Sustainability design

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Sustainability design

- Software increasingly central to the fabric of societies and industries
- Opportunities and goodwill, but few good outcomes
- Initiative started at Requirements Engineering for Sustainable Systems workshop, RE4SuSy 2014, following a suggestion in a position paper
- Aim to provide a common ground for thinking about sustainability in systems design across disciplines related to software

http://sustainabilitydesign.org/who-we-are/
Sustainability in systems design

Sustainability: the "capacity to endure"

sustain what? for whom? for how long?

system thinking

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First-order effect: Immediate opportunities and effects enabled by physical existence of products and processes involved in its design and production

Second-order effect: Organizations and effects arising from the application and usage of product

Third-order effect: Systemic effects of aggregated risk over time

Sustainability Design principles:

1. Sustainability is systemic. Sustainability has multiple dimensions. Sustainability transcends multiple disciplines.
2. Sustainability is a concern independent of the purpose of the system.
3. Sustainability applies to both a system and its wider context.
4. Sustainability requires action on multiple levels.
5. System visibility is a necessary precondition and enabler for sustainability design.
6. It is possible to meet the needs of future generations without sacrificing the prosperity of the current generation.

Sustainability requires long-term thinking.
Selected (mis)perceptions & practices

**Individuals**
- Sustainability as environmental or financial
- Sustainability as separate from software engineering
- Sustainability as a nice-to-have quality

**Professional environment**
- Lack of methodological support
- Roles & responsibilities of customers, engineer & managers
- Management support
- Assumed costs and perception of trade-off

**Norms in engineering practice**
- Project success assessed at delivery only
- Poor communication of sustainability values
- Regulations are drivers for sustainability

The sustainability debt of most systems remains undiscovered.


Strive to advance not just technical and economic, but also social, individual and environmental goals simultaneously.

Need for new approaches:
- Context
- long-term interactions
- socio-technical

Need to counter pervasive misperceptions
- 11 misperceptions and counterpoints

11 misperceptions and counterpoints such as...

- **There is** a tendency to focus on the immediate effects of a new system in terms of its functionality and how it is used.

- **Whereas** the following orders of effects have to be distinguished:
  1. **Direct**, first order effects are the immediate opportunities and effects created by the physical existence of a system and the processes involved in its design and production.
  2. **Enabling**, second order effects are the opportunities and effects arising from its application and usage.
  3. **Structural**, third order effects, finally, are aggregate effects from wide-scale use of a system over time.

Adapted from Karlskrona Manifesto, [http://www.sustainabilitydesign.org/karlskrona-manifesto/](http://www.sustainabilitydesign.org/karlskrona-manifesto/)
Requirements: The Key to Sustainability

Christoph Becker, University of Toronto
Stefanie Betz, Karlsruhe Institute of Technology

Requirements set the foundation for the impact of systems.

Sustainability Design

- Requires an appreciation of ‘wicked problems’ in systems design
- favors integrated understanding over a divide-and-conquer approach to systems analysis.
Decision gates

- Project purpose
- System boundary scoping
- Stakeholder identification
- Requirements elicitation
- Success criteria definition
- ....
Challenges

- Barriers on individual, business & disciplinary levels
- Discourse reveals
  - Reductionist perspective
  - Solutionist mindset
  - Techno-determinism
  - Misperceptions & blind spots
  - Assumptions about the engineering process
Who can help?

- Socio-technical systems
- Social informatics
- Values in design
- Behavioural economics
- ... 
- ... 
- ... 
- Critical Systems Thinking
- Social Construction of Technology
- ...
What can we do?

- The conceptual toolset of SW engineering is inadequate for understanding what we normally call "software sustainability".
- We've barely begun to articulate, within the engineer community, some thoughts about sustainability design.
- SD requires a paradigm shift, but the engineering community is unlikely to get that shift going.
- SSH research has commonly remained in a position of critique.
- SSH needs to engage - constructively.
- Interesting threads exist, but most either on macro-level ("the bicycle") or micro-level (one person’s experience).
What do I plan to do?

- I'm interested in empirical research that helps us understand what exactly is happening when people take trade-off decisions between current & future benefits in software projects
  1. Case studies of systems design projects
     - Understand path-dependent decision making
     - Question assumptions about trade-off decisions
     - Identify leverage points for intervention
  2. Tools to make sustainability debt visible
  3. Action Research with software teams
- Use that insight to develop design methods and tools to support more responsible choices, and translate that into practice
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