders inside a system has a huge potential of motivation, creativity, innovation and costs reduction. The idea is to match the commitment of different actors related to the system and gives them the opportunities to share their thoughts on the corporate vision, how they could actively participate in it, and what could be improved. It is an appropriate tool focused on the social-contextual conditions that facilitate intrinsic motivation, self-regulation, and well-being (Deci and Ryan, 2000). In addition, it helps to reduce four major gaps, which are the lack of knowledge, the lack of communication, the lack of data and the lack of coordination. The idea here is to see participative processes as a positive social epidemic inside the educational system (figure 10).

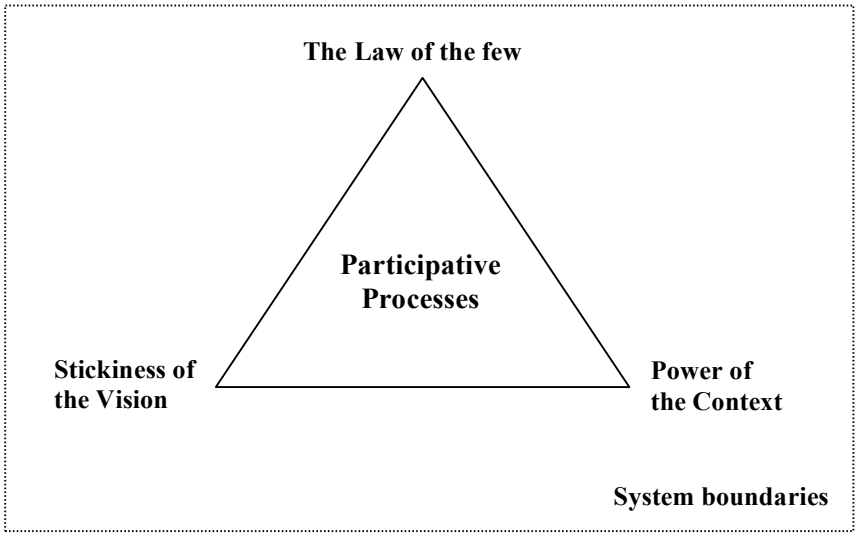


Figure 10. Representation of a Participative Process with the epidemic model of Malcom Gladwell.

Malcom Gladwell explains in his book 'the Tipping point' that there is more than on way to tip an epidemic, in other words. Epidemics are a function of the people who transmit infectious agent, the infectious agent itself, and the environment in which the infectious agent is operating. When an epidemic tips, it is because something has happened, some change has occurred in one (or two or three) of those areas. These three agents of change are called the Law of the Few, the Stickiness of the Vision, and the Power of the Context (Gladwell, 2000).

'The Law of the Few' means they are exceptional people who are capable of finding out about the trend, and through social connections and energy and enthusiasm and personality to spread the word. 'The Stickiness of the Vision' says that there are specific ways of making a contagious message memorable; there are relatively simple

changes in the presentation and structuring of information that can make a big difference in how much of an impact it makes. 'The Power of the Context' says that human beings are a lot more sensitive to their environment than they may seem (Gladwell, 2000).

Knowing the definition of these three agents of change, we can translate the figure 10 as follows:

- The *System Boundaries* means: where does the epidemic occur?
- The *Law of the few* means: who are the main actors of the epidemic?
- The *Stickiness of the Vision* means: what is the message of the epidemic?
- The *Power of the Context* means: when is the adequate social-context for the epidemic?
- The *Participative Process* means: how will be the epidemic supported?

The use of these five elements can be seen as a global framework for implementing social epidemic inside the educational system. But what kind of message is adequate to stick with university paradigm? Who are the relevant stakeholders who can enhance the change? When will be the perfect time to develop a change in their social-context? Where should this change occur? And how will it be supported to show visible results. Those questions are very hard to answer and show the complexity to implement activities with the aim to achieve sustainable education.

Therefore in the case of this master thesis, the next section shows a methodology to enhance a university community to increase education for sustainability (second order change). The main idea is to see the participation of each stakeholder to the change as an epidemic, which will propagate itself inside the university community.

5.2 Creating a social epidemic

Actually, social epidemics can be initiated in many different ways inside a university system. For example, if Al Gore presents his movie "An inconvenient truth" in a university, there will be many people more sensitized on the thematic of global warming, and being ready to act and change the world. But, after a while this motivation will fail, if it's not supported by visible actions in which people can take part to achieve concrete results.

In this section, I am presenting a methodology to enhance participation in a university system with the only aim of creating projects to reduce CO_2 emissions and increasing energy efficiency inside the campus; this represents the "what" of the epidemic. The "where" represents the geographical context of the university and sets the boundaries of the system, in which the participative process and these projects are implemented. The "how" represents the combination of a web platform with a 24 hours workshop, which is the framework to support the participative process and generates those projects. The "who" represents all stakeholders of the system, who will support those projects by participating in the process (directly or indirectly). The "when" represents the working context, in which the participative process and the projects should be integrated.

The main idea behind this methodology is to link all stakeholders of the university system to participate into interdisciplinary projects related to the vision of CO2 reduction and energy efficiency. In participating in a process mixing a platform and workshop, it enables them to exchange their knowledge on the topics and find concrete solutions to be implemented inside the system. Through this, they will be able to influence the whole system to change in two ways. The first is that, because of their success, other stakeholders can be interested in participating into the process and the second is that because resources will be used in an appropriate way, it will change the comportment of the stakeholders inside the system (figure 16).

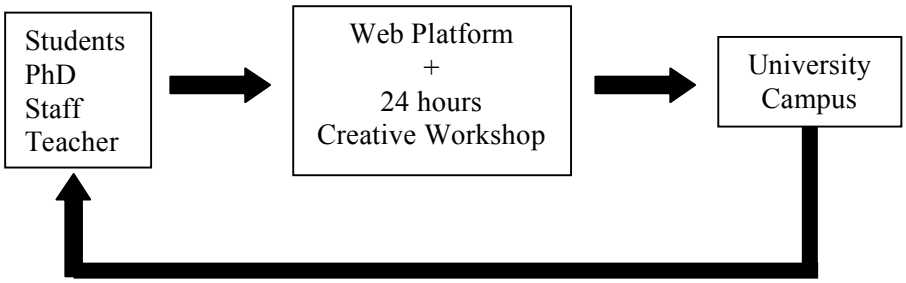


Figure 16. Representation of the influence of participative process on university stakeholders.

The biggest problem of participative process is that people have to participate. With the use of the model of Malcom Gladwell and its agent of change, we are able to understand the key elements, which are behind a social epidemic. In the next sections, I am explaining the steps to create a social epidemic in adaptation with these three agents of change.

5.2.1 Step 1: Identification of the socio-environmental system

As mentioned above, many universities are already implementing projects with the aim to improve sustainable development in education. In fact, many people are already aware of the thematic of sustainable development, especially on the topic of climate change.

The first step of the analysis is to find every policies, initiatives or projects inside the educational system, which are related to this topic. With the use of the three agents of change we can see it as follows:

The law of the few → Find all stakeholders responsible or related to those programs.

The power of the context → Define what kind of hierarchical and functional position they have in the system.

The stickiness of the vision → Analyse the message or projects they promote regarding the topic.

Through this analysis, it enables us to understand the global environmental dynamic of the system, the network behind it, their connections, and which activities they are promoting. To facilitate this approach, we can use the model (figure 17) elaborated by Muster, de Graaf and ter Keurs (1998).

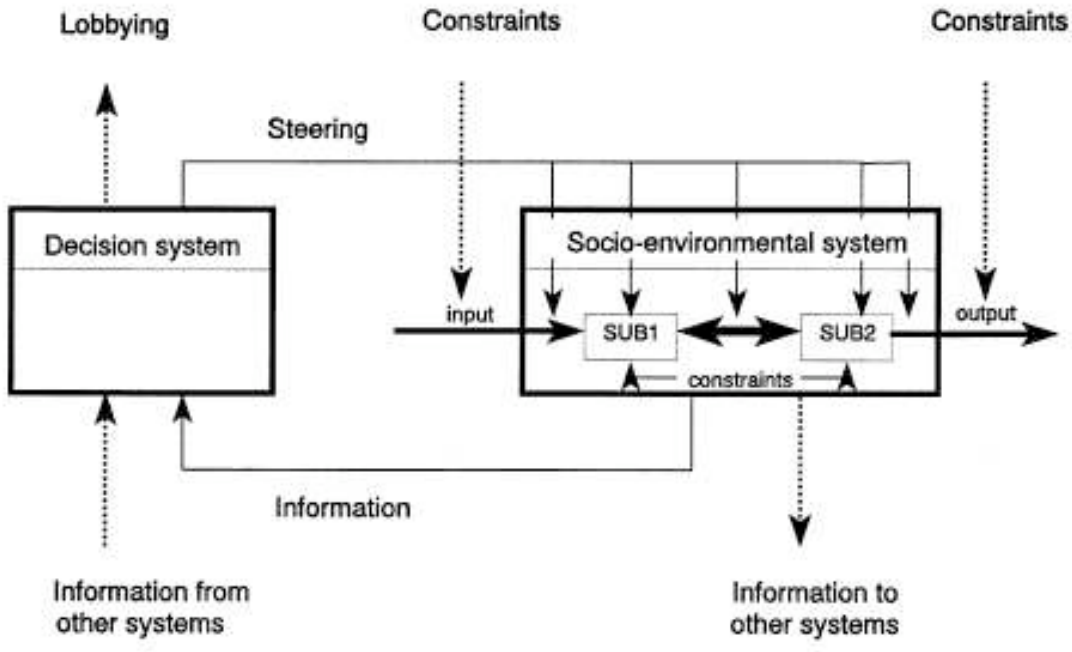


Figure 17. Representation of the steering of the socio-environmental system. SUB = Subsystem

In our case, the SUB – system unit can be seen as diverse department of the university system.

5.2.2 Step 2: Elaborate a concept to increase the environmental behaviour

After having had a global view of the system dynamic, the second step is to elaborate a concept which fits for all stakeholders promoting environmental awareness inside the campus. In our case, we suggest a web platform with a workshop to create interdisciplinary projects with the aim to reduce CO2 emissions and increase energy efficiency of the campus.

Law of the few → Assemble this stakeholder in a steering committee, the people involved should represent the entire stakeholders campus community.

Power of the context → Analyse with them how the concept can be adapted within the working cycle of each type of stakeholders represented in the campus community and define with them the motivation factors and the strategies.

Stickiness of the vision → Draw up with them a project name, which clearly underlines the purpose of the concept.

The notion of working cycle in the power of context can be seen as follows. In the case of students, it is non-sense to launch a workshop when they are in the exam period, they will simply have no time for it.

5.2.3 Step 3: Launching the concept

When the concept name is ready and the concept adapted to the working cycle of the potential participants, we can officially launch the concept and inform the entire campus community of the benefit they would profit from in taking part in (??) the process.

Law of the few → Ask the overall community to put their projects ideas and suggestions on the platform and invite them to participate at the workshop.

Power of the context → Use all the communication channels existing in the system to spread the news.

Stickiness of the vision → Keep the concept vision clear and adapt the communication to each type of stakeholder.

The idea here is to touch a maximum of person inside the campus with diverse communication channels, to make them aware of the vision and invite them to participate. This phase can be seen as infectious contact.

5.2.4 Step 4: Sustaining the concept

After having conveyed the concept inside the campus and invited the community to participate, only a few persons will participate. Those are the infection agents coming out of the workshop, who will have a concrete project to implement inside the campus. The idea here is to sustain those projects in a way that their results will affect the community to participate in the concept.

Law of the few → Find all stakeholders inside the community which are able to sustain the projects of the agents.

Power of the context → Adapt the project implementation with the working cycle of each stakeholders supporting the agents.

Stickiness of the vision → Show visible results related to the agents projected (??) implementation to the entire community. This will prove that the concept is working.

Through these four steps, I have presented a global methodology to create a social epidemic inside a university campus. An important parameter is the costs that such a methodology creates. These have to fit with the expectations of the steering committee regarding the results coming out from the participative process. Moreover, the implementation of the projects needs additional funding; therefore a cost-benefit and risk analysis for each project is required in order to optimize the process.

In the next chapter, I am presenting the project “ecoworks”, which is an initiative of the ETH Zurich to involve the entire community to create projects with the aim of reducing CO_2 emissions and increase energy efficiency inside the campus.

6 The initiative ecoworks a practical case to enhance second order change in a university system.

The case study approach is a main issue for researchers and practitioners to understand how and why a transformation in the learning system occurs or fails. Besides, case study can accommodate a variety of research designs, data collection techniques, epistemological orientations, and disciplinary perspectives. In fact, there is not only one-way to change the behaviour of a system, but more a sum of diverse incentives, which enhance the system to change. Based on the methodology of chapter 5, I am presenting in the section 6.2 a practical project case under the name "ecoworks", which was implemented in 2008 at the ETH Zurich.

For the elaboration of the concept and the implementation of ecoworks, the ETH Zurich mandated the company EarthEffect, which has been a new spin-off of the ETH Zurich since September 2008.

EarthEffect is a company which consults public and private organizations to implement participative structures and processes. Such measures not only improve the environmental performance but also enhance the staff's motivation and foster creativity and innovative power. EarthEffect initiated ecoworks and was responsible for its implementation.

In the next, section I will briefly present the ETH Zurich and the main programs or groups of activists related to sustainable development sensitization and environmental and social awareness over the campus.

6.1 ETH Zurich

ETH Zurich is Federal Polytechnical School of Switzerland and was founded in 1855. The community of the campus represents 18,000 people from 80 nations. The scientific fields of research are divided in five main areas, which are represented by 16 departments and 8 infrastructure divisions (appendix 10.3). ETH Zurich is engaged in basic research founded on scientific findings and in problem-solving research of lasting value. The interdisciplinary research conducted at ETH Zurich sets pointers for sustainable development worldwide. The university is a dependable partner for economy, politics and society. The Executive Board of the ETH Zurich specifies the goals and organization in the areas of teaching, research and administration. The executive board is represented by a president, a rector, a vice-president for Research and Corporate Relations, a vice-president for Finance and Controlling and a vice-president for Human Resources and Infrastructure. Besides, at a federal level, ETH Zurich is part of the ETH Domain[11].

ETH Zurich is involved in many projects related to the concept of sustainable development. Therefore in the next section, I will only briefly present the main program or associations related to the practical case of this master study.

ETHsustainability

Recently, ETH Zurich has implemented the new program ETHsustainability, which was founded at the end of 2008. Reporting directly to the President, it seeks to better coordinate the numerous players and diverse initiatives in the field of sustainable development both inside and outside of ETH Zurich.

The strategy for ETHsustainability concentrates on the following objectives:

- strengthening the involvement of ETH Zurich in sustainability;
- more comprehensively integrating sustainability issues in bachelor, master and PhD programs;
- increasing the accessibility and visibility of sustainability initiatives, activities and institutions within ETH Zurich;
- facilitating the flow of information and the exchange of experts between the units, research initiatives and institutions for sustainability and sustainable development;
- coordinating the activities in international alliances, networks and projects;
- cooperating with various national and international foundations and associations.

[11] The ETH Board is the strategic management and supervisory body of the ETH-Domain (ETH Law Art. 33a). It is presently composed of a president and eight further members from the worlds of science and commerce and industry. The ETH Board is responsible for fulfilling and implementing the science policy performance mandate set by the Federal Council and the Federal Parliament and for the four-year strategy for the ETH-Domain. It is also responsible for the allocation of Federal funding within the ETH-Domain.

RUMBA ETH Zurich

RUMBA is a program for a systematic resource and environmental management, an institution of the Federal Administration. It is based on a resolution of the Federal Council from March 15 1999. The main target of RUMBA is the continuous reduction of the product-related and operational environmental impact of the Federal Administration. Further targets of RUMBA are: to save costs and increase efficiency, to coordinate environmental activities of the Federal Administration, to motivate and stimulate the employees' own initiative and to give an example for environmental effort. The ETH Zurich participates in this program through the department of the vice-president for Human Resources and Infrastructure. The participants of this program are managed by to managers and involved partially one person coming from each department and infrastructure division. Those persons are mainly having a working position as coordinator within these divisions.

The ETH AGS (Alliance for Global Sustainability)

The Alliance for Global Sustainability (AGS) is a unique, international partnership between four of the world's leading science and technology universities:

- Swiss Federal Institute of Technology, Zurich (ETHsustainability)
- Massachusetts Institute of Technology (MIT/AGS)
- University of Tokyo (UT)
- Chalmers University of Technology (Chalmers)

Formally created in 1997, the AGS today brings together hundreds of university scientists, engineers, and social scientists to address the complex issues that lie at the intersection of environmental, economic, and social goals.

Association Project21

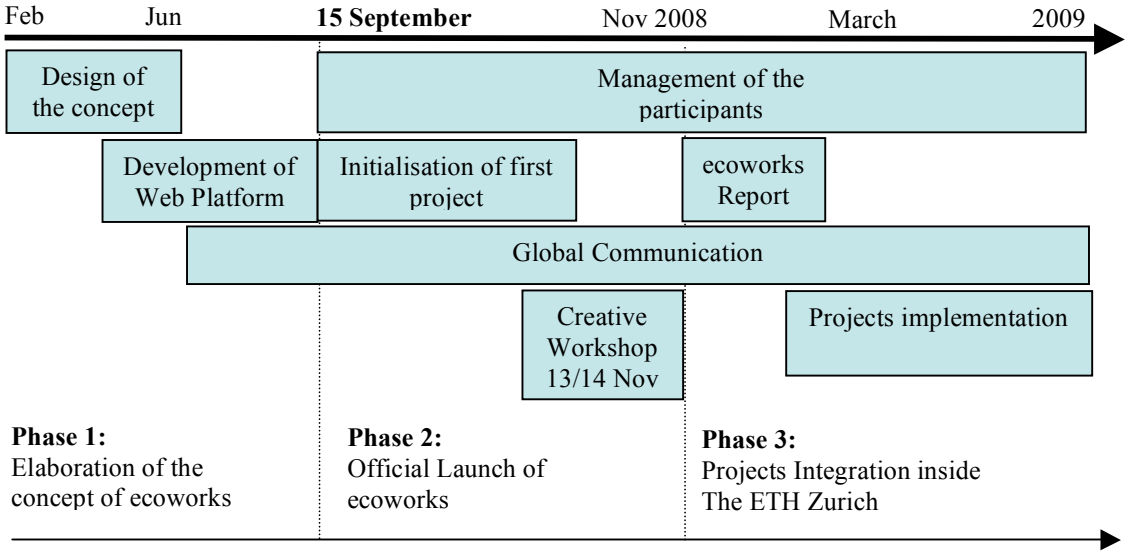
Project21 is the Student Community for Sustainable Development of the University and the ETH Zurich. It is an interdisciplinary group of students from both the University and the ETH Zurich, which engages in discussions and actions for sustainable development. This association was launched in 2001.

6.2 ecoworks, BE PART OF IT!

Ecoworks is an initiative of the ETH Zurich, which supports ideas and projects dealing with a reduction of CO2 or an increase of ETH Zurich's energy efficiency. This project is a socio-technical process, which combines an Internet platform with a 24 hour Creative Workshop, in which students, professors, teaching assistants and other staff of the ETH Zurich can participate. The internet platform serves as a medium of communication to give the important information needed to take part in the initiative and it gives the opportunity to the participants to put their suggestions or ideas in relation with the goal of the project: this is the technical part process. The workshop serves as medium of social exchange in which participants can work on the suggesting ideas coming out from the platform or to add new ideas: this is the social part of the process.

Once project ideas with clear targets are generated, the projects are carried out by students in conjunction with the faculty and will be integrated in the student's study plan and are rewarded with credit points. The projects themselves will be implemented in the ETH Zurich. The targets reached will be presented on the ecoworks platform after project termination.

Ecoworks process plan:



The process of ecoworks has three distinct phases, which are the elaboration of the concept, the official launch and the integration of the projects, coming out of the workshop, inside the ETH Zurich. These three phases are presented in the next sections.

6.3 *Phase 1: Elaboration of the concept*

The main idea behind the initiative ecoworks is to sensitize the community of the ETH Zurich on CO_2 and energy efficiency issues. Despite of having a lot of activities related to environmental education and education about sustainable development, there were a few initiatives made by individuals to create project oriented to the campus directly. The few people active in this area are related to the program RUMBA, which has the aim to improve the environmental impact of the overall campus, the association Project21, some teachers with personal initiative related to their field of study, and some individual students motivated by the thematic of sustainable development and having interest to receive credit points through a technical projects. Therefore, the idea to enhance the participation of these latter became the main interest to create the process. In fact, if we want to reduce the environmental impact of the ETH Zurich, why don't we involve more the students to create environmental projects inside the system they are studying. in. This will sensitize them on the thematic of environmental issues, make them understand better the system they are studying in, having more practical knowledge, meeting other stakeholders of the system and being able to implement a concrete project for the good of the community and additionally receiving credit points.

In our case this initiative arrived at a good time, because the managers from RUMBA were looking for a solution to link the program to the educational system and the board of directors was looking for initiatives to involve students on the thematic of sustainable development. Therefore, we suggest the following model (figure 18):

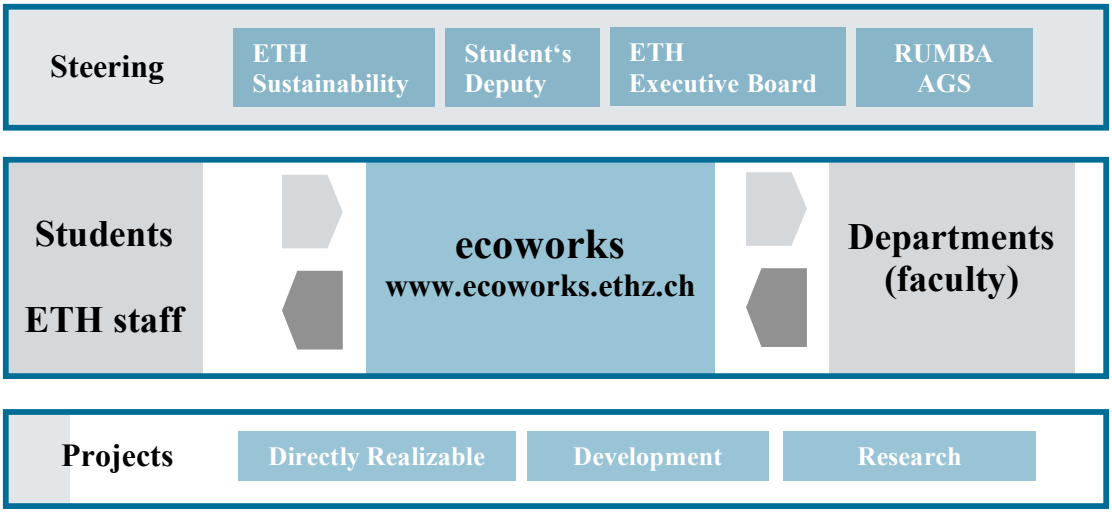


Figure 18. Representation of the initiative ecoworks at ETH Zurich

This model presents the overall vision behind ecoworks. The steering committee represents all relevant stakeholders related to sustainable development at the ETH Zurich. The projects represent all kind of projects possibilities related to the educational activities. Moreover the idea was to regroup the representative of all main activities related to sustainable development in a same basket. The phase 1 will be described more precisely in the next section.

6.3.1 Design of the concept

In a first step, we had to define if the concept and its name ecoworks was adequate to all stakeholders of the university community. The idea was for us to be sure that ecoworks do fit with the underlying message of environmental projects. We present the concepts to each group represented in the steering of figure 18, with the aim to receive their opinion about the concept and their support in being part of the steering committee. Then we worked with them in order to set the criteria of the projects coming out from the platform and the workshop, the right time to launch both actions, and on the motivation factors to invite the community to participate. The projects criteria are:

Implementable Projects

- Logistic and technical measures that lead to a direct reduction of CO2 or an increase in energy efficiency.
- Awareness-raising projects aiming at altering behavior.
- Improvement of resource utilization.
- Projects to enhance knowledge transfer and connect people according to the goals of ecoworks.

Application-minded research projects may include:

- Research and Development (R&D): Activities leading to probable applications for an enhanced environmental performance inside and outside ETH in the future.
- Highlighting potential: Studies highlighting opportunities where and how CO2 emissions can be optimized.

In the same time, we analyze the educational system of the ETH Zurich with the aim to find all environmental courses or possibilities for students to get credit points for these projects or to participate at the workshop. The target being to increase their motivation to participate in the initiative.

6.3.2 Development of web platform

The main idea behind the web platform (appendix 10.4) was to develop an information system, which could explain:

- the goal of the initiative
- how to subscribe for the workshop
- the projects criteria and how to proceed to give ideas and project suggestions

The projects suggestions were made in an art that diverse stakeholders could participate to the same project or have diverse roles in the project. For example, one teacher could give a project suggestion and a student could subscribe for this project or vice versa. Besides, behind the thematic CO_2 and energy efficiency, the participants

had the possibility to choose from five topics, which were mobility, waste, water, energy, other resources, and general sustainability. Also, we worked with a graphic designer and developed a graphical concept related to the goal of the initiative. The use of graphical support is important as it makes the concept more visible.

6.3.3 Global communication part 1

To keep the vision clear for every stakeholder, we organized continuous meetings to give the stage of the project. Those meetings were very fruitful because we could discuss about the last details of the official launch and communicate the next step of the initiative. Besides, it enabled us to adapt the information on the web platform through the feedback and helped us to start spreading the social epidemic. Fortunately, most of the people we were dealing with were highly connected with miscellaneous members of the community through their working function.

Through our analysis of the educational system to get students credit points, we contacted diverse teachers related to the initiative to obtain their support for giving students credit point for this purpose. Moreover, we presented the initiative to all associations of the ETH Zurich in order to get their support.

In the same time we analyzed all communication channels available in the campus and, with the support of the corporate communication of the ETH Zurich, we established a communication plan and defined a strategy to sensitize the overall campus community to the initiative.

In the next section, I am explaining the second phase of ecoworks, which is the official launch of the initiative.

6.4 Phase 2: Official launch

The official launch of the initiative was the 15th September 2008. An information session was organized the 8th of October 2008 to inform the participants on the goal of the initiative and to answer their questions. The 24 h workshop was held during the 13th and 14th October 2008.

6.4.1 Management of the participants - part 1

Once the initiative was launched, we organized a support to respond to the diverse questions coming form the campus community. Besides, for new participants involved we had to manage them in order to inform them continuously of the next steps of the operation.

6.4.2 Initialisation of first project

Through the functionality of the web platform, the participants began to put their idea on it. Here are the main fields they have to fulfil to present their ideas or suggestions:

- Title of the project
- Role in the project
- Project type (Mobility, Waste, and so on)
- Project art (Bachelor, Master, and so on)
- Goal definition
- Problem description
- Solutions
- Date of beginning the project
- Estimation of the time to do the project
- How many participants required for the project
- Skills researched

Once their projects were introduced in the platform, they were visible for other participants.

6.4.3 Global communication - part 2

With the use of the communication plan, we were able to target all stakeholders of the campus. We organized two communication waves. The first one was to make the people aware of the information session and the workshop (appendix 10.5), and the second was more focused on the workshop (appendix 10.6).

The miscellaneous communication actions used were:

- Email (students, teachers, staff global mailing list)
- Poster (distributed in every buildings in the campus)
- Flyers (specific area or directly distributed hand to hand)
- Internet banner (main website)
- Internet Website (linked from other webpage of the campus)
- Professor or a professor associate (Presentation to their students)
- Slide presentation on the electronic screen of the main building
- Administrative or technical employees
- Oral presentations in classes
- Newspaper of the ETH Zurich
- Newsletters from Student association
- Personal contacts through ecoworks team

After the workshop an article was published in the magazine of the ETH Zurich showing the results.

6.4.4 The creative workshop

The workshop was organized in the way that participants having put their ideas or suggestions on the platform could work on it with others during the event. Also, participants having no ideas, but motivated to do something, could simply join in. In order to add more practical knowledge, we invited professional experts to support the participants during the event. Moreover, students coming from the technical school of Luzern were invited to participate in the workshop in order to analyse the dynamic of the participants during the event. The methodology used to enhance group working, creativity and innovation is called unBla[12] and was organized by the professional moderator.

The program of the workshop was established in a way to perform the following phases (more precision of the program see appendix 10.7):

- knowledge networking
- ideas marketplace
- ideas maturation
- team building
- project development
- final presentations to colleagues
- judgment of work for awards

[12] unBla, which means no blabla is a methodology of knowledge management for creative processes in large groups. It was developed by Dr. Patricia Wolf and Dr. Peter Troxler

The goal of the workshop was to have concrete project proposal (appendix 10.8) with motivated teams being able to implement them inside the university campus in a close future. The projects were evaluated as following:

- scope of the project
- goals and problem definition
- description of the solution
- CO_2 reduction/energy saving
- Cost – Benefit breakdown
- Critical factors
- Sustainability of project
- Implementation outlook

At the end, a jury representing diverse backgrounds related to the topic rewarded the best projects and the participants received a certificate for their engagement.

6.5 Phase 3: Project integration inside the ETH Zurich

After generating project ideas and put them into concrete project plans, the last phase was to integrate them inside the campus and to show to the entire community that something had happened and that the results were visible. But more precisely that something had changed and that people could be part of it. As a matter of fact, nowadays the development of the initiative is still in this phase of integration, therefore I will not be able to thoroughly describe the project implementation part.

6.5.1 Ecoworks report

We have elaborated a small report showing the first results. The purpose was to present the initiative and its goal in order to promote it to the rest of the community as a factor of success. Moreover it finalizes the two first phases or the process.

6.5.2 Management of the participants - part 2

After the workshop, we have continued to inform the participants of the next step of the initiative. Three months later, they were asked to participate in the implementation of the projects. Through their feedbacks, in which they were confirming their contribution, we established working groups and started the implementation process.

6.5.3 Global communication - part 3

Directly after the workshop, we presented the results to the steering committee and to each group we had elaborated the concept with. The purpose was to have the first feedback on the impact we had inside the campus, to analyze the factor of success and failure and to define the following steps of the initiative.

Once all the groups were aware of the results and ready to support the continuation of the initiative, we contacted the participants as mentioned in section 6.5.2.

To increase the participation, at the same time we published an article in the magazine of the ETH Zurich and sent an email to specific groups of students inviting them to participate in the implementation of the projects. This was done to involve more participants in the available projects.

As mentioned above, we are still in the part of the integration of the projects. At this point, it is difficult to know the factors of success and failure through the results of the implementation and therefore solving the problems and integrating solutions on the campus. The next chapter will present the results according to the first phases of the initiative ecoworks.

7 ecoworks results

In this chapter, I will present the results coming out of the elaboration phase and the launch phase from the ecoworks initiative. The results are presented in two parts. The first one is related to the involvement of the participants. The second is based on a survey in order to measure the effect of our global communication process, to define the students motivations for participating and know their opinion on the website and the workshop.

The management team of ecoworks expected to get at the end of the workshop approximately 10 to 15 projects, which could potentially be implemented on the campus.

7.1 Results of the creative workshop

The creative workshop was attended by one hundred and nine participants. Thirty-five suggestions and ideas were put on the website and seventeen projects (appendix 10.9) came out of the workshop.

Summary Workshop	Nb. of participants
Project participants	80
ETH intern	7
Experts	8
Jury	9
Ecoworks team	5
Total	109

Table 4. Overall participants at the workshop.

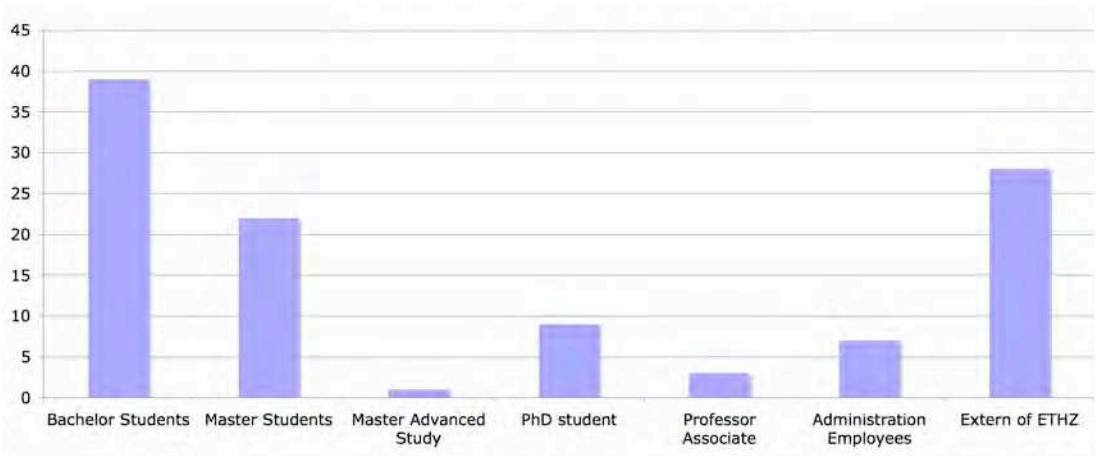
Project participants represent the people having worked on a CO2 or energy efficiency project. ETH intern represents staff members from the campus. Experts are external professionals, who participate in order to improve the quality of the project. The jury represents the participants involved in the quality control of the projects and the ecoworks team (EarthEffect and unbla) is composed of the people managing the workshop.

In order to understand the following results, we have to make a distinction between the project participants, who are mainly students and all ETH Zurich participants. As mentioned in section 6.4.4, external people representing others institutions took part in the workshop process (appendix 10.10). Some of them, especially the students of Lucerne, participated in the project team and others were representing the jury or professionals for project's support.

In the two next sections we are going to see the distribution of the participants coming from the ETH Zurich and the distribution of the participants per project.

7.1.1 Participants coming from the ETH Zurich

During the workshop, eighty-one participants coming from the ETH Zurich have taken part in the event. They correspond to nearly all the types of stakeholders active in the campus (graph 1).



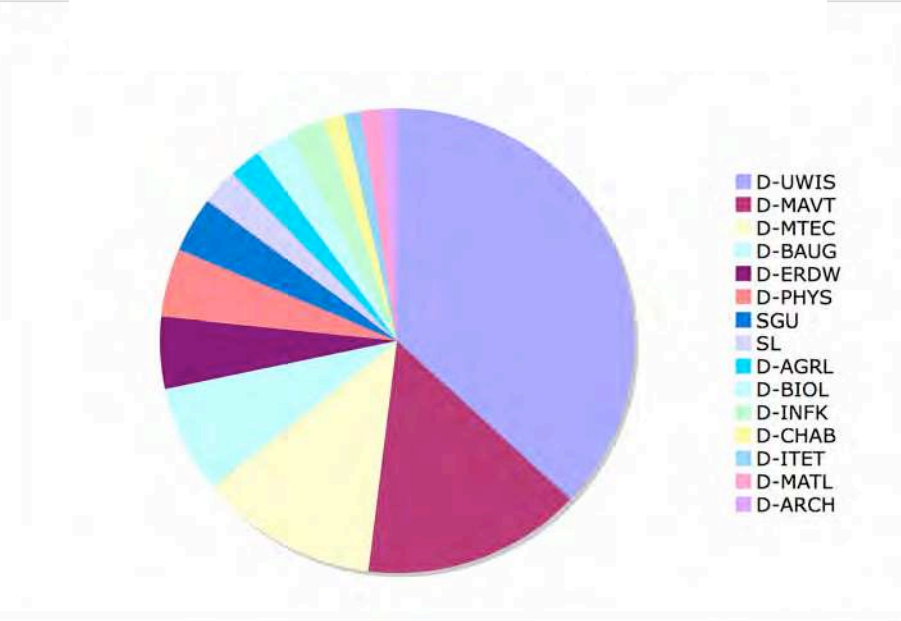
Graph 1. Distribution of participants coming from the ETH Zurich.

Stakholders	Workshop	All ETHZ
Bachelor Students	39	7134
Master Students	22	2987
Master Advanced Study	1	574
PhD student	9	3205
ETHZ Staff	10	6741
Total	81	
Extern of ETHZ	28	

Table 4. Distribution of participants at the workshop compared to the all ETH Zurich community.

Compared to the number of people in the ETH Zurich, we see that the participants represent a really small proportion of the campus community. In table 4, ETHZ Staff represents the administrative employees and the professor associates. Actually, the number of students involved is more than 15'000 and 6'500 full time jobs equivalent for the employes. Because, of the distribution of different activities per employee, I just picked up the relevant numbers to make the comparison (ETHZ Annual report p. 56). The external people of the ETHZ can be found in the appendix mentioned in section 7.1.

Graph 2 shows the distribution of the participants per department and infrastructure division.



Graph 2. Representation of participants per departments and infrastructure divisions

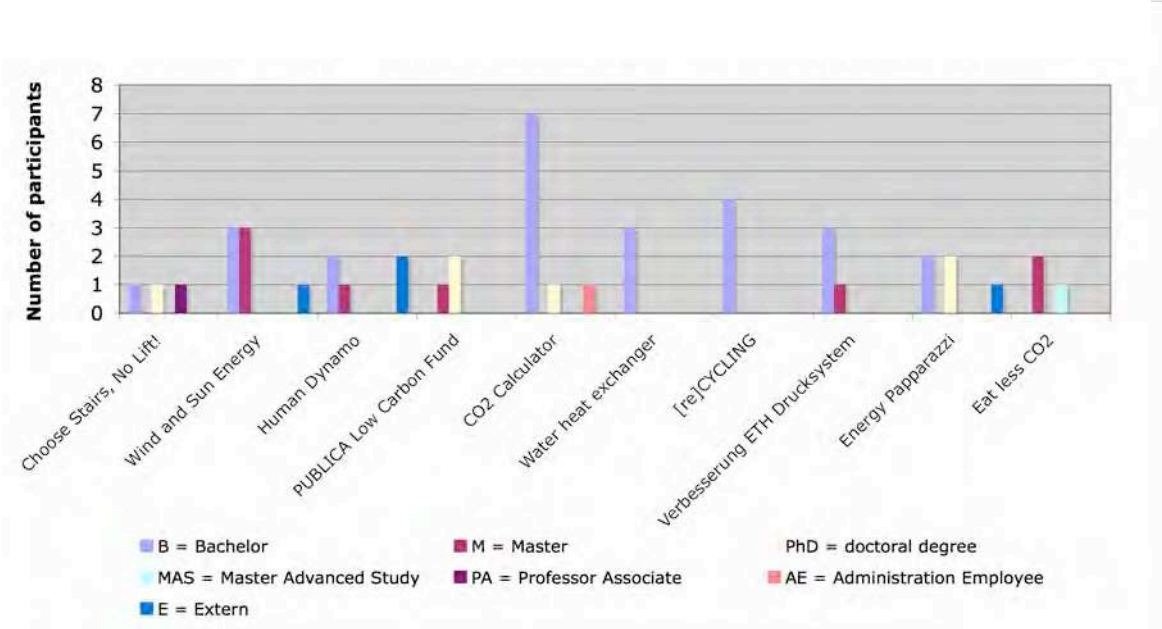
Department or division	Workshop
D-UWIS	30
D-MAVT	12
D-MTEC	10
D-BAUG	6
D-ERDW	4
D-PHYS	4
SGU	3
SL	2
D-AGRL	2
D-BIOL	2
D-INFK	2
D-CHAB	1
D-ITET	1
D-MATL	1
D-ARCH	1
Total	81

Table 5. Distribution of participants per department and infrastructure divisions.

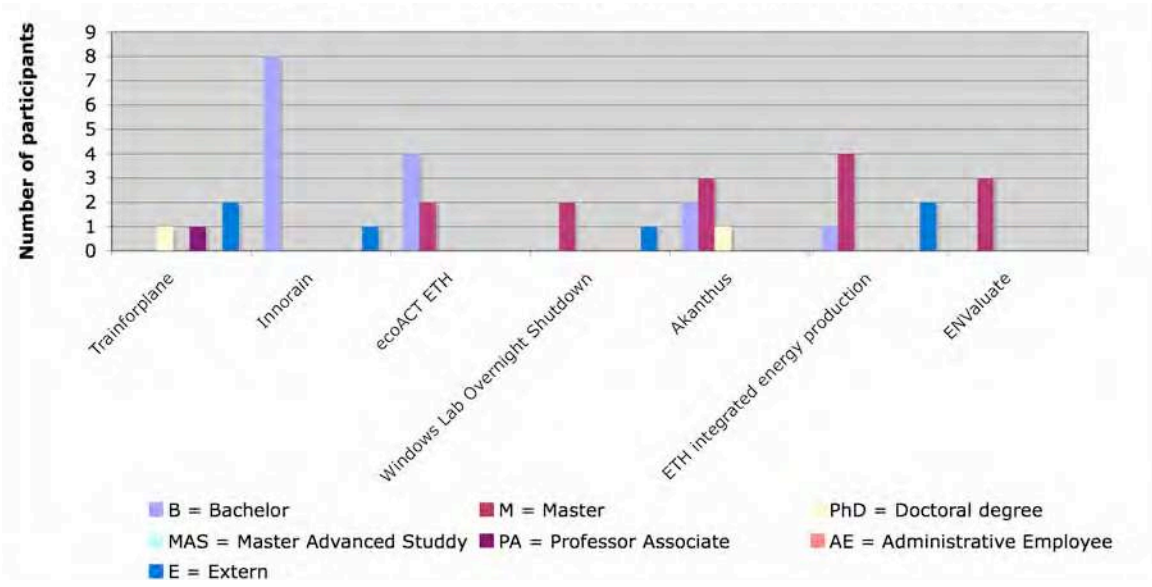
The participants represent 13 departments of the 16 of the ETH Zurich. The executive board (SL) is represented by 2 members and the department for environment and safety (SGU) is represented by 3 members. Unfortunately, it was not possible to compare the number of participants and the number of people in each department and infrastructure divisions as the numbers coming out of the annual report of the ETHZ do not fit with the classification given here.

7.1.2 Distribution of the participants per project

As mentioned above in section 7.1, 17 projects came out from the workshop. In graph 3 and 4, we see the distribution of the diverse stakeholders per project.



Graph 3. Distribution of participants per project part – 1.



Graph 4. Distribution of participants per project part – 2.

We see here that almost each project is represented by more than one type of stakeholders and almost each project has more than one department or infrastructure department represented (appendix 10.11). In the next section, I am presenting the results coming out from the survey, which was submitted to the participants at the end of the workshop.

7.2 Survey results

The aim of this survey was to understand the key elements of the initiative, which motivated them to participate at the initiative, how the message of ecoworks has been perceived and the impact of our miscellaneous communication actions. Table 6 shows the degree of participation in the survey (appendix 10.12).

Ecoworks Survey - Results

	Survey	Total Part.	Participation
Bachelor Student	27	39	69.23%
Master Student	13	22	59.09%
Master Advanced Student	0	1	0.00%
PhD Student	5	9	55.56%
Professor - AP	0	3	0.00%
Admin + Tech employees	0	7	0.00%
External of ETH	0	28	0.00%
Total	45	109	41.28%

Table 6. Participation to survey.

We see that more than forty percent of the participants have responded to the survey and are all students.

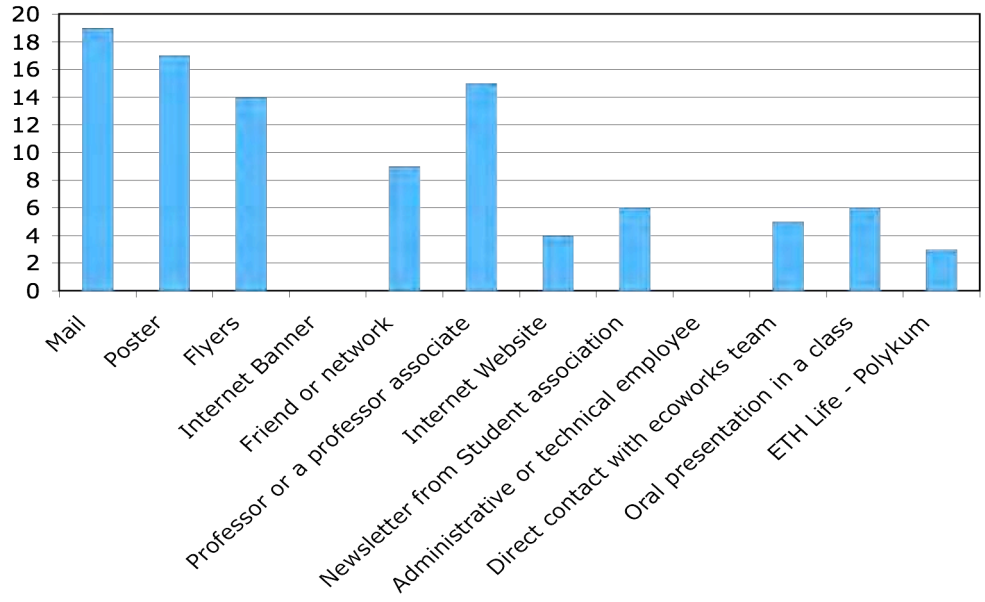
In the interpretation of the following results, we have to be aware that we have a mix of students between the technical school of Lucerne (8) and the ETH Zurich (63).

7.2.1 Global communication

As mentioned in section 6.4.3, to increase the awareness of the community about the initiative, we organized a huge communication's action. On the website data we were able to see the number of individuals hit on the platform. Unfortunately, those results are not so relevant, because many communication actions were undertaken at the same time. Therefore, we are not able to explain which action has a bigger impact than another. The only clear peak that we see in graph 5 (appendix 10.13) is the mail sent to the overall community, but this is not relevant concerning the motivation of the community to participate. Unfortunately, there is a gap in the data, which correspond at the time of the distribution of the flyers..

On graph 6 (appendix 10.13) we accumulate the distribution of the individuals hit to see the progression of the interest, the peak related to the sending of the mail is visible too. For both graph 5 and 6, we separated the hits coming from the ETH Zurich and from Switzerland to see the difference of impact inside and outside the campus. In fact, many people from the ETH Zurich could have a look on the platform at home. Moreover, some external agents have made some publicity outside the campus and we found external websites linking the web platform. The results coming out from the data are only interesting in the way that we see a linear progression of the hit, but we cannot make any relevant conclusion.

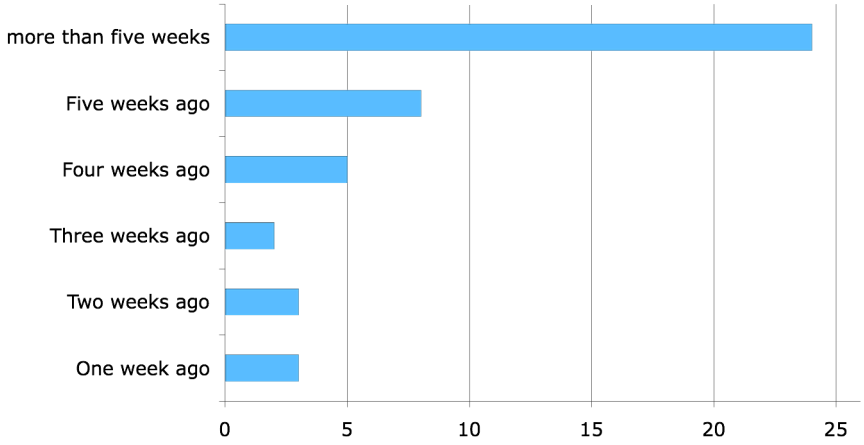
To understand the impact of our communication's action, we asked the participants through which means of communication they did hear about ecoworks. Graph 7 shows us the results (multiple answers possible).



Graph 7. Responses of the participants regarding the diverse communication means used to promote cutworks.

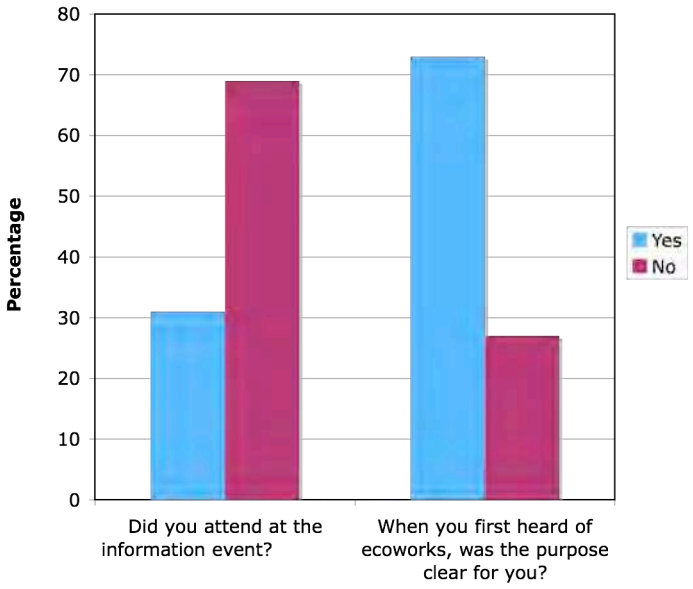
We see here that mails, posters, flyers, through professors or professor associates and friends or network were the main relevant channels to spread the message of ecoworks. But, unfortunately, those results are not relevant. In fact, the results coming from the professors and professor associates are mainly due to the involvement of two professor associates coming from the ETH Zurich, which enabled their students to receive credit points if they took part in the workshop. Because of the miscellaneous channels used to promote the initiative it is possible that some students could have been informed of this initiative, for example, through the posters, , but have forgotten about it and therefore did not write it on the survey.

Another point related to the communication was to know the time scope before the workshop (13 November), in which participants were aware of the launch of the initiative (15 September). This is represented in the graph 8.



Graph 8. Awareness of the participants regarding the initiative.

We see here that the participants were actually quite early aware about the initiative. This does not concluded on their motivation to be part of the process but gives us a big signal that our communication strategy has worked in the sense that we launched the initiative in a good period, in which students were receptive. But this information can also be misinterpreted. In fact, since the beginning of the elaboration of ecoworks, and to assure a success with the initiative, we focused a part of our communication to specific stakeholders with high potential of interest. Therefore, it could explain that most of the participants were informed quite early. This assumption is visible also through the results in graph 9. In fact, for seventy percent of the participants, the purpose was clear the first time they heard about ecoworks and less than 30 % attended the information session.



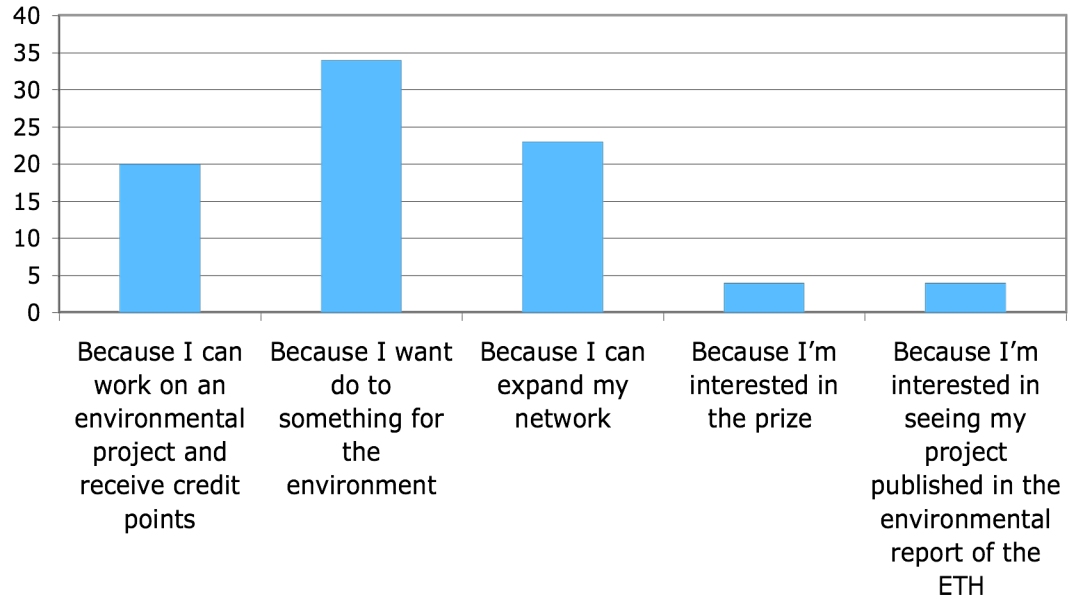
Graph 9. Representation of the clarity of the initiative.

7.2.2 Motivation factors

The main difficulty to encourage the campus community to participate in the initiative was to find the adequate messages to accentuate the interest to joint the workshop. The messages promoted were:

- Taking part of an important environmental process at ETH Zurich.
- Getting ECTS-Points for their project.
- Experiencing implementable project for career entry.
- Getting linked with other students, scientists, and staff of ETH Zurich.
- Experiencing and learning about new methods of creativity and innovation processes in large groups.
- Winning a price for their project.
- Getting a certificate.
- Having the possibility to publish their project the annual environmental report of ETH Zurich.

Through the graph 10, we see the major motivation factors, which have pushed the students to participate (multiple answers possible).

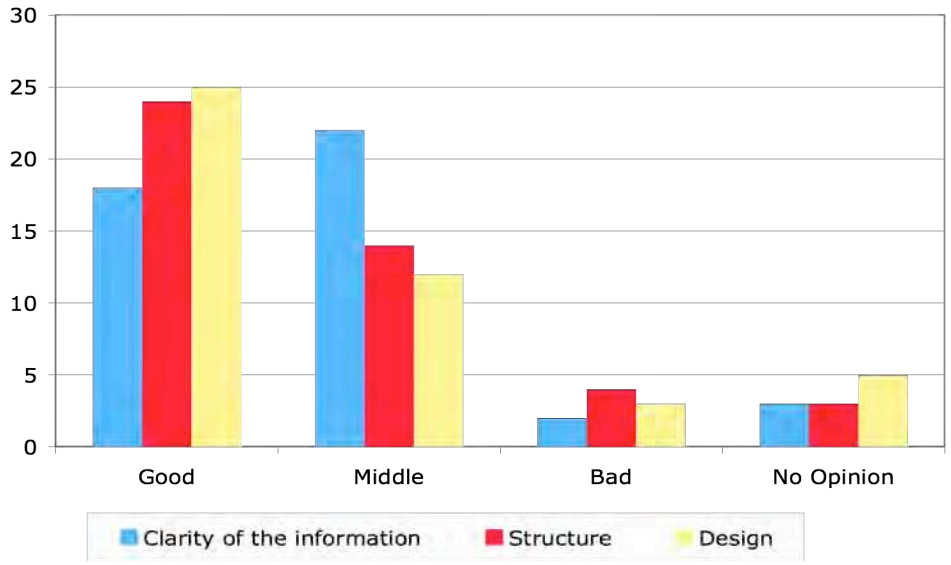


Graph 10. Motivation factors related to the students participation

We see here that the three main motivation factors for the students were the possibility to receive credit points for environmental project, to do something for the environment and to expand their network. With the interpretation of the credit points, we have to be aware that many students were encouraged by their teachers to participate in the workshop and therefore will receive credit points. But, in another way, it is a clear sign that there is a potential interest to be rewarded in this sense.

7.2.3 Web platform

As main tool for our communication, we asked the participants a feedback to see where we should make improvements A first feedback coming from individuals before the official launch of the initiative was positive, but we preferred to do a second one. The results are presented in the graph 12.



Graph 12. Feedback concerning the web platform.

Through the results, we can say that the clarity of the information, the structure and the design was seen as more than acceptable for most of the participants. One important missing parameter was the functionality of the platform. This element is vital, because it is for us a main component behind the dynamic of the platform.

7.2.4 Workshop

Actually another survey was established by the team unBla (section 6.4.4.) concerning the satisfaction of the participants. Unfortunately, the results have not been officially published yet, but regarding the survey results (appendix 10.14) the participants were quite happy with the outcome of the workshop.

*7.3 **Discussion***

Locally we can say that the elaboration and the launch of ecoworks was a success. As mentioned above in chapter 7, through this initiative we were able to joint one hundred and nine participants to work together with the aim to create projects related to the thematic of CO_2 reduction and increase of energy efficiency inside the campus of the ETH Zurich. With the workshop and the platform we achieved seventeen concrete projects related to the topics of the initiative. Those projects are oriented in many fields such as mobility, waste, water, energy, other resources and sustainability in general. Moreover, they represent through their working group a big cultural and skill diversity. In fact, many departments and diverse type of stakeholder of the ETH Zurich were represented; in addition external stakeholders represented by the university of applied sciences and arts high of Lucerne, professional and other institutes coming from the ETH Domain took also part in the process. This participation shows exactly what sustainable development is, a new paradigm, which involved the entire society.

Globally, we are not yet able to define if the initiative is a success. At the present time, we are not able to see the effect of the projects on the overall community for many reasons. The first is that many projects are still under development, and some need the support of new participants to be implemented. Despites the motivation of the participants to work on their project, the management team took too much time before launching the integration phase. Because of the system dynamic, many participants specially the students were already busy with other educational activities. Here we see a particular factor of motivation, keeping the process going without interruption. In fact, to keep people motivated, we always have to inform and manage them in a way that the project integration is seen as time reduction inside the curriculum and not the opposite. For example, by contacting them in March, most of them have already established their study plan and are not able to change it, despites the fact that a management team is available for them. Another factor could be seen through the difficulty to implement the project inside the ETH Zurich. In fact, the uncertainty related to a new study approach will be balanced with the normal educational activities and therefore will be abandoned for an easier task, which gives the same amount of credit points.

Another reason is the reluctance of diverse stakeholders to change the curriculum of the students in order to facilitate the integration of those projects inside the educational plan. This resistance is due to the hierarchy of the system, which is quite resistant to the change. This is mainly due to administration work and social conflict and political interest coming from the decisions leaders, especially in the case of funding. Moreover, without concrete visible results, the risk of a failure and the uncertainty enhance the resistance to the change.

Finally, there are no specific assessment tools to measure in the time the influence of the process on the whole system of the ETH Zurich. Some numbers could be actually used to measure the social participation and the reduction of the environmental impact of the system. We can compared the number of participants with the global community of the campus, the number of bachelor and master projects compared to all projects of the same kind, the number of departments involved in the process, the number of credit points compared to an entire student’s curriculum and so on.

Actually, if we compare the model and the initiative ecoworks, we still have to improve the process in order to involve the overall community to achieve education for sustainability. To increase the second order change, each student should have the possibility through its curriculum to subscribe directly in an ecoworks project, which is not the case at present time in the ETH Zurich. Moreover, they should also be rewarded for their participation in the workshop. In our case, the participation of the students was made on a voluntary basis. We were lucky to have a few professor associates, who have supported us and have invited their students to participate in the workshop in exchange of credit points.

Moreover, we see in the results that only a few people from the staff took part of the process. One reason is probably due to the fact, that the workshop was held in English and most of the people in the staff do not speak this language. In fact, the language used for such a process should fit with the culture of the system. When many languages are used for a complex process like this, misinterpretations in the communication can occur and therefore reduce the motivation to participate. In such a process, it is important to implicate the staff, because through their work and practical knowledge, they have often concrete project proposals that a student could work on. But because of hierarchical pressure and not enough funding, those projects are rarely supported. It is often difficult to suggest amelioration on a project due to a mistake of the supervisor.

To close this section, we see in the results that the main vectors of motivation for the student are to do something for the environment, to increase their network and receive credit points. If we focus them to act in the campus system in which they are learning, we improve those three vectors, through environmental awareness, environmental education, and interdisciplinary knowledge and can enhance education about sustainability to education for sustainability.

8 Conclusions

Achieving sustainable education is not a utopia, but a social transformation in our education system. In fact, society's attempt to achieve sustainability has already begun and is still a long process, which has to be continuously improved and sustained.

As a role model for society and future leaders, universities must involve society and show it how to change its behaviour with natural resources. This change must not only occur in our society, but must take place first in universities themselves. At present time and despite that many actors in education system are already deeply involved in sustainability for higher education, there is no coherent vision on how sustainable education should be. Although many declarations were established during the several world sustainable development conventions, which underline the main principles for it, there is no clear direction for its achievement.

Therefore in the first part of this masters thesis I tried to summarize this evolution and the concept behind our education to achieve what is called sustainable education. Through the model of the two paths to achieve sustainability, which is based on the priority we set on the three pillars of sustainable development, I give a new perspective on the steps to transform our actual educational model based on the homo economicus belief to the new paradigm of sustainable education. This transformation follows three steps of change in learning based on the work of Bateson and Sterling, which are "doing things better" for "doing better things" in order to "see things differently". In fact, our learning system must be accommodated to the topic of sustainable development (education about sustainability), reformed in a way that we implemented it in our daily lifestyle (education for sustainability), and be transformed to achieve sustainability (sustainable education).

At present time many universities of the world still have difficulties to implement concretely sustainable principles in their educational system and to involve all campus stakeholders to participate at it. Therefore in the second part of this master thesis, the introduction of a methodology mixing participative process with an epidemic model to enhance second order change in the learning system has a great potential. This can be seen as a springboard between educating people about sustainability and educated people for sustainability.

Through the initiative ecoworks of the ETH Zurich, we see that locally such process is possible, but unfortunately I'm not able to affirm yet if this initiative has an influence on the overall system. In fact, more data are needed to be available to see the influence of this initiative on the stakeholders and the infrastructure of the system, which will define the success and the possibility to measure the change.

Therefore, further work could be done by the implementation of a new assessment tool, enabling us the possibility to see the impact of each ecoworks projects on the system. Moreover, we could do a comparison with another university, which have not yet implemented similar initiative and compare the degree of attention on sustainable education activities with and without such initiative. Additionally, we could compare the resilience of those systems to adapt themselves to the change by using as control parameter the introduction of credit points in students curriculum.

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10 Appendix

10.1 ***Analysis of the diverse declarations for sustainability for higher education, and diverse university policy***

Policy/declaration	Moral obligation	Sustainable physical operations	Encourage sustainable research	Public outreach	Inter-university cooperation	Partnerships with government, NGOs and industry	Develop inter-disciplinary curriculum	Ecological literacy
Stockholm Declaration	×			×				×
Tbilisi Declaration	×		×	×		×		×
The Talloires Declaration	×	×	×	×	×	×	×	×
The Halifax Declaration	×			×	×	×		×
The Kyoto Declaration	×	×	×	×	×	×		×
Swansea Declaration	×	×	×	×	×			×
CRE Copernicus Charter	×		×	×		×		×
Thessaloniki Declaration	×			×		×	×	×
Dalhousie Draft Environmental Policy	×	×		×		×	×	×
George Washington University	×	×	×	×		×	×	×
Macalester College Implementation Plan	×	×	×	×	×	×	×	×
McGill Draft Environmental Policy	×	×	×					×
Queens University	×	×						
Tufts University	×	×	×	×	×	×		×
U of Buffalo Environmental Policies	×	×		×				
U of British Columbia Policy	×	×	×	×	×	×	×	×
University of Hertfordshire	×	×	×	×			×	×
University of Southern Carolina	×	×		×			×	×
University of Toronto	×	×		×				
University of Wales Swansea	×	×	×					×
University of Waterloo Policy	×	×	×	×			×	

Table 2. Analysis of diverse declarations for SHE and university policy, Wright (2002b)

10.2 ***List of major strengths and weakness of diverse assessment tools***

Assessment Tool	*Major Strengths*	*Major Weakness*
State of the Campus Environment	– Comprehensive; Combines eco-efficiency & sustainability – Identifies barriers, drivers, incentives and motivations – Identifies processes and current status	– Little use of the term "sustainability" – Small sample within each college or university
Sustainability Assessment Questionnaire	– Emphasizes (cross-functional) sustainability as a process – Useful as a conversational and teaching tool – Probing questions that identify weaknesses and set goals	– No mechanisms for comparisons or benchmarking – Difficult for large universities to complete
Auditing Instrument for Sustainability in Higher Education	– Flexible framework for institutional comparisons – Process-orientation which helps prioritize and set goals through developmental stages	– Difficult to comprehend – Motivations are potentially excluded
Environmental Report and Workbook	– Useful in strategic planning and prioritizing – Collects baseline data and best practices	– Operational eco-efficiency and compliance focus – Difficult to aggregate and compare data – Motivations are largely ignored
Greening Campuses	– Comprehensive, action orientation incorporating processes – Explicitly and deeply addresses sustainability – User-friendly manual with case studies, recommendations	– Calculations and comparisons difficult – Focus on Canadian community colleges – Resources out-of-date
Campus Ecology	– Cross-functional, practical "guide" and framework – Baseline for current tools	– Environmentally focused (i.e. not sustainability) – No longer "state-of-the-art"
Environmental Performance Survey	– Process-oriented – Compatible with environmental management systems	– Operational eco-efficiency – Neglect of sustainability and cross-functional initiatives
Indicators Snapshot/Guide	– Quick, prioritized environmental "snapshot" – Opportunity for more depth on issues of concern	– Operational, eco-efficiency focus with little reference to processes, motivations, benchmarking and sustainability
Grey Pinstripes with Green Ties	– Model for data collection and reporting – Links programs and reputations	– Not sustainability-specific – Neglects decision-making processes and operations
EMS Self-Assessment	– Rapid self-assessment focused on processes	– Operational eco-efficiency focus

Table 2. Analysis of diverse assessment tools Shrieberg,(2004)

10.3 ***Department and infrastructure divisions of the ETH Zurich***

Departments

Architecture and Civil Engineering
- Architecture (ARCH)
- Civil, Environmental and Geomatic Engineering (BAUG)

Engineering Sciences
- Biosystems Science and Engineering (BSSE)
- Computer Science (INFK)
- Information Technology and Electrical Engineering (ITET)
- Mechanical and Process Engineering (MAVT)
- Materials Science (MATL)

Natural Sciences and Mathematics
- Biology (BIOL)
- Chemistry and Applied Biosciences (CHAB)
- Mathematics (MATH)
- Physics (PHYS)

System-oriented Natural Sciences
- Agricultural and Food Sciences (AGRL)
- Earth Sciences (ERDW)
- Environmental Sciences (UWIS)

Management and Social Sciences
- Humanities, Social and Political Sciences (GESS)
- Management, Technology and Economics (MTEC)

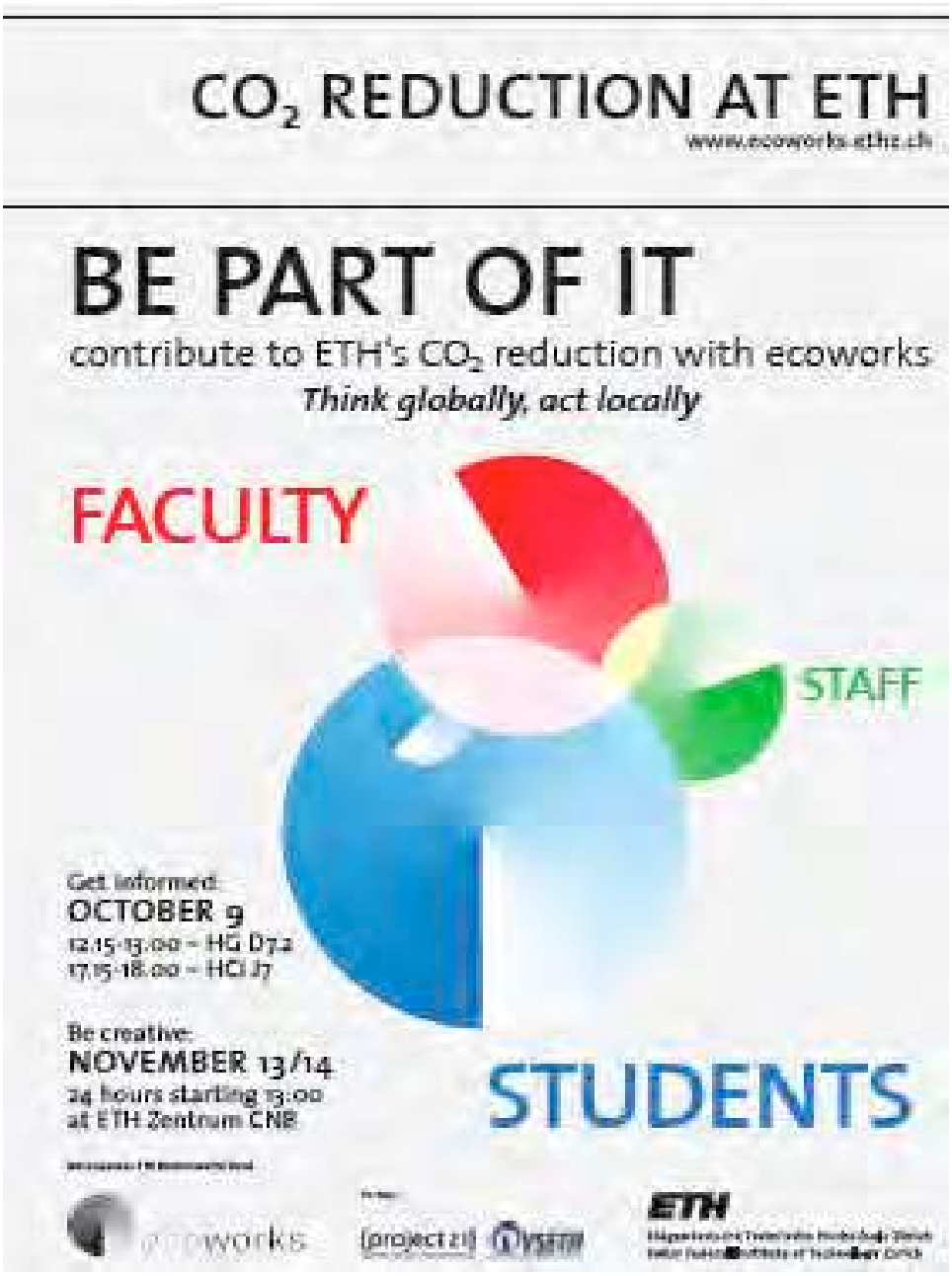
Infrastructure Divisions

- Corporate Communications
- Rectorate
- Centre for higher Education
- ETH Library
- Computing Services
- Personnel Office
- Finance and Controlling
- Immovables: (Building, Operation, Services, Portfolio Management, Security, Health and Environment)

10.4 ***Web platform of ecoworks***

Picture 1: Design of the website of ecoworks.

10.5 ***First communication wave***



Picture 2: First poster distributed inside the campus of the EHT Zurich.

10.6 ***Second communication wave***

Picture 3: Second poster distributed inside the campus of the EHT Zurich.

10.7 ***Creative workshop program of ecoworks***

November 13th 2008

1 pm start and knowledge networking
Opening by Prof. Dr. Roman Boutellier, the new Vice President Human Resources and Infrastructure.

Subsequently, the participants will get to know each other and get together according to their subject (knowledge networking).

5 pm project market
This is about forming teams around project ideas. The teams will work on their projects and may eventually win a prize for them.

6:30 pm chill-out / networking drinks
The bar opens and you will find new opportunities to make acquaintances, to ponder on ideas or just to relax…

7:30 pm dinner buffet
Salads and warm meals will be added to the supply of foods available throughout the event: fruits, sandwiches, tasty appetizers, cakes etc.

9:00 pm nightshift starts!
Those who still have some strength left are invited to work on. This part will be about refining the ideas. Projects will now take on their shape.

12:00 a midnight's soup will be served
Just the right refreshment for those who are still going strong! Regain your strength for the night…

November 14th 2008

From 8:00 am "muesli and Co." and business breakfast
Breakfast for "night shifters" and early risers.
Exchange with experts and interested people from public and private organizations.

09:00 am Now, let's just put it down on paper
The final corrections can now be made. A preset template will help to ease and speed up the writing process.

12:00 noon deadline for the project descriptions

4:00 pm award ceremony for the 3 best projects
Prof. Dr. G. Schmitt, [delegate] Senior Vice President for International Institutional Affairs, will hold a closing speech.

10.8 ***Ecoworks project evaluation form***

Cover Sheet

Project Name	***Error! Bookmark not defined.***
Project ID	***Error! Bookmark not defined.***
Project Member 1	***Error! Bookmark not defined.***
Project Member 2	***Error! Bookmark not defined.***
Project Member 3	***Error! Bookmark not defined.***
Project Member 4	***Error! Bookmark not defined.***
Project Member 5	***Error! Bookmark not defined.***
Project Member 6	***Error! Bookmark not defined.***
Project Member 7	***Error! Bookmark not defined.***
Project Member 8	***Error! Bookmark not defined.***

Instructions

Use this project evaluation form to document your project.

1. *Fill out this cover sheet*
2. *Answer all questions on the following pages. The yellow boxes will be used for project evaluation by the jury.*
3. *Turn in the evaluation form no later than Friday November 14, 13:00 by mailing it to admin@ecoworks.ch*

Scope of Project

(5 lines)

- *Describe in a few sentences the content of your project*
- *What are the expected outcomes in terms of possible CO2 reduction or energy savings?*

Evaluation of scope

☐ *(2 points) Clear description of project scope. Most important aspects and outcomes are described clearly.*

☐ *(1 point) Somewhat unclear.*

☐ *(0 points) Unclear description.*

Analysis

Problem Definition and Goals

(5 - 10 lines)

- *Describe the problem addressed by your project.*
- *What is the current situation? What are the problems associated with it?*
- *What should be optimized? What are the goals to be reached?*

Set of Possible Solutions

(5-10 lines)

- *How could be the problem described above be solved? Explain different approaches to overcome the current situation.*
- *Explain why you have chosen your solution*

Evaluation of Analysis

☐ *(2 points) Clear description of problem definition. It is obvious that project addresses an issue that has the potential to lead to a reduction in CO2 output or energy consumption. It is explained why the chosen solution is the preferred one.*

☐ *(1 point) Somewhat incomplete description. Unclear goal or no alternative solutions described.*

☐ *(0 points) Unclear description.*

Chosen Solution

Solution Description

(10 – 20 lines)

- *What does your project aim at? What is the expected outcome?*
- *How does it address the problem describe above?*
- *Describe the solution in detail.*

Evaluation of Solution Description

☐ *(2 points) Clear description of solution. Solution is feasible.*

☐ *(1 point) Somewhat incomplete description.*

☐ *(0 points) Unclear description.*

CO2 Reduction / Energy Savings

(10 - 20 lines)

- *What are the energy savings and/or CO2 reductions ? State electricity savings in terms of MWh. Make feasible assumptions.*
- *Also calculate 'grey' energy (energy used for the production of goods which are used for your project*

Evaluation of O2 Reduction / Energy Savings

☐ *(2 points) Good and realistic assumptions, correct calculations.*

☐ *(1 points) Calculations are somewhat unclear, assumptions may be improved.*

☐ *(0 points) Wrong assumptions and Calculations*

Cost – Benefit Breakdown

(10 lines)

- *Breakdown of costs (investment, operating cost). Make qualified assumptions, for instance the cost of one employee is CHF 80.- per hour.*
- *Breakdown of financial benefits due to energy savings or other savings.*
- *What is the net profit of the project (if any)?*

Evaluation of Cost – Benefit Breakdown

(2 points) Good and realistic assumptions, correct calculations.

(1 point) Calculations are somewhat unclear, assumptions may be improved.

(0 points) Wrong assumptions and calculations

Critical Factors

(5- 10 lines)

Evaluation of Critical Factors

☐ *(2 points) Good and realistic appraisal of critical factors.*

☐ *(1 point) Not all factors one can think of are mentioned*

☐ *(0 points) Unclear factors.*

Sustainability of Project

(5 – 10 lines)

Ongoing effects:

Positive side effects:

Can the project be replicated, for instance in other organizations?

Evaluation of Sustainability of Project

☐ *(2 points) Project is highly sustainable*

☐ *(1 point) Project is sustainable to a certain extent*

☐ *(0 points) Not sustainable*

Implementation Outlook

(5- 10 lines)

- *What are the major steps / milestones in your project?*

- *How much time do you plan for each of the steps?*

Evaluation of Implementation Outlook

☐ *(2 points) Clear project plan with milestones. Time schedule is feasible.*

☐ *(1 point) Schedule somewhat unclear.*

☐ *(0 points) Unclear description.*

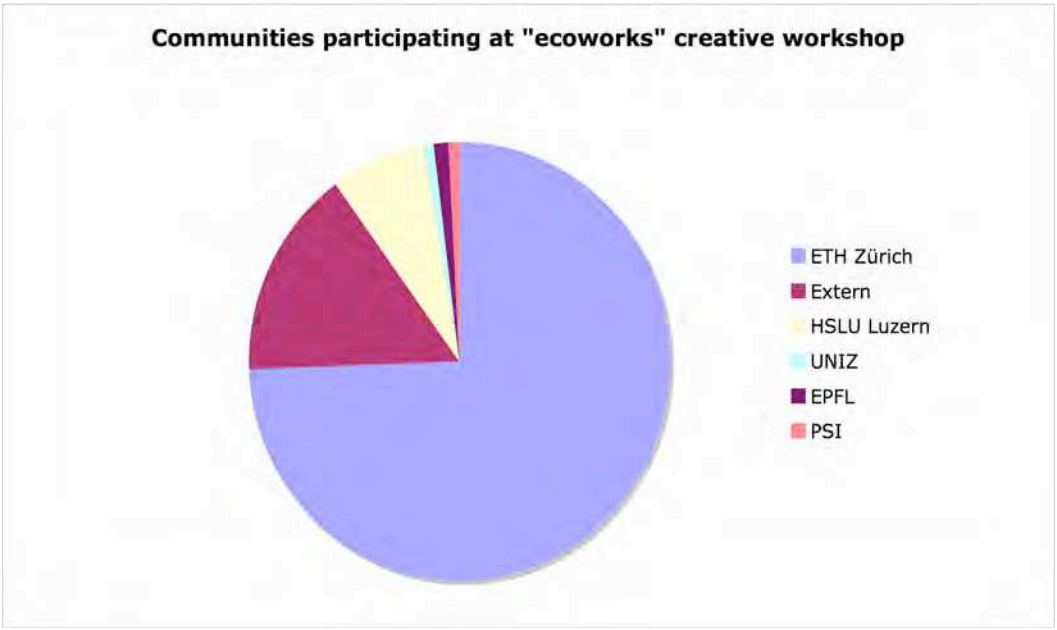
Overall Assessment

Total points from above
CO2 Reduction / energy savings - *very high savings: > 250t CO2 or 100 MWh Electricity per year => 6 points (250 t Co2 is about 1% of the total CO2 emissions of ETH)* - *high savings: 100t – 250 t CO2 / 40 – 100 Mwh => 5 points* - *med to high: 20 – 100 t CO2 / 8 – 40t Mwh => 4 points* - *medium: 10 - 20t CO2 / 4 – 8 Mwh => 3 points* - *low: 5 – 10t CO2 / 2 – 4 Mwh =>2 points* - *very low: 0 - 5t CO2 / 0 – 4 Mwh =>1 points* ***Points to be multiplied with number of points from 3.b 'CO2 Reduction / Energy Savings'***
Net profit of project - *high profit: > 50'000 (which equals 0.5% of the cost of flying for instance) => 6 points* - *medium profit: 10'000 – 50'000 => 5 points* - *low profit: 0 – 10'000 => 4 points* - *low costs: 0 – 10'000 => 3 points* - *medium costs: 10'000 – 50'000 => 2 points* - *high costs: 50'000 – 100'000 => 1 points* - *very high costs: > CHF 100'000 => 0 points* ***Points to be multiplied with number of points from 3.c 'Cost – Benefit Breakdown'***
Total amount of points

10.9 ***Projects coming out from the workshop***

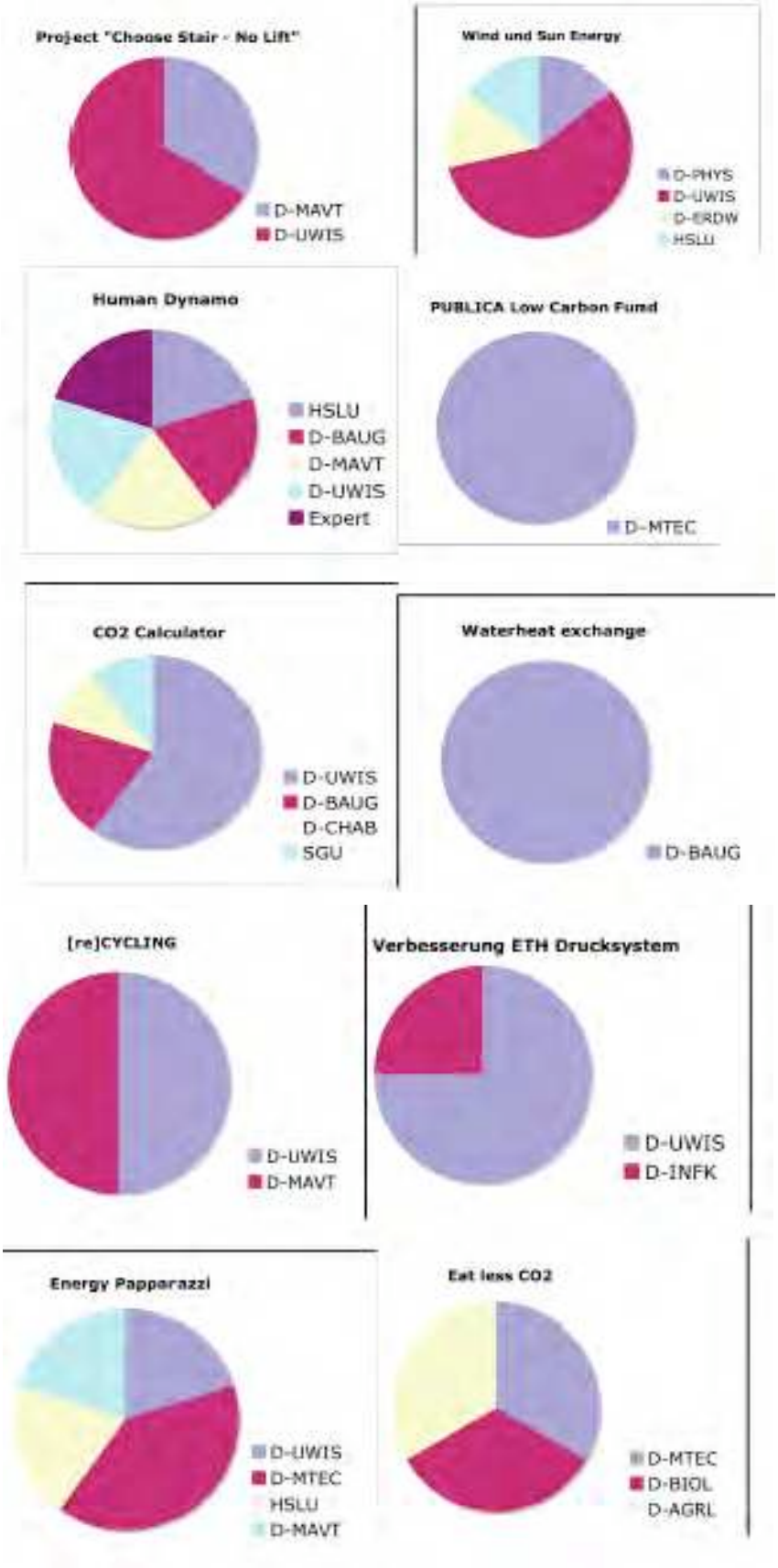
Titel	Nb of partcipant	Thematic
Choose Stairs - Not Lift!	3	Mobility
Wind and Sun Energy	7	Energy
Human Dynamo	5	Energy
PUBLICA Low Carbon Fund (**WINNER**)	3	General Sustainability
CO2 Calculator	10	Energy
Water heat exchanger	3	Energy
[re]CYCLING	4	Waste
Verbesserung ETH Drucksystem (**WINNER**)	4	Resources
Energy Papparazzi	5	Energy
Eat less CO2 (**WINNER**)	3	Resources
trainforplane **(WINNER)**	4	Mobility
Innorain	9	Water
ecoACT ETH	8	General Sustainability
Windows Lab Overnight Shutdown	3	Energy
akanthus	6	Energy
ETH integrated energy production	7	Energy
ENValuate	3	Mobility

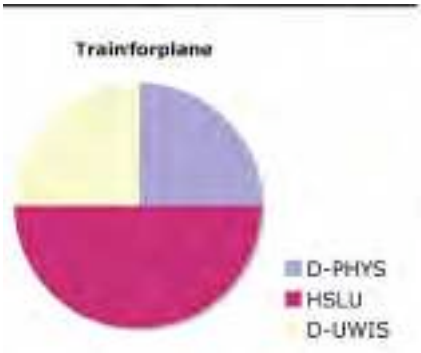
10.10 ***External participants community***

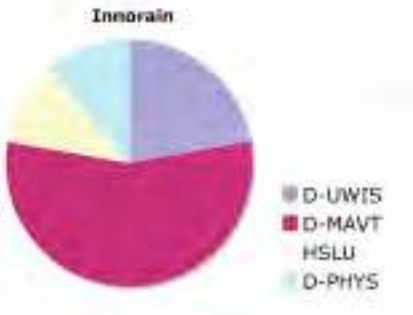


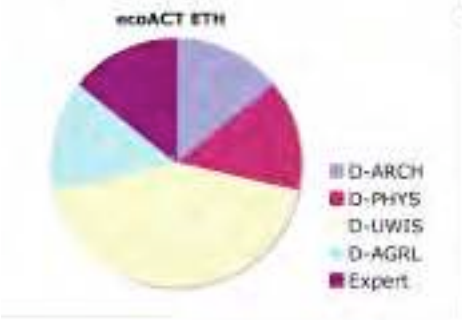
ETH Zürich	81
Extern	17
HSLU Luzern	8
UNIZ	1
EPFL	1
PSI	1
Total	109

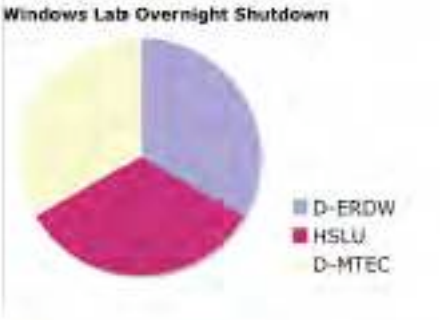
10.11 ***Representation of departments and infrastructure divisions per project***

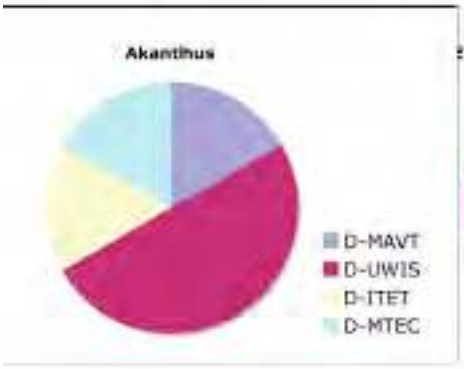


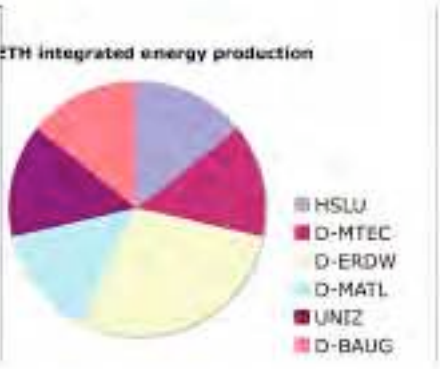

Trainforplane
D-PHYS
HSLU
D-UWIS

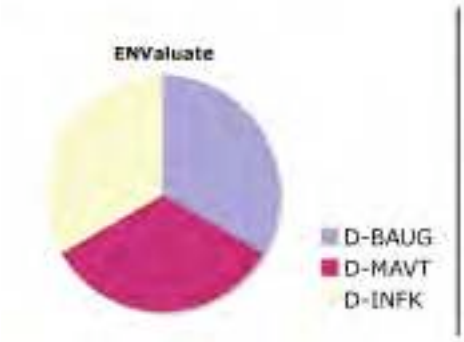

Innorain
D-UWIS
D-MAVT
HSLU
D-PHYS


ecoACT ETH
D-ARCH
D-PHYS
D-UWIS
D-AGRL
Expert


Windows Lab Overnight Shutdown
D-ERDW
HSLU
D-MTEC


Akanthus
D-MAVT
D-UWIS
D-ITET
D-MTEC


ETH integrated energy production
HSLU
D-MTEC
D-ERDW
D-MATL
UNIZ
D-BAUG


ENValuate
D-BAUG
D-MAVT
D-INFK

10.12 ***Global survey***

Ecoworks Communication survey

Your background
☐ Bachelor Student
☐ Master Student
☐ Master Advanced Student
☐ PhD Student
☐ Professor
☐ Associate Professor
☐ Administrative employee
☐ Technical employee
☐ External of ETH please specify:_____
☐ Others please specify:_____

General communication

When did you learn about ecoworks?
☐ One week ago
☐ Two weeks ago
☐ Three weeks ago
☐ Four weeks ago
☐ Five weeks ago
☐ more than five weeks

By what means of communication did you hear about ecoworks? (multiple answers possible)
☐ Mail
☐ Poster
☐ Flyers
☐ Internet Banner
☐ Friend or network
☐ Professor or a professor associate
☐ Administrative or technical employee
☐ Direct contact with ecoworks team
☐ Oral presentation in a class
☐ ETH Life - Polykum
☐ Internet Website please specify:_____
☐ Newsletter from Student association please specify:_____

Did you attend at the information event? ☐ Yes ☐ No

When you first heard of ecoworks, was the purpose clear for you? ☐ Yes ☐ No

If No, please shortly explain:
_____
_____
_____
_____

Why did you decide to take part of ecoworks? (multiple answers possible)

☐ Because I can work on an environmental project and receive credit points
☐ Because I want do to something for the environment
☐ Because I can expand my network
☐ Because I'm interested in the prize
☐ Because I'm interested in seeing my project published in the environmental report of the ETH

Other reasons:
_____
_____
_____
_____

Ecoworks Website

How do you assess the clarity of the information?

☐ Good ☐ Middle ☐ Bad ☐ No Opinion

How do you assess the structure?

☐ Good ☐ Middle ☐ Bad ☐ No Opinion

How do you assess the design?

☐ Good ☐ Middle ☐ Bad ☐ No Opinion

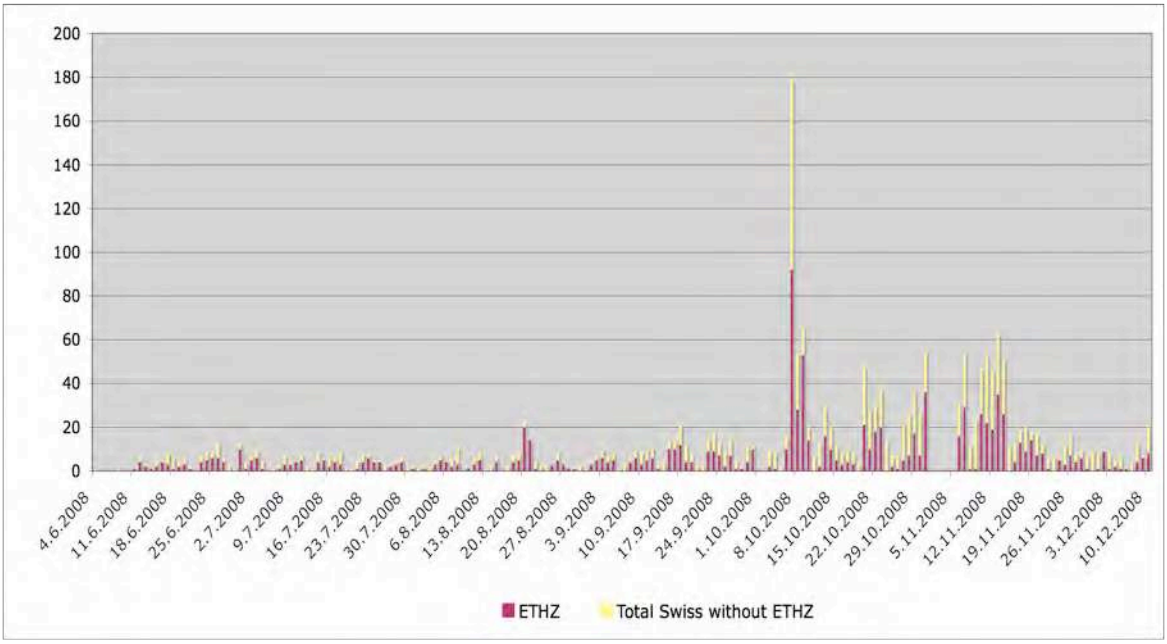
Do you have any suggestions about what is missing on the ecoworks website?

_____
_____
_____
_____
_____

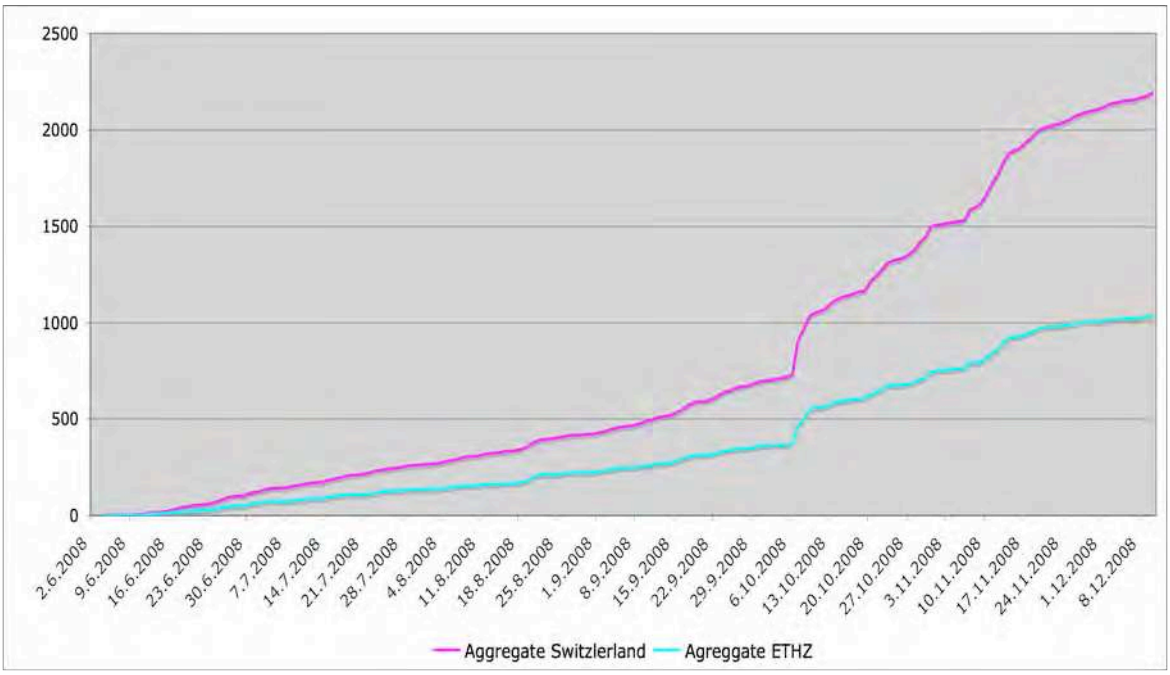
Other remarks:
_____
_____
_____
_____
_____

Ecoworks team thanks you very much for your participation.

10.13 ***ecoworks website data***



Graph 5. Individual hits per day



Graph 6. Aggregation individual hits per day

10.14 ***workshop survey results***

	1	2	3	4	Antworten gesamt
Wie hat Ihnen die Veranstaltung gefallen?*	23	20	4	0	47
Wie stark hat die Veranstaltung inhaltlich Ihren Erwartungen entsprochen?**	22	23	1	1	47
Wie stark hat die Veranstaltung methodisch Ihren Erwartungen entsprochen?**	19	24	4	0	47
Wie zufrieden waren Sie mit der Zusammenarbeit in der Projektgruppe?*	16	14	8	1	39
Wie zufrieden waren Sie mit der Entscheidung der Jury?*	0	10	2	0	12
Wie zufrieden waren Sie mit der Örtlichkeit?*	11	20	9	2	42
Wie zufrieden waren Sie mit Essen und Getränken?*	28	16	2	0	46

* -1= very much/sehr gut, 2= quite a lot/recht gut, 3=not much/es geht, 4= not at all/gar nicht
**- 1=totally/völlig, 2=in parts/teilweise, 3=little/wenig, 4=not at all/gar nicht