A Strategy and a Toolkit to Realize System Integration of Sustainable Development (SISD)

Niko Roorda

Abstract A chain of action research programs on education for sustainable development (ESD) has delivered a coherent strategy to integrate SD into higher education. Based on the 'tree metaphor' for education, a range of tools was developed and applied, e.g., the ESD Checklist, RESFIA+D for SD competences, an introductory textbook, the SD Curriculum Scan, and the AISHE assessment tool plus the ESD Certificate. Together, they enable a university to realize 'SISD', i.e., 'System Integration of Sustainable Development.'The ESD strategy and its toolbox is described, and illustrated through a number of cases.

Keywords ESD · Tree model · Sustainable development · University mission · ESD checklist · Graduation profile · SD competences · RESFIA+D · Fundamentals of SD · Curriculum scan · Interdisciplinary · Transdisciplinary · Assessment · AISHE · Certification · System integration · SISD · Sustainably competent professionals · Pledge

Introduction: The Tree Model

In a series of action research experiments in the Netherlands between 1991 and 2012, a coherent strategy was designed to integrate sustainable development (SD) into higher education.

The present chapter offers a practical description of this 'Education for Sustainable Development' (ESD) strategy and of the 'toolbox' that it makes use of. It does not discuss the philosophy behind the ESD strategy or the validation of its tools. These backgrounds can be found in Roorda (2010).

N. Roorda (✉)
Avans University, Prof. Cobbenhagenlaan 13, 5037 DA Tilburg, The Netherlands
e-mail: nroorda@planet.nl

S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_6,

The strategy is expressed in a compact way with the aid of a metaphor, the 'Tree Model,' in which a bachelor or a master program in a university is compared to a tree, its parts and its environment, as is illustrated in Fig. 1.

For each of the elements of this 'tree,' tools and instruments have been designed, validated and applied. Together, these instruments form a toolkit which enables universities to integrate SD thoroughly in all of its activities, starting from modest starting steps, all the way toward *System Integration of SD* ('SISD'), a concept which is pivotal to the philosophy behind the ESD strategy. Table 1 offers an overview of the instruments.

The Tree Model is a tool in itself. It enables a university (department) to select priorities for organization development, and to define an ESD strategy based on those priorities. This is what the empty 4th column in Table 1 is meant for.

The *Genotype*: The University Mission

Ideally, the university mission is an expression of its identity, translating this into concrete goals and a strategy. An example is the strategy of Avans University in The Netherlands, which is an inspiring example of a university that has decided to become a truly sustainable institution. This is clear from its Mission Statement (Avans 2010):

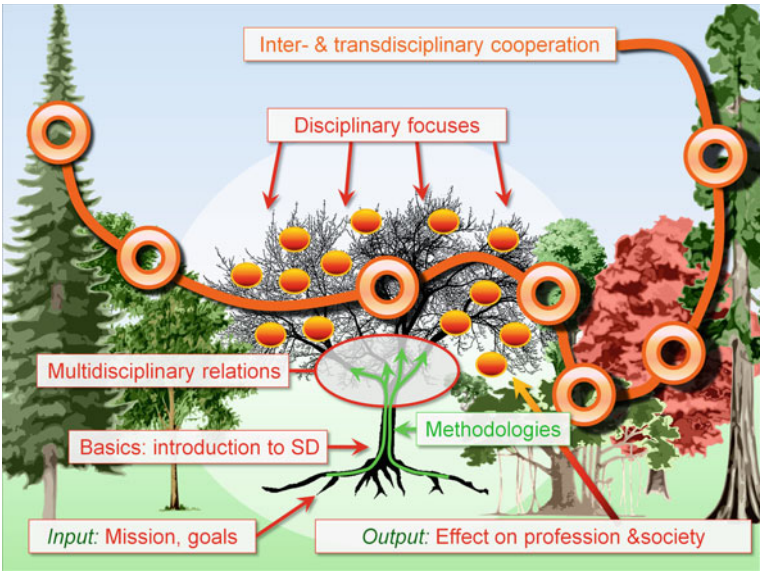


Fig. 1 The 'Tree Model,' a metaphor for a bachelor or master program in a university

Table 1 The tree model: defining the sustainability strategy

Tree aspect	Topic	Tool	Priority
The *genotype*	The university mission	Inspiring examples	
The *phenotype*	Characteristics of education for SD	The *ESD Checklist*	
The *roots*	The graduate profile	The *RESFIA+D Model*	
The *trunk*	The basics: what *every* student should learn	Textbook: *Fundamentals of SD*	
The *branches*	The disciplinary details of a curriculum	The *SD Curriculum Scan*	
The *biochemistry*	Methodologies for the learning process	*Two hundred exercises*	
The *ecosystem*	Inter- and transdisciplinary cooperation	Interdisciplinarity training	
Sprouting and growing	Strategy, assessment, and involvement	*AISHE 2.0*	
The *recognition*	Reward, benchmarking, ranking	The *ESD Certificate*	
Reaching maturity	System integration of sustainable development	*SISD*	
The *fruits*	Sustainably competent professionals	The *Pledge*	

> Avans University educates students to become highly qualified professionals, who continuously develop themselves and their profession, being aware of their societal responsibility. Avans wants to co-create social-cultural and economic developments by being a partner to companies, governments, and organizations for which contributing to sustainable development is pivotal. (…) Our graduates fulfil key positions for the realization of a sustainable society. This demands them to have a societal engagement and an entrepreneuring attitude. (…) From our expertise of, and involvement in the on-going societal developments Avans participates in the societal debate, thus contributing to finding solutions to societal issues.

In 2012, Avans University formally decided to appoint SD as one of its highest priorities. In a vision paper (Avans 2012a), it formulated a 'prospect':

> In 2016, Avans University has reached System Integration of Sustainable Development (SISD), which means that sustainability has been embedded in all of its operations, education, and research. By then, Avans will be a truly sustainable university.

In a legally binding contract with the Dutch Ministry of Education, Avans University decided to make ample use of the strategy and the various tools of the 'Tree Model' (Avans 2012b):

> Before 2015, all 19 academies and all service departments of Avans University have acquired the ESD Certificate at the level of two stars. Besides, all curricula will have integrated the SD competences described by RESFIA+D.

Other excellent examples of mission statements stressing the importance of SD can be found in Roorda (2010) and in various other sources.

The *Phenotype*: Characteristics of Education for Sustainable Development

Much has been written about the notion that higher education, in order to be able to contribute effectively to SD, will have to go through a significant change process. In his dissertation (Roorda 2010), the author of the present chapter presented an overview of the characteristics of ESD (education for SD), partly based on his experiments between 1991 and 2010, and partly on a list of literature sources. The overview is reprinted here as Table 2.

The table can be used as a checklist by those who are designing or redesigning study programs in higher education.

The *Roots*: The Graduate Profile (RESFIA+D)

Competence-based learning has entered higher education in many countries. Discussions are going on in many places: what kind of competences do our highly educated professionals need in order to be able to contribute effectively to SD? In other words: what typifies a *sustainably competent professional*?

To answer this question, a tool was developed and validated called 'RESFIA + D' (see: Roorda 2010 and 2012). RESFIA+D has also been dubbed 'The seven SD Competences,' as it consists of six generic competences, appropriate for each and every discipline or professional, plus a seventh group that varies according to the discipline involved. The six generic competences, each are divided into three sub-competences, as Table 3 shows.

Competence levels

For each of the 6 × 3 sub-competences, four levels of competence have been defined. The four ascending levels are *apply*, *integrate*, *improve,* and *innovate*. This makes it possible to use RESFIA+D as a tool for education design or improvement. As an example, the levels of sub-competence F1 are shown in Table 4.

When RESFIA+D is applied, a group is formed, delegated from: the education management, the teaching staff, the students, and the professional field. Together, they discuss three questions for each of the 18 sub-competences, aiming at reaching consensus:

1. Which competence level should every student of your study program *at least* have acquired at the moment of graduation?
2. Which level is demanded in the present competence profile of the study program?
3. Which level is actually realized for all students in the current curriculum?

Table 2 The ESD checklist: characteristics of education for sustainable development

Principles	Characteristics	Details
Connectivity, Complexity	Systems thinking	Connecting parts, subsystems or aspect systems. Connecting an analytic with a holistic approach; the small with the large; and the local with the global
	Multi-, inter- or transdisciplinary	Connecting disciplines and stakeholders. Balanced regarding Triple P; balanced with disciplinary aspects
	Life-cycle approach	Connecting phases in the lifecycle. Regarding lifecycles of people, products, companies, habitats, cultures, designs, paradigms, etc
	Intercultural, international	Connecting people (sub)cultures, regions, nations. Openness for values and perspectives of others
	Future orientation	Connecting the past, the present and the future. Concerns both long-term and short-term targets, based on visions of sustainable future developments
Innovativity	Openness to changing conditions	Flexibility of mind; capability of dealing with uncertainties
	Openness to new solutions	Creativity, non-linearity, out of the box thinking, acceptance of the unexpected
	Function orientation	Stimulating creative thought and design processes by zooming out from actual products or services to underlying functions or needs, aiming at finding alternative ways of fulfilling them
Action learning, social learning	Application of knowledge	Acquisition and application of knowledge, either sequentially or simultaneously (learning by doing). Aiming at finding useful solutions to real problems
	Multi-methods	E.g., just-in-time lectures, art, discussions, drama, games, etc
	Real-life situations	Context-embedded learning, either in simulated or actually existing situations
	Commitment	Personally engaged towards objectives of sustainable development
	Cooperation	Teamwork within student groups; cooperation with experts, professionals
Reflexivity	Learning to learn	Reflection on own learning process, aiming at continuous improvement. Lifelong learning
	Responsibility	Responsibility for own learning process, and for the definition of learning goals (up to a certain level). Also: responsibility for results of professional activities (stakeholder approach)
	Value-driven	Aware of the relevance and the relativity of embedded values and opinions
	Critical thinking	Critical attitude towards questions, tasks, methods, answers, own functioning
	Robustness of information	Awareness of level of certainty of knowledge, data, conclusions: subjective, intersubjective, objective (opinions, theories, facts)

First published in Roorda (2010). Main sources: Agenda 21 (UNCED, 1992), Orr (1992), De Haan and Harenberg (1999), De Haan (2002), Sterling (2004), UNESCO (2004, 2005), UNECE (2005), Martens (2006), Van Dam-Mieras (2007), Dyball, Brown and Keen (2007), Barth and Burandt (2008), Dieleman and Juárez-Nájera (2008).

Table 3 RESFIA+D : Professional competences for sustainable development *The section numbers refer to the sections of Roorda (2012), in which this table is printed as Table 8.4*

Competence R: Responsibility A sustainably competent professional bears responsibility for his or her own work *I.e., the sustainable professional can …*	*See*	**Competence E: Emotional intelligence** A sustainably competent professional empathizes with the values and emotions of others *I.e., the sustainable professional can …*	*See*
1. Create a stakeholder analysis on the basis of the consequence scope and the consequence period	*§5.5*	1. Recognise and respect his or her own values and those of other people and cultures	*§4.3*
2. Take personal responsibility	*§8.2*	2. Distinguish between facts, assumptions and opinions	*§8.5*
3. Be held personally accountable with respect to society (transparency)	*§8.2*	3. Cooperate on an interdisciplinary and transdisciplinary basis	*§1.3* *§4.8*
Competence S: System orientation A sustainably competent professional thinks and acts from a systemic perspective *I.e., the sustainable professional can …*		**Competence T: Future orientation** A sustainably competent professional works and thinks on the basis of a perspective of the future *I.e., the sustainable professional can …*	
1. Think from systems: flexibly zoom in and out on issues, i.e. thinking analytically and holistically in turn	*§3.5*	1. Think on different time scales-flexibly zoom in and out on short and long-term approaches	*§5.5*
2. Recognise flaws in the fabric and sources of vigor in systems; have the ability to use the sources of vigor	*Ch 2-4*	2. Recognise and utilize non-linear processes	*§7.3*
3. Think integrally and chain oriented	*§8.3*	3. Think innovatively, creatively, out of the box	*§8.4*
Competence I: personal Involvement A sustainably competent professional has a personal involvement in sustainable development *I.e., the sustainable professional can …*		**Competence A: Action skills** A sustainably competent professional is decisive and capable of acting *I.e., the sustainable professional can …*	
1. Consistently involve sustainable development in the own work as a professional (sustainable attitude)	*§4.7*	1. Weigh up the unweighable and make decisions	*§8.5*
2. Passionately work towards dreams and ideals	*§4.2*	2. Deal with uncertainties	*§6.3*
3. Employ his or her conscience as the ultimate yardstick	*§8.2*	3. Act when the time is right, and not go against the current: 'action without action'	*§4.2*
Plus: **Disciplinary competences** for sustainable development (differing for each course, discipline or profession)			

This consensus meeting usually leads to remarkable differences between the answers to the three questions, and thus the team of the study program gives itself evident goals for improvement.

Table 4 Example of a competence card

F: Future orientation			
A sustainably competent professional works and thinks on the basis of a perspective of the future			
Level 1: Apply	Level 2: Integrate	Level 3: Improve	Level 4: Innovate
F1. Think on different time scales–flexibly zoom in and out on short and long-term approaches			
• In concrete working situations, you recognize and describe operational methods for the performance and improvement of your work	• In the case of concrete work related problems, you recognize and describe the differences between short-term methods aiming at reducing the symptoms and long-term methods aiming at eliminating causes	• In the case of work related problems, you contribute to the design of a solution strategy based on a carefully selected combination of short- and long-term methods	• You contribute to the (re)definition and the application of the mission and of the strategic policy of the organization you belong to
• You contribute to the application of these methods, and thus contribute to short-term improvements	• You contribute to the application of symptom reducing methods based on the operational policy of the organization or team you belong to	• You contribute to the design of symptom reducing methods based on the tactical policy of the organization or team you belong to	• You involve present and expected future trends in your working field and in society

The *Trunk*: Fundamentals of Sustainable Development (a Textbook)

As the basis for the SD education, the 'trunk of the tree,' a tool was developed consisting of a textbook called 'Fundamentals of Sustainable Development' (Roorda 2012), and a series of online accessories, which can be retrieved from www.routledge.com/cw/roorda-9781849713863.

The textbook is intended for *all* disciplines, e.g., for technical, economic, social, environmental, agricultural, educational, and art courses. The book offers a broad introduction to the concept of SD.

Consequently, the book does not go into the details of specific disciplines. It is not intended for those who want to become high-level experts on sustainability. For them, many other books exist. The philosophy behind this approach is that, as all of society needs to become more and more sustainable, it is essential that not just some, but *all* professionals with a high level of power and responsibility in every company, government department, ngo, etc., are able to think and act in a sustainable way. So, an introduction to sustainable development at a basic level should be a necessary element in the study programs of each discipline in every university, all over the world.

The online accessories consist of, e.g., a glossary, a set of about 200 student exercises, 40 video clips, and for each chapter: additional texts, a description of the learning goals, a summary, and a powerpoint presentation.

The *Branches*: The SD Curriculum Scan

The above mentioned RESFIA+D model is a tool for education development, starting from the roots; the competence profile. The opposite approach is offered by the SD Curriculum Scan. This tool enables to draw a map of a curriculum, showing which aspects or topics of SD have been realized in which part of the curriculum.

In order to describe the curriculum in such a way, 16 categories of topics have been defined, grouped into four groups: basics, people, planet, and profit, as Fig. 2 illustrates.

For each of the 16 categories, a series of topics was selected. This was not intended as an exact or forcing checklist for the curricula, but just as a source of inspiration for education developers, to give them some impression of how the themes might be interpreted. As an example, for the 'Participation' category, the following topics were selected:

- Participation versus exclusion
- Social cohesion versus segregation
- Freedom versus solidarity
- Civil society
- Cultural values and differences
- Democracy

Period	Basics	People	Planet	Profit
First Year				
Sem.1	Triple P	Education	Agriculture and food	Economy
	Place	Health	Climate	Enterpre-neurship
	Time	Participation	Environment	International cooperation
	Ethics	Welfare and poverty	Nature	Technology
Sem.2	Triple P	Education	Agriculture and food	Economy
	Place	Health	Climate	Enterpre-neurship
	Time	Participation	Environment	International cooperation
	Ethics	Welfare and poverty	Nature	Technology
Second Year				
Sem.1	Triple P	Education	Agriculture and food	Economy
	Place	Health	Climate	Enterpre-

Fig. 2 A (still empty) example of an SD curriculum map

- Equal opportunities
- Gender issues
- Human rights
- Minorities
- Fugitives
- Immigration, integration
- Unemployment.

A practical tool was designed in the shape of a spreadsheet in which spaces are available (the white boxes in Fig. 2) to fill in all kinds of curriculum elements that exist in an actual study program. When filled with the details of a curriculum, the result is an 'SD Curriculum Map.' After a series of practical tests in 2008 and 2009, the Curriculum Scan is now being applied. These applications make it possible to develop the Scan further, from a generic tool to a more specified instrument that can be applied in a variety of disciplines.

The application of the SD Curriculum Scan takes quite some time, as the scan consists of investigating all study materials (e.g., textbooks, lecture notes, exam regulations) and interviewing a selection of professors, lecturers and students, followed by feedback loops and checks. This is why the scan is usually performed by students in educational sciences, performing the scan as a graduation project.

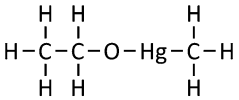
The *Biochemistry*: Methodologies for the Learning Process

Nowadays, there are many didactic approaches that can be used. Examples are: Analysis tasks, numerical exercises (such as calculations, simulations), research tasks, serious games, TED talks, MOOCs, debates & discussions, problem-based learning (PBL), projects, and creative tasks (e.g., movie clips, paintings, events).

An example of how a seemingly traditional exercise can be transformed into an innovative task, demanding creativity and societal involvement from the students, is shown here. Preferably, this exercise is performed by a group of students.

Exercise 8.6. The accidental discharge
A PVC factory has a permit to discharge wastewater into a nearby river. Full use is made of this permit, and on a given summer's day they discharge wastewater at a rate of 4,000 l a minute.The wastewater quality is regularly measured, which is why alarm bells quickly rang out when, at 12:31, it was noticed that a dissolved substance was present in the water, which was highly poisonous and should under no circumstances be released into the surface waters. The substance is called *methyl mercury*—its scientific name is *hydroxyl (1-methylethyl)mercury(II)*, for short: C_3OHgH_8 (Fig. 3)—and its concentration levels in the discharge pipeline stood at three ppm (parts per million).

Fig. 3 The molecular structure of methylmercury



The chemical has a notorious recent history and is highly toxic, with an LD50 value of 1 ppm (LD50 stands for 'Lethal Dose 50 %', the concentration level at which 50 % of sufferers die). Some decades ago methylmercury was discharged into the surface waters of the town of Minamata in Japan, with the locals consuming the fish caught in these waters. What came to be known as Minamata disease claimed many human lives.

Immediately after the alarm was sounded, employees attempted to shut the valve. This is not a small and simple tap but rather a large and very heavy gate valve. At 12:38, the closing disc started moving, initially moved slowly as it is so heavy. The large part of the shut-off operation after that went relatively quickly, although toward the end work slowed as the wastepipe could burst open if the disc was forced shut too fast. By 12:43, it was completely sealed.

The form of the outflow that occurred while staff was busy closing the valve resembles a section of a sine graph; see the graph (Fig. 4).

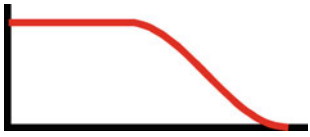
(a) What is the minimum amount, in grams, of the poisonous chemical that was discharged into the environment?
(b) And what is the maximum amount?
(c) What actions might have been undertaken between 12:31 and 13:38?
(d) If you were the company manager, what would you have instructed the company's press secretary to say?

Question (a) in this exercise is straightforward and traditional. Students capable of performing basic mathematic calculations can find the answer easily.

Question (b) appears to be comparable, but it is not, as the proper data to perform the calculation are missing. Consequently, the correct answer is: 'We don't know'. For many students, this is a shocking experience.

Question (c) encourages a wide range of activities, if you allow the students to use sufficient time. Practical experiences showed that some students approached environmental or operational managers of chemical factories, while others phoned

Fig. 4 The outflow of wastewater as a function of time



the local government to get information about regional disaster plans. Still others studied internet sources or consulted lawyers. When these students came together again after their investigations, they combined all those new kinds of information in order to formulate their best answer.

Question (d) evidently raises all kinds of discussions of an ethical, management, or philosophical nature. It's not the exact answer that the students arrive at that matters, but rather the discussion itself.

Another example is illustrated in Fig. 5. Both examples belong to the 200 exercises that are a part of the accessories of 'Fundamentals of Sustainable Development,' the textbook described above. All of them can be downloaded freely.

The second exercise makes use of a serious game called PopSim. This computer application simulates the growth of a population on an isolated island.

Exercise 6.11. PopSim simulation: global scenarios
For this exercise use the program *PopSim*, which can be downloaded from the website of the book.

(a) Launch the program and press the 'Start' button, which will set the simulation running using the 'simple' scenario. Examine the results-what type of growth do you observe?

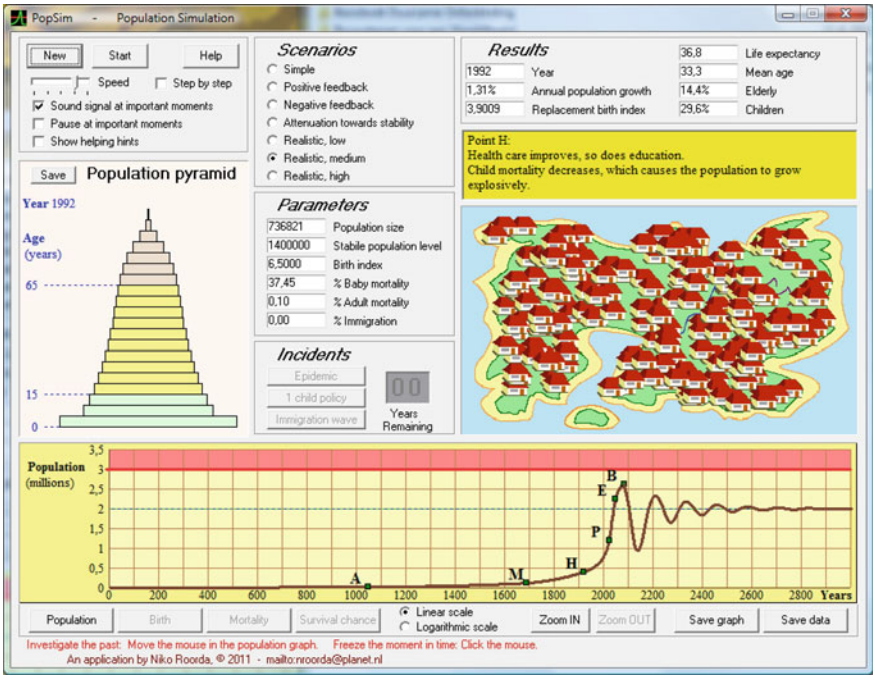


Fig. 5 The World scenario simulation program popSim

(b) Press the 'Help' button and read the program guide.
(c) Select the scenario 'Attenuation towards stability'. What type of growth do you observe?
(d) Experiment with the 'simple' and 'Attenuation towards stability' scenarios by changing the values of the variables. You can invoke one-off events and study the results.
(e) Turn on the 'Pause at important moments' option. Use the three 'Realistic' options-low, medium, and high. Detail your findings.
(f) Which of the three 'realistic' scenarios do you believe most closely resembles the real world, and why?
(g) In your report, also focus on the question of whether a model such as this one can, in spite of the fact that it is a simplified representation of the real world, teaches us something about that real world. If this is the case, what might it teach us? If that is not the case, why not?

The *Ecosystem*: Inter- and Transdisciplinary Cooperation

In *multidisciplinary* education, issues or methods from various disciplines are combined into one curriculum. In other words, multidisciplinary approaches can be performed by one or more students within just one study program. In *interdisciplinary* education, students from various disciplines (e.g., engineering, management, law, social studies) are joined to perform a complicated task as a team in a real-life context (Pohl and Hirsch Hadorn 2007).

In initial experiments around 2000, participating students were hardly prepared for such a task, and their lack of ability to work beyond the borders of their own discipline caused serious struggles and misunderstandings.

For this reason, training and coaching program was developed. This program appeared to be relevant, not only for the students, but certainly also for their lecturers. In the first week of the internship, the involved students and lecturers met with each other, explained their varying views on SD, on the involved company, on professionalism, etc. Exercises were made, e.g., role playing games, to transform the individuals into a team. In the course of some years, this approach was improved and utilized repeatedly. Tools are based, e.g., on the Belbin Test for team roles (Belbin 1981), the Tuckman group development model (Tuckman 1965), and elements from Six Sigma (George 2003).

A next step was taken when a *transdisciplinary* approach was selected. In this case, not just students from various disciplines functioned as a team, but also others were added. In one case, where a planned home for the elderly was

redesigned, en number of them, future inhabitants, joined the project; not just as incidental stakeholders or interviewees, but as true members of the project team. Initial problems were solved by adding them to the first week training program and permanent coaching.

These projects have proved to render excellent results, which would have been impossible within a mono- or just multidisciplinary approach.

Sprouting and *Growing*: Strategy, Assessment, and Involvement (AISHE 2.0)

Assessment of SD in a university or school can have a number of reasons or benefits (see Table 5). It can be used for the development of a strategy to implement SD into the education, the operations, the research, the community outreach, and even into the identity of the university itself. AISHE, the 'Assessment Instrument for Sustainability in Higher Education,' was developed for all of these reasons.

The first version of AISHE was developed and validated in 2000–2001 (Roorda 2001). Since then, the tool has been applied in 11 countries. Case studies are available in, e.g., Roorda (2004) and Roorda and Martens (2008).

A second, expanded version has been developed by an international group (Roorda et al. 2009). This 'AISHE 2.0′ consists of five modules, each with six indicators (Fig. 6).

AISHE was derived from a tool for general quality management in higher education (HBO Expert Group 1999). It makes use of a five-point ordinal scale, describing the natural development of an organization, as Fig. 7 shows.

Characteristics of those five stages are descried for each of the indicators. A group of participants, together representing the professional field, the management, the educators, the non-teaching staff and the students, discusses the indicators, reaching consensus on the present stage within the assessed organization (e.g., a

Table 5 Nine reasons for the assessment of ESD

1.	Assessment = tool for strategy and policy development
2.	Assessment = tool for evaluation of policy results
3.	Assessment strengthens awareness and involvement for ESD among management, staff, and students
4.	Integration of ESD in quality management is necessary to get ESD in mainstream of education
5.	Reporting offers transparency toward stakeholders (financiers, potential students, etc.)
6.	Reporting strengthens feeling of responsibility among management and staff
7.	ESD certification works as an incentive
8.	Benchmarking and ranking raise feeling of competition
9.	Standardized assessment enables universities to learn from each other and cooperate on ESD

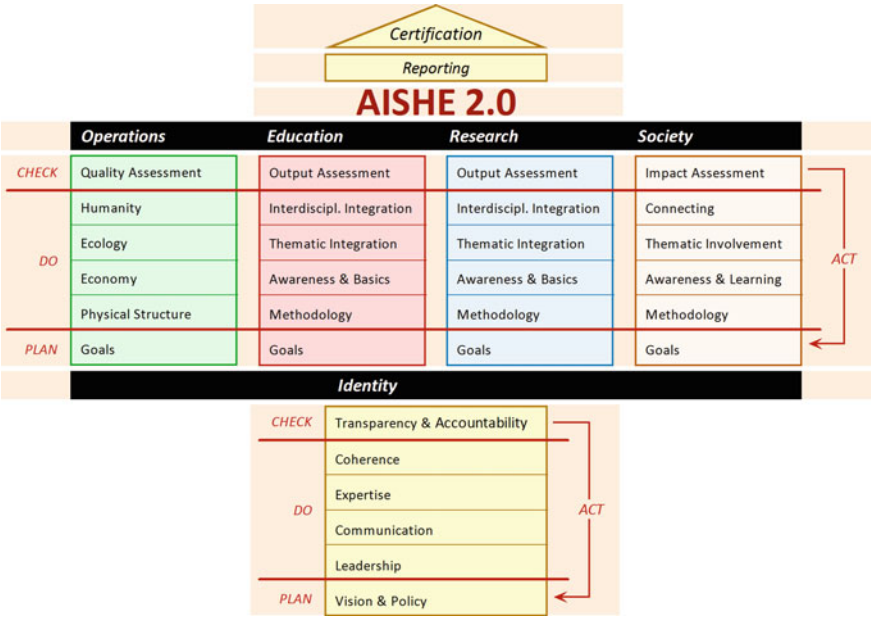


Fig. 6 The five modules of AISHE 2.0

faculty or a campus), and also on the ambitions that are to be realized within a next strategy period. Thus, AISHE has proved to be a successful strategic ESD instrument (Roorda 2010).

The *Recognition*: Reward, Benchmarking, Ranking (The ESD Certificate)

Based on the results of AISHE, assessments, a Certificate for Sustainable Development in Higher Education was defined by the Dutch ESD organization DHO. The certificate has been awarded to universities about 100 times. It is a 'star system,' corresponding to the five stages of AISHE. The certificate has been formally recognized by the Dutch and Flemish Accreditation Organization for Higher Education (NVAO).

Case studies (Roorda 2010) show that the certificate is an effective incentive for continued efforts to implement ESD more and more thoroughly, eventually leading to *SISD*.

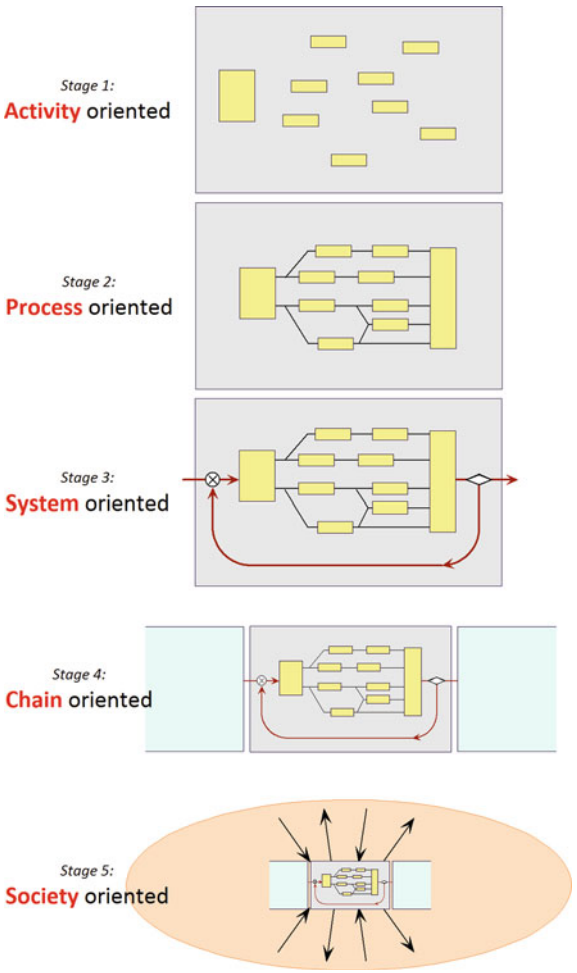


Fig. 7 The five stages of AISHE

Reaching *Maturity*: System Integration of Sustainable Development (SISD)

When a university or a department takes its first steps concerning the integration of SD into its education or its organization, this is described by the stages 1 and 2 of AISHE. If this process is continued and ESD becomes systematically integrated, the three-star certificate may be reached, establishing a state called 'System Integration of Sustainable Development,' 'SISD.' This concept is defined as follows (Roorda 2010, p. 138):

> SISD not only refers to a systematic integration of sustainable development into an educational organization (or a functional unit within it, e.g., a faculty, a school, or a study program), but also, and even primarily, at integration at a systems level. This implies that

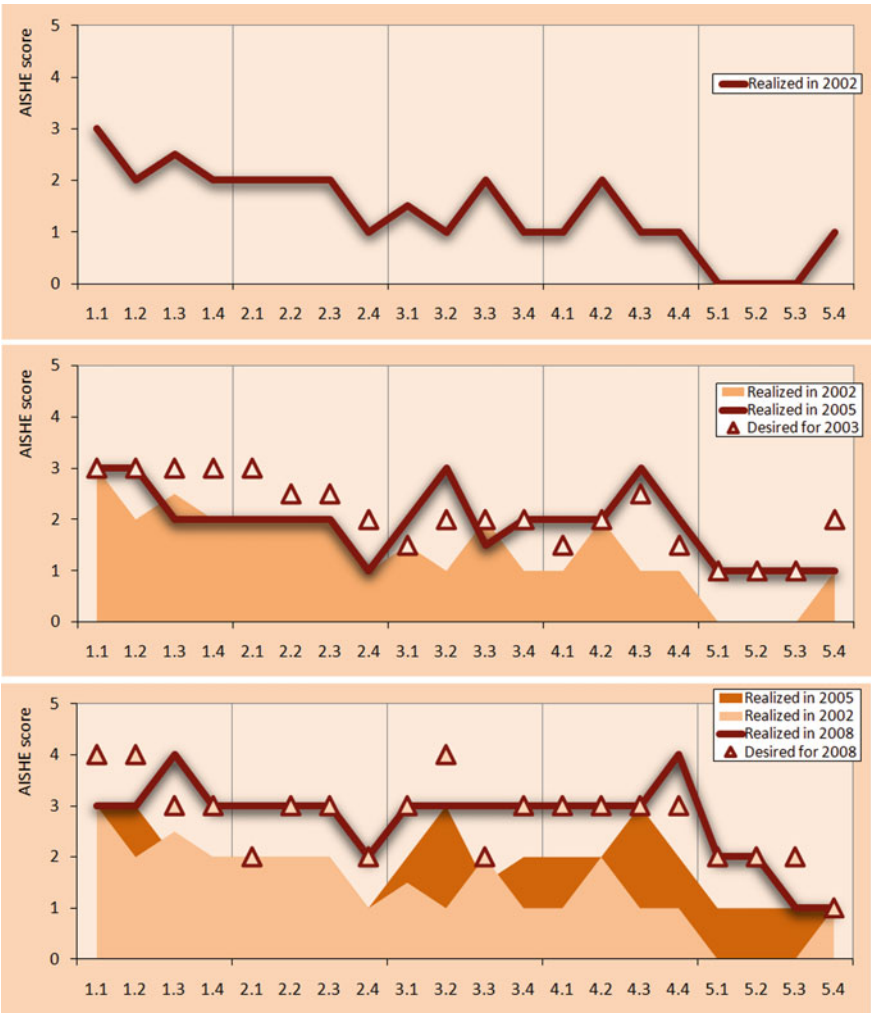


Fig. 8 A case study: the development of a faculty toward SISD

sustainable development has become a part of the fundamental characteristics of the organization, of its very identity. If this is the case, it will be observed that sustainability has become a part of all or most activities, or at least of the thoughts and philosophies behind those activities.

Figure 8 shows the case of a faculty (Fontys School of Applied Sciences, Eindhoven, Netherlands) in which SISD was realized in 2008 as the result of a six-year process.

The SISD concept is an appropriate final goal for an SD strategy of a university, as it is both assessable and realistic, as several cases on the faculty level have proved. An example of a SISD ambition at the full university level is Avans

University. Its mission statement was quoted above, containing the SISD concept as its prospect, to be reached around 2016. Avans University designed a detailed ESD strategy, applying the entire ESD toolbox described in this chapter, to realize its ambition.

The *Fruits*: The Effects on Profession and Society

If the process toward SISD is followed through consistently, making use of AISHE to design and evaluate the strategy, and making use of RESFIA+D to define the educational goals, the effect will be that the graduates will all be sustainably competent professionals. The final indicators for success will naturally be the dissertations by the students, and later their efforts and successes concerning SD in the course of their careers.

The final element in the toolbox of the ESD strategy, described in this chapter, is a pledge that students may make at the moment of their graduation. The pledge is introduced in Roorda (2012):

The Pledge

I promise that in my work I will consistently consider the consequences of my actions for society and for the environment, both today and in the future. I shall, before making decisions and while making them, conscientiously assess issues. I shall not undertake any actions geared toward harming people or the natural environment. I shall use my education, talents, and experiences in order to make a contribution to a better world through sustainable development.

I accept that I am personally responsible for my choices and actions, and I promise that I will be held publically accountable for my work by everyone for whom that work holds consequences. I shall not appeal to the fact that I acted on the instructions of others.

I promise that in my work I will not only make an effort for my own interests and my career, but also for my dreams and my ideals. In this I shall respect the values and the interests of others.

I understand that there will be times in the course of my career when it will be difficult to do what I am now promising to do. I will adhere to this pledge, even in those times.

References

Avans. (2010). *Mission statement and four-year strategy plan* (pp. 2011–2014). Tilburg : Avans University.

Avans. (2012a). *Evaluatie maart 2012,Focusgroep Duurzaam Regionaal Verankerd*. Tilburg : Avans University.

Avans. (2012b). *Prestatieafspraken met het Ministerie van Onderwijs, Cultuur en Wetenschappen*. Tilburg : Avans University.

Barth, M. J., & Burandt, S. (2008). Learning settings to face climate change. *EMSU, 2008*, 5–17.
Belbin, R. M. (1981). *Management Teams: Why they succeed or fail*. Oxford: Butterworth-Heinemann.
Corcoran, P. B., & Wals, A. E. J. (Eds.). (2004). *Higher Education and the challenge of sustainability*. Dordrecht: Kluwer.
de Kraker, J., Lansu, A., van Dam-Mieras, R. (2007). Crossing boundaries. *Innovative learning for sustainable development in higher education.* Verlag für Akademische Schriften, *Frankfurt am Main*.
Dieleman, H., & Juárez-Nájera, I. (2008). How can we design critical education for sustainability?. *EMSU 2008*, 201–213.
Dyball, R., Brown, V. A., Keen, M. (2007). Towards sustainability: Five strands of social learning. In: Wals (Ed.), *Social learning towards a sustainable world* (pp. 181–194). The Netherlands : Wageningen Academic.
EMSU. (2008). A new knowledge culture. Universities facing global changes for sustainability. In *Proceedings of the international EMSU 2008 Conference, Technical University of Barcelona.*
George, M. L. (2003). *Lean six sigma for service*. USA: McGraw-Hill Education.
Haan, G. de. (2002). Die Kernthemen der Bildung für eine nachhaltige Entwicklung. *ZEP–Zeitschrift für internationale Bildungsforschung und Entwicklungspädagogik*, 1, 13–20.
Haan, G. de., & Harenberg, D. (1999). *Gutachten zum Programm Bildung für eine nachhaltige Entwicklung*. Materialien zur Bildungsplanung und zur Forschungsförderung, Heft 72, Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung, Bonn.
HBO Expert Group. (1999). *Method for improving the quality of higher education based on the EFQM model* (3rd version). The Netherlands, Groningen: Hanzehogeschool (representative).
Martens, P. (2006). Sustainability: Science or fiction? *Sustainability: Science, Practice, and Policy*, 2(1), 36–41.
Orr, D. (1992). *Ecological literacy: Education and the transition to a postmodern world*. Albany: State University of New York Press.
Pohl, C. & Hirsch Hadorn, G. (2007). *Principles for designing transdisciplinary research. Proposed by the Swiss Academies of Arts and Sciences*, München: oekom Verlag.
Roorda, N. (2001). AISHE—Assessment Instrument for Sustainability in Higher Education. Publication in Dutch and English: Stichting Duurzaam Hoger Onderwijs (DHO), Amsterdam. Swedish translation. (2008). *AISHE: Självvärderingsverktyg för hållbar utveckling i högre utbildning*. Eskilstuna, Västerås: Mälardalens högskola.
Roorda, N. (2004). Policy development for sustainability in higher education—results of AISHE audits, In Corcoran and Wals (Eds.), p. 305–318.
Roorda, N., Rammel, C., Waara, S. & Fra Paleo, U. (2009): *AISHE 2.0 Manual: Assessment Instrument for Sustainability in Higher Education, Edition 2.0*. Second draft, Retrieved from https://www.box.net/s/0dglhugzyyzta4kkfb83.
Roorda, N. & Martens P. (2008). Assessment and certification of higher education for sustainable development. *Sustainability: The Journal of Record*, 1(1), 41–56.
Roorda, N. (2010). *Sailing on the winds of change. The odyssey to sustainability of the universities of applied science in the Netherlands*, Ph. D. dissertation, The Netherlands: Maastricht University Press. To be retrieved from: https://www.box.net/shared/nz75typdk5.
Roorda, N. (2012). *Fundamentals of Sustainable Development*. London: Routledge.
Sterling, S. (2004). Higher education, sustainability and the role of systemic learning. In: P. B. Corcoran & A. E. J. Wals (eds.) *Higher education and the challenge of sustainability: Problematic, Promise, and Practice*(pp. 47–70). Kluwer Academic Press: Dordrecht.
Tuckman, B. W. (1965). Developmental sequence in small groups. *Psychological Bulletin, 63*, 384–399.
UNCED (1992). *Agenda 21*. United Nations Conference on Environment and Development. Retrieved from http://www.un.org/esa/dsd/agenda21.

UNECE. (2005). *UNECE strategy for education for sustainable development, adopted at the High-level meeting*. Committee on Environ-mental Policy: High-level meeting of Environment and Education Ministries, Vilnius.

UNESCO (2004), *Report for the Higher-level panel meeting on the United Nations decade of education for sustainable development (2005-2014): Preparing the Draft International Implementation Scheme, A brief summary of the preparatory process*. Paris: UNESCO.

UNESCO. (2005). *Report by the Director-General on the United Nations of Education for Sustainable Development: Draft International Implementation Scheme and UNESCO'S contribution to the implementation of the Decade (2005–2014). Hundred and seventy-second session*. Paris: UNESCO.

Van Dam-Mieras, M. C. E. (2007). Learning for sustainable development in a globalizing world. In de Kraker et al (Eds.) (2007), p. 12–43.