# Design Principles and Guidelines for the Sustainability of Cultures of Participation and Personal Information Environments

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**Abstract**

The sustainability of Cultures of Participation (CoPs) and Personal Information Environments (PIEs) is critical for fostering inclusive, adaptable, and resilient systems that empower users as co-creators. My contribution to the CoPDA 2025 workshop will be focused on:

- identification of design principles and guidelines based on failure and success stories of major past developments
- initial articulation of how these design guidelines should be reconsidered and further developed by integrating the possibilities of current and future AI developments
- contribution to seed discussions at the workshop about the sustainability of different approaches.

**Keywords**

sustainability, cultures of participation, personal information environment

## 1. Sustainability and its Different Facets

Sustainability refers to the ability to meet present needs without compromising the ability of future generations to meet their own needs. Its most prominent use is Environmental Sustainability {UN} with a focus on climate change, renewable energy and biodiversity. This paper uses different contexts to explore the concept of sustainability:

- **Social Sustainability** including themes such as democratization of participation, engagement of diverse stakeholders, integration of local knowledge
- **Cognitive Sustainability** including topics such as distributed cognition, collective intelligence, social creativity, linking action and reflection spaces
- **Technological Sustainability** including: co-creation, meta-design, seeding/evolutionary growth/reseeding model

These different facets are explored in the context of:

- **cultures of participation** providing opportunities, means, and rewards for all people to participate and to contribute actively in personally meaningful problems
- **personal information environments** refer to tools, platforms, devices, and digital ecosystems an individual uses to store, manage, access, and share information.

Grounded in End-User Development (EUD) perspectives focused on empowering all stakeholders (designers, users, workers, learners, teachers) to actively participate and to make their voices

*Joint Proceedings of IS-EUD 2025: 10th International Symposium on End-User Development, 16-18 June 2025, Munich, Germany*

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heard in personally meaningful problems, failure and success stories of previous developments will identify design principles and guidelines for making future developments more sustainable.

## 2. Failures

### 2.1 Expert Systems

A big hype developed around expert systems in the 1980s [1]). Te design was based on a framework that knowledge engineers would interview experts, capture their knowledge in explicit rules, and the resulting expert system would perform like experts in the domain and replace them. Some of the reasons why they could be sustained [2;3] in the long run were that users (e.g., medical doctors) could not evolve them as new insights become available. The overhyped expectations (e.g., the marketing claims and actual system capabilities) led to disappointment and provided one of the main reasons for the AI Winter in the late 1980s and 1990s.

**Lesson Learned:** Systems need to evolve and the end-users must be empowered (e.g.: with support for human problem-domain interaction) to contribute to this evolution. Support for the seeding, evolutionary growth, and reseeding (SER) model is critical [4].

### 2.2 One Laptop per Child (OLPC) Initiative

The OLPC initiative (https://en.wikipedia.org/wiki/One_Laptop_per_Child) was an ambitious project aiming to bridge the digital divide by providing affordable, durable laptops to children in developing countries. While it initially garnered widespread attention and support, the initiative struggled to sustain itself as a successful model in the long term. There are again many reasons that the initiative could not be sustained in the long run; the primary ones for our discussion being: it focused heavily on the hardware (the "$100 Laptop) and assumed that technology alone would transform education; it adopted a one-size-fits-all approach, failing to tailor its solutions to the specific needs of different communities.

**Lessons Learned:** Technology is necessary for enhancing and democratizing education — but it is not sufficient without support for robust community engagement, localized strategies, and a focus on long-term sustainability.

### 2.3 Wikis: Communal Memories

Wikis [5;6] were conceptualized as open, collaborative socio-technical environments designed to support communal memory, knowledge-sharing, and collective content creation. While there are notable success stories (see next section), most wikis did not succeed. For example: we created the seed for a Wiki to support the research groups supported by the National Science Foundation program "Science of Design" (https://www.nsf.gov/funding/opportunities/sod-science-design/12766/nsf07-505) which created some initial excitement of creating content among the funded research groups and people who were interested in the topic, but suffered from low contributor engagement over time leading to stagnation. Sustainability in wiki environments requires deliberate design choices that balance openness with quality control, empower communities through governance and incentives, and ensure the tools align with users' evolving needs. By learning from past failures, future wikis can better foster resilient, sustainable cultures of participation.

**Lessons Learned:** Many potential community efforts suffer from a lack of sustained participation ("Build It and No One Comes:") by ignoring the necessary combination of social and technical issues.[7]

## 3. Successes

### 3.1 LEGO: Sustaining the Creative Mindset

There is a substantial number of humans of all ages who play with LEGO not because they "have to" but because they "want to" [7]. LEGO's ability to engage users across generations makes it a powerful model for sustainable long-term involvement [8]. The LEGO system provides the foundation for a mindset of being an active, life-long learner and designer.

**Lessons Learned:** Create environments and use communities that foster creativity, adaptability, and continuous engagement facilitated by a low threshold and high ceiling.

### 3.2 Scratch

Scratch [9] is a programming environment promoting a culture of participation where users actively create, remix, and share projects. From a sustainability perspective, they support long-term engagement, skill-building, and inclusive learning ecosystems.

**Lessons Learned:** Scratch and the community using it is successful as a sustainable culture of participation by (1) Enabling long-term engagement through a participatory, remix-friendly platform, (2) Bridging the digital divide being free and by making programming accessible to broad communities, and (3) Fostering open-ended learning with a low-threshold and high-ceiling architecture.

### 3.3 Wikipedia

Wikipedia represents a **free, comprehensive, and neutral encyclopedia** accessible to everyone. It represents a success model for a CoP from which many design criteria can be derived.

**Lessons Learned:** (1) successful balance openness with governance; (2) evolution dynamic, evolving knowledge) over archival (static repositories); (3) incentive structures for the acquisition of social capital and recognition of participants motivating their sustained involvement.

### 3.4 CoPDA workshops

The 2025 CoPDA workshop is the 9th workshop in this series and previous workshops were associated with EUD, AVI, and NordiCHI conferences. We believe that the rationale of the ongoing interest in these workshops is based on the multi-faceted and interdisciplinary nature of "cultures of participation" and the identification of specific themes for the individual workshop that were regarded as essential challenges for creating a deeper understanding, frameworks and socio-technical environments in support of CoPs.

### 3.5 MOOCs: Failure or Success

Massive Open Online Courses (MOOCs) have generated enthusiasm, excitement, and hype worldwide as well as skepticism [10]. The promises of MOOCs were perceived to address SDG 4 "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" by fostering cultures of participation and lifelong learning by supporting "education for everyone and for all interests for free." Originally Invented and promoted by universities, in the years following commercial companies (e.g.: Coursera, edX, and Udacity) were formed to support the sustainability of these approaches.

### 3.6 Potential AI Contributions to Increase the Sustainability of CoPs and PIEs

AI is emerging as a tool for sustainability with a promise of being transformational. While there are substantial discussions and developments achieve how to ambitious climate and environmental goals, our interest is to explore principles and guidelines how future AI

developments can increase the successes and reduce the failures analyzed in the previous sections.

### 3.7 Major Google Objective: "Making AI more helpful for everyone"

Starting with a major address in 2023 (https://blog.google/technology/ai/google-io-2023-keynote-sundar-pichai/#helpful-ai), Google declared that to make progress in delivering its mission to organize the world's information and make it universally accessible and useful, it will explore and support the objective "Making AI more helpful for everyone".

### 3.8 Personal Information Environments: Challenges associated with their Sustainability

We have studied for a long time PIEs including Email, Endnote, Photos, Maps, Password Managers, and Apps used by most people in today's world. For these environments, "Experts" (users who know everything about the functionality of a PIE) no longer exist.

A fundamental design objective for PIEs:

$$\text{Utility} = \frac{\text{Value}}{\text{Effort}}$$

**Claim:** If stakeholders associate a high utility value with their PIEs they will engage in activities to learn, use, evolve, and sustain their PIEs over extended periods of time contributing to their quality of life [11].

### 3.9 AI replacing Humans or AI empowering Humans

How AI developments in the future will increase the sustainability of CoPS and PIEs and which design guidelines should be explored depends critically on which of the overall two fundamental objectives "AI replacing Humans" or "AI empowering Humans" are primarily pursued. This differentiation has guided our research for the last few decades [12;13] and is core objective of the research community focused on Human-Centered AI [14].

To succeed in sustaining cultures of participation and end-user development mindsets, the lessons learned from the analysis of failure and success briefly analyzed in earlier sections, design guidelines and principles can be grounded by characterizing objectives and developments falling in two fundamentally different approaches which will be briefly characterized.

**AI replacing Humans.** Developments of this approach can be characterized by:

- replacing teachers with Intelligent Tutoring Systems (ITSs) and tutorials such as Khanmigo (https://www.khanmigo.ai) with design objectives such as delivering instruction efficiently and effectively in a personalized way
- adaptive components
- grounded in an emulation approach based on the metaphor that to improve human-computer collaboration is to endow computers with "human-like abilities".

*weaknesses of this approach:*

- AI technologies are used in ways that constrain learner agency, focus on "close-ended" problems, and undervalue human connection and community.

*strengths of these approaches:*

- exploits non-human resources to support new levels of distributed cognition
- takes advantage in situations where AI components provide unique opportunities surpassing human abilities (e.g.: line calls in tennis, traffic jams identified by Goople Maps)

**AI empowering Humans. Developments of this approach can be characterized by:**

- stakeholders have control and autonomy
- personally meaningful problems
- wicked, open-ended problems with no final answers only design trade-offs
- design with and by people
- grounded in a complementing approach based on computers are not human and that human- centered design should exploit the asymmetry of human and computer by developing new interaction and collaboration possibilities

*weaknesses of this approach:*

- learning demands: how to cope with extensive learning demands required by tools that allow humans to exploit the benefits of complex HCAI technologies in distributed cognition approaches?
- participation overload: in the context of cultures of participation will the support for active engagement lead to participation overload (particularly in personally irrelevant activities)?

*strengths of this approach*

- control: Creating the tools that enable people to solve their own problems

## 4. Uses for LLMs (ChatGPT) Impacting CoPs and PIEs

One collaborative effort of the participants during the workshop could be to explore different uses of LLMs and their impact on the sustainability of CoPs and PIEs. My initial assumptions (grounded in the discussions of CoPDA'2024) which could serve for seeding discussions at the workshop:

- uses *positively* influencing sustainability:
  - provide access to relevant information (e.g., reducing information overload)?
  - serve as a digital assistant (e.g., drafting initial responses, increasing the backtalk of situations with critiquing systems)?
  - enhance learning by providing explanations and generating examples?
  - integrate adaptive features (generated by ChatGPT) with adaptable components (contributed by humans)?
- uses *negatively* influencing sustainability:
  - create an overreliance on technology?
  - suppress critical thinking skills needed to analyze bias and misinformation?
  - reduce the autonomy of end users by imposing its view and value system of the information generated?
  - replace workers in tasks that the workers can do better and would like to do themselves?

## 5. Summary Statement

In the current and future digital age, it is more important than ever that all people (learners, workers, citizens) can develop and exercise their abilities to think critically and creatively, engage and work collaboratively, exploit powerful tools supporting new levels of distributed cognition. This will empower them to address the challenges of a complex, fast-changing world full of wicked problems and contribute to the sustainability of CoPs and PIEs.

## Declaration on Generative AI

The author has not employed any Generative AI tools.

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