Chapter in the book:
'*Sustainability Assessment Tools in Higher Education Institutions*',
Sandra Caeiro et al (editors),
Springer Verlag, 2014,
P. 101 – 120
www.amazon.com/Sustainability-Assessment-Higher-Education-Institutions/dp/3319023748/

A strategy and a toolkit to realize
System Integration of Sustainable Development (SISD)

Niko Roorda, PhD
Avans University, Prof. Cobbenhagenlaan 13,
5037 DA Tilburg, The Netherlands

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.*

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.

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 ESD strategy ('Education for Sustainable Development') 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).
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 figure 1.

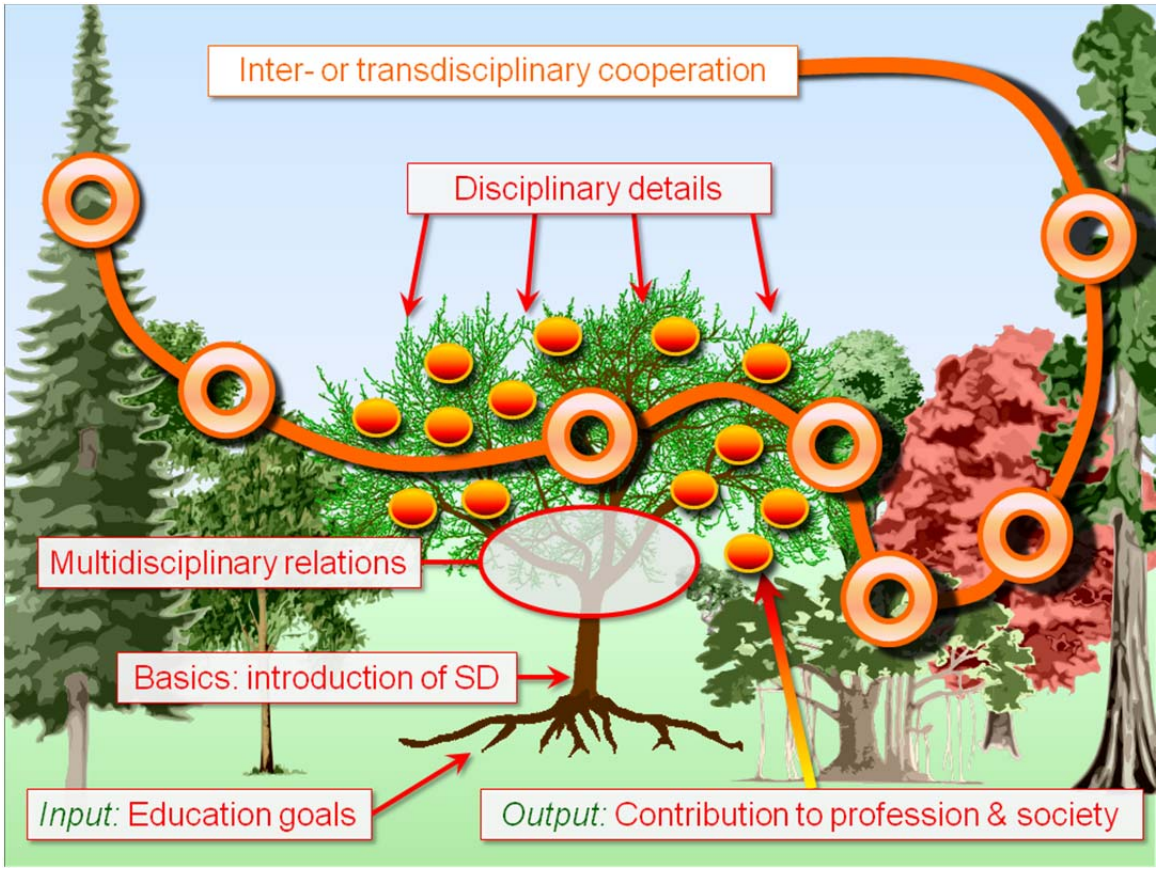

Figure 1. The 'Tree Model', a metaphor for a bachelor or master program in a university

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 towards *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.

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 & 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*	

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):

> *"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 fulfill 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.

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 & Harenberg (1999), De Haan (2002),Sterling (2004), UNESCO (2004, 2005), UNECE (2005), Martens (2006), Van Dam-Mieras (2007), Dyball, Brown & Keen (2007), Barth & Burandt (2008), Dieleman and Juárez-Nájera (2008).

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 Roorda, 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.

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 empathises 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 vigour in systems; have the ability to use the sources of vigour	*Ch. 2-4*	2. Recognise and utilise 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)			

Competence levels

For each of the 6 x 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.

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. • You contribute to the application of these methods, and thus contribute to short term improvements.	• 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. • You contribute to the application of symptom reducing methods based on the operational policy of the organization or team you belong to.	• 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 design of symptom reducing methods based on the tactical policy of the organization or team you belong to.	• You contribute to the (re)definition and the application of the mission and of the strategic policy of the organization you belong to. • You involve present and expected future trends in your working field and in society.