

Sustainability Awareness Framework (SusAF)



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Sustainability Awareness Framework

A question-based “sustainability Awareness Framework” (SusAF) for raising awareness of the impacts that a software system could have on sustainability

SusAF aims to:

- Help identify the sustainability impacts and effects of IT products and services on the five dimensions of sustainability (social, individual, environmental, economic, and technical) across three orders of effect (direct, indirect, and systemic)
- Support discussion about the anticipated effects of IT products and services



SusAF Process



Key Elements in SusAF

Foundation (1): 5 dimensions of sustainability



[GIBSE'13] Birgit Penzenstadler, Henning Femmer
A Generic Model for Sustainability with Process- and Product-specific Instances.
1st Intl. Workshop on Green In Software Engineering, Green By Software Engineering (at AOSD'13)

The 5 dimensions of Sustainability :

1. The **environmental dimension** is about conserving natural resources and protect global ecosystems to support health and wellbeing, now and in the future
2. The **economic dimension** is concerned with finance, profit, investment
3. The **social dimension** covers relationships between individuals and groups.
4. The **individual dimension** focus on o the maintenance of individual human capital
5. The **technical dimension** refers to maintenance and evolution, resilience of IT products, services or software systems

Key Elements in SusAF

Economic Dimension: maintaining financial capital

- Assets
- Capital
- Added Value

The focus is on how to design and develop IT products, services or software systems in a cost-effective manner.



Key Elements in SusAF

Technical Dimension: the ease of system transitions and evolution with changing requirements and condition.

‘How can IT products, services or software systems be designed and developed for easy evolution, maintainability, adaptability to changes in the future’?

Some factors:

- Technical debt
- Scalability
- Data integrity
- Software Testing



Key Elements in SusAF

Individual dimension: Well-being of individuals and equal access to services. It includes the ability of individuals (end users) to thrive and exercise their rights.

How does IT products, services or software systems support the individual endeavor towards the goals of that person (end user)?”

- Support adaptation
- Personalization (end user).
- Mental and physical well-being
- Self-respect

For software developers this individual sustainability may also mean their own satisfaction of their product.



Key Elements in SusAF

Social dimension: The factors that affect interaction between group of people or communities such as trust, equality.

‘What are the impacts of IT products, services or software systems on the society?’ Example:

- Communication
- sense of belonging,
- interaction and social equity



Key Elements in SusAF

Environmental dimension refers to the use and maintenance of natural resources. For software engineering (SE), 'How does IT products, services or software systems impact and affect the environment and energy consumption'. Example:

- Material and resource usage
- Energy usage
- CO2 Emissions



Key Elements in SusAF

Social	(1) Sense of Community; (2) Trust; (3) Inclusiveness and Diversity; (4) Equality; (5) Participation and Communication;
Individual	(1) Health; (2) Lifelong learning; (3) Privacy; (4) Safety; (5) Self Awareness and Free will;
Environment	(1) Material and Resources; (2) Soil, Atmospheric and Water Pollution; (3) Energy; (4) Biodiversity and Land Use; (5) Logistics and Transportation;
Economic	(1) Value; (2) Customer Relationship Management (CRM); (3) Supply chain; (4) Ecosystem; (5) Governance and Processes; (6) Innovation and R&D;
Technical	(1) Maintainability; (2) Usability; (3) Extensibility and Adaptability; (4) Security; (5) Scalability;

Key Elements in SusAF

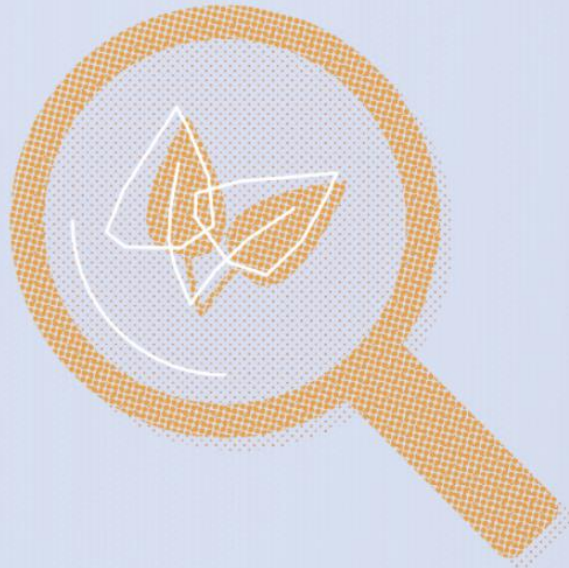
The assessment of sustainability effects on different time scale are classified into three order of impacts:

1. **First order (Immediate effects)** are the direct effects of the production, operation, use and disposal of socio-technical systems. This includes the properties and the full lifecycle impacts, such as in the Life-Cycle Assessment (LCA) approach. Although the timeline for the changes might be rather long (as we look at the lifecycle of the product), these effects are still direct consequences of the product.
2. **Second order (Enabling effects)** of operation and use of a system include any change enabled or induced by the system usage. These effects are not tied to the actual product but are side effects when the product is taken into use.
3. **Third order (Structural or systemic)** effects represent structural changes caused by the ongoing operation and use of the socio-technical system. These are usually consequences of changed habits due to the use of product and typically take a longer time to evolve. However, these effects are the game changers in sustainable development, effects that can truly make a difference.

SusAF Scoping

Warm-Up

Introduce participants,
the SusAF,
and the IT product



Description of the IT **Product or Service**:

🕒 10 Min

List the **known sustainability effects** (SDG? CSR?):

🕒 10 Min

Key Elements in SusAF

Discuss & Select

Instructions

🕒 7 Min discuss & select for every single question

Discuss all the ideas within the team

- a. Decide which effects are worth capturing
- a. Paste in likelihood & impact matrix



Prioritize: Classify the effects using their likelihood and their level of impact



Dimensions: Social

Sense of community means the feeling of belonging to an organization, to an area or to a group of like-minded people.

- How can the product or service affect a person's sense of belonging to these groups?

Trust means having a firm belief in the reliability, truth, or ability of someone or something.

- How can the product or service change the trust between the users and the business that owns the system?

Inclusiveness and diversity refers to the inclusion of people who might otherwise be excluded or marginalized.

- How can the product or service impact on how people perceive others?
- What effects can it have on users with different backgrounds, age groups, education levels, or other differences?

Equity means the quality of being fair and impartial.

- How can the system make people to be treated differently from each other? (think data analytics or decision support)

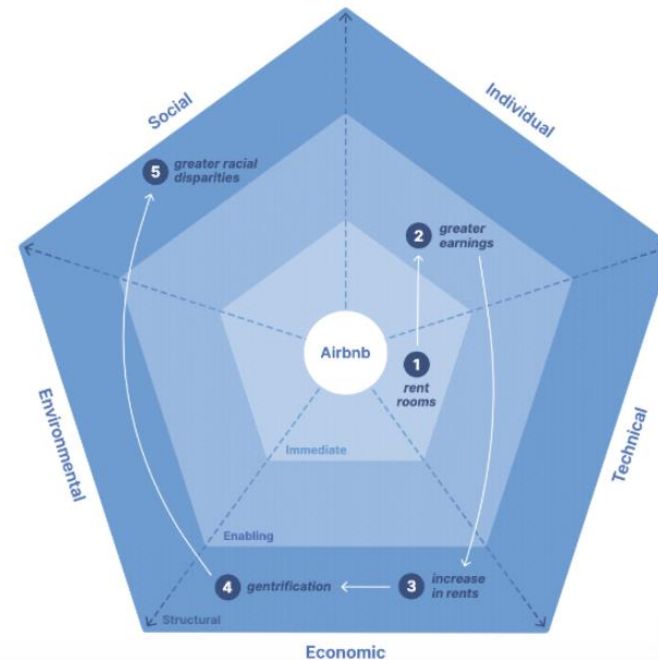
Participation and communication refers to imparting or interchanging thoughts, opinions or information by speech, writing, or signs.

- How can the product or service change the way people:
 - › create networks?
 - › participate in group work?
 - › support, criticize or argue with others?

Key Elements in SusAF

Sustainability Awareness Diagram

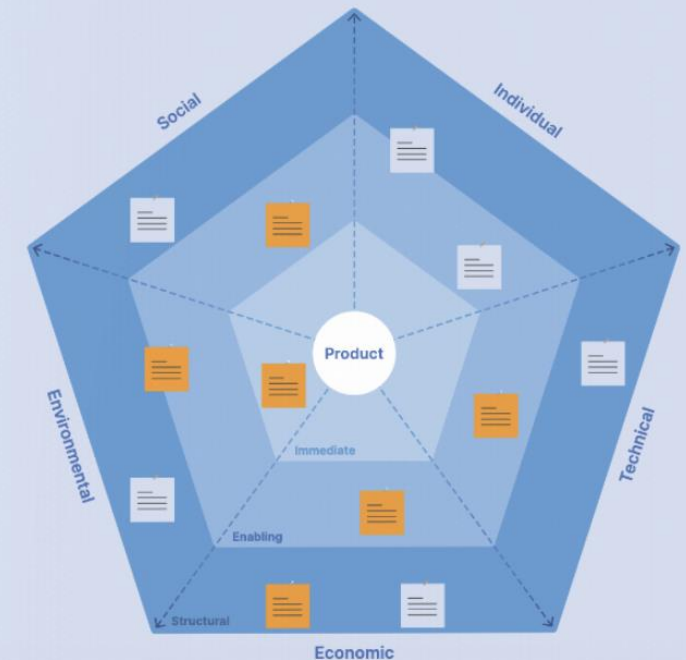
- › Is based on a radar chart
- › It is about cause and effects
 - › How do we get to a specific effect?
 - › What does this effect lead to?
- › Effects are placed in the dimensions and order of effects. They are connected with arrows (Cause and Effect); see Airbnb example.



Filling the SusAD

15 Min

1. Paste the effects from the high impact and likelihood corner of the matrix onto the SusAD according to dimension and order of effect.
2. Look at the remaining, less likely or less impactful, ones and choose which ones to still add to the SusAD (so it does not get too crowded).
3. Imagine your IT product or service is being used by many people over an extended period of time. What consequences may this have? And how do they relate?



- **SusAD:** a graphical illustration to visualize these impacts
- Write down effects/impacts of the IT product or service or software system features according to dimension and order of effect.

Key Elements in SusAF

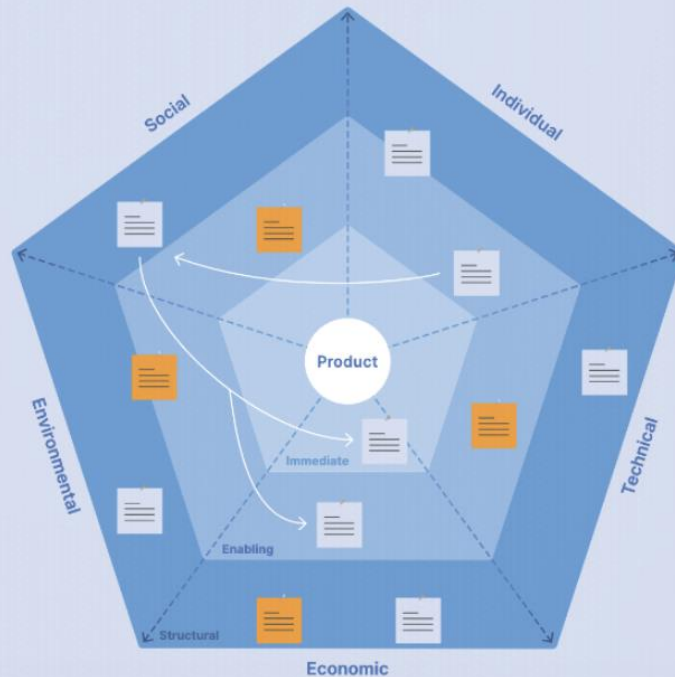
Chains of effects

Identify chains of effect:

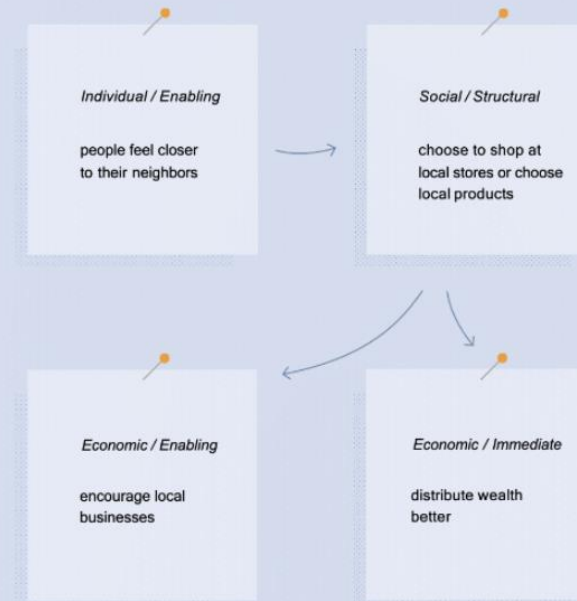
🕒 15 Min

Draw relations between the effects that may happen when many people use this product or service for several years:

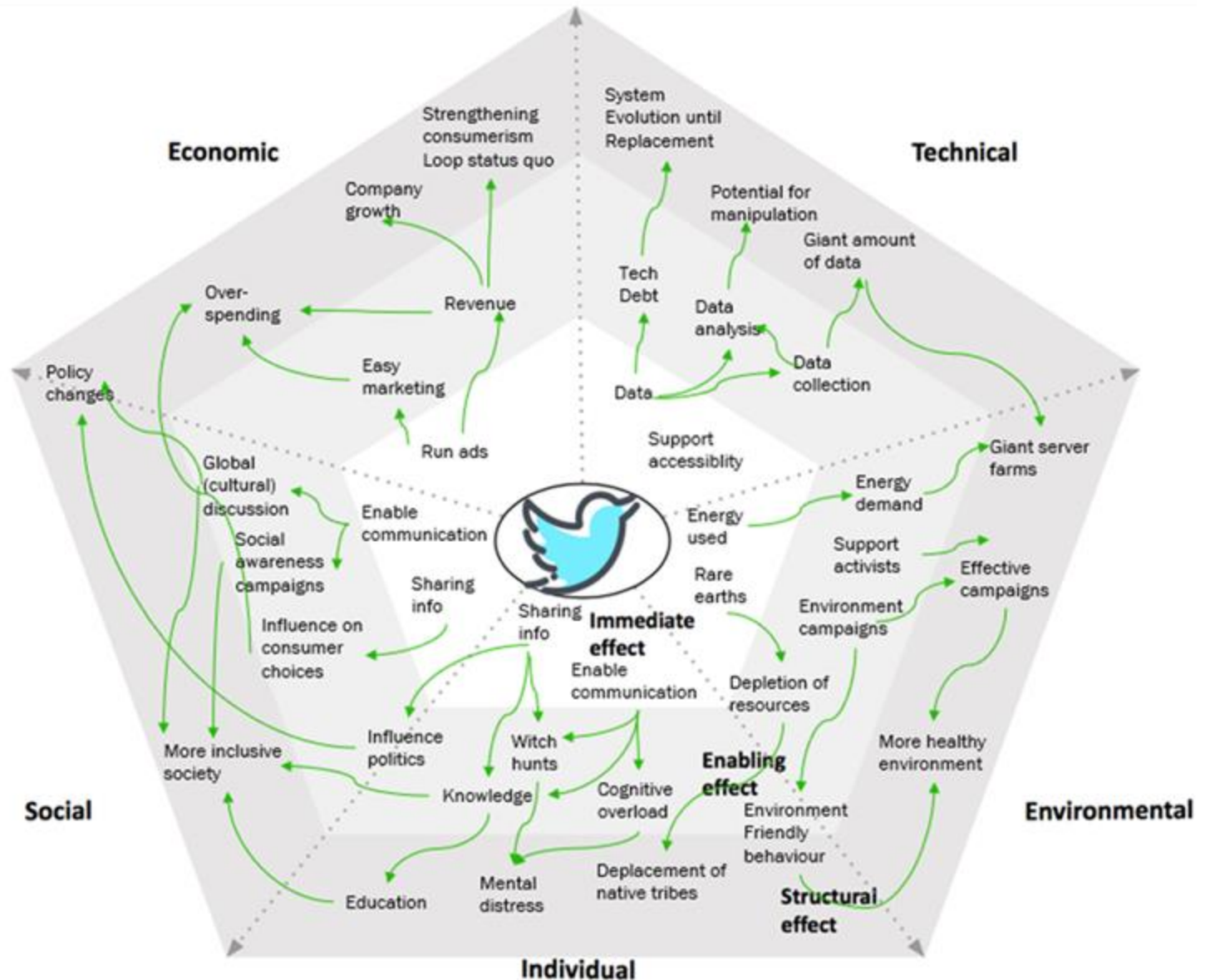
1. Think about which second order effects stem from which first order effects, and
2. Which third order effects can be a consequence of some second order effects
3. Effects can also have a related effect of the same order, and/or of a different dimension



Example: If people feel closer to their neighbors, they can choose to shop at local stores or choose local products, which can encourage local businesses and ultimately distribute wealth better



Key Elements in SusAF - Example



Analysis: SusAD

- Draw a relationship between effects that may happen when people use the IT product or services or software system

Key Elements in SusAF

Synthesis: Threats, opportunities, actions

- A structure to communicate sustainability impacts to diverse stakeholders.

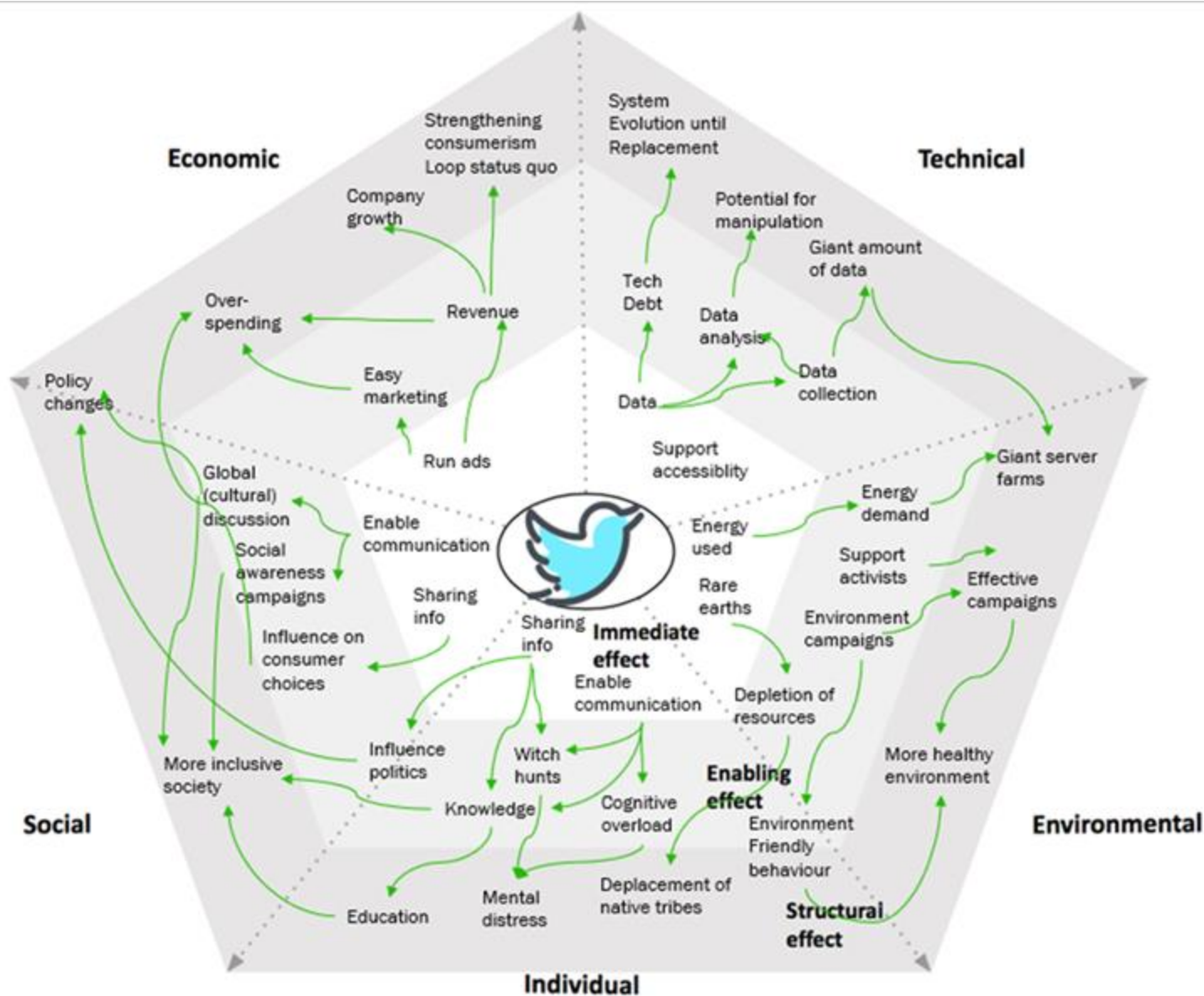


Synthesis: Threats, opportunities, actions

Identification of the biggest threats and opportunities ⌚ 15 Min
as well as the development of adequate measures

Opportunities → Actions

Threats → Actions



Questions ?