Erika Quendler, Jannie van der Luit, Massimo Monteleone, Pedro Aguado, Manou Pfeiffenschneider, Klaus Wagner, Francesca Valente and Cristina Cunha-Queda

Sustainable development: an employers' perspective

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Nachhaltige Entwicklung aus Arbeitgebersicht

Authors

Erika Quendler, Federal Institute of Agricultural Economics, Austria, erika.quendler@awi.bmlfuw.gv.at

Jannie van der Luit, Van Hall Larenstein, University of Applied Sciences, Netherlands, jannie.vanderluit@wur.nl

Massimo Monteleone, University of Foggia, Italy, m.monteleone@unifg.it

Pedro Aguado, University of Leon, Spain, pedro.aguado@unileon.es

Manou Pfeiffenschneider, Efor-Ersa Consulting Engineers, Luxembourg, manou.pfeiffenschneider@efor-ersa.lu

Klaus Wagner, Federal Institute of Agricultural Economics, Austria, klaus.wagner@awi.bmlfuw.gv.at

Francesca Valente, University of Teramo, Italy fvalente@unite.it

Cristina Cunha-Queda, Instituto Superior de Agronomia, Portugal, crisqueda@isa.utl.pt

The report draws on some of the results from Work Package 4 (WP4) entitled "Professionalization" and some from Work Package 2 (WP2) entitled "Information collection concerning sustainable development in life sciences in Europe" which has been carried out within the frame of the ISLE Erasmus Thematic Network (Innovation in the teaching of Sustainable Development in Life Sciences in Europe) and is co-financed by the European Community in the framework of the Lifelong Learning Programme.
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Erika Quendler, Jannie van der Luit,
Massimo Monteleone, Pedro Aguado,
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Sustainable development: an employers' perspective

"... the people who will succeed fifteen years from now, the countries which will succeed, are those which are most based on a sustainable vision of the world. That is what we should be training people to do." (Rt Hon Charles Clarke MP, Secretary of State for Education and Skills, 25th March 2003, United Kingdom).

Wien, 2013

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Preface

In the spring of 2009, the first major conference within the framework of the UN Decade of Education for Sustainable Development in Bonn, Germany, resulted in the following agreement. The field of education must have priority if we wish to achieve sustainable development. The global agreements on sustainability and initiatives for sustainable development can only become reality if people support them locally. This, in turn, calls for education. It is only through education that individuals are empowered to rethink their behaviour, and to consider the idea of sustainable development within the private and occupational environment alike.

Since economic activity includes ecological, social and financial risks and opportunities, the conviction that sustainable development is an open guiding principle, or orientation target, in this perpetual process is becoming increasingly established within the economic sector. Many enterprises understand sustainable development as a fundamental component of their activities and actions. Accordingly, aspects of sustainable development are being integrated into the educational profiles of employees expected.

Professional activity – i.e., a job or occupation – forms an essential part of our lives. Indeed, for many people, an occupation is more than just making a living as it gives meaning to their lives. By fully adapting the idea of sustainable development, sustainable action becomes part of an employee's character and identity. Thus, beyond formal job competences, the employee's professional decisions will also be in the interests of sustainable development.

As an internationally active research institute we, too, have devoted our attention to these issues. Participation in the EU ISLE network project enabled us to play a part in anchoring sustainable development within education and employment.

This study on the topic "Sustainable development: an employers' perspective" is one result of our participation in the project. The study considers, for the first time, topics that the European Union has explicitly mentioned as horizontal issues, namely "sustainable development" and "education," on the level of higher education in the field of life sciences in connection with "employment."

The study describes and analyses comprehensively the European situation concerning the positioning of sustainable development in higher education in the field of life sciences, as well as the expectations of employers towards education for sustainable development. Furthermore, the study concludes by giving series of recommendations for the adaptation of curricula.

This in-depth survey aims to amplify the discourse on sustainable development within higher education in the field of life sciences in Europe, as well as to build further bridges between education and employment.

I wish to express my sincere thanks to all of the dedicated individuals who collaborated on this orientation study. I am especially grateful to Corrine Stewart and her team for organising and managing the project, and a special thank you also goes to all ISLE network partners.

Klaus Wagner
Interim Head of the Institute

Vorwort

Auf dem ersten großen Gipfeltreffen im Rahmen der UN-Dekade „Bildung für eine nachhaltige Entwicklung" im Frühjahr 2009 in Bonn gab es eine Übereinstimmung: Das Feld der Bildung muss Priorität haben, wenn wir eine nachhaltige Entwicklung erreichen wollen. Die weltweiten Vereinbarungen zur Nachhaltigkeit und Initiativen zur nachhaltigen Entwicklung werden nur dann mit Leben erfüllt, wenn die Menschen vor Ort sie tragen. Das aber setzt Bildung voraus: Nur durch sie wird der Einzelne dazu befähigt, sein Verhalten zu überdenken und das Konzept der nachhaltigen Entwicklung im privaten und beruflichen Umfeld zu berücksichtigen.

Da ökologische, soziale wie ökonomische Risiken und Chancen Bestandteil des Wirtschaftens sind, setzt sich in der Wirtschaft immer stärker die Überzeugung durch, dass nachhaltige Entwicklung ein offenes Leitbild – ein Orientierungsziel – eines fortwährenden Prozesses ist. Viele Unternehmen begreifen nachhaltige Entwicklung als elementaren Bestandteil ihrer Betätigung und ihres Handelns. Dem entsprechend werden Aspekte der nachhaltigen Entwicklung in das Bildungsprofil der ArbeitnehmerInnen integriert.

Die berufliche Tätigkeit – sprich die Arbeit oder der Beruf – ist ein wesentlicher Bestandteil unseres Lebens. Bei sehr vielen Menschen dient sie nicht nur dem Lebensunterhalt, sondern gibt ihrem Leben einen Sinn. Durch die Verankerung des Konzepts der nachhaltigen Entwicklung wird nachhaltiges Handeln zu einem Teil des Persönlichkeitsbildes des Berufstätigen. Seine professionellen Entscheidungen werden über die formalen fachlichen Kompetenzen hinaus im Sinne der nachhaltigen Entwicklung beeinflusst.

Wir, ein international engagiertes Forschungsinstitut, haben uns auch diesen Themen gewidmet. Die Teilnahme im EU ISLE Network-Projekt ermöglichte uns, an der Verankerung der nachhaltigen Entwicklung im Lehr- und Arbeits-Bild mitzuarbeiten.

Die vorliegende Studie zum Thema „Sustainable development: an employers' perspective" ist ein Teilergebnis dieser Projektteilnahme. In dieser Studie werden erstmals die von der Europäischen Union explizit als Querschnittsthemen genannten Bereiche „Nachhaltige Entwicklung" und „Bildung" für die höhere Bildung der Lebenswissenschaften in Verbindung mit der „Arbeit" betrachtet.

In umfassender Weise wurde die europäische Situation der Verankerung der nachhaltigen Entwicklung in der höheren Bildung der Lebenswissenschaften sowie die Anforderungen der Arbeitgeber an die Bildung für nachhaltige Entwicklung dargestellt und analysiert. Konkrete Handlungsempfehlungen für die Anpassung von Lehrplänen wurden erarbeitet.

Mit diesem fundierten Abriss soll der Diskurs zur Umsetzung und Etablierung der nachhaltigen Entwicklung in der höheren Bildung der Lebenswissenschaften Europas intensiviert und weitere Brücken zwischen Lehre und Arbeit gebaut werden.

An dieser Stelle danke ich allen sehr herzlich, die an der Erarbeitung dieses ‚Orientierungswerkes' mitgewirkt haben. Mein besonderer Dank geht an Corrine Stewart und ihrem Team, die die Leitung und Organisation des Projektes übernahmen, und an die Partner im ISLE Netzwerk.

Klaus Wagner
Interimistischer Leiter

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Finally, we acknowledge our thanks to Corinne Stewart of AgroSup Dijon France, the ISLE project leader and her staff, without whom there would have been no ISLE project.

Abstract (English)

A great many people have already embraced the need for education and training as a key to moving the workforce and society in general towards a sustainable living process. Education bodies and employers are beginning to recognise this trend and know about the need for training in the manifold aspects of sustainable development (SD). Different actions are being set by educational bodies and employers are also becoming aware of the needs (competences, knowledge and skills for SD) of their employees.

39 partners in 30 countries have carried out a network project about 'Innovation in the teaching of Sustainable Development in Life Sciences in Europe' (ISLE Erasmus Thematic Network). Firstly, this project enables one to develop and exchange thinking and practise on SD in teaching. Secondly, it focuses on the needs of employers by conducting a survey.

The purpose of this report was to identify competences, knowledge and skills for SD required by the European workforce in order to supply Higher Education Institutions in the field of life sciences (HEIs) with information on how they can adapt their curricula. In this report an indication is given of:

(1) whether the concept of SD is present in education and companies;
(2) the importance of SD issues, competences, knowledge and skills according to professional practise, in Europe; and
(3) whether there is a need for new jobs in the field of SD.

Abstract (Deutsch)

Viele Menschen wissen um die Schüsselposition der Bildung bei der berufstätigen Bevölkerung sowie in der Gesellschaft im Allgemeinen, um die Lebensführung nachhaltig auszurichten. Bildungseinrichtungen und Arbeitgeber reagieren auf diese Entwicklung und sind für die Einbeziehung der verschiedenen Aspekte der nachhaltigen Entwicklung in die Bildung. Verschiedene Bildungsaktionen wurden bereits gesetzt und den Arbeitgebern ist der Bildungsbedarf der ArbeitnehmerInnen zu den Kompetenzen, den Fähigkeiten und dem Wissen für nachhaltige Entwicklung gegenwärtig.

39 Partner in 30 Ländern beteiligten sich an einem Netzwerk-Projekt zum Thema ‚Innovation in the teaching of Sustainable Development in Life Sciences in Europe' (ISLE Erasmus Thematic Network). Mit diesem Projekt ist es möglich, Gedanken und Praktiken zur nachhaltigen Entwicklung in der Bildung auszutauschen und Innovationen zu diskutieren sowie mit einer Befragung den Bildungsbedarf für nachhaltige Entwicklung der ArbeitnehmerInnen bei den Arbeitgebern zu erfassen.

Mit dieser Studie werden die Kompetenzen, die Fähigkeiten und das Wissen für eine Verankerung der nachhaltigen Entwicklung in der europäischen Berufswelt erhoben, um die Universitäten und Lehreinrichtungen in der höheren Bildung der Lebenswissenschaften über mögliche Anpassungen der Lehrpläne zu informieren. Es wird eine Einschätzung abgegeben,

(1) ob und wie das Konzept der nachhaltigen Entwicklung in der Bildung und im beruflichen Alltag umgesetzt wurde,
(2) welches Wissen und welche Themen, Kompetenzen sowie Fähigkeiten für nachhaltige Entwicklung im Berufsleben wichtig sind und
(3) ob es ‚neuer' Berufe für den Bereich der nachhaltigen Entwicklung bedarf.

1. Introduction

The work described in this report is based on the results presented in the second workshop of the ISLE Thematic Network that was held at Harper Adams University (United Kingdom) from April 23rd to 27th 2012. It covers some of the results from Work Package 4 (WP4) entitled "Professionalization" and some from Work Package 2 (WP2) entitled "Information collection concerning sustainable development in life sciences in Europe". This has been carried out within the frame of the ISLE Erasmus Thematic Network (Innovation in the teaching of Sustainable Development in Life Sciences in Europe) which is co-financed by the European Community in the framework of the Lifelong Learning Programme. 39 partners in 30 countries, inside and outside Europe, are involved in the ISLE project. The focus of this project is on a topic that has not been investigated enough. "Everyone" talks about sustainable development (SD); its demand is evident in education and daily working life.

Education is essential if we want to achieve a development which is sustainable. Employers around the world recognise that current economic development trends are not sustainable and that education and training are a key to moving the workforce and society in general toward a sustainable living process. Beyond that there is little agreement. People argue about the term SD and whether or not it is sufficiently prominent in curricula and daily working life.

For many employers, the path to a sustainable future for their employees – and citizenry in general – begins with greater access to basic higher education. Many European countries have already embraced the need for education in achieving SD. The principles of SD call for a holistic approach within the education offered by Higher Education Institutions in the field of life sciences (HEIs) and the needs of employers. In the long run education alone cannot ensure the full integration of SD into our professional life if insufficient progress is made regarding what competences, knowledge and skills are required and what are the new jobs in the field of SD in practise.

The implementation of SD programmes in higher education, particularly in life sciences curricula, pre-supposes that the competences, knowledge and skills required related to SD have already been identified by employers. However, an extensive review of literature indicated that such information is not available in the European or international context. The purpose of this report was to identify the competences, knowledge and skills required related to SD by the European workforce in order to supply HEIs with information on how to adapt their curricula.

The report was conducted in two main phases. Phase 1 consisted of a general scan of literature and research on environment, society and economy in order to identify key issues pertaining to SD. Additionally, an extensive review of literature and research was conducted to identify competences, knowledge and skills for SD required by the European workforce. Phase 2 processed select data from a survey among companies (WP4) and a previous survey among HEIs (WP2). This data was subjected to a number of statistical analyses and subsequently interpreted. Finally, the results were then validated (within focus group WP4 of ISLE WP4 activities).

2. Background and definitions

2.1 What is SD?

There are many definitions of SD which are influenced by people's values and culture. The most common and best known is the United Nations (UN) definition of SD, now commonly referred to as the "Brundtland definition", which states:

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

This definition contains within it two key concepts: (i) the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and (ii) the idea of limitations, imposed by the state of technology and social organisation on the environment's capacity to meet present and future needs. Furthermore, this definition is founded on the consideration of the value 'respect': respect for others, both present and future generations, respect for the planet and what it provides to us (e.g. resources, fauna and flora).

Both the ISLE project team and specially the focus group WP4 use the Brundtland ideals and objectives as the basis for the project in general and the further elaboration of the issues, competences, knowledge and skills related to SD.

In theory, development that is sustainable and not damaging to the planet is very possible. Of course though, in reality there are a lot of (man-made) issues present in our daily life (cf. Shah 2012). While there are many complex issues that influence SD, certain main key issues (table 1), which have increasingly become matters of concern over the last decade, have been identified by the focus group WP4 based on the ISSP report by Willard et al. (2010) and correspondingly elaborated.

Table 1. SD issues.

SD issues	
SD issues appear in every level of (working) life and affect the prosperity and the survival of humankind. SD issues are inter-related suggesting that approaching SD requires understanding the issues from many angles, not just from an environmentalist or economic or social perspective.	
SD1	Energy efficiency "*Energy efficiency improvements refer to a reduction in the energy used for a given service (heating, lighting, etc.) or level of activity. The reduction in the energy consumption is usually associated with technological changes, but not always since it can also result from better organisation and management or improved economic conditions in the sector (non-technical factors).*" (World Energy Council 2012).

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SD2	CO_2 neutral operations *"The term carbon neutral refers to a zero sum calculation of carbon emissions for any process, product, business, system, person, or even country. In other words, something that is carbon neutral, also referred to as having a net zero carbon footprint or climate neutral, offsets as many carbon emissions as it emits. Carbon neutrality doesn't refer only to carbon dioxide emissions but to any greenhouse gas emission that contributes to global warming, usually measured in carbon dioxide equivalence."* (Eco Lifestyle Network Company 2001).
SD3	Sustainable procurement *"Sustainable procurement aims to integrate environmental considerations into all stages of the purchasing process with the goal of reducing the impact on human health and the environment."* (Council for Local Environmental Initiatives 1995-2008). Sustainable procurement is also called eco-procurement, green purchasing, environmentally friendly purchasing and affirmative procurement. Sustainable procurement is not only about the environment, it also requires advocacy of fundamental rights of people and labour rights and delivering progress in the economy.
SD4	Reduced water consumption and water reuse Reduction in water consumption refers to a reduction in water use accomplished by implementation of water conservation or water efficiency measures. Water reuse or waste water reuse involves recycling systems that allow for the reuse of grey water for flushing toilets or watering gardens or refers to the recycling of wastewater through purification at a water treatment facility.
SD5	Efficient use of natural resources *"Using resources more efficiently will help us achieve many of the EU's objectives. It will be key in making progress to deal with climate change and to achieve our target of reducing EU greenhouse gas emissions by 80 to 95 % by 2050. It is needed to protect valuable ecological assets, the services they provide and the quality of life for present and future generations. It will help us ensure that the agricultural and fisheries sectors are strong and sustainable and reduce food insecurity in developing countries. By reducing reliance on increasingly scarce fuels and materials, boosting resource efficiency can also improve the security of Europe's supply of raw materials and make the EU's economy more resilient to future increases in global energy and commodity prices."* (EC 2011).
SD6	Renewable resources Renewable resources are any natural resource (such as biomass or solar energy or wind) that can be replenished naturally within an acceptable period of time. Renewable resources are an important aspect of SD. (Wiema & Media 2009).
SD7	Organic farming *"Organic farming works in harmony with nature rather than against it. This involves using techniques to achieve good crop yields without harming the natural environment or the people who live and work in it."* (HDRA 1998).

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SD8	Scarcity of raw materials Material scarcity (or any scarcity) is controlled by only two factors: the supply of the material versus its demand. "Supply" here should be interpreted as the raw material – especially non-renewable resources – that is made available to industry. It must be noted that the recycling of raw materials would be an alternative supply stream. The demand for a material is ultimately determined by the end users together with the effectiveness of the supply chain. With a growing world population which is also getting more prosperous, the demand for products increases and therefore also the demand for resources. (cf. Wouters & Bol 2009).
SD9	Prevention of damage to biodiversity Mankind is damaging nature and biodiversity in endless ways and at increasing speed. Apart from pollution, mankind causes massive erosion, builds cities, covers increasing areas with concrete, disrupts sea floors and corals, burns forests, desertifies large areas, makes land and sea radioactive, produces new organisms or transports foreign species that may overtake local nature, etc. (Oiconmy n.d.). In order to keep the earth we have to set prevention actions – also including a better understanding of the mechanisms and effects of our pressure on nature to assess the consequences.
SD10	Waste reduction The Waste Framework Directive defines waste as any substance or object which the holder discards or intends or is required to discard (Directive 2006/12/EC). Waste affects every part of society and is not only environmentally damaging but also expensive. Businesses, local authorities, government and members of the public play a part in the creation, management and disposal of waste and it is vital that they all recognise the benefits of reducing waste and the roles they must play in doing this. (Authority of the House of Lords 2008).
SD11	Emission reduction The act or process of limiting or restricting the discharge of pollutants or contaminants, such as by setting emission limits or by modifying the emission source. In this way companies reduce the impact of their day-to-day operations on global climate change in the form of greenhouse gases [carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_20), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6)] into the atmosphere from a specified activity or over a specified area, and a specified period of time. (Bruun 2007).
SD12	Development of SD products and services for clients The development of new products and services by companies and organisations that are especially aimed at helping their clients to improve their contribution to SD.

SD issues	
SD issues appear in every level of (working) life and affect the prosperity and the survival of humankind. SD issues are inter-related suggesting that approaching SD requires understanding the issues from many angles, not just from an environmentalist or economic or social perspective.	
SD13	Corporate social responsibility Corporate social responsibility (CSR, also called corporate conscience, corporate citizenship, social performance, or sustainable responsible business/responsible business) is a form of corporate self-regulation integrated into a business model. CSR policy functions as a built-in, self-regulating mechanism whereby a business monitors and ensures its active compliance with the spirit of the law, ethical standards, and international norms. The goal of CSR is to embrace responsibility for the company's actions and encourage a positive impact through its activities on the environment, consumers, employees, communities, stakeholders and all other members of the public sphere who may also be considered as stakeholders. (Wood 1991).
SD14	Sustainable supply chain Supply chain sustainability is a business issue affecting an organisation's supply chain or logistics network in terms of environmental, risk, and waste costs. SD in the supply chain is increasingly seen among high-level executives as essential to delivering long-term profitability and has replaced monetary cost, value, and speed as the dominant topic of discussion among purchasing and supply professionals. (N.N. 2009).
SD15	Rethinking the business by using SD as a principle Rethinking the business is the process of examination, analysis and alteration of the existing business principles of a company or organisation by using SD as a leading principle. The objective is to maintain the existing functionality but improve on SD goals.
SD16	SD as means to improve business opportunities *"Sustainable development strategies uncover business opportunities in issues which, in earlier stages of the journey, might be regarded as costs to be borne or risks to be mitigated. Results include new business processes with reduced external impacts, improved financial performance, and an enhanced reputation among communities and stakeholders."* (IISD 2012).

2.2 Why is there a need for education on SD?

The UN has declared the decade from 2005 to 2014, the Decade of Education for SD, because education has been recognised internationally as fundamentally important to addressing the critical global challenges we all face. Education for SD challenges us all to adopt new behaviours and practises to secure our future. (cf. UN 2011).

Promoting SD requires that individuals and organisations acquire the competences, knowledge, skills, values, and motivation to respond to the complex SD issues they encounter in their personal and working lives. From the perspective of the person 'learning' sustainable education, as the successful transfer of knowledge, is defined as when the learner is able to apply his/her profile of competences, knowledge and skills in a variety of situations (cf. Weinert 1996). It is a continuous process of learning and trains the multi-perspective view for complex problem

solving as outlined by the concept of Green Pedagogy (table 2). Through education and lifelong learning, we can achieve a lifestyle based on economic and social justice, food security, ecological integrity, sustainable livelihoods, respect for all life forms, and strong values that foster social cohesion, democracy and collective action, i.e. a more sustainable living approach and society. (cf. UNESCO 2010).

Table 2. Green Pedagogy and its principles.

Green Pedagogy
The focus behind the idea of Green Pedagogy is to set up sustainable education processes, which deal with ecological, economic and social subject areas and provide support through mentoring and coaching for learners in their individual development. The concept of Green Pedagogy is characterised by the following HEI principles: • An interdisciplinary approach to pedagogical content • A holistic treatment of ecological and economic issues • The targeted networking of specialised knowledge on SD and sensible economic growth with dactic expertise • Strategies which are targeted to future problem solving • Cultural awareness, value orientation and emotional development • A diversity of methods to foster independent activity, participation, collective responsibility • A integrated connection to practise, life, space, nature and culture • The solid anchorage of disciplinary and didactic knowledge in practise • The ability to keep in mind the bigger picture when dealing with openness and contrariness

Source: Hochschule für Agrar- und Umweltpädagogik 2013: 23

At the UN level there is a common notion that HEIs play a key role in the awareness-raising of SD issues, mainly: *"Since Higher Education Institutions educate and train decision makers, they play a key role in building more sustainable societies and creating new paradigms. As educational institutions, they have the mission to promote development through both research and teaching, disseminating new knowledge and insight to their students and building their capabilities. Given the objectives of Rio+20[1], Higher Education Institutions have a special responsibility to provide leadership on education for sustainable development."* (UN 2011).

In the words of UN (2011) we should highlight that promoting SD requires high level skills and knowledge in various combinations of employees resulting in a level of competence. *"Education for sustainable development aims at enabling everyone to acquire the values, competences, skills and knowledge necessary to contribute to building a more sustainable society. This implies revising teaching content to respond to global and local challenges. It should also promote teaching methods that enable students to acquire skills such as interdisciplinary thinking, integrated planning, understanding complexity, cooperating with others in decision-making processes, and participating in local, national and global processes towards sustainable development."* (cf. Green Pedagogy).

1 Earth Summit Rio+20 — officially named the United Nations Conference on SD from June 20th to 22nd 2012 in Rio de Janeiro, Brazil. It took place twenty years after the first historic summit in Rio de Janeiro in 1992 and ten years after the 2002 Johannesburg summit. For further info see http://rio20.net/en/on-the-road-to-rio20.

2.3 What competences are we looking for?

Simply described, competence is the consistent application of knowledge and skill that, when effectively applied, produces a (minimum or maximum level of) performance in a defined function or activity in the workplace (cf. Gorsline 1996; Athey et al. 1999). It embodies the ability to transfer and apply skills and knowledge to new situations and environments (Spencer 1983). Competences are observable, measurable, and can be developed to reinforce competitive advantages and future performance (Van der Klink et al. 2000). Furthermore, Dubois & Rothwell (2004:16) define competences as the multi-dimensional characteristics linked to the desired level of performance. Competences ... *"are the characteristics that individuals have and use in appropriate, consistent ways in order to achieve desired performance. These characteristics include knowledge, skills, aspects of self-image, social motives, traits, thought patterns, mind-sets, and ways of thinking, feeling, and acting"* (cf. Gorsline 1996). The competence approach allows portability and transferability. Competent employees are able to work in functions of similar nature (Greenhaus & Callanan 1994). For example, a person who is competent enough to manage his/her own farm is able to work in a wide variety of jobs whose functions require managing resources to complete a task or deliver a service within defined parameters of time, cost, and quality – not only on a farm. In addition, if the person is certified by a trusted source, the person increases his/her future employability and career development opportunities.

The literature reveals a broad range of competences and their characteristics (cf. Fermilab n.d.; National Centre for Workforce Development 2003; OECD n.d.; Wiek, Withycombe & Redman 2011; Willard et al. 2010). The issue of how company-specific human resource competences are and how competences are considered is a controversial point. Boon & van der Klink (2001) argue that many organisations possess very fixed and rather broad listings of competences and do not engage in efforts to produce a set of company-specific descriptions or take proactive steps to develop these competences. The focus group WP4 has agreed upon the following competences for SD by Roorda (2012) as shown in table 3.

Table 3. Competences for SD.

Competences for SD	
Competences for SD identify characteristics based on knowledge and skills that all employers are expected to demonstrate to carry out the mission and goals of the company under consideration of the idea of SD. Employees have the understanding, knowledge and skills they need to enable them to grasp the right opportunities and innovations for SD in their workplace in a rapidly changing and interconnected world of market-places, communications, and social and environmental challenges.	
G1	Social responsibility A sustainable professional takes responsibility for his/her own work: can make a stakeholder analysis, assume personal responsibility and be held accountable to society.
G2	System orientation A sustainable professional can think and work from a systemic perspective: he/she can zoom in and out, can think in details and holistically, can recognise strengths and weaknesses in systems and use their strengths.

Competences for SD	
G3	Future orientation The sustainable professional thinks and works from a future oriented perspective: he/she thinks in varying timescales, zooms in and out between a short term and long term approach, recognises and utilises non-linear processes, thinks innovatively, and is creative outside the box, with a focus more on function than product.
G4	Global awareness The sustainable professional thinks and works from both a local and global perspective, he/she is able to take into account the global consequences of his/her local actions.
G5	Emotional intelligence and communication A sustainable professional recognises and respects his/her own values as well as those of other people and cultures, can distinguish between facts, presumptions and opinions and can collaborate in an inter- and transdisciplinary way. He/she is open-minded and able to communicate and network with internal and external stakeholders effectively. He/she works from the principle of social equity.
G6	Personal involvement A sustainable professional dedicates him/herself personally to SD: he/she can consistently involve SD in his/her own work as a professional, can work with passion on dreams and ideals, applying their own conscience as an ultimate standard.
G7	Action and practical skills A sustainable professional acts decisively and competently: He/she can weigh "unweighable" aspects and makes choices, deals with uncertainties and acts when the time is ripe. He is focused on solving problems, and can work systematically.

Source: Roorda 2012

Effective, comprehensive work for SD requires proficiency in several cross-disciplinary skill and knowledge areas. This selection of competences enables a SD professional to analyse the cross-disciplinary nature of development issues. Drawing from the key disciplines in the field of life sciences, these competences define the essential knowledge and skills of an effective SD professional and include, but are not limited to, the knowledge areas and skill sets listed below (table 4 and table 5, respectively).

2.4 What do we need to know?

Most commonly, knowledge is understood and referred to as 'familiarity' with something. This includes facts, information, descriptions or skills acquired through experience or education. In other words: knowledge is understood as cross-linked information. It can refer to the theoretical or practical understanding of a subject. It can be implicit (as with practical expertise) or explicit and it can be more or less formal or systematic (cf. Oxford Dictionaries).

The challenge of meeting the development of human needs while protecting the earth's life support systems confronts scientists, technologists, policy makers, and communities from local to global levels. While a significant body of knowledge has emerged on the concept

and practise of SD, much of this information is fragmented and is often not available in a form that is convenient for professionals. In group sessions, during the elaboration of the questionnaire, the focus group WP4 formulated knowledge core topics on concepts, theories, ideas and processes concerning SD based on the ISSP report by Willard et al. (2010); the result is presented in table 4.

Table 4. SD knowledge: concepts, theories, ideas, processes.

SD knowledge	
SD knowledge refers to enabling the competences to be applied for SD in daily working life.	
K1	GENERAL KNOWLEDGE
K1.1	Triple P bottom line/Brundtland report/basic knowledge of SD Knowledge on the triple bottom line (abbreviated as TBL or 3BL, and also known as people, planet, profit or the three pillars) which captures an expanded spectrum of values and criteria for measuring organisational (and societal) success: economic, ecological, and social. With the ratification of the UN and ICLEI TBL standard for urban and community accounting in early 2007, this became the dominant approach to public sector full cost accounting. Similar UN standards apply to natural capital and human capital measurement to assist in the measurements required by TBL, e.g. the EcoBudget standard for reporting ecological footprint.
K2	ECOLOGY
K2.3	Basic principle of natural systems Knowledge on basic principles of a system of biological classification based upon morphological and anatomical relationships and affinities considered in the light of phylogeny and embryology.
K2.7	Ecological integrity The quality of being honest and having strong moral principles that you refuse to change with regards to ecology.
K2.13	Ecosystem Knowledge on all the living things in an area and the way they affect each other and the environment.
K2.16	Natural resources and biodiversity Knowledge on natural resources, which are all the land, forests, energy sources and minerals existing naturally in a place that can be used by people. Biodiversity is the existence of a wide variety of plants and animal species living in their natural environment.
K3	ANALYSING ENVIRONMENTAL IMPACTS
K3.5	Carbon footprint Knowledge on someone's carbon footprint which is a measurement of the amount of carbon dioxide that their activities generate.
K4	REDUCING ENVIRONMENTAL IMPACTS
K4.9	Environmental management systems Knowledge on the system that a company uses for making certain that it does everything possible to protect the environment and obeys all laws relating to the environment.

SD knowledge	
SD knowledge refers to enabling the competences to be applied for SD in daily working life.	
K5	ECONOMICS
K5.6	Economics Knowledge on the way trade, industry or the flow of money is organised.
K5.10	Gross national product Knowledge on the total value of goods and services produced by a country in one year, including profits made in foreign countries.
K5.22	Efficiency Knowledge on how to use time, resources and energy well, without wasting any.
K5.23	Externalities Knowledge on the concept of externality, or transaction spillover, as a cost or benefit that is not transmitted through price and is incurred by a party who was not involved as either a buyer or seller of the goods or services causing the cost or benefit. The cost of an externality is a negative externality, or external cost, while the benefit of an externality is a positive externality, or external benefit.
K5.2	Niche market Knowledge on how you can position your products in a niche market. A niche market is the subset of the market on which a specific product is focusing. So the market niche defines the specific product features aimed at satisfying specific market needs, as well as the price range, production quality and the demographics that is intended to impact. It is also a small market segment.
K5.4	Business model A description of the different parts of a business or organisation showing how they will work together successfully to make money.
K5.17	Supply chain Knowledge on the system of people and things that are involved in getting a product from the place where it is made to the person who buys it.
K5.18	Value chain Knowledge on the series of companies involved in the different stages of producing a product or service that is sold to consumers, with each stage adding to its value.
K5.14	Globalisation Knowledge on the increase of trade around the world, especially by large companies producing and trading goods in many different countries.
K6	VALUE OF NATURE
K6.12	Ecological economics Knowledge on the way in which trade, industry or money is organised in relation to ecology.
K6.21	Ecosystem services Knowledge on how humankind benefits from a great many of the resources and processes that are supplied by natural ecosystems. Collectively, these benefits are known as ecosystem services and include products like clean drinking water and processes such as the decomposition of wastes. While scientists and environmentalists have discussed ecosystem services for decades, these services were popularised and their definitions formalised by the UN 2005 Millennium Ecosystem Assessment (MEA).

SD knowledge	
SD knowledge refers to enabling the competences to be applied for SD in daily working life.	
K7	SOCIAL ASPECTS OF SUSTAINABLE DEVELOPMENT
K7.15	Human rights Knowledge on rights regarded as belonging fundamentally to all persons as described in the Universal Declaration of Human Rights (UN 1945).
K7.19	Social responsibility Knowledge on the practise of producing goods and services in a way that is not harmful to society or the environment.
K7.20	Social justice Knowledge on social justice as an underlying principle for peaceful and prosperous coexistence within and among nations. We uphold the principles of social justice when we promote gender equality or the rights of indigenous peoples and migrants. Social justice is advanced when we remove barriers that people face because of gender, age, race, ethnicity, religion, culture or disability. (UN 2012).
K7.11	Environmental justice Knowledge on how inequitable distributions of environmental burdens (such as pollution, industrial facilities, and crime) can be redressed under the general view of the environment as encompassing 'where we live, work, and play' (some definitions also include 'pray' and 'learn').

Generally, SD is not a problem of lack of knowledge. Focusing on "need to know" as an issue assumes that lack of knowledge is the problem and suggests that there is a cure — namely, more and more "adequate" knowledge. But, as Orr (1991) has correctly observed, *"As important as research is, the lack of it is not the limiting factor in the conservation of biodiversity."* Together with attitude the issues of SD are primarily problems of power, on the one hand, and political will, on the other hand.

SD confronts us with a situation where, as Funtowicz & Ravetz (1991) have observed, *"facts are uncertain, values in dispute, stakes high, and decisions urgent."* Nevertheless, we should recognise the limitations of human knowledge. Dealing with SD we should always consider what an acceptable level of ignorance and uncertainty is in order to act in a timely fashion. SD should always be coupled with the highest degree of certainty possible while avoiding harm and doing good in the short- and long-term.

2.5 What skills are we looking for?

Generally, people need a broad range of skills in order to be part of the workforce and take their place in the society of today and tomorrow. A skill is the capacity learned to carry out a task in order to achieve pre-determined results often with the minimum outlay of time, energy, or both – moreover, skill stresses ability acquired or developed through experience. Skill usually requires certain environmental stimuli and situations to assess the level of skill being shown and used. Skills can often be divided into the two domains of general and specific skills (Niaz 1994). For example, in the domain of work, some general skills would include time

management, teamwork and leadership, self-motivation and others, whereas specific skills would be useful only for a certain job.

Generally, the skills for SD required from an employee are not just about work. They also serve essential social purposes. Achieving a fair, more inclusive society depends also on trained graduates (of HEIs) with the skills they need to work. However, there are no occupational standards at national or international level that spell out the necessary skills for SD. In group sessions, during the elaboration of the questionnaire, the focus group WP4 formulated core topics on skills, process dynamics, tools and methodologies concerning SD based on the ISSP report by Willard et al. (2010); the result is shown in table 5.

Table 5.
SD skills (process dynamics, tools, and methodologies).

SD skills	
SD skills indicate an ability to be able to do something in order to contribute to and/or enhance SD. Moreover, they are the foundation of flexibility, employability and further learning throughout life.	
S1	ANALYSING ENVIRONMENTAL IMPACTS
S1.2	Analysis of environmental problems The ability to analyse problems relating to the environment. The environment is the air, water and land in or on which people, animals and plants live.
S1.6	Systems thinking The ability to understand how things influence each another within a whole. In nature, systems thinking examples include ecosystems in which various elements such as air, water, soil, plants and animals interact. In organisations, systems consist of people, structures, and processes that work together to make an organisation healthy or unhealthy. Systems thinking has been defined as an approach to problem solving, by viewing 'problems' as parts of an overall system, rather than relating to specific parts, outcomes or events and potentially contributing to the further development of unintended consequences. Systems thinking is not one thing but a set of habits or practises within a framework that is based on the belief that the component parts of a system can best be understood in the context of relationships with each other and with other systems, rather than in isolation. Systems thinking focuses on cyclical rather than linear cause and effect. (Aronson 1996).
S1.8	Full cost accounting The ability to carry out accounting which recognises the economic, environmental and social costs of an action or decision (BD, www.Businessdictionary.com).
S1.11	Life cycle analysis The ability to compile and evaluate inputs, outputs and the potential environmental impacts of a product system throughout its life cycle. Life cycle covers the consecutive and interlinked stages of a product system, from raw material acquisition or generation of natural resources to final disposal (ISO 2006).

SD skills	
SD skills indicate an ability to be able to do something in order to contribute to and/or enhance SD. Moreover, they are the foundation of flexibility, employability and further learning throughout life.	
S1.12	Ecological foot print The ability to calculate ecological footprint/appropriated carrying capacity (EF/ACC) and interpret the results. EF/ACC is a simple yet effective tool which provides an accounting framework for the biophysical services that a given economy requires from nature. It is calculated by estimating the land area, in various categories, necessary to sustain the current level of consumption by the people in that economy, using prevailing technology. An economy's full ecological footprint would include all the land whose services this economy needs to provide necessary resource inputs and to assimilate corresponding waste outputs. The EF/ACC concept thereby demonstrates the ecological dependence of economic systems. It is both an analytic and heuristic device for understanding the sustainability implications of different kinds of human activities, and serves as an awareness tool and action-oriented planning tool for decision making towards SD. (Wackernagel, 1994).
S1.16	Indicators and indexes The ability to calculate and interpret indicators and indexes in order to assess SD.
S2	REDUCING ENVIRONMENTAL IMPACTS
S2.1	Pollution prevention programme The ability to deal with the Pollution Prevention Act (PPA). PPA establishes a bold national objective for environmental protection: *"[T]hat pollution should be prevented or reduced at the source whenever feasible."* (Browner 1993).
S3	POLLUTION TRADING
S3.3	Cap and trade The ability to understand and implement 'cap and trade' principle. This means there is a 'cap', or limit, on the total amount of certain greenhouse gases or other pollutants that can be emitted by the factories, power plants and other installations in the system. Within this cap, companies receive emission allowances which they can sell to or buy from one another as needed. The limit on the total number of allowances available ensures that they have a value. (EC 2011).
S3.5	Pollution trading The ability to understand and to be able to do pollution trading, cf. cap and trade.
S4	ECONOMIC SENSE
S4.7	Business case The ability to create a business case. An explanation or set of reasons describing how a business decision will improve a business, product, etc. and how it will affect costs and profits and attract investments.

SD skills	
SD skills indicate an ability to be able to do something in order to contribute to and/or enhance SD. Moreover, they are the foundation of flexibility, employability and further learning throughout life.	
S4.13	Economic restructuring The ability to be able to deal with and understand economic restructuring. Economic restructuring refers to the development of the economy in a country or around the world. There is an on-going process shifting from the primary sector to the secondary and tertiary one but also further on to experiences and transformation services (cf. Pine & Gilmore, 1999). This development has affected demographics including income distribution, employment, social hierarchy and institutional arrangements (cf. Sassen 1990; Noyelle & Stanback 1984; Logan & Swanstrom 1990; Musterd & Ostendorf 1998; Kalleberg 2000 and Katz 1997).
S4	ECONOMIC SENSE
S4.15	Efficiency The quality of being able to do a task successfully without wasting time or energy. It has an effect on the • *productive efficiency* which occurs when the economy is utilising all of its resources efficiently (Fried, Schmidt & Lovell 1993); • *allocative efficiency,* which occurs when goods and services are distributed according to consumer preferences (Markovits 1998); • *efficiency of scale*, which occurs when the firms produces on the lowest point of its long run average cost and therefore benefits fully from economies of scale (Sullivan & Sheffrin 2003); • *social efficiency*, which occurs when externalities are taken into consideration and occurs at an output where the social cost of production is equal to the social benefit (cf. Lefeber & Vietorisz 2007); • *technical efficiency*, which deals with the optimum combination of factor inputs to produce a good: related to productive efficiency (Kalirajan & Shand 1999); • *pareto efficiency*, which is a situation where resources are distributed in the most efficient way. It is defined as a situation where it is not possible to make one party better off without making another party worse off (cf. Sen 1993); and • *distributive efficiency,* which is concerned with allocating goods and services according to who needs them most. Therefore, requires an equitable distribution (cf. Lerner 1944).
S5	COMMUNICATION
S5.9	The 4 P's (product, price, place and promotion) of marketing The ability to understand and work with the four major controllable factors of a marketing mix: product, price, place (distribution) and promotion.
S5.14	Effective communication The ability and quality of an information sharing process which involves one party sending a message that is easily understood by the receiving party.
S6	IMPLEMENTING SUSTAINABILITY
S6.10	Designing a sustainable system The ability to design systems that are capable of operating continuously while meeting today's (global) economic, environmental, and social needs without compromising the opportunity for future generations.

SD skills	
SD skills indicate an ability to be able to do something in order to contribute to and/or enhance SD. Moreover, they are the foundation of flexibility, employability and further learning throughout life.	
S6.18	Sustainability planning The ability to plan through a process of thinking about and organising the activities required to achieve a desired goal in SD.
S6.4	Socially responsible investing The ability to invest under consideration of sustainable, socially conscious, 'green' or ethical aspects. Socially responsible investing is the practise of making investment decisions on the basis of both financial return and social good (Hutton & Johnsen 1998).
S7	LEADERSHIP AND TEAMWORK
S7.17	Influencing the organisation The ability to bring in your educational profile to influence the development of your organisation in a sustainable way.
S7.19	Leadership skills The ability to motivate a group of people towards a common goal.

3. Conceptual framework

A scan of literature and research was conducted to provide the theoretical orientation and the underlying structure to the report. This review was used to elaborate a conceptual framework for the identification of the competences, knowledge and skills profile related to SD required by the European workforce as well as SD issues now and in five years. The framework consists of two main elements, namely (1) SD issues and (2) human performance enablers by certain company criteria, i.e. company category, size and country. The human performance enablers incorporate the three dimensions which are assumed to be critical for sustainable human performance, namely competences, knowledge and skills. The SD issues were formulated considering the three pillars, namely economic, ecological and social aspects of SD. An illustration of the framework is presented in figure 1.

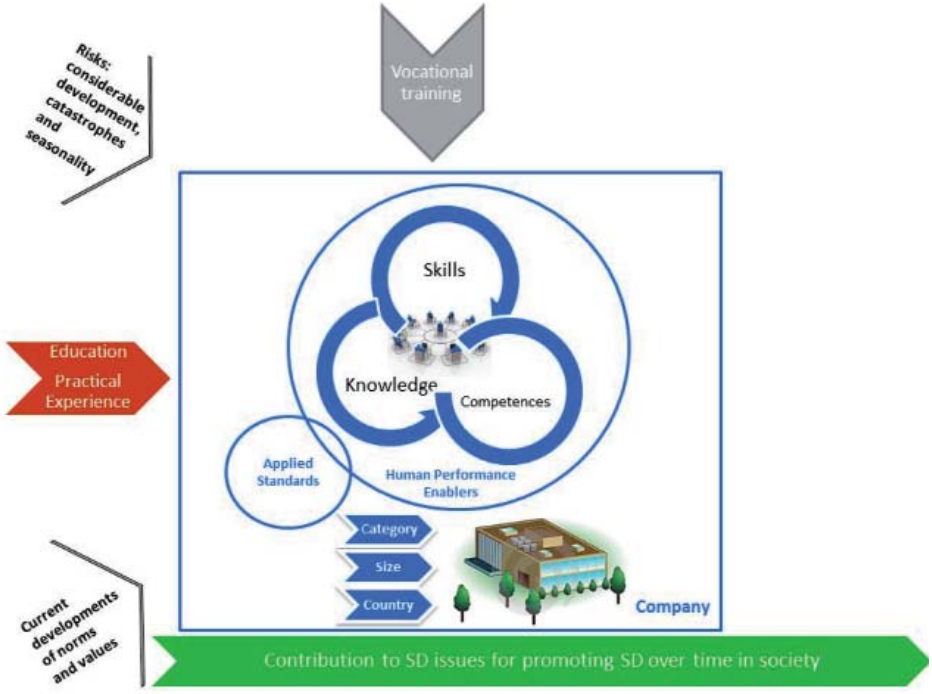


Figure 1. Conceptual framework for SD performance enablers: competences, knowledge and skills.

As shown in figure 1 competences, knowledge and skills are acquired through many different learning situations (e.g. classes at universities, practical experiences etc.) in order to tackle with the different current or upcoming issues of SD.

Within this framework we should also consider that companies already apply certain standards in order to fulfil market needs or improve their companies' performance. Furthermore, companies have incorporated responsibilities for SD at different levels in their businesses. Besides external factors, such as risks (e.g. catastrophes and seasonal specifics), the current development of norms and values influences how companies act with regard to SD issues.

4. Methods

In the following section the design of the survey and the processing of relevant data derived from two surveys (HEIs survey in WP2 and company survey in WP4) are described in order to assess educational needs from a HEIs' and an employers' perspective.

To aid understanding we would like to explain that in an earlier stage of the ISLE project (WP2, Information collection concerning SD in life sciences in Europe) a survey was done at the educational level of HEIs. In a following step (WP4 professionalization) a survey was carried out to learn about SD from an employers' perspective. In chapter 4.1 the designs of the two surveys carried out are described.

4.1 Design of the surveys

4.1.1 HEIs – Higher Education Institutions in the field of life sciences

The purpose of the HEIs survey was to collect data from students, professors, staff and relevant partners in each of the network's member institutions, in order to identify the current state of affairs in the integration of SD into the institutions and studies, related to the field of life sciences.

The survey was divided into three main blocks, namely a (i) students survey, (ii) academic staff survey and (iii) institutional survey. Each block covers questions about how SD issues are implemented in teaching, research and organisational issues. (ISLE project 2012a). The questions about learning outcomes at HEIs and the general status quo about the implementation of SD issues at HEIs are relevant for the following discussion and the results.

The basic sample design applied in all countries was based on the ISLE project partners and their educational activities. The total sample size was controlled but the representative coverage in each country was not assured (table 6).

The survey was translated when the corresponding partner considered it was convenient. Finally, the survey was translated into the following languages: English, French, German, Greek, Portuguese, Spanish, Italian, Hungarian, Polish and Turkish.

The survey was sent out by partners of the ISLE network by email with an accompanying letter and a link to the online questionnaire (free software limesurvey). Partners sent the link to their networks in civil society by May 10th and the links to questionnaires were active till June 10th 2011.

The relevant data from all country files was transferred to an Excel spreadsheet for further statistical analysis. The total number of replies in the raw database was 2,937 students and 852 academics (table 6).

Table 6. Sampling and response rate – survey of HEIs.

Country	Students		Academic staff	
	Survey population	Sample	Survey population	Sample
AUSTRIA	300	30	12	4
BELGIUM	*	0	*	0
BULGARIA	4,514	32	150	64
CYPRUS	200	29	25	13
CZECH REPUBLIC	6,000	190	900	103
DENMARK	*	77	*	23
ESTONIA	2,706	104	311	26
FINLAND	472	6	43	5
FRANCE	*	28	*	12
GERMANY	519	100	17	11
GREECE	2,000	3	190	10
HUNGARY	*	367	*	45
ICELAND	97	3	15	5
IRELAND	*	15	*	4
ITALY	*	53	*	19
LATVIA	*	4	*	20
LITHUANIA	600	39	90	4
LUXEMBOURG	*	2	*	0
MALTA	1,964	174	161	95
NETHERLANDS (THE)	3,972	175	523	49
NORWAY	*	8	*	4
POLAND	*	402	*	7
PORTUGAL	1,700	57	129	22
ROMANIA	8,000	329	384	25
SLOVAK REPUBLIC	*	0	*	0
SLOVENIA	1,250	109	250	42
SPAIN	3,835	133	379	44
SWEDEN	*	49	*	70
TURKEY	800	103	75	34
UNITED KINGDOM	2,100	316	110	92
TOTAL		2,937		852
Confidence interval for countries in which the population is known		2.18		3.50

* Survey population is not known.
Source: ISLE project 2012

4.1.2 Companies

The company survey aimed to map genuinely and comprehensively the tasks, functions and opportunities of education in SD in daily working life already perceived by employers. It was not the intention to derive a political instrument from it, but rather, in the first instance, to ascertain

impartially what is going on in the "minds of the employers" and (i) how can this clarify the needs of the labour market in order to adjust higher education as well as (ii) investigate in which fields new jobs are expected to be created (ISLE project 2012c).

Three main blocks were at the forefront of this survey: (i) general questions about the companies; (ii) questions related to SD, to ascertain the situation on SD in professional life sciences practise and (iii) questions about competences, knowledge and skills required for SD.

Table 7. Sampling and response rate – survey of companies.

Country	Total records in survey	Gross responses	Complete responses	Incomplete responses
AUSTRIA	430	84	44	40
BELGIUM	*	2	0	2
BULGARIA	*	26	15	11
CYPRUS	*	10	5	5
CZECH REPUBLIC	10	0	0	0
DENMARK	*	0	0	0
ESTONIA	818	73	26	47
FINLAND	1	1	1	0
FRANCE	*	29	12	17
GERMANY	950	29	13	16
GREECE	18	18	10	8
HUNGARY	21	8	6	2
ICELAND	*	0	0	0
IRELAND	5	5	5	0
ITALY	114	47	35	12
LATVIA	*	0	0	0
LUXEMBOURG	127	26	14	12
MALTA	5	3	1	2
NETHERLANDS (THE)	6,000	364	150	214
NORWAY	35 (+4,000 universities)	10	5	5
POLAND	50	6	3	3
PORTUGAL	200	30	23	7
ROMANIA	300	32	22	10
SLOVAK REPUBLIC	9	9	9	0
SLOVENIA	*	22	9	13
SPAIN	726	45	28	17
SWEDEN	*	48	15	33
TURKEY	2	2	2	0
UNITED KINGDOM	379	30	16	14
TOTAL	10,200 (+4,000 universities)	959	469	490
Questionnaires used (countries with a response > 10)	total number of questionnaires used (ANOVA)	903	432	471

* Total record in survey is not known.
Source: ISLE project 2012d

The basic sample design applied in all countries was entirely based on contacts of the partner/university in the field of life sciences: alumni, partners in projects, research, internships and thesis projects; if no network/database of relations was available selected contacts of the network representatives were used. Neither the sampling size nor the responses were checked. Therefore it was not possible to give a categorical total coverage or representative coverage for each country but it was possible to determine an overall trend for a European perspective.

The survey was sent out by partners of the ISLE network by email with an accompanying letter and a link to the online questionnaire (free software limesurvey). Partners had made the choice to either translate the complete questionnaire or the accompanying letter or use the English version of both. Partners sent the link to their working networks between August 1st and September 15th 2011 and the links to the questionnaires were kept active from August 1st till October 7th 2011.

The relevant data from all national files were transferred to an Excel spreadsheet for further statistical analysis. In the case of the "analysis of variance" (ANOVA) statistical procedure, the total number of replies in the raw database was 959 (table 7). To improve the reliability of the database, countries with less than 10 responses were excluded from the analysis of variance. Differently, applying the "Chi Square" statistical test, all the available answers with respect to each specific question were considered. Due to incomplete responses the number of replies differs from question to question (table 8, table 9, table 10 and table 18). Finally, the results were then validated by the focus group WP4.

Readers are reminded that survey results indicate a trend, the accuracy of which depends, inter alia, upon the sample size and the number of collected answers.

4.2 Statistical data processing

4.2.1 HEIs data

With respect to SD in HEIs, simple summaries have been made about the sample and the corresponding observations. The responses to the question about the importance of learning outcomes were expressed through the assignment of a score; according to the personal beliefs of each respondent. The score ranged from 1 to 5 (score 1 means not important, while score 5, conversely, extremely important).

4.2.2 Company data

With respect to SD in companies, simple summaries have been made about the sample and the corresponding observations. Moreover, some of the answers to the questionnaire which were expressed as "Yes" or, alternatively, "No" have been processed according to the "Chi Square" test, thus comparing the proportion observed with the one expected and statistically assessing the significance of these deviations.

In contrast, other responses to the questionnaire were expressed by the assignment of a score; according to the personal beliefs of each respondent. The scores ranged from 1 to 5 (score 1 means a completely unimportant consideration about the topic, while score 5, on the other hand, indicates a very relevant concern).

In this latter case, each question is related to a particular SD "dimension", such as issues (table 1), competences (table 3), knowledge (table 4) and skills (table 5). Each "dimension" is described by several individual "attributes" that are able to characterise properly that dimension (for example: the dimension of "knowledge" is characterised, among others, by the following "attributes" or "descriptors": environmental justice, ecological economics, globalisation, human rights, and so on, according to table 4).

Some factors can affect the average score assigned to each attribute; these factors relate to specific qualities of respondents, like the European country they belong to, the category and the size of the company or organisation they work in or they are managing. Each factor is considered according to several levels, quality or modes, according to its proper nature (for example: the size of the company is defined as 'big', 'medium', 'small' or 'micro').

A simple and straightforward method to process this data statistically is to compute the average values of the score assigned to every attribute either alone or in combination with their factors. According to this approach, no statistical inference can be drawn from the data and the analysis is limited to a simple description of the results.

In contrast, ANOVA allowed one to test the attributes that are significantly below or above the grand mean value ($\bar{Y}$) as well as the factors that exert a relevant influence. Also important is the possibility of assessing the significance of the relationship between attributes and factors (interaction effect); in fact, it is possible that the score assigned to one attribute may differ according to the level or mode of a particular factor.

Thus an ANOVA experimental model was carried out considering one SD "dimension" at a time (issues, competences, knowledge and skills) and three factors (country, category and size of the company) in factorial combination. The model has the following mathematical structure (according to the "general linear model" approach):

$$Y_{ijkm} = \bar{Y} \pm \alpha_i \pm \beta_j \pm \gamma_k \pm \chi_m \pm \delta_{ij} \pm \phi_{ik} \pm \lambda_{im} \pm \varepsilon_{ijkm}$$

where:

Y_{ijkm}	is the "score" observed;
$\bar{Y}$	is the "grand" mean score of the considered SD "dimension" (i.e. "knowledge");
α_i	defines the score effect of the "i" attribute related to that "dimension" (i.e. "environmental justice", "ecological economics", "globalisation", "human rights", etc.);
β_j	is the score effect of the modality "j" of the first factor (i.e. "country");
γ_k	is the score effect of the modality "k" of the second factor (i.e. "category of the company");
χ_m	is the score effect due to the modality "m" of the third factor (i.e. "size of the company");
δ_{ij}, ϕ_{ik} and λ_{im}	are the score interaction components between one of the SD dimensions ("i") and one of the three factors ("j", "k" and "m", respectively), i.e. a specific combination between a SD dimension and a factor. Finally, the term
ε_{ijkm}	represents the experimental error (the residual variability not explained by the model); this term is essential in order to judge the statistical significance of each effect.

According to the model applied, results are expressed as deviations from the grand mean ($\bar{Y}$) and are directly compared with that value. As a consequence, when deviation is different from zero at a probability level $P < 0.01$ an effect is considered "highly significant" or "significant" at the probability level $P < 0.05$. At higher P level the deviation is considered "not significant". Deviations, of course, could be positive or negative.

4.2.3 Combined data of the two surveys HEIs and companies

In order to compare responses obtained from the universities coherently (HEIs survey: data on SD competences taught) and those obtained from the companies (company survey: data on SD competences requested), the two data-bases had to be rearranged to allow a joint data-set with a good matching between the variables and their quantities. The relationship between the learning outcomes of the HEIs survey and the competences, knowledge and skills of the company survey is shown in the appendix, p 81.

The degree of association or, in other words, the measure of dependence between the two quantities (scores assigned by "company" and by "education") was determined calculating the correlation coefficient (also known as Pearson coefficient). The Pearson correlation is +1 in the case of a perfect positive (increasing) linear relationship, −1 in the case of a perfect negative (decreasing) linear relationship and some value between −1 and 1 in all other cases, indicating the degree of linear dependence between the two variables. A Pearson coefficient close to zero identifies the absence of correlation.

5. Results

In this chapter the results are presented. Sub-chapter 5.1 highlights the status quo of SD implementation in HEIs and the key results of the survey (HEIs survey), which are required to answer the question, 'does education meet the market-needs?'. After the presentation of the key results of the company survey in sub-chapter 5.2, the question 'does education meet the market-needs?' is discussed in sub-chapter 5.3.

5.1 SD in HEIs

5.1.1 Status quo

Most countries, namely 73 % of partners participating, have a National Strategy for SD, based on the guidelines defined in the EU Sustainable Development Strategy (SDS). The overall aim of the up-dated EU SDS is *"to identify and develop actions to enable the EU to achieve continuous improvement of quality of life both for current and for future generations, through the creation of sustainable communities able to manage and use resources efficiently and to tap the ecological and social innovation potential of the economy, ensuring prosperity, environmental protection and social cohesion".* Those countries that do not yet have a National Strategy of SD have institutions to develop it in the near future. These National Strategies for SD highlight the importance of education in achieving SD goals, in some cases there are specific references to higher education at universities. Several countries – i.e. 40 % – have policies of education for SD, which focus on SD in any level of education. Almost all have an education strategy, which refers to the importance of SD. In the majority of the cases this item is included in the field of environmental education – usually to follow the proposal of UNESCO in its declaration of the Decade of Education for Sustainable Development (2005-2014). (Aguado et al. 2011).

Most universities have adopted institutional policies of SD. There are only 7 % saying they do not and an additional 20 % who say they do not have the data to answer that question. Furthermore, a small number of countries do not express any kind of policy on this topic in any of their universities. On the contrary, there are some universities that are very advanced in adopting a comprehensive policy on university education based on the principles of SD. There is a particular case in which law will force universities to revise the syllabus and introduce at least the foundations of SD in them. As a result, almost all countries and their universities – 68 % – have research programmes for SD or closely related topics. The funding of the research projects in most cases comes from national or regional institutions with competences in research. At present SD aspects are considered among the priority areas by the national institutions for research funding. Furthermore, there are universities in Europe (13 % in the majority, 27 % in some and 30 % in few, 10 % no and 20 % no answers) that have courses in the field of life sciences directly related to SD. However, there are many universities (namely 60 % in the majority, 17 % in some and 6 % in few and 17 % no answers) that have subjects on SD. The specific courses about SD usually are postgraduate or specialised studies – most commonly in

(i) Environmental Sciences, (ii) Agronomy and Agricultural Engineering and (iii) Health Sciences. So SD is a very common concept, which is included in many studies in the field of life sciences. This is due to the fact that SD is a general and cross-cutting concept for many of these studies. However there are few countries with compulsory basic common contents of SD in their courses in the field of life sciences. Additionally they cover the practical activities on SD – in figures: 27 % in the majority, 27 % in some and 17 % in few universities. (Aguado et al. 2011).

5.1.2 What are the learning outcomes from the university point of view?

During WP2 a HEIs survey was conducted among the academic staff in each participant institution of the ISLE project. One of the questions deals with indicating the importance of the following learning outcomes:

- Understanding of the ethical responsibility towards present and future generations
- Knowledge of how to use natural resources sustainably
- Understanding of the sustainable relationship between human activities and the environment
- Knowledge of the role of science and technology in relation to SD
- Ability to design technical solutions taking into account the life cycle analysis
- Ability to apply the SD criteria in the studied discipline
- Ability to establish connections between the different dimensions of SD
- Knowledge of the current actions and policies on SD
- Negotiation capacity to solve SD conflicts
- Ability to develop new proposals about SD
- Ability to communicate SD aspects to specialised and non-specialised public
- Ability to work in multidisciplinary teams on SD
- Capability for analysis and synthesis of SD concepts
- Knowledge of the economic aspects of SD

Academic staff had to give a value to the importance that these learning outcomes have in the university study programmes in the field of life sciences of their university and the importance that they consider they should have. For this purpose a scale of 1 to 5 was used (1 = not important at all, 5 = extremely important). The results are shown in figure 2.

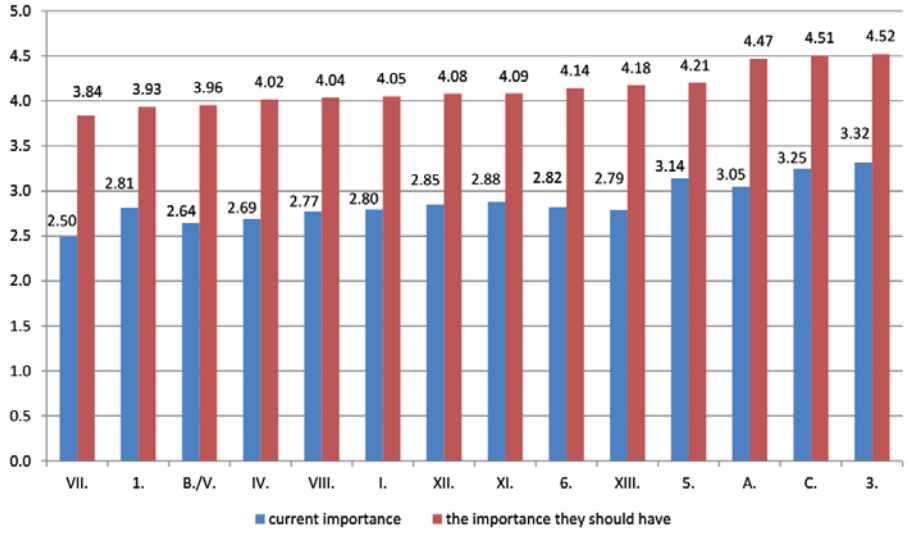


Figure 2. Importance of learning outcomes according to the opinion of the academic staff in HEIs.

Annotation:

Competences	
A.	Understanding of the ethical responsibility towards present and future generations
B.	Ability to establish connections between the different dimensions of SD
C.	Understanding of the ethical responsibility towards present and future generations
Knowledge	
1.	Knowledge of the current actions and policies on SD
3.	Knowledge of how to use natural resources sustainably
5.	Knowledge of the role of science and technology in relation to SD
6.	Knowledge of the economic aspects of SD
Skills	
I.	Capability for analysis and synthesis of SD concepts
IV.	Ability to develop new proposals on SD
V.	Ability to establish connections between the different dimensions of SD
VII.	Negotiation capacity to solve SD conflicts
VIII.	Ability to communicate SD aspects to specialized and non-specialized public
XI.	Ability to apply the SD criteria in the studied discipline
XII.	Ability to design technical solutions taking into account life cycle analysis
XIII.	Ability to work in multidisciplinary teams on SD

Source: ISLE project 2012

Figure 2 shows that in the opinion of the academic staff surveyed the importance of all learning outcomes should be increased. All have a value above 2.5, which indicates that currently these outcomes have a certain importance. In detail, the most valued (importance that they should have) are:

- Understanding of the ethical responsibility towards present and future generations (social responsibility in company survey, cf. appendix, p 81)
- Knowledge of how to use natural resources sustainably
- Understanding of the sustainable relationship between human activities and the environment (social responsibility in company survey, cf. appendix, p 81)

And the least valued (importance that they should have):

- Ability to establish connections between the different dimensions of SD (system orientation in company survey, cf. appendix, p 81)
- Knowledge of the current actions and policies on SD
- Negotiation capacity to solve SD conflicts

Figure 3 shows the necessity of increasing the importance. One can observe that in all cases there is more than 1 point of difference. This highlights the necessity of reinforcing these learning outcomes in the current courses of study. The biggest difference is in the outcome 'understanding of the ethical responsibility towards present and future generations', which is also the most valued outcome. And the least are in 'knowledge of the role of science and technology in relation to SD' and 'knowledge of the current actions and policies on SD'.

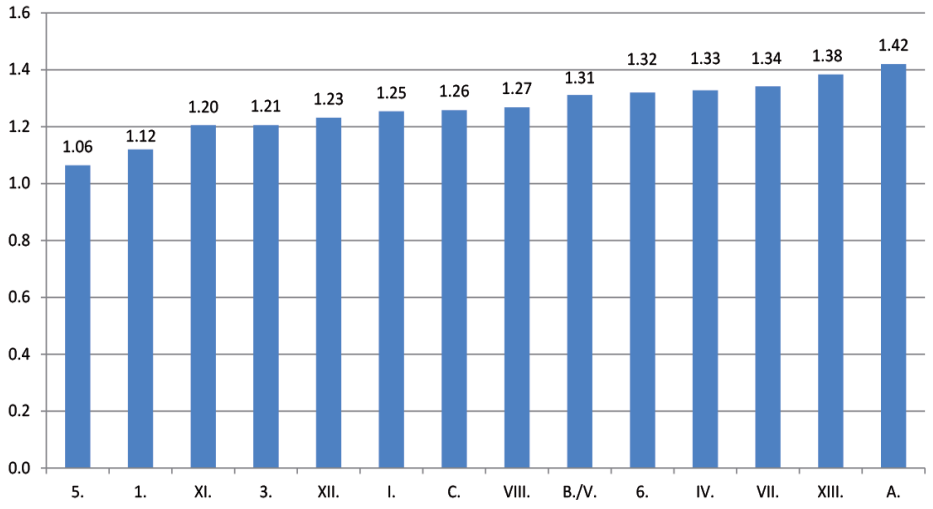


Figure 3. Importance of learning outcomes by difference between the importance they have and that they should have.

Annotation:

Competences	
A.	Understanding of the ethical responsibility towards present and future generations
B.	Ability to establish connections between the different dimensions of SD
C.	Understanding of the ethical responsibility towards present and future generations
Knowledge	
1.	Knowledge of the current actions and policies on SD
3.	Knowledge of how to use natural resources sustainably
5.	Knowledge of the role of science and technology in relation to SD
6.	Knowledge of the economic aspects of SD
Skills	
I.	Capability for analysis and synthesis of SD concepts
IV.	Ability to develop new proposals on SD
V.	Ability to establish connections between the different dimensions of SD
VII.	Negotiation capacity to solve SD conflicts
VIII.	Ability to communicate SD aspects to specialized and non-specialized public
XI.	Ability to apply the SD criteria in the studied discipline
XII.	Ability to design technical solutions taking into account life cycle analysis
XIII.	Ability to work in multidisciplinary teams on SD

Source: ISLE project 2012

5.1.3 What can be learned?

As shown in figure 2 the academic staff considers the learning outcomes related to 'social responsibility' and 'future orientation' as very important and thinks that their importance should be increased in the current university studies. Moreover, 'system orientation' is not one of the most important outcomes but needs big improvement.

Figure 3 shows that the learning outcome related to the knowledge aspect 'knowledge of the economic aspects of SD' is considered by the academic staff as important but it is one of the less rated and so needs less improvement. Learning outcome 'understanding of the sustainable relationship between human activities and the environment' related to the knowledge aspects 'ecology' was considered by the academic staff as very important and is one of the most needed, therefore its importance should be increased. The learning outcomes related to the 'knowledge aspect on how to reduce environmental impacts' have different rates and one can only conclude that they are given less importance than they should have in the current university studies in the field of life sciences. The learning outcome related to the knowledge aspects 'economics and value of nature' (knowledge of the economic aspects of SD) was moderately rated by the academic staff but needs a significant increase in its importance in the current university studies in the field of life sciences. It can be also observed that learning outcome 'understanding of the ethical responsibility towards present and future generations' related to the knowledge aspects 'social aspects of SD' was considered by the academic staff as very important and as it is one of the most needed its importance should be increased.

Figure 3 shows that the learning outcomes related to skills of 'analysing environmental impacts' were moderately rated by the academic staff both in their importance and in the necessity of improvement in the current university studies in the field of life sciences. This is also the case for the learning outcomes related to the skill 'reducing environmental impacts'. It can be also observed that the learning outcome 'ability to develop new proposals on SD' related to the skills of 'pollution trading and economic sense' was moderately rated by the academic staff but needs an important increase in importance in the current university studies in the field of life sciences. The learning outcomes related to skills of 'communication' have different rates and one can only conclude that they have less importance than they should have in the current university studies in the field of life sciences. The learning outcomes related to skills of 'implementing sustainability' were moderately rated by the academic staff both in their importance and in the necessity for improvement in the current university studies in the field of life sciences. The learning outcome related to the skills of 'leadership and teamwork' (ability to work in multidisciplinary teams on SD) was moderately rated by the academic staff but needs an important increase in importance in the current university studies in the field of life sciences.

Summarising the opinion of the surveyed academic staff, all aspects (competences, knowledge and skills) related to SD have a moderate presence in the university studies in the field of life sciences, however their importance should be greatly increased. Moreover,

knowledge and subject competences in curricula approaches for education for SD tend to focus on the environment. They may refer to broad SD concepts and skills (e.g. values, citizenship) but not generally to specific SD subject matter or knowledge. Curricula guidance is needed for formal education systems which go beyond environmental education to teach students about SD. This includes the more complex concepts and thinking related to SD, including systems and measurement approaches. Subject competences for education for SD can be linked to other competences (social and personal) and professional ones needed in daily work.

5.2 SD in companies

The societal and technology drivers ensure that the future will be a challenging and a competitive one with all, but not only, European countries investing in SD. To gain a better insight into how companies deal with SD we asked the following questions in the survey:

- whether SD is an issue in companies now, and in the near future, and SD knowledge and skills are a criterion when recruiting new employees,
- about the ideal length of time for student placements related to SD, the mission statement and application of standards as well as the importance of SD issues now and in 5 years,
- which competences, knowledge and skills related to SD in daily working life are needed, and
- whether there is an need for new jobs in the field of SD.

Some information about the distribution of the whole data set among countries, categories and sizes of the organisations that have replied to the questionnaire are presented in the following paragraph.

Approximately 35 % of responses were obtained by companies or organisations from the Netherlands. Organisations from Austria, Estonia, Italy and Spain accounted for some 5-10 % of the total responses. Finally, a further 10 countries were within the range of 1.5-5 %, while the remaining 9 countries participated with a number of companies under 1.5 %. 15 countries were therefore considered in the further data processing while the 9 countries below the 1.5 % threshold were excluded. Regarding the company categories, 'agriculture' is the most representative sector (32 % of responses), followed by 'technology' (17 %), 'education' (14 %) and 'environment' (11 %). Two other categories fell within the range 5-10 % ('consultancy' and 'administration'). All the other categories are below the 5 % threshold. Finally, considering the size of the companies, the highest frequency observed in the company sample was that of 'micro' organisations (35 %); 'large', 'medium' and 'small' companies fell within the range of 20-23 %, showing quite similar values.

5.2.1 Status quo

SD as an issue

According to the survey, for 77 % of the respondents SD is certainly an issue in their organisation (table 8.A). This percentage is significantly higher ($P < 0.01$) with respect to the hypothesis of an equal partition between affirmative and negative responses. Table 8.B shows several countries with a relevant negative deviation compared to the average (i.e. lower number of "Yes" responses with respect to the general behaviour); particularly relevant and statistically significant are the negative deviations observed for Poland (-44 %), Romania (-35 %), Germany and Hungary (-27 %), Spain (-24 %). In contrast, several countries (Belgium, Finland, Ireland, Malta, Norway) with a positive deviation, higher than +20 %, have been observed; due to a limited number of samples, although this deviation turned out not to be statistically significant it is a trend and gives an indication for future research. Austria, Bulgaria, Italy and Slovenia showed positive deviation slightly higher than 10 % (but still not statistically relevant). Only the Netherlands showed a statistically relevant positive deviation (+7 %), numerically lower than the previous countries but supported by a very large sample. Larger companies (table 8.D) showed a greater propensity to trust in SD issues: large and medium enterprises showed positive deviations (+13 and +9 %), highly significant ($P < 0.01$) and significant ($P < 0.05$) respectively, while, on the other hand, the significant negative deviations (-11 %) showed by the 'micro' enterprises, together with the negative values offered by the 'small' ones, reveals that their general interest in SD is limited.

Knowledge on SD

For 65 % of the respondents knowledge on SD is not a very critical criterion in the recruiting procedure for new employees (table 9.A). This percentage is significantly higher ($P < 0.01$) with respect to the hypothesis of an equal partition between affirmative and negative responses. Norway (+45 %), Cyprus (+37 %) and Bulgaria (+25 %) showed a positive deviation of their percentage compared to the average, significantly higher than the other countries, while for Estonia (-19 %) this deviation was statistically lower (table 9.B). Considering the company categories (table 9.C), 'education' showed a significant increase in the affirmative replies (+17 %) while all the other categories were not significantly different from the average proportion. Finally, regarding the size of the company (table 9.D), 'micro' enterprises showed highly significant positive deviations ($P < 0.01$) from the general behaviour while all the other company sizes were characterised by negative deviations.

The considerable influence of the 'size' of the company with regard to SD criteria is a crucial issue. We need to better understand if the preference of larger companies towards SD issues, in comparison with smaller ones, is a strategic orientation towards the future or is also a current attitude.

This is apparently in contrast with the observation that 'micro' companies are more interested in SD knowledge in recruiting; this is probably due to intrinsic reasons linked to the production activity (small scale production). The trend observed, however, indicating larger companies more focused on such kind of implementation recognise the technological and commercial maturity of those SD requirements associated with the production of goods and services.

	OBSERVED		EXPECTED						
A. TOTAL	No	Yes	No	Yes	Tot	Dev. (%)	Chi Sq.	Prob.	Sig.
	106	364	235.00	235.00	470	27.45	141.63	0.0000	**
B. COUNTRY	No	Yes	No	Yes	Tot	Dev. (%)	Chi Sq.	Prob.	Sig.
AUSTRIA	5	40	10.15	34.85	45	11.44	3.37	0.0663	
BELGIUM	0	2	0.45	1.55	2	22.55	0.58	0.4454	
BULGARIA	2	14	3.61	12.39	16	10.05	0.93	0.3360	
CYPRUS	2	4	1.35	4.65	6	-10.78	0.40	0.5275	
ESTONIA	7	19	5.86	20.14	26	-4.37	0.28	0.5939	
FINLAND	0	1	0.23	0.77	1	22.55	0.29	0.5894	
FRANCE	2	10	2.71	9.29	12	5.89	0.24	0.6256	
GERMANY	6	6	2.71	9.29	12	-27.45	5.18	0.0229	*
GREECE	2	8	2.26	7.74	10	2.55	0.04	0.8468	
HUNGARY	3	3	1.35	4.65	6	-27.45	2.59	0.1077	
IRELAND	0	2	0.45	1.55	2	22.55	0.58	0.4454	
ITALY	4	28	7.22	24.78	32	10.05	1.85	0.1736	
LUXEMBOURG	1	13	3.16	10.84	14	15.41	1.90	0.1677	
MALTA	0	1	0.23	0.77	1	22.55	0.29	0.5894	
NETHERLANDS (THE)	24	130	34.73	119.27	154	6.97	4.28	0.0385	*
NORWAY	0	5	1.13	3.87	5	22.55	1.46	0.2276	
POLAND	4	2	1.35	4.65	6	-44.11	6.68	0.0097	**
PORTUGAL	7	16	5.19	17.81	23	-7.88	0.82	0.3658	
ROMANIA	11	8	4.29	14.71	19	-35.34	13.59	0.0002	**
SLOVAK REPUBLIC	3	4	1.58	5.42	7	-20.30	1.65	0.1987	
SLOVENIA	1	7	1.80	6.20	8	10.05	0.46	0.4963	
SPAIN	14	16	6.77	23.23	30	-24.11	9.99	0.0016	**
SWEDEN	3	11	3.16	10.84	14	1.12	0.01	0.9198	
TURKEY	2	0	0.45	1.55	2	-77.45	6.87	0.0088	**
UNITED KINGDOM	3	14	3.83	13.17	17	4.91	0.23	0.6284	
Total	106	364			470		64.56	0.0000	**
C. CATEGORY OF THE COMPANY	No	Yes	No	Yes	Tot	Dev (%)	Chi Sq.	Prob.	Sig.
ADMINISTRATION	4	29	7.44	25.56	33	10.43	2.06	0.1516	
AGRICULTURE	40	116	35.18	120.82	156	-3.09	0.85	0.3561	
CONSULTANCY	8	36	9.92	34.08	44	4.37	0.48	0.4878	
EDUCATION	10	54	14.43	49.57	64	6.93	1.76	0.1848	
ENVIRONMENT	7	44	11.50	39.50	51	8.83	2.28	0.1314	
NATURE	3	17	4.51	15.49	20	7.55	0.65	0.4190	
OTHER	5	5	2.26	7.74	10	-27.45	4.31	0.0378	*
SOCIAL	4	8	2.71	9.29	12	-10.78	0.80	0.3716	
TECHNOLOGY	25	55	18.04	61.96	80	-8.70	3.46	0.0627	
Total	106	364			470		16.65	0.0339	*
D. SIZE OF THE COMPANY	No	Yes	No	Yes	Tot	Dev (%)	Chi Sq.	Prob.	Sig.
BIG	9	88	21.96	75.04	97	13.36	9.88	0.0017	**
MEDIUM	13	81	21.28	72.72	94	8.81	4.16	0.0413	*
MICRO	54	108	36.67	125.33	162	-10.70	10.58	0.0011	**
SMALL	27	75	23.09	78.91	102	-3.83	0.86	0.3549	
Total	103	352			455		25.49	0.0000	**

Annotation: Tot Total, Dev. Deviation, Chi Sq. Chi Square, Prob. Probability, Sig. significance

Table 8.
SD as an issue in European companies or organisations. Responses ("Yes" or "No") were processed by total (A), country (B), company category (C) and size of the company (D).

Table 9. Knowledge on SD as a criterion to recruit new employees by European companies or organisations. Responses ("Yes" or "No") were processed by total (A), country (B), company category (C) and size of the company (D).

	OBSERVED		EXPECTED						
A. TOTAL	No	Yes	No	Yes	Tot	Dev. (%)	Chi Sq.	Prob.	Sig.
	294	156	225.00	225.00	450	-15.33	42.32	0.0000	**
B. COUNTRY		No	Yes	No	Yes	Tot	Dev. (%)	Chi Sq.	Prob.
AUSTRIA	21	19	26.13	13.87	40	12.83	2.91	0.0881	
BELGIUM	1	1	1.31	0.69	2	15.33	0.21	0.6486	
BULGARIA	6	9	9.80	5.20	15	25.33	4.25	0.0392	*
CYPRUS	2	5	4.57	2.43	7	36.76	4.18	0.0410	*
ESTONIA	21	4	16.33	8.67	25	-18.67	3.85	0.0499	*
FINLAND	0	0	0.00	0.00	0	0.00	0.00	1.0000	
FRANCE	11	1	7.84	4.16	12	-26.33	3.67	0.0553	
GERMANY	10	2	7.84	4.16	12	-18.00	1.72	0.1901	
GREECE	4	6	6.53	3.47	10	25.33	2.83	0.0923	
HUNGARY	6	0	3.92	2.08	6	-34.67	3.18	0.0744	
IRELAND	2	0	1.31	0.69	2	-34.67	1.06	0.3029	
ITALY	19	13	20.91	11.09	32	5.96	0.50	0.4788	
LUXEMBOURG	9	5	9.15	4.85	14	1.05	0.01	0.9344	
MALTA	0	1	0.65	0.35	1	65.33	1.88	0.1698	
NETHERLANDS (THE)	104	41	94.73	50.27	145	-6.39	2.61	0.1059	
NORWAY	1	4	3.27	1.73	5	45.33	4.54	0.0332	*
POLAND	6	0	3.92	2.08	6	-34.67	3.18	0.0744	
PORTUGAL	16	6	14.37	7.63	22	-7.39	0.53	0.4662	
ROMANIA	11	8	12.41	6.59	19	7.44	0.46	0.4957	
SLOVAK REPUBLIC	3	3	3.92	2.08	6	15.33	0.62	0.4300	
SLOVENIA	7	1	5.23	2.77	8	-22.17	1.74	0.1877	
SPAIN	15	15	19.60	10.40	30	15.33	3.11	0.0776	
SWEDEN	6	7	8.49	4.51	13	19.18	2.11	0.1462	
TURKEY	2	0	1.31	0.69	2	-34.67	1.06	0.3029	
UNITED KINGDOM	11	5	10.45	5.55	16	-3.42	0.08	0.7740	
Total	294	156			450		50.31	0.0013	***
C. CATEGORY OF THE COMPANY	No	Yes	No	Yes	Tot	Dev. (%)	Chi Sq.	Prob.	Sig.
ADMINISTRATION	25	6	20.25	10.75	31	-15.31	3.21	0.0732	
AGRICULTURE	104	45	97.35	51.65	149	-4.47	1.31	0.2521	
CONSULTANCY	25	18	28.09	14.91	43	7.19	0.98	0.3216	
EDUCATION	28	30	37.89	20.11	58	17.06	7.45	0.0063	**
ENVIRONMENT	31	17	31.36	16.64	48	0.75	0.01	0.9131	
NATURE	12	7	12.41	6.59	19	2.18	0.04	0.8421	
OTHER	7	3	6.53	3.47	10	-4.67	0.10	0.7565	
SOCIAL	5	7	7.84	4.16	12	23.67	2.97	0.0849	
TECHNOLOGY	57	23	52.27	27.73	80	-5.92	1.24	0.2661	
Total	294	156			450		17.31	0.0271	*
D. SIZE OF THE COMPANY	No	Yes	No	Yes	Tot	Dev. (%)	Chi Sq.	Prob.	Sig.
BIG	68	23	59.76	31.24	91	-9.05	3.31	0.0690	
MEDIUM	60	30	59.11	30.89	90	-0.99	0.04	0.8429	
MICRO	87	70	103.11	53.89	157	10.26	7.33	0.0068	**
SMALL	72	27	65.02	33.98	99	-7.05	2.18	0.1394	
Total	287	150			437		12.86	0.0049	**

Annotation: Tot Total, Chi Sq. Chi Square, Prob. Probability

	OBSERVED				EXPECTED						
A. Total	1 month	1-2 months	3-6 months	7-12 months	1 month	1-2 months	3-6 months	7-12 months	Tot	Chi Sq.	Prob.
	26	111	151	97	96.25	96.25	96.25	96.25	385	84.68	0.0000
B. Country	1 month	1-2 months	3-6 months	7-12 months	1 month	1-2 months	3-6 months	7-12 months	Tot	Chi Sq.	Prob.
AUSTRIA	3	13	12	9	2.50	10.67	14.51	9.32	37	1.06	0.3040
BELGIUM	0	0	1	0	0.07	0.29	0.39	0.25	1	1.55	0.6709
BULGARIA	0	6	6	3	1.01	4.32	5.88	3.78	15	1.82	0.6095
CYPRUS	1	3	1	2	0.47	2.02	2.75	1.76	7	2.21	0.5305
ESTONIA	2	9	8	5	1.62	6.92	9.41	6.05	24	1.11	0.7752
FINLAND	0	1	0	0	0.07	0.29	0.39	0.25	1	2.47	0.4810
FRANCE	0	3	3	2	0.54	2.31	3.14	2.02	8	0.75	0.8602
GERMANY	2	3	4	2	0.74	3.17	4.31	2.77	11	2.37	0.4984
GREECE	1	2	3	4	0.68	2.88	3.92	2.52	10	1.51	0.6792
HUNGARY	0	3	3	0	0.41	1.73	2.35	1.51	6	3.03	0.3874
IRELAND	0	0	0	1	0.07	0.29	0.39	0.25	1	2.97	0.3964
ITALY	1	4	11	12	1.89	8.07	10.98	7.05	28	5.94	0.1145
LUXEMBOURG	1	3	4	5	0.88	3.75	5.10	3.28	13	1.31	0.7265
MALTA	0	0	1	0	0.07	0.29	0.39	0.25	1	1.55	0.6709
NETHERLANDS (THE)	9	36	51	18	7.70	32.87	44.71	28.72	114	5.41	0.1444
NORWAY	0	1	2	1	0.27	1.15	1.57	1.01	4	0.41	0.9384
POLAND	0	4	2	0	0.41	1.73	2.35	1.51	6	4.95	0.1756
PORTUGAL	0	7	6	5	1.22	5.19	7.06	4.54	18	2.05	0.5613
ROMANIA	1	2	9	7	1.28	5.48	7.45	4.79	19	3.62	0.3061
SLOVAK REPUBLIC	1	0	3	3	0.47	2.02	2.75	1.76	7	3.50	0.3212
SLOVENIA	0	1	2	3	0.41	1.73	2.35	1.51	6	2.23	0.5258
SPAIN	1	1	15	11	1.89	8.07	10.98	7.05	28	10.29	0.0162
SWEDEN	1	5	2	2	0.68	2.88	3.92	2.52	10	2.76	0.4302
TURKEY	0	0	1	0	0.07	0.29	0.39	0.25	1	1.55	0.6709
UNITED KINGDOM	2	4	1	2	0.61	2.59	3.53	2.27	9	5.79	0.1220
Total	26	111	151	97					385	72.21	0.4708
C. Category of the Company	1 month	1-2 months	3-6 months	7-12 months	1 month	1-2 months	3-6 months	7-12 months	Tot	Chi Sq.	Prob.
ADMINISTRATION	3	5	10	8	1.76	7.50	10.20	6.55	26	2.04	0.5647
AGRICULTURE	9	41	46	32	8.64	36.90	50.20	32.25	128	0.82	0.8440
CONSULTANCY	3	11	12	6	2.16	9.23	12.55	8.06	32	1.22	0.7486
EDUCATION	3	16	24	11	3.65	15.57	21.18	13.61	54	1.00	0.8010
ENVIRONMENT	5	8	17	13	2.90	12.40	16.86	10.83	43	3.51	0.3199
NATURE	0	5	8	3	1.08	4.61	6.28	4.03	16	1.85	0.6040
OTHER	1	2	5	1	0.61	2.59	3.53	2.27	9	1.71	0.6347
SOCIAL	0	1	5	4	0.68	2.88	3.92	2.52	10	3.07	0.3807
TECHNOLOGY	2	22	24	19	4.52	19.32	26.28	16.88	67	2.24	0.5231
Total	26	111	151	97					385	17.46	0.8282
D. Size of the Company	1 month	1-2 months	3-6 months	7-12 months	1 month	1-2 months	3-6 months	7-12 months	Tot	Chi Sq.	Prob.
BIG	3	27	32	14	4.92	21.71	30.52	18.85	76	3.35	0.3406
MEDIUM	7	18	30	25	5.18	22.86	32.13	19.84	80	3.16	0.3676
MICRO	4	39	55	37	8.73	38.57	54.22	33.48	135	2.95	0.3991
SMALL	10	22	32	16	5.18	22.86	32.13	19.84	80	5.27	0.1528
Total	24	106	149	92					371	14.74	0.0984

Annotation: Tot Total, Chi Sq. Chi Square, Prob. Probability

Table 10. Recommended length of a practical placement in SD during the study programme. Responses were processed by total (A), country (B), company category (C) and size of the company (D).

Practical experience

Practical experience offers students the opportunity to demonstrate and develop professional competences, knowledge and skills in the workplace and combine formal education with relevant practical experience. In the highly competitive global market, combining practical experience with education, will give the competences, knowledge and skills that students needs for their careers. (cf. Aysan 1997).

From a company's point of view, practical placement provide students with hands-on experience; in this way approximately 25 % of the respondents prefer that students have practical experience in the field of SD of between 7 to 12 months and 39 % of between 3 to 6 months, making 64 % by merging the two classes (table 10). This was the highest percentage observed. Even considering that 21 % of the replies tended towards a further extension of the period of practical experience, it is possible to ascertain the great relevance assigned to practical experience based on employers' preference. According to the Chi Square test (table 10), no statistical significance can be attributed to countries, company categories or sizes of the respondent organisations.

It is well known that in fast-growing sectors or areas with a shortage of employees some types of practical placements may be so much in demand that it is difficult to find someone with the relevant competences, knowledge and skills willing to work as a trainer for trainees. Over the last years – also as a result of the crises – the number of available training periods in firms has been decreasing. Considering this, one can conclude that there needs to be a balance, getting the right number of training places for different types of job but also the "right competences, knowledge and skills" from an educational point of view.

Mission statement

Every organisation, company or institution needs to define its fundamental purpose, philosophy, and values. The mission statement answers the basic question of why the organisation exists, and describes the needs the organisation was created to meet. Without the guidance of a mission statement, programmatic priorities are difficult to establish and the success of an organisation and its programmes cannot be judged. (Grace 2003).

Looking at the mission statement of companies, we find out that words such as sustainable, sustainability or SD are only mentioned explicitly in 13.4 % of the mission statements given. 1.5 % implicitly mentioned SD issues by including words like three pillars, circular economy etc. and 15.4 % included words such as environment, environmental, eco-, ecology or ecological in their mission statement. Furthermore, 6.5 % of the respondents mentioned in their mission statement words related to activities such as green, nature conservation, renewable energy, organic farming, biodiversity, climate etc..

Standards

Sustainability standards (also known as "sustainability guidelines" or "SD guidelines") are agreed criteria by which the production, transportation and processing services can be assessed with regard to environmental, social, ethical, food safety issues or other values. Standards

guarantee that production, processing and trade are beneficial with respect to the social well-being of the people (people), the ecosystem (planet) and the economy (profit). (cf. Slaper and Hall 2011). Standards help to make life simpler and to increase the reliability and the effectiveness of many goods and services we use. Standards are created by bringing together the experience and expertise of all interested parties such as producers, sellers, buyers, consumers and regulators of a particular material, product, process or service. (BSI 2010). Standards can help consumers and others judge whether given products are "environmentally friendly" and/or "social or ethical" and/or fulfil a certain level of quality or attainment.

One set of questions in the professionalization questionnaire concerned the application of standards within companies and organisations. The questions related to the type of standards applied by the companies, the reason for applying them or the reasons for not applying any standards and the relation between standards and SD.

About 55 % of the companies and organisations polled do not apply any standard. 28 % apply one standard whereas 17 % apply two or more standards. So far the standards most applied are the ISO 9000 series (32 % of the companies apply these standards) followed by ISO 14001 (17 %). Further standards applied are: OHSAS 18001 (5 %), ISO 26000 (4 %), FSC/PEFC (4 %) EMAS (4 %), BREEAM/HQE (3 %), EN 16001 (1 %) and others (28 % – for example ISO 17025, GMP/HACCP) – for explanation see appendix, p 82ff.

The main reasons for applying standards are

- company image (21 %),
- corporate responsibility (18 %),
- the optimisation of internal procedures (17 %)
- and compliance with outside requirements (16 %).

Furthermore, 12 % of the companies expect to find better business opportunities by applying standards whereas another 12 % use standards to reduce their energy, waste and/or water costs.

43 % of the companies apply their own standards to reduce their impact on the environment or to implement SD. 51 % of the companies see standards as a means to implement SD. The majority of the companies does not plan to implement (further) standards in the near future.

Companies stated that the most important arguments against the application of environmental standards were the following: (i) no need to, because there are no external requirements (42 answers), (ii) no benefit expected (36 answers), (iii) too complicated (25 answers), (iv) internal costs such as administration, involvement of staff, etc. (24 answers) and (v) external costs such as fees, etc. (20 answers).

The answers to the questionnaire showed a wide range of standards applied by the companies and organisations, standards that are more or less related to SD and more or less destined effectively to reduce the environmental impacts of companies. The sheer number of standards makes it difficult for the public to know what impact this or that standard has on a company's activities. Still, standards seem to influence the way companies are seen by the public since 21 % of the companies see standards as a means to improve their image and 12 % think it helps improve their business opportunities.

It is interesting to see that more than 40 % of the companies are applying their own, internal standards to reduce their environmental impact. This provides an opportunity to apply standards with less administrative and external costs. On the other hand, internal standards are not, or less, visible to the public so that they have no, or less, impact on the company's image and related business opportunities.

The fact that 78 companies do not apply standards because there are no external requirements to do so and/or because they do not see the benefits is questionable. This shows that outside pressure by politics/legislation and/or society is still needed to make further progress towards SD within the business world and that voluntariness has its limits. This is underlined by the fact that more than half of the companies/organisations do not apply any standard at all although the right standards can help to reduce environmental impacts effectively.

SD issues

The survey asked people about the importance of SD issues in their companies, now and in five years. ANOVA results (table 11) showed a significant influence of the four single factors (SD issues, country, category and size of the company) and a significant relationship between SD issues and country.

Table 11. Results of ANOVA on SD issues. A. with respect to the present; B. within a 5-year time period.

	A. now					B. in 5 years			
	DF	SS	F Ratio	Prob. > F	Sig.	SS	F Ratio	Prob. > F	Sig.
SD issues	15	148.96	6.54	<.0001	**	128.00	5.88	<.0001	**
COUNTRY	14	343.88	16.17	<.0001	**	366.66	18.06	<.0001	**
CATEGORY	8	144.92	11.92	<.0001	**	39.92	3.44	0.0006	**
SIZE	3	89.00	19.53	<.0001	**	51.87	11.92	<.0001	**
COUNTRY*SD issues	210	393.02	1.23	0.0140	*	422.19	1.39	0.0002	**
CATEGORY*SD issues	120	143.57	0.79	0.9573		153.30	0.88	0.8184	
SIZE*SD issues	45	60.22	0.88	0.6973		80.17	1.23	0.1412	

Annotation: DF degrees of freedom, SS sum of squares of all observations, Prob. Probability, Sig. significance

At a first look (figure 4) it is noted that the general interest in SD issues remains mostly at a medium-high average value (3.28 is the average score with respect to the present time; 3.85 is the one projected within five years), with some exceptions. The concepts of energy efficiency, efficient use of natural resources, renewable resources and waste reduction are considered the most interesting (significantly higher scores, figure 4) whereas organic farming and the scarcity of raw materials are the less favoured ones (significantly lower scores, figure 4), showing an overall tendency of the companies towards the optimisation of internal processes. This signifies the beginning of a process of the integration of SD concepts within the company, a kind of internalisation under development. The reasons why companies have become so sensitive and specific regarding these new concepts vary. They range from the need to adapt to current trends or development regulations to improving manufacturing efficiency in order to contain costs and, in view of the crisis and possibly decreasing prices, maintain their margins. On the other hand, the efficiency in terms of SD could create new

levers for the marketing department and consequently the ability to reach new target markets, thereby leading to increased sales as well as the improvement of margins. Conversely, given the limited presence in the sample of firms in primary agricultural production this reason could be attributed to the lack of interest in organic farming.

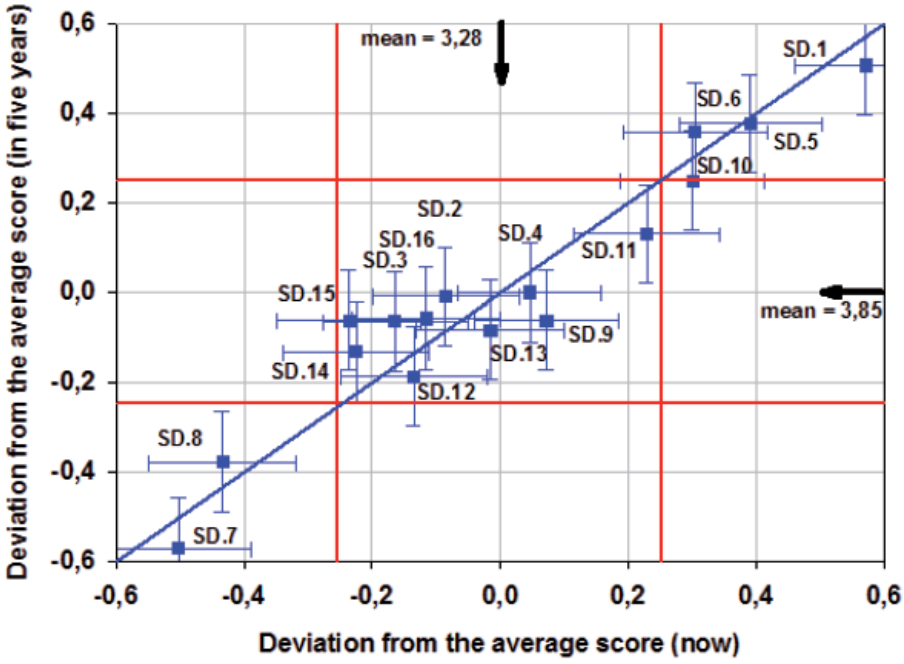


Figure 4. Relevance of SD issues now and in five years. The red horizontal and vertical lines mark values that are significantly higher or lower than the average values.

Annotation:

SD issues		SD issues	
SD1	Energy efficiency	SD2	CO_2 neutral operations
SD3	Sustainable procurement	SD4	Reduced water consumption and water reuse
SD5	Efficient use of natural resources	SD6	Renewable resources
SD7	Organic farming	SD8	Scarcity of raw materials
SD9	Prevention of damage to biodiversity	SD10	Waste reduction
SD11	Emission reduction	SD12	Development of SD products and services for clients
SD13	Corporate social responsibility	SD14	Sustainable supply chain
SD15	Rethinking the business by using SD as a principle	SD16	SD as means to improve business opportunities

Comparing the interest in the concepts of SD by company categories at this time and in five years (figure 5) it seems that in future the level of interest will settle at consistent values of medium-high. The only exception is the natural and social sectors that show more interest (the first one both at present and within five years; the second one only at present). Particular is the case for companies operating in 'administration' and in 'education'. For the moment, they are lagging behind the other sectors, they will, in the next five years, however, settle at the current level of the others.

'Small' companies (data not showed) were confirmed to be less interested in SD issues, both at present and in the projected future, while 'big' companies were shown to be the most involved in SD issues within five years.

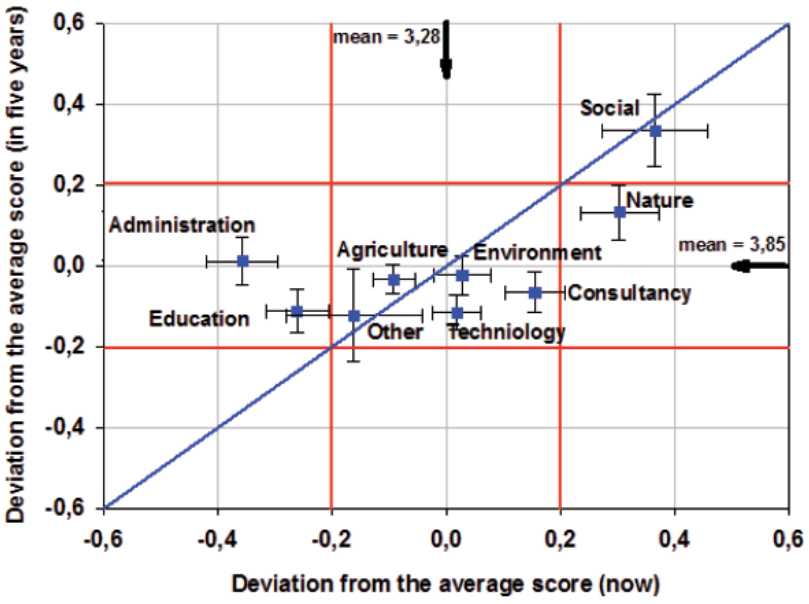


Figure 5. Relevance of SD issues according to the company categories. The red horizontal and vertical lines mark values that are significantly higher or lower than the average values.

Regarding the significant relationship between countries and SD issues (data not showed), it is worth mentioning that

- Austria showed a higher interest in organic farming, both at present or within five years, than the other countries as well as a higher interest in the scarcity of raw materials in the future. This is coherent with the fact that Austria[2] has (after Liechtenstein[3]) the highest proportion of organic farming in Europe.
- Also Bulgaria, according to the opinions of the respondents, will be much more involved in organic farming in the near future then the other EU countries. Furthermore, SD issues are considered, now and in five years, a very interesting way to improve business opportunities. At present, the scarcity of raw materials is not considered a very important issue.
- Italy showed a lower involvement than the average EU value in sustainable procurement (both now and in the near future), in scarcity of raw material and prevention of damage to biodiversity with respect to a five years prospect. While at present a lower interest is assigned to organic farming a higher interest is indicated to the development of SD products and services.

2 In 2010, 16.2 % of Austria's farmers cultivate more than 19 % of the utilised agricultural area in accordance with organic principles (Klingbacher n.d.).
3 26 % of all farms that get direct payments (FiBL 2011).

- The development of SD products and services is also considered to become more important in Spain in the near future. CO_2 neutral operation was not considered as a critical issue in Spain, both at present and within the following five years.
- Finally, in the United Kingdom organic farming is supposed to become a less relevant issue in the upcoming five years.

5.2.2 What are the competences, skills and knowledge needed?

In the survey people were asked about the competences, skills and knowledge that they consider important for their employees. The results are presented in the following section.

The statistical analysis (ANOVA, table 12, 13 and 14) showed no significant relationship between SD response indicators (competences, knowledge or skills) with the other experimental factors (country, category and size of the company, respectively). In this way, results can be simply analysed considering one factor at a time.

Table 12. Results of ANOVA on SD competences.

	DF	SS	F Ratio	Prob. > F	Sig.
COMPETENCE	6	9.55	1.94	0,0711	n.s.
COUNTRY	14	134.71	11.73	<.0001	**
CATEGORY	8	31.21	4.75	<.0001	**
SIZE	3	7.38	3.00	0.0296	*
COUNTRY*COMPETENCE	84	56.64	0.82	0.8778	n.s.
CATEGORY*COMPETENCE	48	15.29	0.39	1.0000	n.s.
SIZE*COMPETENCE	18	7.34	0.50	0.9607	n.s.

Annotation: DF degrees of freedom, SS sum of squares of all observations, Prob. Probability, Sig. significance

Table 13. Results of ANOVA on SD knowledge

	DF	SS	F Ratio	Prob. > F	Sig.
KNOWLEDGE	22	227.90	9.76	<.0001	**
COUNTRY	14	390.15	26.25	<.0001	**
CATEGORY	8	129.30	15.22	<.0001	**
SIZE	3	106.20	33.34	<.0001	**
COUNTRY*KNOWLEDGE	308	341.70	1.04	0.2865	n.s.
CATEGORY*KNOWLEDGE	176	168.33	0.90	0.8208	n.s.
SIZE*KNOWLEDGE	66	51.69	0.74	0.9451	n.s.

Annotation: DF degrees of freedom, SS sum of squares of all observations, Prob. Probability, Sig. significance

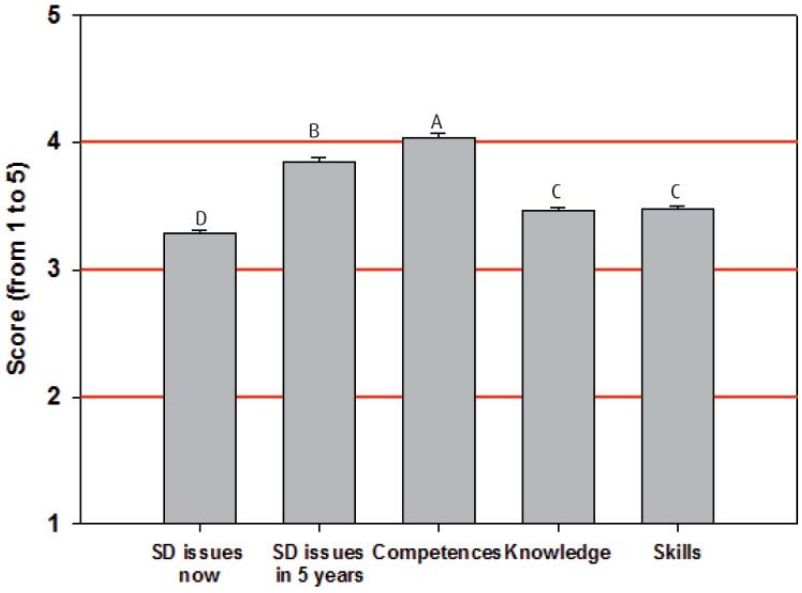
Table 14. Results of ANOVA on SD skills.

	DF	SS	F Ratio	Prob. > F	Sig.
SKILLS	18	193.32	9.96	<.0001	**
COUNTRY	14	408.60	27.06	<.0001	**
CATEGORY	8	81.24	9.41	<.0001	**
SIZE	3	62.82	19.41	<.0001	**
COUNTRY*SKILLS	252	314.95	1.16	0.0520	n.s.
CATEGORY*SKILLS	144	130.89	0.84	0.9131	n.s.
SIZE*SKILLS	54	53.34	0.92	0.6501	n.s.

Annotation: DF degrees of freedom, SS sum of squares of all observations, Prob. Probability, Sig. significance

On a scale between 1 and 5, the average score for competences was 4.03. This score is the highest one compared to the general scores of other SD indicators, such as SD issues, skills and knowledge (figure 6). Nevertheless, no significant differences were detected among the various kinds of competences presented in the questionnaire (data not shown).

Figure 6. Average score values assigned to SD indicators. Bars with different letters recognise significantly different values (P < 0.01).



Annotation: A, B, C and D It means that a mean value identified with the letter "A" is significantly higher than another mean value identified with the letter "B", and so on. The probability level is 0.01 in other words the level of confidence in the mean discrimination is the 99 %.

As can be observed from table 15, Spain, Slovenia, Italy and Bulgaria proved to greater rely on SD competences than the other EU countries; in contrast, Romania, Austria and Germany are relatively less confident in them. 'Education' and 'administration' were observed as the kind of company category where SD competences are more involved or sought after, while 'micro' companies seemed to be more attracted by the investigated kinds of competences.

A. COUNTRY	Dev	Sig.		B. COUNTRY	Dev.	Sig.
SPAIN	0.35	**		EDUCATION	0.22	**
SLOVENIA	0.30	**		ADMINISTRATION	0.15	*
ITALY	0.26	**		CONSULTANCY	0.10	
BULGARIA	0.24	*		NATURE	0.10	
ESTONIA	0.12			ENVIRONMENT	0.05	
UNITED KINGDOM	0.09			SOCIAL	0.02	
SWEDEN	0.07			AGRICULTURE	-0.02	
PORTUGAL	0.05			TECHNOLOGY	-0.03	
GREECE	0.05			OTHER	-0.59	**
NETHERLANDS (THE)	0.02					
FRANCE	-0.10			SIZE C.	Dev.	Sig.
LUXEMBOURG	-0.14			MICRO	0.08	**
ROMANIA	-0.26	**		BIG	0.00	
AUSTRIA	-0.45	**		SMALL	-0.03	
GERMANY	-0.58	**		MEDIUM	-0.06	

Annotation: Dev. deviation, Sig. significance

Table 15. Mean deviation in SD competences as a consequence of ANOVA. The values are expressed as deviations from the average score of 4.03 ± 0.03.

Considering SD knowledge, table 16 shows that highly significant positive deviations from the average score ($P < 0.01$) were found for the categories of 'environment' (K3.8), 'efficiency' (K5.22), 'natural resources and biodiversity' (K2.16); while significant positive deviations ($P < 0.05$) were observed for 'ecosystems' (K2.13) and 'ecological integrity' (K2.7). On the other hand, highly significant negative deviations from the average score ($P < 0.01$) were found for the categories of 'gross national product' (K5.10), 'niche markets' (K5.2), 'business models' (K5.4); while significant negative deviations ($P < 0.05$) were observed for 'environmental justice' (K7.11) and 'human rights' (K7.15).

Table 16. Mean deviation in SD knowledge as a consequence of ANOVA. The values are expressed as deviations from the average score of 3.46 ± 0.02.

Code	SD knowledge	Dev.	Sig.
K3.8	Environment	0.60	**
K5.22	Efficiency	0.58	**
K2.16	Natural resources and biodiversity	0.40	**
K2.13	Ecosystems	0.23	*
K2.7	Ecological Integrity	0.20	*
K2.3	Basic principles of natural systems	0.19	
K7.19	Social responsibility	0.17	
K4.9	Environmental Management systems	0.16	
K6.12	Ecological economics	0.11	
K5.6	Economics	0.03	
K6.21	Eco system services	0.00	
K1.1	Triple P bottom line/Brundtland report/basic knowledge of SD	-0.01	
K5.17	Supply chains	-0.04	
K5.18	Value chains	-0.05	
K5.23	Externalities	-0.07	
K5.14	Globalisation	-0.12	
K3.5	Carbon footprint	-0.16	
K7.20	Social Justice	-0.17	
K7.15	Human rights	-0.22	*
K7.11	Environmental justice	-0.22	*
K5.4	Business models	-0.38	**
K5.2	Niche markets	-0.58	**
K5.10	Gross national product	-0.64	**

Annotation: Dev. deviation, Sig. significance

Insofar as the SD skills are concerned, results from table 17 show that the most important skills (positive deviations from the average score for $P < 0.01$) are: 'efficiency' (S4.15), 'leadership skills' (S7.19), 'sustainability planning' (S6.18), 'effective communication' (S5.14) and 'analysis of environmental problems' (S1.2). For $P < 0.05$ the positive deviation is 'systems thinking' (S1.6). Negative significant deviations ($P < 0.01$) were found for the skills 'cap and trade' (S3.3), the '4 P's (product, price, place and promotion) of marketing' (S5.9), 'pollution prevention programme (S2.1), 'pollution trading' (S3.5), and 'economic restructuring' (S4.13); for $P < 0.05$ the negative deviation is that of 'socially responsible investing' (S6.4).

Code	SD knowledge skills	Dev.	Sig.
S4.15	Efficiency	0.49	**
S7.19	Leadership skills	0.39	**
S6.18	Sustainability planning	0.39	**
S5.14	Effective communication	0.38	**
S1.2	Analysis of environmental problems	0.30	**
S1.6	Systems thinking	0.23	*
S7.17	Influencing the organisation	0.12	
S6.10	Designing a sustainable system	0.08	
S1.11	Life cycle analysis	0.07	
S1.16	Indicators and indexes	0.02	
S1.12	Ecological foot print	0.01	
S1.8	Full cost accounting	-0.04	
S4.7	Business case	-0.07	
S6.4	Socially responsible investing	-0.24	*
S4.13	Economic restructuring	-0.33	**
S2.1	Pollution prevention programme	-0.38	**
S3.5	Pollution trading	-0.39	**
S5.9	The 4 P's (product, price, place and promotion) of marketing	-0.46	**
S3.3	Cap and trade	-0.57	**

Annotation: Dev. deviation, Sig. significance

Table 17. Mean deviation in SD skills as a consequence of ANOVA. The values are expressed as deviations from the average score of 3.47 ± 0.02.

From figures 7, 8 and 9 it is possible to detect the high correlation that links SD knowledge and skills with respect to countries, categories and sizes of the companies. The average values related to 'knowledge' and 'skills' were approximately the same (3.46 and 3.47, respectively) and not significantly different.

Considering the effect of country, figure 7, Bulgaria, Slovenia and Italy showed higher positive deviations from the average score, both for knowledge and skills. These countries, therefore, have a significantly ($P < 0.01$) greater consideration of SD knowledge and skills than the other EU countries. On the other hand, Germany, Romania, Luxemburg and France revealed significantly ($P < 0.01$) negative deviations from the average score, again both for 'knowledge' and 'skills'. Furthermore, in Germany, Luxemburg and France sustainability and SD have been discussed and implemented at the company level over the last two to three decades. Several actions and standards to improve their sustainable performance have been established and have already achieved a very good standard in sustainable performance. Currently, there are no new hot topics but countries like Sweden, Netherlands and Austria are in a process of continuous improvement.

Looking at the effects of the company categories (figure 8), 'social' and 'environment' are the categories that displayed a highly significant positive deviation from the average score; the opposite was observed with respect to 'education' and 'other' categories.

Finally, the size of the companies (figure 9) also plays an influential role in SD knowledge and skills. Big companies, as already seen when considering other kinds of SD indicators, are more significantly ($P < 0.01$) and positively affected by SD than 'small' companies, the latter significantly ($P < 0.01$) but negatively influenced.

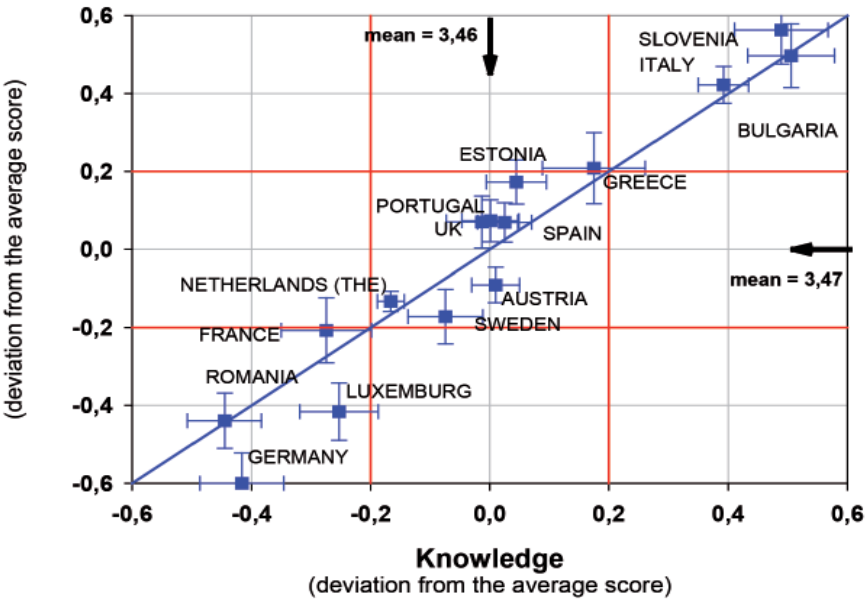


Figure 7. Relation between knowledge and skills by country. The red horizontal and vertical lines mark values that are significantly higher or lower than the average values.

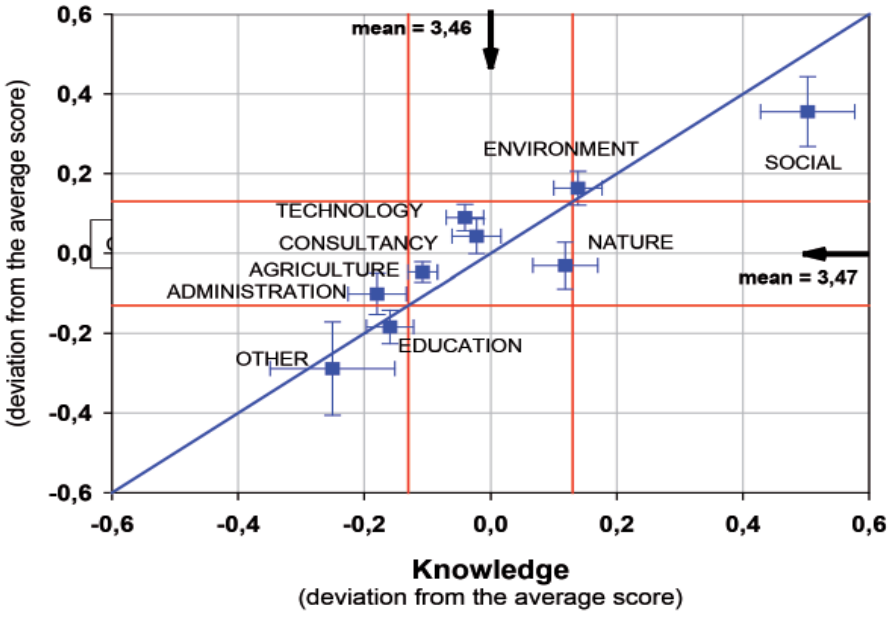


Figure 8. Relation between knowledge and skills by company category. The red horizontal and vertical lines mark values that are significantly higher or lower than the average values.

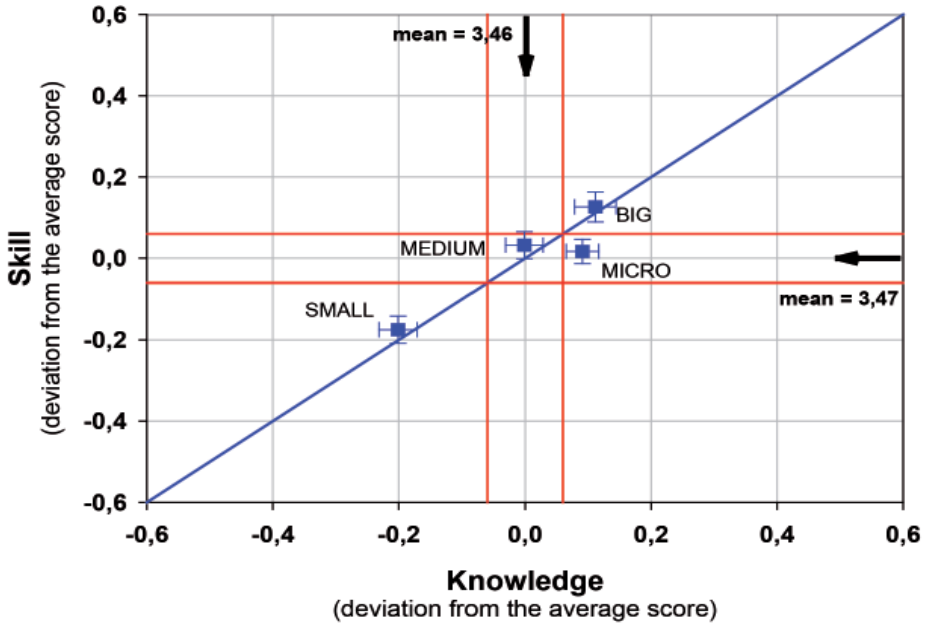


Figure 9. Relation between skills and knowledge by company size. The red horizontal and vertical lines mark values that are significantly higher or lower than the average values.

5.2.3 What can be learned about new jobs?

Considering the companies' expectations regarding the creation of new jobs related to SD activities or productive implementations, we have to stress that the 59 % of respondents do not believe in these kind of opportunities (table 18.A): this proportion is statistically significant ($P < 0.01$) as compared with the starting hypothesis of equal partition between respondents. Italy showed a significantly higher level of trust in job creation (table 18.B) than other counties (+27 %, $P < 0.01$), together with Greece (+39 % but not statistically significant due to the limited number of samples). The opposite was displayed by Estonia (-25 %, $P < 0.01$) and Hungary (-41 %, $P < 0.05$). The sector of 'education' (table 18.C), again, is to be considered more oriented to the opportunity that SD can contribute to job creation (deviation equal to +16 %, $P < 0.05$), while 'agriculture' and 'administration' displayed the opposite character (deviations equal to -18 and -11 % respectively, with a significant P level). Finally, 'small' companies (table 18.D) were confirmed to be less confident in the creation of jobs compared to larger companies (deviation -13 %, $P < 0.05$).

Table 18. Expectations of European companies on the creation of new jobs related to SD. Responses ("Yes" or "No") were processed by total (A), country (B), company category (C) and size of the company (D).

	OBSERVED		EXPECTED						
A. TOTAL	No	Yes	No	Yes	Tot	Dev. (%)	Chi Sq.	Prob.	Sig.
	256	175	215.50	215.50	431	-10.86	15.22	0.0001	**
B. COUNTRY	No	Yes	No	Yes	Tot	Dev. (%)	Chi Sq.	Prob.	Sig.
AUSTRIA	24	18	24.95	17.05	42	2.25	0.09	0.7661	
BELGIUM	2	0	1.19	0.81	2	-40.60	1.37	0.2423	
BULGARIA	8	7	8.91	6.09	15	6.06	0.23	0.6325	
CYPRUS	2	4	3.56	2.44	6	26.06	1.69	0.1936	
ESTONIA	21	4	14.85	10.15	25	-24.60	6.27	0.0122	**
FINLAND	0	1	0.59	0.41	1	0.00	0.00	1.0000	
FRANCE	0	2	1.19	0.81	2	59.40	2.93	0.0872	
GERMANY	8	3	6.53	4.47	11	-13.33	0.81	0.3680	
GREECE	2	8	5.94	4.06	10	39.40	6.44	0.0112	*
HUNGARY	6	0	3.56	2.44	6	-40.60	4.10	0.0428	*
IRELAND	0	2	1.19	0.81	2	59.40	2.93	0.0872	
ITALY	10	21	18.41	12.59	31	27.14	9.47	0.0021	**
LUXEMBOURG	10	4	8.32	5.68	14	-12.03	0.84	0.3593	
MALTA	0	1	0.59	0.41	1	59.40	1.46	0.2265	
NETHERLANDS (THE)	89	54	84.94	58.06	143	-2.84	0.48	0.4891	
NORWAY	2	3	2.97	2.03	5	19.40	0.78	0.3771	
POLAND	0	0	0.00	0.00	0	0.00	0.00	0.0000	
PORTUGAL	13	10	13.66	9.34	23	2.88	0.08	0.7789	
ROMANIA	8	11	11.29	7.71	19	17.29	2.36	0.1248	
SLOVAK REPUBLIC	5	2	4.16	2.84	7	-12.03	0.42	0.5168	
SLOVENIA	3	4	4.16	2.84	7	16.54	0.79	0.3729	
SPAIN	20	8	16.63	11.37	28	-12.03	1.68	0.1948	
SWEDEN	10	3	7.72	5.28	13	-17.53	1.66	0.1982	
TURKEY	2	0	1.19	0.81	2	-40.60	1.37	0.2423	
UNITED KINGDOM	11	5	9.50	6.50	16	-9.35	0.58	0.4462	
Total	256	175			431		48.81	0.0020	**
C. CATEGORY OF THE COMPANY	No	Yes	No	Yes	Tot	Dev (%)	Chi Sq.	Prob.	Sig.
ADMINISTRATION	24	7	18.41	12.59	31	-18.02	4.18	0.0410	*
AGRICULTURE	95	40	80.19	54.81	135	-10.97	6.74	0.0094	**
CONSULTANCY	23	19	24.95	17.05	42	4.63	0.37	0.5408	
EDUCATION	26	34	35.64	24.36	60	16.06	6.42	0.0113	*
ENVIRONMENT	24	23	27.92	19.08	47	8.33	1.35	0.2447	
NATURE	13	7	11.88	8.12	20	-5.60	0.26	0.6099	
OTHER	6	2	4.75	3.25	8	-15.60	0.81	0.3688	
SOCIAL	6	6	7.13	4.87	12	9.40	0.44	0.5074	
TECHNOLOGY	39	37	45.14	30.86	76	8.08	2.06	0.1514	
Total	256	175			431		22.63	0.0039	**
D. SIZE OF THE COMPANY	No	Yes	No	Yes	Tot	Dev (%)	Chi Sq.	Prob.	Sig.
BIG	44	42	51.68	34.32	86	8.93	2.86	0.0907	
MEDIUM	53	36	53.49	35.51	89	0.55	0.01	0.9163	
MICRO	86	63	89.54	59.46	149	2.38	0.35	0.5533	
SMALL	67	25	55.29	36.71	92	-12.73	6.22	0.0127	*
Total	250	166			416		9.44	0.0240	*

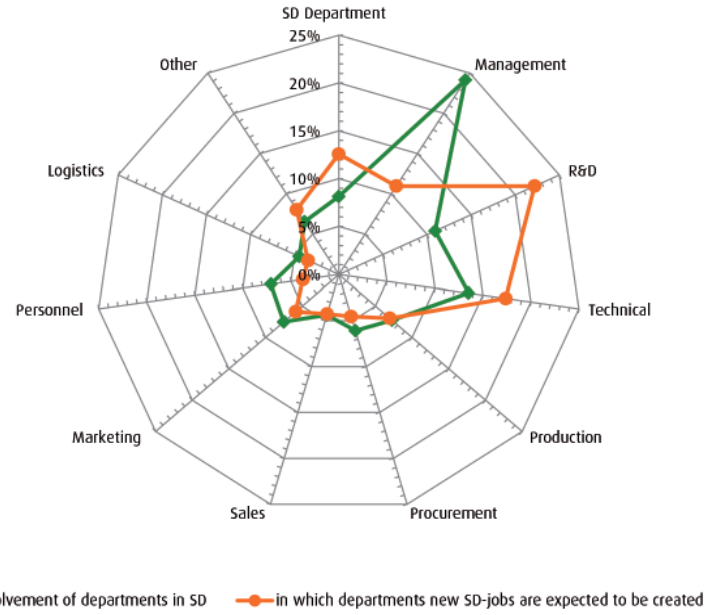
Annotation: Tot Total, Dev. Deviation, Chi Sq. Chi Square, Prob. Probability, Sig. significance

Nevertheless, there seems to be an overall consensus that in the future, the number of new jobs created in connection with SD will only be marginal. Mostly because SD would probably be a concept included within competences, knowledge and skills already present in actual jobs. Moreover, currently only 26 % of the respondents are already looking at SD criterion when recruiting new employees (table 9). This notwithstanding, 71 % of participants in the survey agreed that it is important that graduates have an excellent scientific/technological knowledge in their field of expertise.

It seems that in the future 'research & development' (R&D) and the 'technical' field will be those most affected by the concept of SD at the expense of management (cf. figure 10). This shift of responsibility from management to the process denotes the desire to make SD a pillar within the company. As we have also seen initially in analysing the SD issue, this outlines a commitment from the companies to increasingly internalise the concept of SD. They are no longer trying to introduce the concept from above, but they are in the process of trying to implement it from the inside until it gets its own business processes. In fact, we notice the growing interest in creating a special department for the management of the subject, probably due to increased complexity and importance of the issue within the company.

Something that is rather worrying and in disagreement with the general trend seems to be linked to other departments. We find the 'logistics' together with the 'personnel', 'sales', 'procurement', 'production', and 'marketing' in a position of estrangement with respect to SD (cf. figure 10). Taking these departments together we could see them as covering all the stages of the supply chain and a proper and efficient supply chain management is crucial for SD. In particular if we consider 'marketing', we can detect this lack of connection to SD in another disparity, the skills ones, where we noted a significantly negative response from employers in the 4 P's, probably because they are not able to see the connection with the SD concept.

Figure 10. Responsibilities for SD in a company and future needs of jobs.



Source: ISLE project 2012d

5.3 Does education meet the market-needs – vice versa?

Generally, HEIs need to deliver the right mix of competences, knowledge and skills both to meet student needs and to match the requirements of the labour market. One way of planning a response to current and future labour market needs is through competences, knowledge and skills assessment at the educational and employers' level – cf. sub-chapter 5.1.2, 5.1.3 and 5.2.3.

A comparison of competences, knowledge and skills looked at in the two surveys about SD in education at university and at work in companies shows that: The competences (i) future orientation, (ii) social responsibility, (iii) system orientation were part of the questionnaire dealing with SD in companies and the competences (iv) action and practical skills, (v) emotional intelligence and communication, (vi) personal involvement and (vii) global awareness were not considered in the questionnaire dealing with SD at university level. Furthermore, ecology skills were included as competences to be investigated at the universities' level. Nevertheless, similar knowledge aspects were considered in the university and company questionnaire.

Table 19 shows those competences, knowledge and skills which were investigated either for education at the university (cf. sub-chapter 5.1 SD in HEIs – Higher Education of life sciences) and in companies during two different surveys.

19 COMPETENCES
C1 SOCIAL RESPONSIBILITY
C2 SYSTEM ORIENTATION
C3 FUTURE ORIENTATION
20.1 KNOWLEDGE
K1 GENERAL SUSTAINABLE DEVELOPMENT KNOWLEDGE
K3 HOW TO ANALYSE ENVIRONMENTAL IMPACTS
K4 HOW TO REDUCE ENVIRONMENTAL IMPACTS
K5 ECONOMICS
K6 VALUE OF NATURE
K7 SOCIAL ASPECTS OF SUSTAINABLE DEVELOPMENT
20.2 SKILLS
S1 ANALYSING ENVIRONMENTAL IMPACTS
S2 REDUCING ENVIRONMENTAL IMPACTS
S3 POLLUTION TRADING
S4 ECONOMIC OPTIMISATION
S5 COMMUNICATING
S6 IMPLEMENTING SUSTAINABILITY
S7 LEADERSHIP AND TEAMWORK

Table 19. Competences, knowledge and skills investigated in education and at company level.

No significant correlation was observed between competences, knowledge and skills expressed by companies as compared to universities (Pearson coefficients equal to 0.21 and P=0.43). This means that the assessment criteria in the two systems are notably different. Moreover, as shown in figure 11, companies attribute more importance to all SD competences, knowledge and skills than universities do in their education. This is substantiated by a significantly higher average score of 'company' (3.52) compared to 'education' (2.79).

'Future orientation' (C3) and 'social responsibility' (C1) are considered the most important competences, both by universities and companies. Companies also consider 'system orientation' (C2) and 'analysing environmental impacts' (S1) as very important. In contrast, skills like 'pollution trading' (S3) or 'reducing environmental impacts' (S2) are not considered very relevant. From the side of 'education', 'analysing environmental impact' (K3), closely followed by 'social aspect of SD' (K7) are the most important ones; while 'general SD knowledge' (K1) and 'reducing environmental impacts' (K4) are the least relevant.

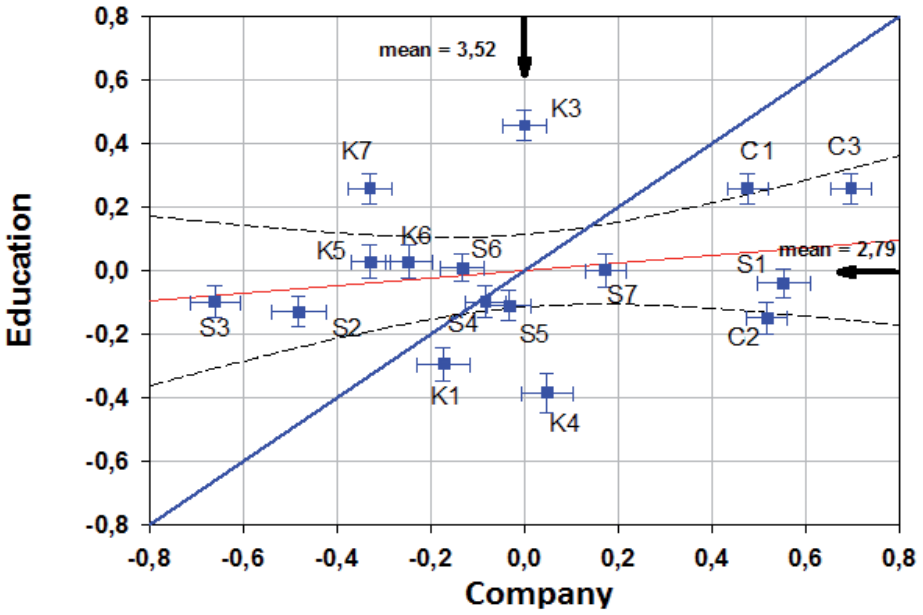


Figure 11. Comparison of the competences, knowledge and skills analysed in education (HEIs) and at company level. The blue line represents the 1:1 or bisector; the red line is the regression between company and education; with the dashed line confidence curves of the regression line are displayed.

Clearly, employers are in a strong position to judge what mix of competences, knowledge and skills is optimal for particular occupations (like farming) and it therefore makes sense for employers to play a key role in establishing the curriculum. However, if employers have too dominant an influence, degree programmes may overestimate the importance of specific skills to match occupational requirements and give insufficient attention to the generic skills needed for mobility between firms and between occupations (Smits 2007). The interests of employers depend on the level at which they are expressed. While locally employers may not wish their apprentices to have strong transferable skills, collectively employers have an interest in a flexible and adaptable labour force in their sector.

In the following general conclusion no differentiation between countries, size and categories of companies is made. Moreover, we suggest that a further dialogue between universities and professional practise be started on the subjects covered in our survey, to shed light on e.g. the interpretation of the differences between countries and between categories.

6 Gaps and future directions

This report has given rise to significant findings. The link between HEIs dealing with SD in teaching and the practical experience of SD in companies focusing on the importance of developing clear emphases on and broad interpretations of competences, knowledge and skills for SD.
Among the trends and findings shown, emergent signs of promising and positive new practises are evident in the report dealing with the power of education-company partnerships in a world where these sectors had often been regarded as not being well linked.

Our review of SD competences, knowledge and skills in education and daily working life also exposes and highlights a number of gaps in training and practical knowledge that might set a useful agenda for further research inquiry and intervention strategy by the politics.

Education and labour markets

- What measures have been and can be taken to raise the status and attractiveness of SD aspects in European countries (at the education and company level)?
- What measures are European countries taking to avoid outward migration and retain their highly skilled graduates in SD?
- Where have universities partnered successfully with companies as well as social and community agencies to initiate successful development and training initiatives in SD. What are the key characteristics of these partnerships? How might they be replicated elsewhere?

Monitoring and evaluation

- What is the impact, in HEIs, of the expansion of quality assurance regimes, on the assessment of teaching and learning for SD competences, knowledge and skills?
- What is the evidence and what are the indicators that SD competences, knowledge and skills and new basics are being taught and applied in practise? How can labour market outcomes be assessed for youths who are taught the new competences, knowledge and skills for SD (benchmarking)?
- What measurable indicators of SD can be developed that would serve as useful guides and quality assurance mechanisms for steering and evaluating intervention in the areas of education, training and company performance (benchmarking)?

Competency-based, skill-based and outcome-oriented curriculum reform

- Is there a viable version of the so-called key SD competences, knowledge and skills taking shape in European countries? What is the role of those competences and standards in higher education and how can they be taught?
- How do systems of standards and competences in connection with SD need to be developed in ways that are appropriately ambitious yet also sufficiently realistic, given existing levels of capacity about the workforce in European countries?
- What tools or strategies can be identified or devised that locate and link standards frameworks and capacity levels to interact and propel one another through upward spirals of development and improvement on SD?

7. Conclusion and recommendations

Our prosperity, today and tomorrow, depends on how many people are in work and how they handle SD issues in their daily working life. The correct competences, knowledge and skills for SD are the best guarantee of our ability to sustain our life and secure lasting prosperity. Competences, knowledge and skills also underpin personal development and well-being.
This report gives an indication of:

(1) whether the concept of SD is present in education and companies,
(2) what professional practise in Europe considers as being the important SD issues, competences, knowledge and skills and
(3) whether there is a need for new jobs in the field of SD.

Future orientation for companies (employers) and education (HEIs) are summarised as key findings – pointed out in box 1 to box 4.
An analysis of key SD competences, knowledge and skills in education and working life would be of little interest if current patterns were judged to be already sustainable. A lot is going on and many different messages are emerging as shown in box 1.

Box 1. Summary of key findings together with conclusions from companies and education – status quo.

<table>
<tr><th>Key findings</th><th>Companies</th><th>Education</th></tr>
<tr><td>The mission of companies can be used to communicate business principles and goals of SD.</td><td>Sustainable, sustainability or SD is mentioned in some mission statements. It is not a commonly used term in mission statements.</td><td>Most universities have already adopted institutional policies of sustainability.</td></tr>
<tr><td rowspan="2">Standards are a means to implement SD on a business level – especially they help to reduce negative impacts on the environment.</td><td colspan="2">A wide range of standards has already been applied.</td></tr>
<tr><td>Beside the widely used standards (ISO and EMAS) many companies (two fifths of interviewed companies) create internal standards.</td><td></td></tr>
<tr><td rowspan="4">SD is a development path in process.</td><td>There is a general interest on SD issues.</td><td>SD is a very common concept in many studies because SD is a general and cross-cutting concept for many of the studies.</td></tr>
<tr><td colspan="2">Although there is a certain level of interest in SD issues in future, the natural and social sectors show more interest than the other ones. Particular is the case for companies operating in administration and in education. For the moment, they are lagging behind the other sectors, they will, in the next five years, settle at the current level of the others.</td></tr>
<tr><td>Small companies were confirmed to be the less interested in SD issues, both at present and in the projected future, while big companies showed to be the most involved in SD issues within the near future.</td><td></td></tr>
</table>

It is a mixture of a lack of knowledge and visibility on the current and future supply and demand of issues, competences, knowledge and skills related to SD that prevents a better match between them, i.e. between the SD competences, knowledge and skills we have available and those that are required by the labour market. This is coupled with the inertia of education and training systems alongside labour market failures. Upgrading, adapting and widening the SD issues, competences, knowledge and skills portfolio of students and working people is one of the greatest challenges facing Europe today. Need of action on the employers' and educational side are summarised briefly in box 2.

Box 2. Summary of key findings together with conclusions from companies and education – SD issues, knowledge, skills and competences.

<table>
<tr><th>Key findings</th><th>Companies</th><th>Education</th></tr>
<tr><td>SD issues indicate an overall concentration of business towards the optimisation of internal processes.</td><td>The concepts of energy efficiency, efficient use of natural resources, renewable resources and waste reduction are the most interesting issues whereas organic farming and scarcity of raw materials are less favoured ones (now and within five years).</td><td></td></tr>
<tr><td>While a significant body of knowledge has emerged on the concept and practise of SD, much of this information is fragmented and is often not available in a form that is convenient for professionals.</td><td>There is a special need for knowledge in the field of 'environment', 'efficiency', 'natural resources and biodiversity' and 'ecological integrity'.
'Micro' companies are more interested in SD knowledge in recruiting. The trend observed, however, indicating larger companies more focused on such kind of implementation recognise the technological and commercial maturity of those SD requirements associated with the production of goods and services.</td><td rowspan="3">Increasing the importance of all learning outcomes pertaining to SD, especially ethical responsibility, knowledge on the sustainable use of natural resources, understanding of the relationship between human activities and the environment</td></tr>
<tr><td>A broad range of skills on SD is needed in order to be part of the workforce.</td><td>There is a special need for skills in the field of 'efficiency', 'leadership skills', 'sustainability planning', 'effective communication', 'analysis of environmental problems' and 'systems thinking'.</td></tr>
<tr><td rowspan="2">Competences are needed to perform in a defined function or activity.</td><td>Companies attribute more importance to all SD competences than universities do in their education.</td></tr>
<tr><td colspan="2">'Future orientation' and 'social responsibility' are considered the most important competences, both by universities and companies.</td></tr>
</table>

A more highly educated and trained workforce is a more employable workforce. And yet, it is an inconvenient truth that, despite progress in recent years, much of Europe is not sufficiently trained regarding SD issues. Furthermore, working life for individuals should be an active and

continuing process of competences, knowledge and skills related to SD needs, where there are high stakes involved in keeping up with the pace of change and being able to move easily. What can be learned about new jobs and practical experience is summarised in box 3.

Key findings	Companies	Education
Practical experience offers the opportunity to demonstrate and develop professional SD competences, knowledge and skills in the workplace and combine formal education with relevant practical experience.	It is possible to ascertain the great relevance assigned to practical experiences based on employers' preferences.	Practical training as a necessary tool that makes the difference from content-centred to learner-centred curricula and also as an empowering tool for the development of soft skills.
Nevertheless, there seems to be an overall consensus that in the future, the number of new jobs created in connection with SD, will only be marginal. Mostly because SD would probably be a concept included within competences, knowledge and skills already present in actual jobs.		

Box 3. Summary of key findings together with conclusions from companies and education – what can be learned about new jobs and practical experience?

If the principle of SD is to be implemented successfully in daily working life, there is also a need for education and training in higher education in order to be well prepared for working life. Professionals in SD will require new ways of thinking as well as certain competences, knowledge and skills to be able to contribute to the achievement of the goals of SD. This will also require changes in the training in the field of life sciences of HEIs; furthermore, 'education and training' and 'work' will no longer be two separate entities. They will be much more integrated into a single lifelong learning process, open to innovation and accessible to everybody. What can be done to get the right mix is shown in box 4.

Key findings	Companies	Education
Empowering cooperation	Involvement in the curriculum development	Tailoring study programmes to labour market needs
Strengthening of the knowledge system, to encourage students and/or employees to adopt sustainable methods in daily (working) life.	Getting the right training places for different types of job.	Getting the "right competences, knowledge and skills" from an educational point of view Considering all aspects of SD as far as possible in the curriculum – nowadays main focus on environmental issues

Box 4. Summary of key findings together with conclusions from companies and education – getting the right mix.

Whilst this report is by no means exhaustive, it does provide important insights into the complexities of the relationship between higher education and corporate practise. With its statistical analysis and series of findings as an integral part of the ISLE project, this report identifies trends, current steps being taken as well as potential risks and stumbling blocks. Aiming at a holistic integration of the concept of SD in a form which is both transparent and acceptable to both, it looks at important areas of competence, skills and knowledge which link higher education and company practise and forms a stepping stone in inspiring them to complement one another towards an era of "Common Sense" i.e. SD.

8. Schlussfolgerung und Empfehlung

Auf den Wohlstand gegenwärtiger und zukünftiger Generationen hat einen Einfluss, wie viele Menschen arbeiten und wie diese mit den Themen der nachhaltigen Entwicklung im Arbeitsalltag umgehen. Entsprechendes Wissen, die geeigneten Kompetenzen und Fähigkeiten für nachhaltige Entwicklung sind die beste Garantie unser Leben zu erhalten und sichern nachhaltig den Wohlstand. Wissen, Kompetenzen und Fähigkeiten tragen auch zur persönlichen Entwicklung und dem Wohlbefinden bei.

In dieser Studie wird ein Bild gegeben, (1) ob und wie das Konzept der nachhaltigen Entwicklung in der Bildung und im beruflichen Alltag umgesetzt wurde, (2) welches Wissen und welche Themen, Kompetenzen sowie Fähigkeiten für nachhaltige Entwicklung im Berufsleben wichtig sind und (3) ob es ‚neuer' Berufe für den Bereich der nachhaltigen Entwicklung bedarf. Die Kernergebnisse als Anregungen zur zukünftigen Orientierung für die Arbeitgeber (Unternehmen) und die Bildungseinrichtungen der höheren Bildung in den Lebenswissenschaften (Bildung) werden in den Boxen 1 bis 4 zusammengefasst.

Box 1. Zusammenfassung der Kernergebnisse für die Unternehmen und die Bildung – Status quo.

<table>
<tr><th>Kernergebnisse</th><th>Unternehmen</th><th>Bildung</th></tr>
<tr><td>Für eine angemessene Kommunikation können die Grundsätze und Ziele für eine nachhaltige Entwicklung der Geschäftstätigkeit in die Mission integriert werden.</td><td>Nachhaltig, Nachhaltigkeit oder nachhaltige Entwicklung wird von manchen Unternehmen in ihrer Mission angeführt. Es ist kein üblicher Begriff des Mission-Statements von Unternehmen.</td><td>Die Institutionspolitik der meisten Universitäten beinhaltet die Begriffe Nachhaltigkeit oder nachhaltige Entwicklung.</td></tr>
<tr><td rowspan="2">Standards sind eine Möglichkeit um nachhaltige Entwicklung auf der Unternehmensebene umzusetzen – insbesondere tragen sie bei, die negativen Wirkungen auf die Umwelt zu reduzieren.</td><td colspan="2">Viele verschiedene Standards werden bereits angewandt.</td></tr>
<tr><td>Neben den anerkannten Standards (ISO und EMAS) wenden viele Unternehmen (50 % der interviewten Unternehmen) ihre eigenen internen Standards an.</td><td></td></tr>
<tr><td rowspan="4">Nachhaltige Entwicklung ist ein kontinuierlicher Entwicklungsprozess.</td><td>Es besteht ein allgemeines Interesse an den Themen der nachhaltigen Entwicklung.</td><td>Das Konzept nachhaltige Entwicklung ist weit verbreitetet in den verschiedenen Studienprogrammen – vor allem wegen ihrer allgemeinen Gültigkeit und Querschnittsthematik.</td></tr>
<tr><td colspan="2">Obwohl zukünftig ein gewisses Interesse für die Themen der nachhaltigen Entwicklung besteht, zeigt der Umwelt- und soziale Sektor mehr Interesse als die anderen. Auch die Unternehmen der Verwaltung und Bildung liegen derzeit in der Umsetzung hinter den anderen Sektoren zurück.</td></tr>
<tr><td>Kleine Unternehmen haben bestätigt, dass derzeit und in Zukunft ihr Interesse an Themen der nachhaltigen Entwicklung gering ist. Große Unternehmen zeigen sich für die nahe Zukunft sehr engagiert und interessiert für die Themen der nachhaltigen Entwicklung.</td><td></td></tr>
</table>

Das Wissen, die Kompetenzen und die Fähigkeiten für eine nachhaltige Entwicklung in der Bildung und dem Arbeitsleben würden kaum das Interesse einer Analyse wecken, wenn die gegenwärtigen Handlungsmuster als nachhaltig beurteilt worden wären. Vieles ist umgesetzt oder in Umsetzung und es gibt auch Handlungsbedarf, wie in Box 1 dargestellt.

Es ist eine Mischung zwischen einem Mangel an Wissen und der Vorhersehbarkeit des gegenwärtigen und zukünftigen Angebots sowie der Nachfrage an den Themen, den Kompetenzen, den Fähigkeiten und dem Wissen für nachhaltige Entwicklung, die ein besseres Abstimmen erschweren. Dies hängt auch zusammen mit der Unvereinbarkeit der Aus- und Weiterbildung sowie mit den Unsicherheiten am Arbeitsmarkt. Erneuern, Anpassen und Erweitern der Themen, der Kompetenzen, der Fähigkeiten und des Wissens für eine nachhaltige Entwicklung bei den Studierenden und den Arbeitgeber ist eine der größten Herausforderungen des 21. Jahrhunderts in Europa. Der Handlungsbedarf an Aktionen für die Unternehmen und die Bildung wird in Box 2 zusammenfassend dargestellt.

Box 2. Zusammenfassung der Kernergebnisse für die Unternehmen und die Bildung – die Themen, das Wissen, die Fähigkeiten und die Kompetenz für eine nachhaltige Entwicklung.

<table>
<tr><th>Kernergebnisse</th><th>Unternehmen</th><th>Bildung</th></tr>
<tr><td>Die Themen der nachhaltigen Entwicklung indizieren eine Optimierung der internen Prozesse.</td><td>Die Konzepte der Energie-Effizienz, der effizienten Verwendung natürlicher Ressourcen und der Abfallreduktion sind die interessantesten, hingegen wurde der biologischen Landwirtschaft und der Knappheit an Rohstoffen eine geringe Bedeutung zugewiesen (jetzt und in fünf Jahren).</td><td></td></tr>
<tr><td>Während bedeutendes Wissen um das Konzept und die Praktiken der nachhaltigen Entwicklung entstand, sind viele dieser Informationen in Fragmenten und nicht in einer für die ArbeitnehmerInnen angenehmen Form verfügbar.</td><td>Ein spezieller Bedarf an Wissen in den Bereichen der Umwelt, Effizienz, natürliche Ressourcen und Biodiversität sowie ökologische Integrität ist gegeben.
Für mikro Unternehmen ist das Wissen der JobanwärterInnen über nachhaltige Entwicklung interessanter. Auch zeigt der beobachtete Trend, dass große Unternehmen mehr Wert legen auf die technologischen und kommerziellen Anforderungen in Zusammenhang mit der nachhaltigen Entwicklung in der Produktion von Gütern und Leistungen.</td><td rowspan="4">Verbesserung der Lernziele und -ergebnisse für nachhaltige Entwicklung, insbesondere in den Bereichen ethische Verantwortung, Wissen über die nachhaltige Verwendung natürlicher Ressourcen, Verstehen der Wirkungen des menschlichen Handelns auf die Umwelt.</td></tr>
<tr><td>Verschiedenste Fähigkeiten für nachhaltige Entwicklung sind notwendig, um ein/e aktive/r AbeiterIn zu sein.</td><td>Ein spezieller Bedarf an Fähigkeiten in den Bereichen der Effizienz, der Führungsqualitäten, des nachhaltigen Planens, der effektiven Kommunikation, der Analyse von Umweltproblemen und des Systemdenkens ist gegeben.</td></tr>
<tr><td rowspan="2">Kompetenzen ermöglichen, eine Leistung nach einer definierten Arbeitsweise oder in Form einer Tätigkeit zu erbringen.</td><td>Die Unternehmen messen mehr Bedeutung den Kompetenzen für nachhaltige Entwicklung bei, als es die Universitäten in ihrem Bildungsauftrag tun.</td></tr>
<tr><td colspan="2">'Zukunftsorientierung' und 'soziale Verantwortung' werden von den Universitäten und Unternehmen als sehr wichtig eingestuft.</td></tr>
</table>

Bessere aus- und weitergebildete ArbeitnehmerInnen sind vielfältiger einsetzbar. Trotz der Ver-Nachhaltigung der Bildung in den letzten Jahren besteht ein Bedarf an Bildung in den Themen, aber auch dem Wissen, den Kompetenzen und den Fähigkeiten für nachhaltige Entwicklung. Des Weiteren soll das Arbeitsleben des Einzelnen ein aktiver und kontinuierlicher Prozess der Entwicklung an Wissen, Kompetenzen und Fähigkeiten für die Anforderungen an eine nachhaltige Entwicklung sein, um auf Veränderungen im Aufgabenbereich reagieren und sich flexibel anpassen zu können. Zusammengefasst werden die Kernergebnisse zu der Frage nach ‚neuen' Berufen und beruflicher Praxis in Box 3.

Kernergebnisse	Unternehmen	Bildung
Berufliche Praxis ermöglicht, das verfügbare Fachwissen, die entwickelten Fachkompetenzen und -fähigkeiten am Arbeitsplatz einzusetzen, aber auch zu entwickeln. Auch verbindet die berufliche Praxis die formale Bildung mit wichtigen beruflichen Erfahrungen.	Es ist wichtig, die Bedeutung der beruflichen Praxis für die Arbeitgeber zu kommunizieren.	Berufliche Praxis ist ein wichtiger Baustein, um sich vom Stoff-orientierten zum Lerner-orientierten Lehrplan zu entwickeln und ist ein förderliches Instrument zur Entwicklung von ‚weichen' Fähigkeiten.
Es besteht ein weitgehender Konsens, dass die Anzahl geschaffener ‚neuer' Berufe in Verbindung mit nachhaltiger Entwicklung gering sein werden. Nachhaltige Entwicklung ist ein Konzept, das bereits in den derzeitigen Arbeitsplatzbeschreibungen im allgemeinen Wissen, den Kompetenzen und den Fähigkeiten gegenwärtig ist.		

Box 3. Zusammenfassung der Kernergebnisse für die Unternehmen und die Bildung – die Frage nach ‚neuen' Berufe und beruflicher Praxis.

Um die Prinzipien der nachhaltigen Entwicklung erfolgreich im täglichen Arbeitsleben zu implementieren, bedarf es vorbereitend auch einer entsprechenden (Weiter-)Bildung in der höheren Bildung. Fachpersonal mit dem Schwerpunkt nachhaltige Entwicklung benötigen neue Wege im Denken und gewisse Kompetenzen und Fähigkeiten sowie spezielles Wissen, um zum Prozess der nachhaltigen Entwicklung beizutragen. Auch die höhere Bildung in den Lebenswissenschaften hat ihren Beitrag zu leisten. ‚Bildung und Weiterbildung' sowie ‚Arbeit' sind nicht zwei getrennte Bereiche, sondern greifen ineinander in einem lebenslangen Lernprozess; offen für Innovation und zugänglich für jeden. Was getan werden kann für das richtige Maß der Zusammenarbeit von Seiten der Unternehmen und der Bildung, wird in Box 4 aufgezeigt.

Kernergebnisse	Unternehmen	Bildung
Kooperation in Form des Lernens voneinander	Einbeziehen in die Erstellung der Lehrpläne	Anpassen der Studienprogramme an die Anforderungen des Arbeitsmarktes
Stärken des Wissenssystems, um Studierende oder ArbeitnehmerInnen zu ermutigen Methoden der nachhaltigen Entwicklung im täglichen (Arbeits-) Leben umzusetzen.	Anbieten der richtigen Praktikumsplätze für die verschiedenen Berufe	Vermitteln des „richtigen Wissens", der „richtigen" Kompetenzen und Fähigkeiten aus der Perspektive der Bildung Berücksichtigen aller Aspekte der nachhaltigen Entwicklung soweit wie möglich in den Lehrplänen – heutzutage der Schwerpunkt bei den Umweltbelangen

Box 4. Zusammenfassung der Kernergebnisse für die Unternehmen und die Bildung – das richtige Maß.

Die Studie erhebt keinen Anspruch auf Vollständigkeit, sondern soll einen Einblick geben in die Komplexität der Beziehung zwischen dem Bildungsauftrag der höheren Bildung und den Anforderungen der betrieblichen Praxis. Mit den statistischen Analysen, Schlussfolgerungen und Empfehlungen als ein wesentliches Ergebnis des ISLE-Projektes, geht diese Studie auf die aktuelle Situation ein, zeigt Trends auf und führt mögliche Risiken sowie Stolpersteine an. Mit dem Ziel das Konzept der nachhaltigen Entwicklung für beide Seiten transparent und akzeptabel ganzheitlich umzusetzen, werden in dieser Studie das relevante Wissen, die Kern-Kompetenzen und -fähigkeiten, die das Bindeglied zwischen dem Lernergebnis der Bildung und den Anforderungen der beruflichen Praxis sind, dargestellt. Diese Studie ist ein Meilenstein, um sich gegenseitig zu inspirieren und hat eine Brückenfunktion, um gemeinsam in die Richtung einer Ära des „gesunden Hausverstandes", d.h. der nachhaltigen Entwicklung, zu gehen.

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Appendices

A Relationship between HEIs survey (WP2) and company survey (WP4)

The relationship between the learning outcomes of the HEIs survey (WP2) and the competences of the company survey (WP4) is as follows:

Competences WP4	Learning outcomes WP2
C1 Social responsibility	A. Understanding of the ethical responsibility towards present and future generations
C2 System orientation	B. Ability to establish connections between the different dimensions of SD
C3 Future orientation	C. Understanding of the ethical responsibility towards present and future generations

The relationship between the learning outcomes of the HEIs survey (WP2) and the knowledge aspects of the company survey (WP4) is as follows:

Knowledge aspects WP4	Learning outcomes WP2
K1 Economy	1. Knowledge of the current actions and policies on SD
K2 Ecology	2. Understanding of the sustainable relationship between human activities and the environment
K3 How to analyse environmental impacts K4 How to reduce environmental impacts	3. Knowledge of how to use natural resources sustainably 4. Understanding of the sustainable relationship between human activities and the environment 5. Knowledge of the role of science and technology in relation to SD
K5 Economics K6 Value of nature	6. Knowledge of the economic aspects of SD
K7 Social aspects of SD	7. Understanding of the ethical responsibility towards present and future generations

The relationship between the learning outcomes of the HEIs survey (WP2) and the skills of the company survey (WP4) is as follows:

Skills WP4	Learning outcomes WP2
S1 ANALYSING ENVIRONMENTAL IMPACTS	I. Capability for analysis and synthesis of SD concepts II. Ability to establish connections between the different dimensions of SD III. Ability to design technical solutions taking into account the life cycle analysis
S2 REDUCING ENVIRONMENTAL IMPACTS	IV. Ability to develop new proposals on SD V. Ability to establish connections between the different dimensions of SD
S3 POLLUTION TRADING S4 ECONOMIC SENSE	VI. Ability to develop new proposals on SD
S5 COMMUNICATION	VII. Negotiation capacity to solve SD conflicts VIII. Ability to communicate SD aspects to specialised and non-specialised public IX. Ability to work in multidisciplinary teams about SD
S6 IMPLEMENTING SUSTAINABILITY	X. Ability to develop new proposals on SD XI. Ability to apply the SD criteria in the studied discipline XII. Ability to design technical solutions taking into account life cycle analysis
S7 LEADERSHIP AND TEAMWORK	XIII. Ability to work in multidisciplinary teams on SD

B Standards applied

ISO 9000 (www.iso.org)

The ISO 9000 family addresses various aspects of quality management and contains some of ISO's best known standards. The standards provide guidance and tools for companies and organisations who want to ensure that their products and services consistently meet customer's requirements, and that quality is consistently improved. (Source: http://www.iso.org/iso/iso_9000).

ISO 14001 (www.iso.org)

ISO 14001:2004 specifies requirements for an environmental management system to enable an organisation to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organisation subscribes, and information about significant environmental aspects. It applies to those environmental aspects that the organisation identifies as those which it can control and those which it can influence. It does not itself state specific environmental performance criteria.

ISO 14001:2004 is applicable to any organisation that wishes to establish, implement, maintain and improve an environmental management system, to assure itself of conformity with its stated environmental policy, and to demonstrate conformity with ISO 14001:2004 by

a) making a self-determination and self-declaration, or
b) seeking confirmation of its conformance by parties having an interest in the organisation, such as customers, or
c) seeking confirmation of its self-declaration by a party external to the organisation, or
d) seeking certification/registration of its environmental management system by an external organisation.

All the requirements in ISO 14001:2004 are intended to be incorporated into any environmental management system. The extent of the application will depend on factors such as the environmental policy of the organisation, the nature of its activities, products and services and the location where and the conditions in which it functions. (Source: http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=31807).

OHSAS 18001

OHSAS 18000 is an international occupational health and safety management system specification. It comprises two parts, 18001 and 18002 and embraces a number of other publications. OHSAS 18001 is an Occupation Health and Safety Assessment Series for health and safety management systems. It is intended to help an organisations to control occupational health and safety risks. It was developed in response to widespread demand for a recognised standard against which to be certified and assessed. (Source: http://www.ohsas-18001-occupational-health-and-safety.com/what.htm).

ISO 26000 (www.iso.org)

Business and organisations do not operate in a vacuum. Their relationship to the society and environment in which they operate is a critical factor in their ability to continue to operate effectively. It is also increasingly being used as a measure of their overall performance. ISO 26000 provides guidance on how businesses and organisations can operate in a socially responsible way. This means acting in an ethical and transparent way that contributes to the health and welfare of society. (Source: http://www.iso.org/iso/home/standards/iso26000.htm).

FSC (www.fsc.org)

The Forest Stewardship Council (FSC) is an international not for-profit, multi-stakeholder organisation established in 1993 to promote responsible management of the world's forests. Its main tools for achieving this are standard setting, independent certification and labelling of forest products. This offers customers around the world the ability to choose products from socially and environmentally responsible forestry. FSC is a global forestry certification systems established for forests and forest products.

Forest management according to FSC's internationally recognised standards delivers environmental services to local and global communities, including clean air and water, and contributes to mitigating the effects of climate change. FSC directly or indirectly addresses issues such as illegal logging, deforestation and global warming and has positive effects on economic development, environmental conservation, poverty alleviation and social and political empowerment.

FSC is an international association of members. It is a platform for forest owners, timber industries, social groups and environmental organisations to come together to find solutions to improve forest management practises. FSC works to ensure the permanent existence of forest areas through responsible forest management and conservation.

Moreover, the idea of the FSC logo is to guarantee that the product comes from responsible sources — environmentally appropriate, socially beneficial and economically viable. The FSC label can be found on a wide range of timber and non-timber products from paper and furniture to medicine and jewellery. The logo empowers point-of-sale purchasers to express their demand in the market for responsible forestry by supporting an independent, global and credible label for forest products. (Source: http://en.wikipedia.org/wiki/Forest_Stewardship_Council).

PEFC (www.pefc.org)

The Programme for the Endorsement of Forest Certification (PEFC) is an independent, non-profit, non-governmental organisation which promotes sustainably managed forests through independent third party certification. PEFC was founded in 1999 in response to the specific requirements of small and family forest owners as an international umbrella organisation providing independent assessment, endorsement and recognition of national forest certification systems. It responded to the need for a mechanism enabling the independent development of national standards tailored to the political, economic, social, environmental and cultural realities of the respective countries, while at the same time ensuring compliance with internationally accepted requirements and global recognition.

EMAS

The EU Eco-Management and Audit Scheme (EMAS) is a management tool for companies and other organisations to evaluate, report and improve their environmental performance. The scheme has been available for participation by companies since 1995 and was originally restricted to companies in industrial sectors. Since 2001 EMAS has been open to all economic sectors including public and private services. Interest in the environmental performance of organisations is continually increasing. Operating without taking into account the environmental consequences of their actions becomes almost impossible for organisations. Organisations with a proactive approach to environmental challenges look for ways to continually improve their environmental performance. EMAS is the premium environmental management tool to achieve this. It leads to enhanced performance, credibility and transparency of registered organisations. Currently, more than 4,500 organisations and approximately 7,800 sites are EMAS registered. EMAS is a voluntary tool available for any kind of organisation aiming to:

- Improve its environmental and financial performance;
- Communicate its environmental achievements to stakeholders and society in general.

(Source: http://ec.europa.eu/environment/emas/index_en.htm).

BREEAM (www.breeam.org)

BREEAM is the world's foremost environmental assessment method and rating system for buildings. BREEAM sets the standard for best practise in sustainable building design, construction and operation and has become one of the most comprehensive and widely recognised measures of a building's environmental performance.

A BREEAM assessment uses recognised measures of performance, which are set against established benchmarks, to evaluate a building's specification, design, construction and use. The measures used represent a broad range of categories and criteria from energy to ecology. They include aspects related to energy and water use, the internal environment (health and well-being), pollution, transport, materials, waste, ecology and management processes.

A certificated BREEAM assessment is delivered by a licensed organisation, using trained assessors. This provides clients, developers, designers and others with:

- market recognition for low environmental impact buildings,
- confidence that tried and tested environmental practise is incorporated in the building,
- inspiration to find innovative solutions that minimise the environmental impact,
- a benchmark that is higher than regulation,
- a system to help reduce running costs, improve working and living environments, and
- a standard that demonstrates progress towards corporate and organisational environmental objectives.

HQE (http://assohqe.org/hqe/)

The *Haute Qualité Environnementale* or HQE (High Quality Environmental standard) is a standard for green building in France, based on the principles of SD first set out at the 1992 Earth Summit. The standard is controlled by the Paris based *Association pour la Haute Qualité Environnementale (ASSOHQE).*

The standard specifies criteria for the following:

Managing the impacts on the outdoor environment

- Harmonious relationship between buildings and their immediate environment
- Integrated choice of construction methods and materials
- The avoidance of nuisance by the construction site.
- Minimising energy use
- Minimising water use
- Minimising waste in operations
- Minimising building maintenance and repair

Creating a pleasant indoor environment

- Hydrothermal control measures
- Acoustic control measures
- Visual attractiveness
- Measures to control smells
- Hygiene and cleanliness of the indoor spaces
- Air quality controls
- Water quality controls

(Source: http://en.wikipedia.org/wiki/Haute_Qualit%C3%A9_Environnementale).

EN 16001

Today more than ever, effective energy management is a crucial issue for the success of any business. For many, the answer is an Energy Management System (EnMS) – a framework for the systematic management of energy. As well as enhancing energy efficiency, an EnMS can cut costs and reduce greenhouse gas emissions providing you with a competitive advantage. EN 16001 represents the latest best practise in energy management building upon existing national standards and initiatives. The standard specifies the requirements for an EnMS to enable your organisation to develop and implement a policy, identify significant areas of energy consumption and target energy reductions.

ISO 17025 (www.iso.org)

ISO/IEC 17025:2005 specifies the general requirements for the competence to carry out tests and/or calibrations, including sampling. It covers testing and calibration performed using standard methods, non-standard methods, and laboratory-developed methods. It is applicable to all organisations performing tests and/or calibrations. These include, for example, first-, second- and third-party laboratories, and laboratories where testing and/or calibration forms part of inspection and product certification. (Source: http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=39883).

GMP/HACCP

GMP (Good Manufacturing Practice) is a system to ensure that products meet food safety, quality and legal requirements. As a food manufacturer you should have GMP in place.

HACCP (Hazard Analysis and Critical Control Point) can be part of GMP. It is a systematic preventive approach to food safety and pharmaceutical safety that identifies physical, allergenic, chemical, and biological hazards in production processes that can cause the finished product to be unsafe, and designs measurements to reduce these risks to a safe level. In this manner, HACCP is referred as the prevention of hazards rather than finished product inspection. The HACCP system can be used at all stages of a food chain, from food production and preparation processes including packaging, distribution, etc..

A HACCP programme consists of the following steps:

- Identify the hazards that must be prevented, eliminated or reduced
- Identify the critical control points where control is essential to prevent, eliminate or reduce a hazard
- Establish and implement effective monitoring procedures at critical control points
- Establish corrective actions when monitoring
- Establish procedures to verify that the programme is working effectively
- Document your food safety work

HACCP is the recommended approach to control the possibility of allergen contamination.

Critical points for control of the hazard from allergens that food companies need to consider include employee training and supervision, product design and formulation, supply chain of raw materials, manufacturing premises, equipment and processes, cleaning, and packaging and labelling.

(Source: http://www.foodallergens.info/Manufac/GMP.html; http://en.wikipedia.org/wiki/Hazard_analysis_and_critical_control_points).

List of acronyms

ACC	Appropriated Carrying Capacity
ANOVA	Analysis of Variance
BREEAM	Building Research Establishment Environmental Assessment Method
cf.	from Latin: confer, „compare"
Chi Sq.	Chi Square
Dev.	Deviation
DF	Degree of Freedom
EC	European Commission
EF	Ecological Footprint
EU	European Union
e.g.	for example, the abbreviation of Latin „exempli gratia"
et al.	et alii
etc.	et cetera
EMAS	EU Eco-Management and Audit Scheme
EnMS	Energy Management System (EN 16001)
EU ETS	Emission Trading Systems
ff.	and the following pages
FSC	Forest Stewardship Council
GMP	Good Manufacturing Practise; GMPs are the first steps to HACCP.
HACCP	Hazard Analysis and Critical Control Point
HEI	Higher Education Institution in the field of life sciences
HQE	Haute Qualité Environnementale or High Quality Environmental Standard
ICLEI	Local Governments for Sustainability
i.e.	that is, the abbreviation i.e. comes from Latin „id est"
ISLE	Innovation in the teaching of Sustainable Development in Life Sciences in Europe
ISO	International Organization for Standardization
ISSP	International Society of Sustainability Professionals
n.d.	no date
OECD	Organisation for Economic Co-operation and Development
OHSAS	Occupation Health and Safety Assessment Series
PEFC	Programme for the Endorsement of Forest Certification
PPA	Pollution Prevention Act
Prob.	Probability
R & D	research & development
SD	sustainable development
SS	sum of squares of all observations
TBL or 3 BL	triple bottom line
Tot	total
MEA	Millennium Ecosystem Assessment
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
WP2	work package 2
WP4	work package 4

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39 partners in 30 countries have carried out a network project about 'Innovation in the teaching of Sustainable Development (SD) in Life Sciences in Europe' (ISLE Erasmus Thematic Network). Firstly, this project enables one to develop and exchange thinking and practice on SD in teaching. Secondly, it focuses on the needs of employers by conducting a survey. The purpose of this report was to identify competences, knowledge and skills for SD required by the European workforce in order to supply Higher Education Institutions in the field of life sciences with information on how they can adapt their curricula.

BUNDESANSTALT für Agrarwirtschaft