Key Competencies in Sustainability

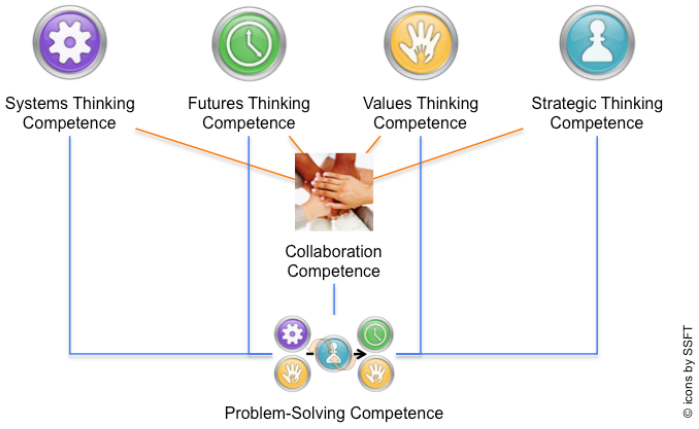
Competencies entail more than just issue-related knowledge, e.g., on the global water cycle, consumption patterns in the U.S., or distributional injustices in developing countries. Competencies are defined in a way that they can accommodate all topical knowledge required for successful problem solving in a particular context. *Competencies in sustainability are complexes of knowledge, skills, and attitudes that enable successful task performance and problem solving related to real-world sustainability problems, challenges, and opportunities.*

Since ten years key competencies are being used for curriculum development (Program-Level Learning Objectives) and course development (Learning Outcomes) in sustainability education. A set of six key competencies in sustainability, synthesized from the literature, has received quite some attention over the past few years and has been used in sustainability programs at universities around the world. The faculty of the School of Sustainability has agreed on using this competencies set for the development of the SOS curricula. The key competencies are:

- *Systems Thinking Competence*
- *Futures Thinking (Anticipatory) Competence*
- *Values Thinking (Normative) Competence*
- *Strategic Thinking Competence*
- *Interpersonal (Collaboration) Competence*

There is a critical *sixth* competence (implicitly mentioned), which is the meta-competence of meaningfully using and integrating the five key competencies for solving sustainability problems and fostering sustainable development:

- *Integrated Problem-Solving Competence*



In the following, we present profiles of the six competencies by providing: a definition, selected concepts it entails, selected methods it entails, and an exemplary professional task.

Systems Thinking Competence

Graduates, who are competent in systems thinking, are able to analyze sustainability problems cutting across different domains (or sectors) and scales (i.e., from local to global), thereby applying systems concepts including systems ontologies, cause-effect structures, cascading effects, inertia, feedback loops, structuration, etc.

Graduates are also able to describe the need for systemic thinking in sustainability problem-solving, for example, for anticipating future trajectories (from a systemic perspective), for identifying intervention points and critical actors, and for testing transition strategies. Finally, graduates are able to describe how different professional activities contribute to, or solve/mitigate sustainability problems.

Selected concepts

- Systems and problem ontologies
- Variables/indicators, clusters, sub-systems
- Cause-effect chains, cascading effects, feedback loops, delays
- Tipping points, resilience, adaptation
- Across/multiple scales: local to global
- Across/multiple/coupled domains: society, environment, economy, technology, culture
- Values, needs, perceptions, actions, tactics
- Institutions (e.g., rules, rights, decision-making processes), power relations, structuration

Selected methods

- Qualitative system analysis (e.g., structural analysis, cognitive mapping)
- Quantitative modeling (e.g., system dynamics or statistical modeling)
- Institutional analysis
- Causal problem analysis (causal chain analysis, etc.)
- Social and agent network analysis
- Participatory systems approaches (e.g., participatory modeling)

Exemplary Professional Task

In practice, systems thinking competence is necessary, for instance, for a sustainability officer at an energy company. The competence entails the knowledge and skills required for understanding the complex relations and tradeoffs between meeting energy demand, generating revenues, preserving the natural environment, fostering technological innovation, creating social benefits, and so forth. This type of thinking is critical in large corporate structures that have thrived from compartmentalization (supply chain, finance, CSR, etc.). The competence would enable the officer to identify opportunities as well as unintended consequences (i.e., species and habitat lost, contaminants emitted, workers endangered) as they pertain to a new technology for extracting oil, or the selection of a new drilling location.

Futures Thinking (Anticipatory) Competence

Graduates, who are competent in futures thinking, are able to anticipate how sustainability problems might evolve or occur over time (scenarios), considering inertia, path dependencies, and triggering events; as well as creating and crafting sustainable and desirable future visions, considering evidence-supported alternative development pathways.

Graduates are also able to describe the need for futures thinking in sustainability problem-solving, for example, for informing strategy building, including prevention, mitigation, and adaptation responses (responding to scenarios), as well as actively pursuing visions; further, for exercising precaution in decision making, and motivating change. Finally graduates are able to anticipate how one's job might evolve over time (career trajectory) and how one's professional activities might contribute to, or mitigate future sustainability problems.

Selected concepts

- Temporal terms, phases, states, continuity and non-linearity (conceptualized differently in different cultures)
- Possibility, plausibility, probability, and desirability
- Inertia, path-dependency, and non-intervention features
- Consistency and coherence
- Quality criteria of visions (visionary, tangible, plausible, shared, etc.)
- Risk, precaution, and intergenerational equity

Selected methods

- Scenario construction/analysis methods (qualitative and quantitative)
- Forecasting from statistical and simulation models
- Visioning methods, including the first module of backcasting
- Participatory anticipatory approaches (e.g., Delphi)

Exemplary Professional Task

In practice, anticipatory competence is important, for instance, for a city planner. Planning has a long history of adopting rather short-term (5-year) planning horizons and focusing on a single future (forecast), which reduces preparedness and responsiveness. Cities are complex systems where policies in one area have resonating impacts in other areas and a range of plausible impacts far into the future. Competence in anticipation enables city planners to consider alternative but plausible outcomes to plans and policies while thinking systemically about how the city will function in the short and long term. Tools such as scenario building can be used by planners to create more sophisticated plans that consider different futures from plausible to desirable, while incorporating perspectives of the public.

Values Thinking (Normative) Competence

Graduates, who are competent in values thinking, are able to specify, compare, apply, reconcile, and negotiate sustainability values, principles, goals, and targets, informed by concepts of justice, equity, responsibility, etc., in various processes, including visioning, assessment, and evaluation.

Graduates are also able to describe the need for values thinking in sustainability problem-solving, for example, for providing normative orientations to problem analysis, futures thinking activities, and strategy building. Finally, graduates are able to assess the sustainability effects/impact of one's job activities and envision a sustainable future for one's profession.

Selected concepts

- Sustainability, sustainable development
- Viability, vitality, livability, (social-ecological) integrity, etc.
- Sustainability principles, goals, targets, thresholds, tipping points, etc.
- Justice, fairness, responsibility, etc.
- Risk, harm, damage, etc.
- Ethics
- Resource stewardship, fair use, and conservation
- Tradeoffs (bounded, etc.) and "win-wins" synergies

Selected methods

- Sustainability assessment and appraisal methods
- Multi-criteria assessment methods (MCA, cost-benefit analysis, etc.)
- Impact assessment methods (LCA, SIA, etc.)
- Risk analysis
- Visioning methods
- Participatory normative methods (e.g., negotiation methods, consensus conference)

Exemplary Professional Task

Technical advisors and consultants are traditionally brought in by administrations, corporations, or agencies to assess the environmental impacts of products and services. Broader normative competence is required if they want to apply sustainability as a comprehensive and value-laden guiding principle. Beyond skills in Life Cycle Assessment and Environmental Impact Assessment, normative competence in sustainability would enable technical advisors or consultants to elicit the spectrum of values and preferences that are embedded in products and services. The critical skill is then to assess those values and preferences against sustainability principles such as intergenerational equity (how do we seriously consider future generations in large infrastructure decisions?). And finally, this competence would constructively be used for crafting visions of products and services that would align with sustainability principles (what does a sustainable food system look like?).

Strategic Thinking Competence

Graduates, who are competent in strategic thinking, are able to design and implement systemic interventions, transformational actions, and transition strategies toward sustainability, accounting for unintended consequences and cascading effects. They are able to develop intentional plans that leverage assets (carriers) and stakeholder coordination (alliances) to overcome systemic inertia, path dependencies, and other barriers to reach envisioned outcomes.

Graduates are also able to describe the need for strategic thinking in sustainability problem-solving, for example, in designing and carrying out plans, interventions, and actions towards transformational change. Finally, graduates are able to position one's job activities in a way that it contributes to sustainability transitions.

Selected concepts

- Intentionality, behavior change, and decision making
- Theories of change (social learning etc.)
- Strategies, action programs, transition agendas, and systemic intervention
- Adaptation and mitigation strategies
- Quality criteria including, success factors, viability, feasibility, effectiveness
- Barriers including, obstacles, inertia, path dependencies
- Carriers including, incentives, assets and resources, roles and responsibilities
- Stakeholder networks and alliances
- Power, politics, authority in strategy building and change (vested interests in the status quo)

Selected methods

- Intervention design (e.g. constructive governance design, policy design)
- Program planning and evaluation
- Decision support (e.g. tools, techniques)
- Organizational change management strategies
- Behavioral change strategies (behavioral economics)
- Transition management strategies (e. g. strategies, tactics, operational)
- Reflexive learning (e.g. socio-technical integration research)

Exemplary Professional Task

Sustainability is becoming a popular concept among public administrators interested in transforming their administration (e.g., in schools) so that it positively contributes to economic stability, social cohesion, and environmental quality. To successfully manage this transition an administrator needs to acquire strategic competence. The barriers to sustainability in today's public administration are numerous and administrators need to develop smart and robust action programs to transform facilities and practices while accounting for external and internal constraints (lack of funding, local politics, etc.). Strategic competence enables administrators to build critical alliances, enhance accountability, and create critical synergies.

Interpersonal (Collaboration) Competence

Graduates, who have acquired interpersonal competence, are able to motivate, enable, and facilitate collaboration towards sustainability. This requires core skills related to project (group) management, communication, deliberation, negotiation, collaboration, leadership, pluralist (trans-cultural) understanding, and empathy empathetic listening and engagement.

Graduates are able to perform problem analysis, conduct sustainability assessments, develop visions, and build transition strategies in teams and with diverse groups of stakeholders.

Selected concepts

- Benefits and limits of cooperation and empathy
- Effective verbal communication criteria (e.g. listening, clarity, and constructive inquiry)
- Effective written communication criteria (e.g. personal versus professional)
- Functions, types, and dynamics of stakeholder engagement and team work
- Project (group) management
- Cross-cultural collaboration and empathy
- E- communication
- Leadership styles, techniques and attributes
- Solidarity, ethnocentrism, nationalism, etc. (impacts of culture and perspective on participation)

Selected methods

- Strategies for effective communication, listening, inquiry, negotiation, etc.
- Constructive conflict resolution
- Trust building, including non-judgmental interactions and relationship building (e.g. identifying shared goals or interests
- Empathy education including perspective taking and immersive experiences
- Group facilitation techniques including active listening, rapport building, managed conflict, and consensus building

  Ethnography, non-judgmental interaction

Exemplary Professional Task

Millions of dollars are poured annually into international agencies whose missions are to provide relief and community recovery in the aftermath of disasters. Year after year, recovery initiatives, despite their intentions, fail to create resilient societies that are capable of living without foreign aid. Employees for these agencies, such as USAID, need to acquire strong interpersonal competence in order to understand the cultural and institutional contexts that influence preparedness and responsiveness to disasters. To have interpersonal competence means that aid workers are able to prioritize collaborative agreements over individual agendas. It ensures that aid workers have an open ear (and language competence), are able to map different perspectives and values, can facilitate dialogue, and reconcile differences across social and cultural backgrounds.

Integrated Problem-Solving Competence

Graduates, who are competent in integrated problem-solving competence, are familiar with and able to apply different problem-solving frameworks to complex sustainability problems and develop viable solution options. This capacity enables graduates to meaningfully integrate problem analysis, sustainability assessment, visioning, and strategy building.

Graduates are also able to describe the need for integrated problem-solving activities and how the different competencies enable this effort to foster sustainability (this is complementary to the ability to articulate the individual contributions of the previous five competencies to sustainability problem-solving). Graduates are able to articulate the roles, responsibilities, and contributions of different stakeholder groups to effective sustainability problem-solving.

Selected concepts

- Transitions and transformations (and other change dynamics)
- Roadblocks and barriers
- Triggers and supporting factors
- Social movements and organizational change (learning)
- Power, politics, authority in transition processes

Selected methods

- Transition management / governance
- Organizational change management
- Linking foresight and backcasting
- Transformational planning methodology

Exemplary Professional Task

A sustainability consultant works with city administration and stakeholder groups on a program to develop, test and implement strategies for sustainable urban development. This calls for a well-founded integrated problem-solving competence. A problem-solving framework is selected and adapted to the specific context. Strategies are the ultimate goal intended to redirect urban social-ecological systems from unsustainable trajectories toward a sustainable future state. To this end, the current state, past developments, as well as future trajectories of the city are analyzed systemically and key leverage or intervention points in the system are identified. This requires systems-thinking competence. These points are assessed against sustainability criteria (to identify critical trajectories and consider trade-offs), which requires normative competence. Based on new knowledge and learning, the strategies are conceptualized as being continuously adapted in order to redirect path-dependent future trajectories in the city toward the visions of a sustainable future, which requires anticipatory competence. The collaboration among a suite of urban stakeholders, including scientists, policy-makers, managers, planners, and citizens is critical for understanding the system's complexity, exploring scenarios, crafting sustainability visions, and developing robust strategies in ways that are scientifically credible, create shared ownership, and are conducive for action—all of which requires interpersonal competence.

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