

Structured Comprehension For Systems Thinking, Learning And Leadership Towards Sustainability

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Abstract

The Blekinge Institute of Technology (BTH) Karlskrona, Sweden, will begin a new Master's programme focusing on sustainable development in September 2004. The programme is intended to contribute to a growing international network of sustainability practitioners, including early and mid-career professionals, resource managers, executives and political decision-makers. As with many programmes of this type, this one will require coverage of numerous complex economic, social and ecological issues. In so doing, it will cover a number of interrelated disciplines concepts and tools (e.g. environmental science, system dynamics, public policy, business strategies, corporate social responsibility, dematerialization and 'green technologies'). Various sectors of the sustainability arena will also be studied including agriculture, transportation, health, energy and product development.

To deal with the high complexity inherent in sustainable development, we intend to test the enhanced learning capabilities of three unique and interrelated aspects of this Master's programme including: (1) a structured comprehension of sustainable development, using "Backcasting from Basic Socio-Ecological Principles of Sustainability"; (2) free creativity within basic constraints established by the structured comprehension and (3) a learning process that 'walks the talk' with respect to free creativity within basic constraints. Recognizing that "society within the biosphere" is inherently a complex system, the programme will revolve around a generic, structured model for planning and decision-making in *any* complex system. The model is adaptable to any system at any scale – e.g. an organization, a football game, and in this case, "society in the biosphere". The programme distinguishes five essential system levels including: (i) the system; (ii) success; (iii) strategy; (iv) actions and (v) tools. Second, a structured comprehension, anchored to basic principles at the success level – the 'trunk and branches of sustainability' – allows for and promotes free creativity on actions in a particular context – the 'leaves'. Third, the students will be exposed to a learning process of creative use of actions and tools that the model allows for in any organization – sharing the basic trunk and branches and practicing free creativity amongst the leaves.

The programme's learning process will facilitate a systematic approach to analysis of all kinds of current sectors and problem areas through envisioning of solutions and finding strategic paths of actions and tools towards sustainable outcomes within those sectors. It will culminate in a thesis, following the same general structure, during the last-half of the programme.

Introduction

The Blekinge Institute of Technology (*Blekinge Tekniska Högskola, or BTH*) in Karlskrona, Sweden, begins a nine-month Master's Programme entitled "Strategic Leadership Towards Sustainability" in the fall of 2004. The programme, focused on sustainable development, is intended to make a significant contribution to a growing international network of sustainability change agents operating in all sectors of society. It has been designed for existing students, early and mid-career professionals, resource managers, executives and political decision-makers wishing to play a leadership role in this emerging field.

In designing such a programme, the project team had to consider a number of conceptual challenges inherent in any education for sustainable development. First, there are a growing number of specific, social and ecological issues to consider such as climate change, bio-accumulation of toxins, depletion of natural capital as well as growing concerns with health epidemics, poverty and social violence. Second, to respond to this complex array of challenges, at scales from global to local, is a growing number of concepts, tools and models designed to address various aspects of each challenge. This includes, for example, cleaner production technologies, corporate social and environmental responsibility (CSR), public policy and institutional design, organizational learning, strategic business planning, environmental management and monitoring systems, to name just a few. Different concepts and tools are also applicable to different sectors of society such as: public policies for agriculture, 'sustainable tourism' indicators, life cycle assessment for product development, sustainable transportation modeling, 'green economy' initiatives and environmental management systems (EMS) such as ISO 14001.

Third, even if it was decided to cover all of the approaches in detail, in a programme of 'everything-ology' (which, in itself, is highly questionable), it would take many years to do so! Fourth, assuming the programme *content* was clear, an appropriate learning *process* would need to allow the students to engage in a creative, group-learning process and meaningful purpose (as opposed to a more passive 'receiving of knowledge').

We intend to test three key elements for their effectiveness combating these challenges and to therefore improve our understanding of 'strategic leadership towards sustainability.' They include: (1) the effectiveness of a structured comprehension, using "Backcasting from Basic Socio-ecological Principles of Sustainability; (2) the usefulness of using free creativity around the details within the basic constraints established by the structured comprehension and (3) the effectiveness of allowing students a learning process that 'walks the talk' on free creativity within basic constraints.

Structured Comprehension

Society within the biosphere is inherently a highly complex system. This programme is founded with the basic premise that to achieve 'success' – i.e. an attractive, sustainable society – within such a complex system, success must be understood at a basic principle level. From this understanding, one can "backcast" to the present and begin to take action as part of a clearly focused strategy. This approach – *backcasting from basic principles for*

socio-ecological sustainability – has been published in peer-reviewed, scientific journals and been used extensively in the business community as The Natural Step framework (named after the non-governmental organization of the same name) [1, 2].

The framework is based on a generic and therefore, widely applicable, five-level model for planning and decision-making in any complex system [1,3]. The five levels of this model include:

(i) *The Systems level.* The overall principle functioning of the system (in this case the biogeochemical cycles of the biosphere and the basic relationship of this system with the flows and practices of human society) is studied enough to arrive at a

(ii) *Basic definition of success* within the system (in this case sustainability), which in turn, is required for the development of

(iii) *Strategic guidelines*, in this case a systematic step-by-step approach to comply with the definition of success (backcasting) while ensuring that financial and other resources continue to feed the process of choosing the appropriate

(iv) *Concrete actions*, i.e. every concrete action in the transition towards sustainability should follow strategic guidelines, which in turn, require

(v) *Tools* that can systematically monitor the (iv) actions to ensure they are (iii) strategic to arrive at (ii) success in the (i) system.

The following section describes these levels as they will be addressed in the Master's programme:

1.) *The Systems level – individuals, organizations, nations, society in the ecosphere.* The fundamental physical characteristics of society existing within the ecosphere will include considerations of subjects such as thermodynamics and conservation laws, photosynthesis and primary production, the biogeochemical cycles and basic ecology. In addition, fundamental societal characteristics will be explored such as people's self-organizing, interdependent pursuit of human needs, the importance of diversity as well as the role and functional characteristics of social institutions, organizations and networks.

The systems view, for example, reveals an important reality of today's unsustainable society. The problem of unsustainability is not only that we have emitted a lot of pollutants causing some impacts. The problem is that industrial society is designed so that pollutants are bound to increase in concentrations globally. For example, emission of greenhouse gases has resulted in a certain amount of climate change but it follows from the laws of nature that as long as energy systems are organized as they are, atmospheric concentrations of greenhouse gases will continue to increase. At the same time natural systems are systematically declining from destruction by physical means such as over-harvesting and growth of infrastructure. In short, waste is steadily accumulating and resources are steadily declining. Therefore, the resource-potential for society and the economy is systematically decreasing. At the same time, the Earth's population is increasing and the gaps between the haves and the have-nots are growing. Therefore, non-sustainable development can be

visualized as society entering deeper and deeper into a funnel, in which the space for deciding on options is becoming narrower and narrower per capita. This reality contrasts sharply with a widely held illusion that we are in a 'cylinder', where isolated social and ecological impacts come and go in an *ad hoc* series of events.

2.) *Basic definition of success – basic principles for social and ecological sustainability.* Basic principles for socio-ecological sustainability have been arrived at through scientific consensus [1,2]. They define a basic principle understanding of sustainability (that any sustainable scenario must comply with) and provide direction for development of strategy and selection of appropriate actions and tools. As such, these principles have been carefully scrutinized to ensure they are:

... based on a scientifically agreed upon view of the world of the type described above. That is they must be derived, through strict logic, from natural sciences and an understanding of people's will to meet their basic needs;

... necessary to achieve sustainability. That is, if any of the principles are not met by society, then we can say with confidence that society is not sustainable;

... sufficient to cover all aspects of the sustainability concept. Cover in this context is different than contain. A set of basic principles that cover all aspects only means that all aspects of sustainability can be structured (e.g. 'categorized') under one of the principles;

... general enough to include all activities relevant to sustainability. That is, they must be equally applicable for all sectors and activities of any society;

... concrete enough to guide action and serve as directional aids in problem analyses and solutions. That is, they must provide discernable, directional guidance at any scale of application and inform concrete planning and

... mutually exclusive and collectively exhaustive in order to enable comprehension and structured analyses of the issues. That is, each principle must cover a distinct category of sustainability issues which is essential for comprehension, and for the development of tools that can monitor the transition to compliance with the principles.

It is logical to design principles for sustainability as restrictions, that is, principles that determine what human activities must *not* do in order to not destroy the system. In what principle ways could we destroy the system biosphere/society's ability to sustain us? The answer to this question can be found in upstream cause-effect chains, where basic principle errors of societal design trigger all the thousands of negative impacts that later occur downstream. By adding "not," with respect to upstream causes of downstream impacts, principles become conditions for the system biosphere/society – "system conditions."

The first three basic principles provide a framework for ecological sustainability that implies a set of restrictions within which sustainable societal activities must be incorporated and based on that reasoning, a fourth social principle is formulated. The four basic principles for socio-ecological sustainability state that in the sustainable society, nature is not subject to systematically increasing...

- I ...concentrations of substances extracted from the Earth's crust,
 - II ...concentrations of substances produced by society,
 - III ...degradation by physical means
- and, in that society. . .
- IV... people are not subject to conditions that systematically undermine their capacity to meet their needs.

As a first step for an organization or a project or a societal sector that wants to make progress towards sustainability, the basic principles must be “translated” into objectives that are relevant to the individual actors (since the basic principles are for all of society and the biosphere). By adding ‘not contribute’, the basic principles are translated – i.e. the ultimate sustainability objectives of an organization/project/societal sector are to:

1. ...eliminate its contribution to systematic increases in concentrations of substances from the Earth's crust.
2. ... eliminate its contribution to systematic increases in concentrations of substances produced by society.
3. ... eliminate its contribution to systematic physical degradation of nature.
4. ... eliminate its contribution to the undermining of human’s ability to meet their needs worldwide.

Each individual organization must draw its own conclusions from these basic principles as regards problems, solutions, goals, and sub-goals, based to a large extent, on its particular function, culture and institutional structure. The point is that when people ask themselves if they “contribute to the violation of the system conditions,” it opens up the senses to realize the full scope of current activities from a sustainability perspective, not to be reduced to only some currently known impacts or current ‘popularized’ issues. It is within this context that creative Master’s students will find the basic principles or conditions inspiring, where ‘everything becomes possible’, subject only to four, basic constraints for achieving success.

3.) *Strategy for success – beginning with the end in mind.* Students will learn strategic principles for a process to arrive at sustainability and, notably, the application of logical and generic guidelines built on “backcasting from basic principles”. This approach is founded on a clear understanding of success at the basic principle level and asking what must be done today, in a step-by-step manner to conform to basic principles of success. This approach leads to a systematic approach to prioritizing and managing economical actions as flexible platforms within an overall strategy. It is analogous to chess, where many different combinations of actions can lead to complying with basic principles for success (i.e. “checkmate”). Strategy development will be examined at the individual (e.g. dialogue and diplomacy), organizational (e.g. organizational learning techniques and ‘triple bottom line’) and societal levels (e.g. laws, taxation and “green economy” policies).

Other approaches to strategy development will be studied within the context of ‘backcasting from basic principles of success’, including:

- “Backcasting from scenarios” [4], where specific images of the future are created for a particular context and must not only lead to compliance with basic principles of success but be adaptable to changes in technology and stakeholder consensus [1], and
- “Forecasting”, where different future scenarios are ‘projected’ into the future and can be compared (virtually) with basic principles for sustainability to assess their desirability from a sustainability perspective.

4.) *Concrete actions - all actions that fit strategic guidelines (level 3) to arrive at (2) success in (1) the system.* During the programme, a wide sampling of case studies from businesses, communities and society-at-large will be explored covering, for example, the transportation, agriculture, energy, forestry, buildings, municipal services, manufacturing and fishery sectors. Students will be encouraged to bring a fresh, creative perspective to all kind of projects as they relate to making strategic progress towards sustainability.

5.) *Tools.* Various concepts and tools for specific aspects of sustainability are available and will be explored in relationship to the other four levels. In addition, the programme will investigate management systems (e.g. Environmental Management Systems such as ISO 14,001 and EMAS) and other tools and concepts such as Life Cycle Assessment, Virtual Prototyping, Product Development Processes, Factor 10, Zero Emission, Ecological Footprinting, Natural Capitalism and additional tools and concepts brought forward by students. In a recent publication, the framework’s structuring (complementary principles) of the largest possible scale in time (as long as it takes) and scale (the whole biosphere) has been applied to study the focus of, and relationships between, such concepts and tools [3].

Free Creativity within Basic Constraints for Success

The overall comprehension, based on backcasting from basic principles for success, by definition, allows considerable freedom for students to learn, experiment, innovate and practice leadership competencies together. The topics chosen will likely be diverse, consisting of those sample sectors, actions and tools listed above and others.

Practicing creativity within basic constraints is analogous to playing, and winning, the “sustainability game”. For example, with football (soccer), once the ground rules and the principles for success are established (e.g. there are 11 players on either team, all but the goaltender cannot use their hands, the winner is the team that puts the ball in the opponents net more than their opponent does), then the creative process opens up in terms of strategy (e.g. distributing the players around the field in order to pass the ball faster within it), actions (e.g. each pass, or series of passes) and tools (e.g. fitness training and monitoring player performance).

When constraints of planning in a complex system are constituted by a basic generic understanding of the system, it opens up for creativity (as opposed to other types of constraints such as traditional assumptions or hierarchical ‘demand and control’). And creativity is indeed needed, because there are many possible paths towards compliance with basic principles, and there are many options to consider as ultimate stepping stones. We know that the experienced player of chess is more adept at prioritizing moves towards the

basic principles of checkmate than the player who has just learnt about the rules. In short, playing ‘the sustainability game’ is where the art begins. It’s about community building, genuine creativity, ethics, esthetics, group dynamics, common sense and psychology. It’s the musicians and chess-players mastering the basics that can improvise. It is exactly this realization that is sure to animate what is both the programme’s title and its theme: “strategic leadership towards sustainability”.

A Learning Process that ‘Walks the Talk’

The entire masters programme will be designed based on learning about the basics and ultimately, the subtleties, of a dynamic relationship between the structured comprehension on the one hand and a creative learning process that allows students to practice ‘playing the sustainability game’ on the other hand.

Students will learn primarily by “playing chess” and gaining experience rather than listening and reading about it in lecture halls. In so doing, the students will also be encouraged to apply their social skills such as optimism, humour and creativity as fundamental aspects of community building and leadership. For example, significant emphasis will be placed on student’s ability to use their systems thinking and knowledge of core concepts to formulate questions that are most relevant to ‘strategic leadership towards sustainability’.

Students will build their personal leadership capabilities in the context of organizational learning. How does change happen? What role can an individual within an organization play? What approaches are most effective? What are the characteristics (and contributing factors) for a group that is performing well? A systems approach to personal and organizational learning will guide the class learning process. See for example Senge’s Fifth Discipline concept [5, 6]. Students will work together and learn about applied issues that have particular purpose and meaning for them.

The actual delivery of curriculum will follow a “non-linear” approach. That is, the five-level model and overview will be introduced on the first day of the programme and then revisited, in ever-increasing depth and sophistication, over the following four and a half months (an ‘outward-spiraling approach’). Students will be able to simultaneously explore details and subtleties at all systems levels, while always referring to basic principles for success and guidelines for strategy. This will allow an adaptive learning approach as the programme progresses adjusting programme emphasis in an on-going dialogue with students.

To help facilitate this learning process, an adaptive mix of learning methodologies will be utilized including: (1) introductory lectures (including lectures by faculty and external lecturers/practitioners, break-out groups and informal insights and discussion on new concepts); (2) group, project work and role play (both self-organizing and externally structured); (3) individual, self-guided study; (4) E-learning and review of videotapes; (5) seminars and tutorials and (6) special attention to students teaching and evaluating their peers and being evaluated on both (pedagogical learning).

The *initial* programme schedule plans to cover the structured, five-level model five times (five ‘circles’) in ever-increasing depth. Each circle, especially Circles 3 – 5, will include considerable practice in playing the sustainability game.

Period One: Weeks 1-9:

Circle 1 (Day 1) – overview of “strategic leadership towards sustainability” core concepts and five-level model.

Circle 2 (Weeks 1-2) – in-depth explanation and analysis of five-level model and the basics of strategic leadership towards sustainability.

Circle 3 (Weeks 3-9) – These weeks will involve in-depth review of key branches of sustainable development with continued reference to the five level model. Topics studied will include: sustainability science, social sustainability and institutions, organizational learning, strategic business and management systems, public policy, system dynamics, industrial ecology, strategic life cycle assessment, sustainable product development and various tools and concepts such as ecological footprinting, cleaner production technologies, zero emissions, and natural capitalism.

Period Two: Weeks 10-19:

Circle 4 – This period represents the beginning of specialization by students who will focus on strategic management, advanced societal leadership or engineering for a sustainable technosphere. Students will also explore, in more detail, topics outlined above (Circle 3) with continued reference to the five-level, structured comprehension.

Periods Three and Four: Weeks 20-42:

Circle 5 – Thesis. This represents the most in-depth work – theses will be carried out by groups of 2 or 3, and progress will be reviewed continuously by a student peer group (a sub-set of the overall class) as well as their thesis supervisors. Draft final, and final presentations will be delivered and evaluated by peers in front of the entire class as an important part of constructive knowledge transfer and co-learning amongst peers. A special emphasis will be placed on group creation and group learning during these two periods.

Instructors

This programme was conceived by Dr. Göran Broman, Professor at BTH and Dr. Karl-Henrik Robèrt, Adjunct Professor at BTH and Founder/Chair of The Natural Step organization. Professors Broman and Robèrt have recruited an interdisciplinary team of educators and researchers as well as a broad network of sustainability practitioners to create both the faculty and a cadre of external instructors. Joining the two founders of this programme as internal instructors (to make up the ‘project team’) will be David Waldron, Henrik Ny and Sophie Byggeth who, collectively, bring expertise in change management,

sustainable communities, strategic planning, environmental science, life cycle assessment, systems dynamics and product development.

External lecturers have been secured to bring training from outside the university. This training is intended to be integral to the overall programme. Lecturers include: Ms. Margot Wallström, EU Commissioner for the Environment, Dr. Göran Carstedt, Society for Organizational Learning, former President of IKEA North America, Dr. Manfred Max-Neef, Rector, Universidad Austral de Chile in Valdivia and a member of the Club of Rome, Mr. Leif Johansson, CEO, AB Volvo, Mr. Jonas Oldmark, Secretary General, The Natural Step (Det Naturliga Steget), Sweden, Dr. Christian Azar, Professor, Chalmers University of Technology and member of Intergovernmental Panel on Climate Change, Mr. Anders Wijkman, Former head of Swedish Red Cross, Member of EU Parliament and a member of the Club of Rome.

Community Connections

Strategic leadership towards sustainability is inherently about broad, societal change and the BTH Project Team plan to ‘walk the talk’. For example, numerous partnerships from local to global scales are already being developed to promote and assist such societal learning and change. Some of these early initiatives include:

Blekinge Institute of Technology – institutional profile – influenced by the proponents of this programme, BTH has now revised its overall profile to state: “dedicated to applied information technology and sustainable development of industry and society”;

Community and Region Sustainability Initiatives – BTH, through senior administration and the programme team are cooperating with the community of Karlskrona, Region of Blekinge and ‘Sustainable Sweden Southeast’ on a common, sustainable development initiative;

Sweden – BTH is cooperating with *Det Naturliga Steget* (The Natural Step Sweden) and their partners on common sustainability initiatives throughout Sweden, and

Global – BTH is cooperating with The Natural Step International (and its ten, member country organizations) and related organizations in the private and non-profit sectors to build research and global ‘best practice’ initiatives for ‘strategic sustainable development’, notably in the area of “innovation and design” and “sustainable communities”. In addition, *we are looking forward to future partnerships and exchanges with post-secondary institutions worldwide.*

We anticipate that through these cooperative arrangements, students, instructors and industry representatives will continue to benefit from the learning exchange on both the conceptual and applied aspects of strategic leadership towards sustainability. These partnerships should be most valuable also as the programme itself learns and adapts to the learning experiences.

References

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