← Slides are online!

Exercise workbook (3rd lecture part) →

4. Social and Individual Sustainability

Sustainable Software Engineering
CS4575

Luís Cruz
L.Cruz@tudelft.nl

Carolin Brandt
C.E.Brandt@tudelft.nl

Enrique Barba Roque
E.BarbaRoque@tudelft.nl

Announcements

Organizational

Thursdays = Steering meetings

(No fixed events on Thu after W3.3)

4	2	**Lecture.** Social and Individual Sustainability.
6	2	**Lecture.** Green Software Engineering — Part II: units of energy.
5	2	**Project.** Project 1 - steering meeting and formative assessment.
7	3	**Lecture.** Green Software Engineering — Part III: Energy efficiency in mobile computing; carbon-aware data centres.
9	3	**Lecture.** Green AI.
8	3	**Project.** Project 1 - steering meeting.
	3	⏰ Deadline for Project 1 Friday, Feb 28.

Announcements
Organizational

- Is everyone part of a project group?

- You need to partake in the project to receive a grade for this course!

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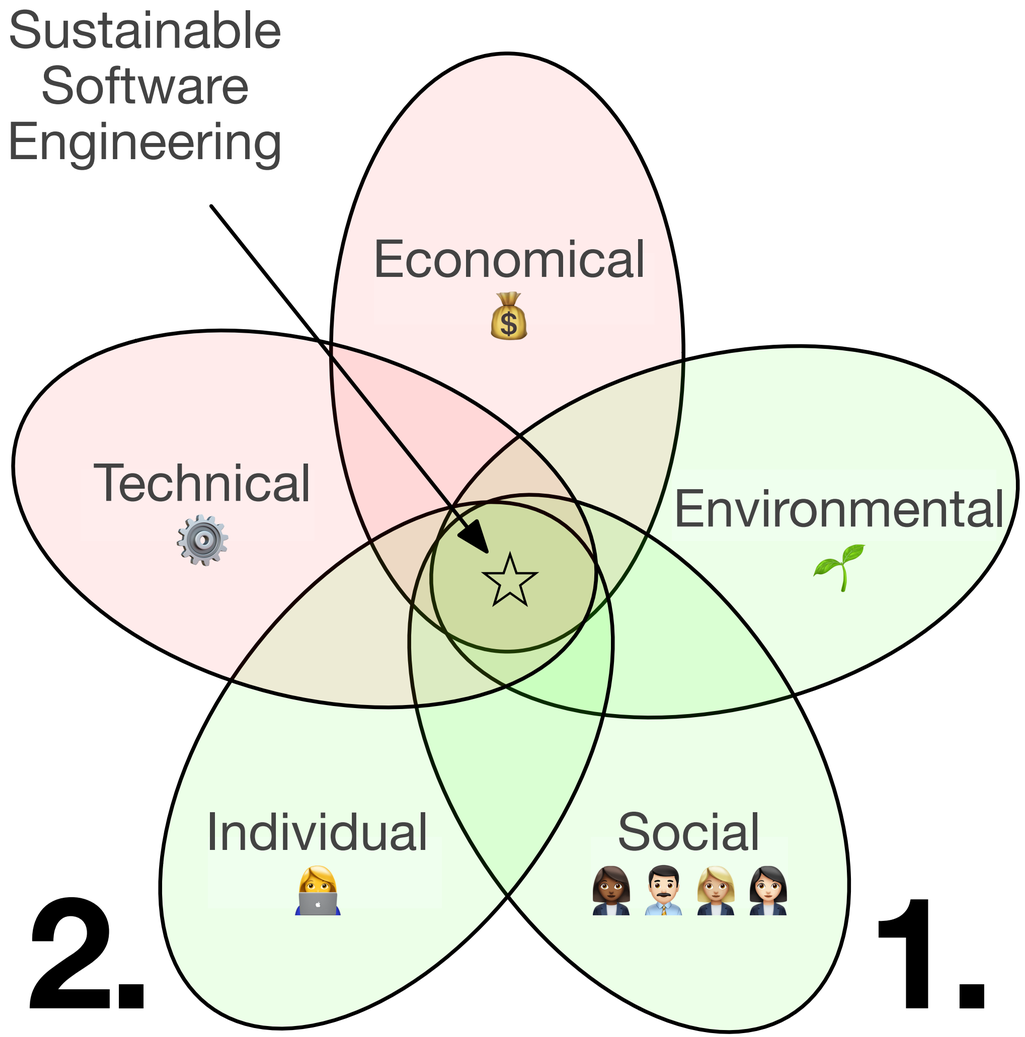
My research line:

Human- and Developer-centered Software Engineering

*Considering the **humans who will use** our software*
*and the **developers who create it** during software engineering processes.*



3. Exercise: Application with the Sustainability Awareness framework

At the end of this lecture, you will be able to…

- Understand key facets of social sustainability
- Explain factors influencing developer experience
- Apply the sustainability awareness framework to identify chains of sustainability effects caused by software systems.

Social Sustainability

Social Sustainability

In Software Engineering

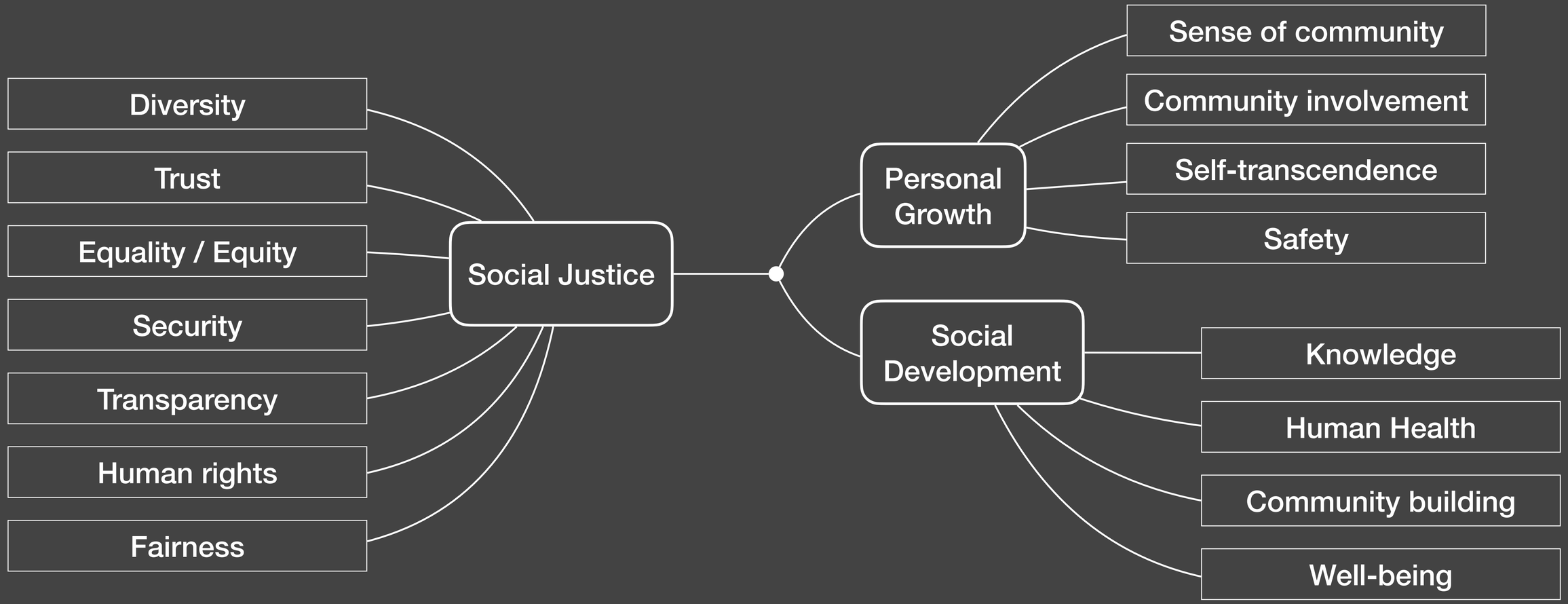
- refers to the impact of the software on the broader social and societal context.
- concerned with **societal communities** (groups of people, organisations) and the factors that impact **trust in society**.
- preserving the societal communities in their solidarity and services.

What facets concretely should we consider?

SUSTAINABLE DEVELOPMENT GOALS

Social Sustainability Goals, in SE Research

Moises de Souza et al. (2023)



Using Frameworks / Checklists is essential

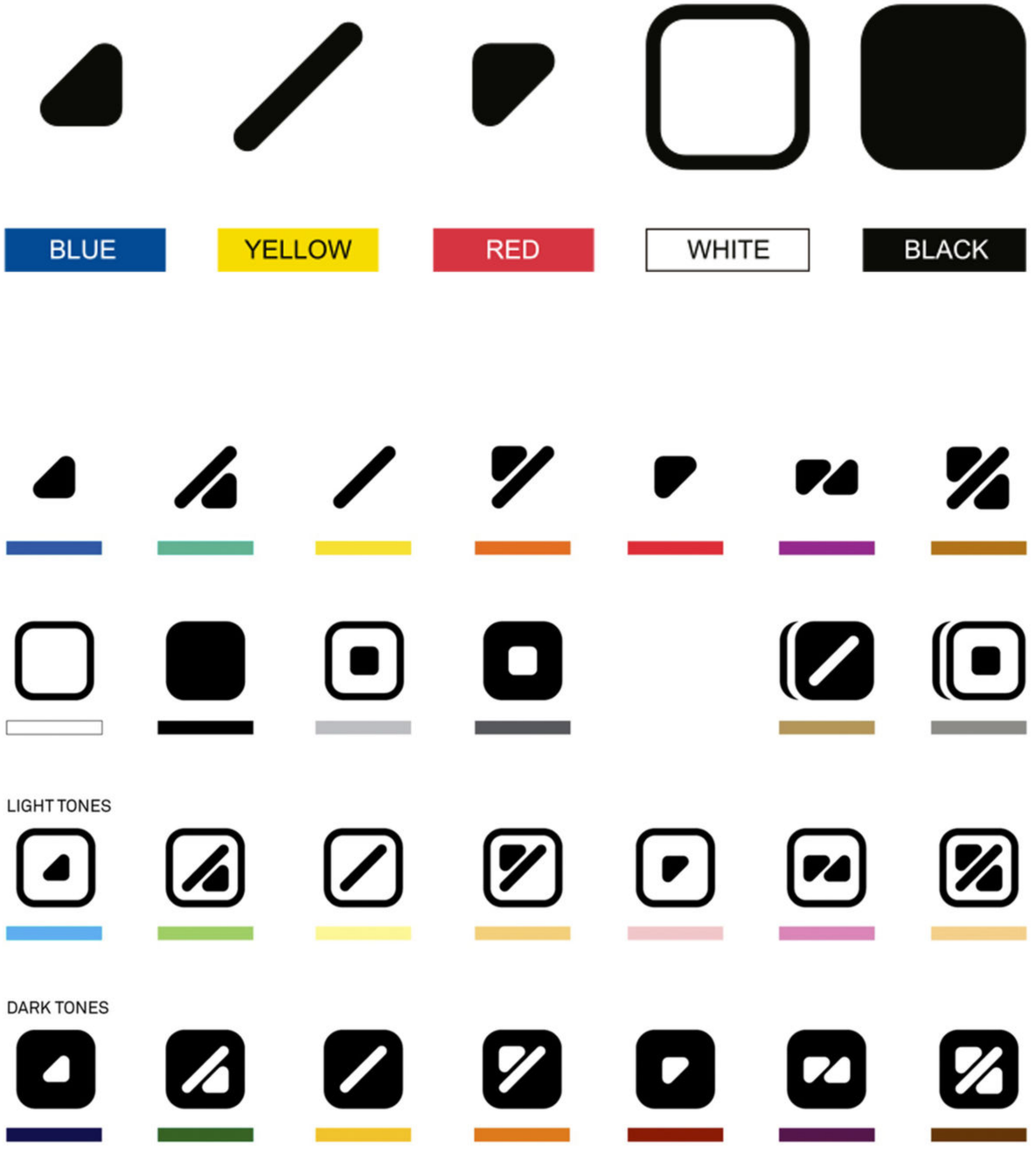
- Everyone personal experiences & values
  - Influence what we find important in society
  - Blind spots guaranteed!
  - Diverse teams can help :)

Inclusiveness

- Accessibility features
  - Color-blind users
- Elderly people
- People without digital presence
- …
- Gender, Culture, Age, Backgrounds…

ColorADD

The Color Alphabet



Gender-biased AI models

- Amazon’s recruiting system based on AI models.
- Automatically processing CV’s to do a first-stage screening
- Feedback loops: the training data contains **unwanted biases**. I.e., the software was amplifying the male dominance across the tech industry.
- (Fixed in 2015)
- **How can we prevent such biases?**

Inclusive Language in Technology

- Replace potentially offensive language in code bases and documentation
- General Guidelines When Writing Code or Documentation **(based on Academy Software Foundation)**
  - 1. Avoid using terms that have social history.
  - 2. Avoid using idioms and jargons.
  - 3. Write inclusive examples. (Avoid culturally-specific examples)
  - 4. If you’re unsure, ask.

Common terms and replacements (I)

Inclusive Language in Technology

- **Socially-charged language**
  - Master, slave → primary/main, secondary/replica
  - Owner, master → lead, manager, expert
  - Blacklist → deny list, exclusion list, block list, banned list
  - Whitelist → allow list, inclusion list, safe list
  - Native feature → core feature, built-in feature
  - Culture fit → values fit
  - Housekeeping → cleanup, maintenance

Common terms and replacements (II)

Inclusive Language in Technology

- **Gendered Language**
  - Man hours → labor hours, work hours
  - Manpower → labor, workforce
  - Guys (referring to a group) → folks, people, engineers/artists
  - Girl/Girls (referring to women age 18 and older) → woman/women
  - Middleman → middle person, mediator, liaison
  - Gendered pronouns (he/him/his, she/her/hers) → they, them, theirs

Common terms and replacements (III)

Inclusive Language in Technology

- **Ableist Language** (superiority)
  - Crazy, insane → unpredictable, unexpected
  - Normal → typical
  - Abnormal → atypical

Common terms and replacements (IV)

Inclusive Language in Technology

- **Ageist Language**
  - Grandfather, grandfathering, legacy → flagship, established, rollover, carryover
- **Violent language**
  - Crushing it, killing it → elevating, exceeding expectations, excelling

Examples

Inclusive Language in Technology

- Github (master -> main)
- Linux kernel’s official coding-style
- Apple’s official coding style: https://help.apple.com/applestyleguide (whole chapter on inclusive writing)
- Twitter Engineering

Twitter Engineering @TwitterEng · Jul 2, 2020

Inclusive language plays a critical role in fostering an environment where everyone belongs. At Twitter, the language we have been using in our code does not reflect our values as a c
We want to chan

> **regynald** @
> Twitter eng rec
> language in ou
> want to speak
> so far.
>
> cnet.com/news

Twitter Enginee
@TwitterEng

We're starting with
away from using in
such as:

Avoid non-inclusive language	⇒	Prefer inclusive versions
Whitelist	⇒	Allowlist
Blacklist	⇒	Denylist
Master/slave	⇒	Leader/follower, primary/replica, primary/standby
Grandfathered	⇒	Legacy status
Gendered pronouns (e.g. guys)	⇒	Folks, people, you all, y'all
Gendered pronouns (e.g. he/him/his)	⇒	They, them, their
Man hours	⇒	Person hours, engineer hours
Sanity check	⇒	Quick check, confidence check, coherence check
Dummy value	⇒	Placeholder value, sample value

6:52 PM · Jul 2, 2020

https://twitter.com/TwitterEng/status/1278733305190342656

Individual Sustainability

Individual Sustainability

maintaining human capital (e.g., health, education, skills, knowledge, leadership, and access to services)

→ *Well-being of the individuals in an organization*

- It is difficult to **recruit** and **retain** good people
- Productivity requires **respecting** people
- It is important that responsibilities **reflect** their **skills** and **experience**.

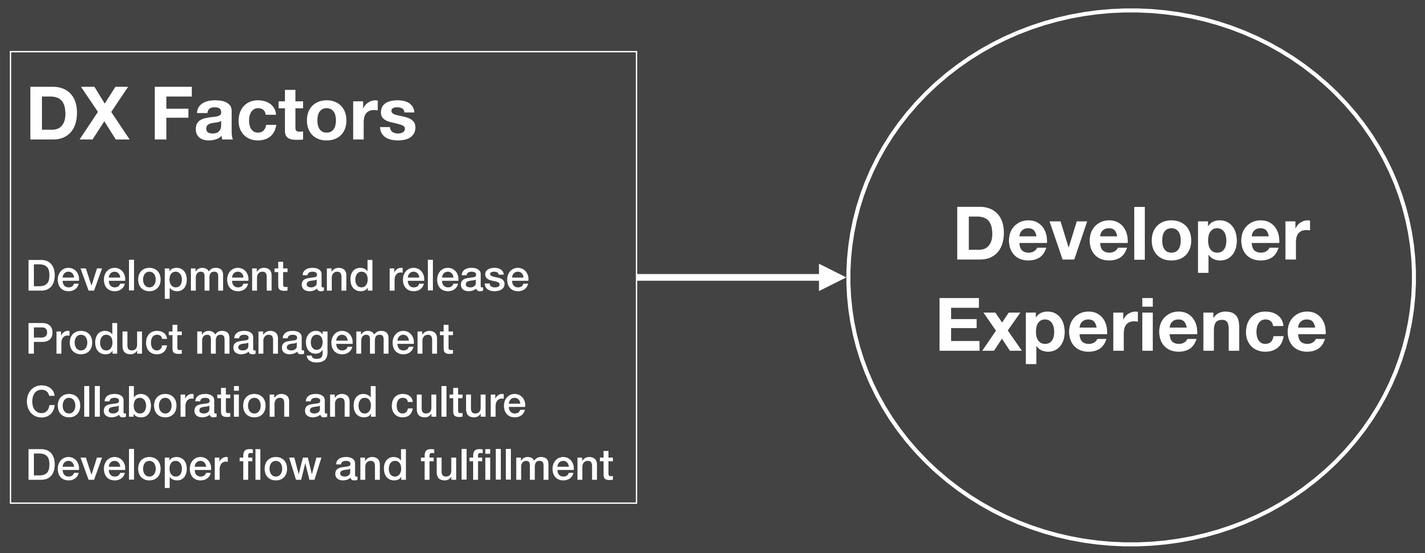
Zooming in: Developer Experience

- Typically: try to measure developer productivity & satisfaction
- Depending on individual, team, organization and project context

- Developer Experience captures how developers **feel about, think about and value their work**.
- Which **actionable** factors impact developer experience?

Actionable Developer Experience Framework

Greiler et al.



DX Factors

Development and release

- Codebase health
- Development environment
- Automated testing
- **Frictionless release**

Product management

- Clear goals, scope, requirements
- Working iteratively
- Reasonable deadlines
- Having a say on roadmap/priorities
- **Providing value to the business**

Collaboration and culture

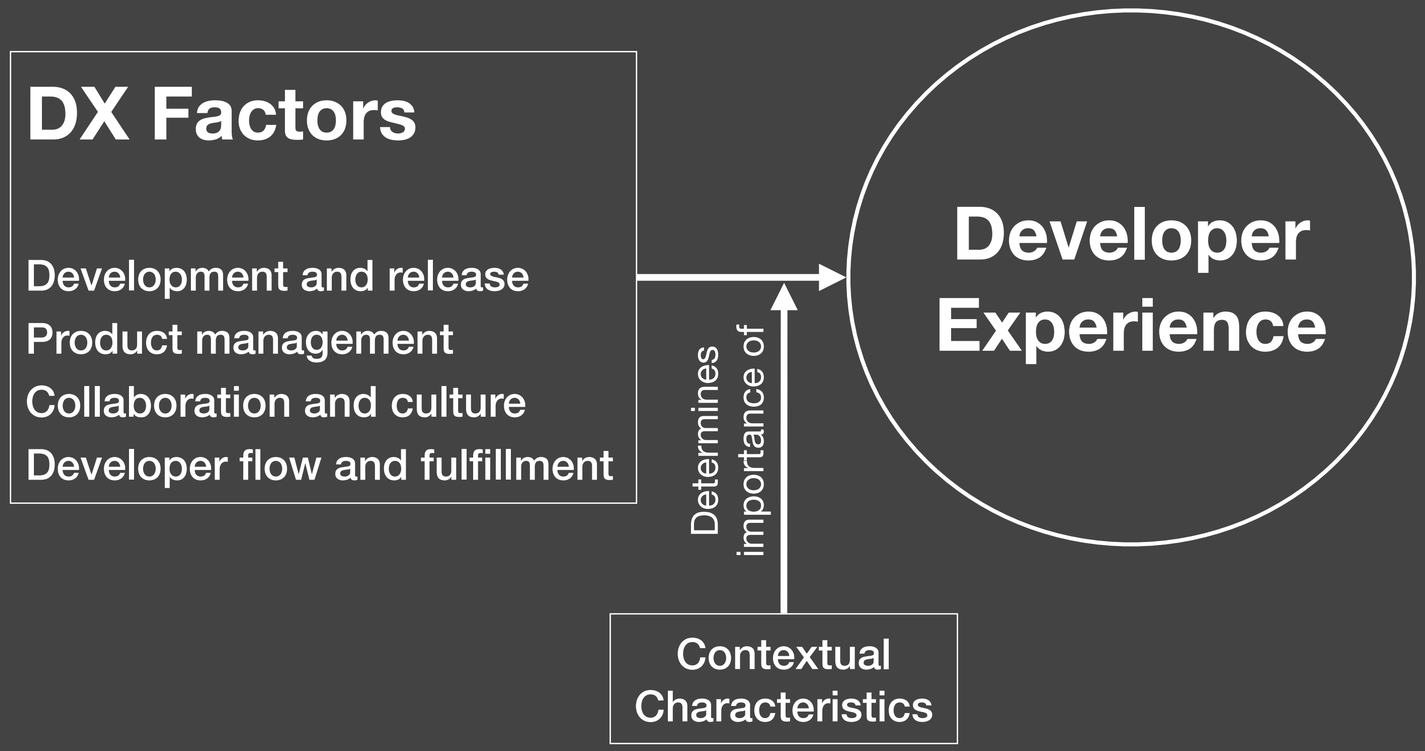
- Supportiveness
- Knowledge sharing
- Feeling connected
- Code review process
- Collaboration between departments
- **Psychological safety**
- Communication
- Having aligned values
- Getting recognition

Developer flow and fulfillment

- Autonomy
- Challenging/stimulating work
- Making progress without obstacles
- **Uninterrupted time**
- Work-life balance
- Learning
- Stability of job and team
- **Clear paths for career growth**

Actionable Developer Experience Framework

Greiler et al.



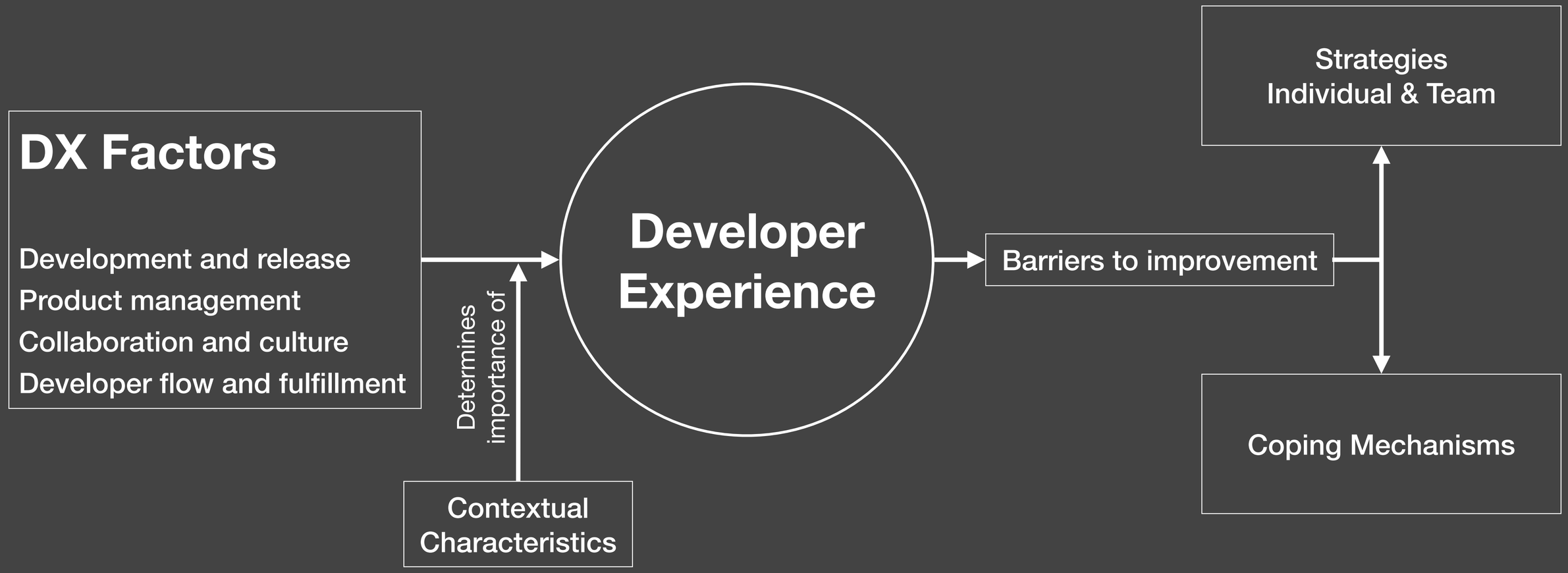
Contextual Factors

Influence importance of DX Factors

- **Seniority (Junior vs. Senior Dev)**
- Presence & frequency problems
- Expectations
- **Personal interests**
- Company goals, Company maturity

Actionable Developer Experience Framework

Greiler et al.



DX Effects

Often multiple combined!

Barriers to improvement

- Low prioritization
- Inability to quantify problems
- Lack of visibility/awareness
- Lack of buy-in
- **Lack of ownership**
- Undefined expectations
- **Lack of incentives**
- Unclear process
- No viable solutions
- Organizational politics

Strategies

Individual:

- **Job crafting**
- Taking risks
- Speaking up
- Local improvement
- Workarounds
- **Mimicking success**
- Being pragmatic

Team:

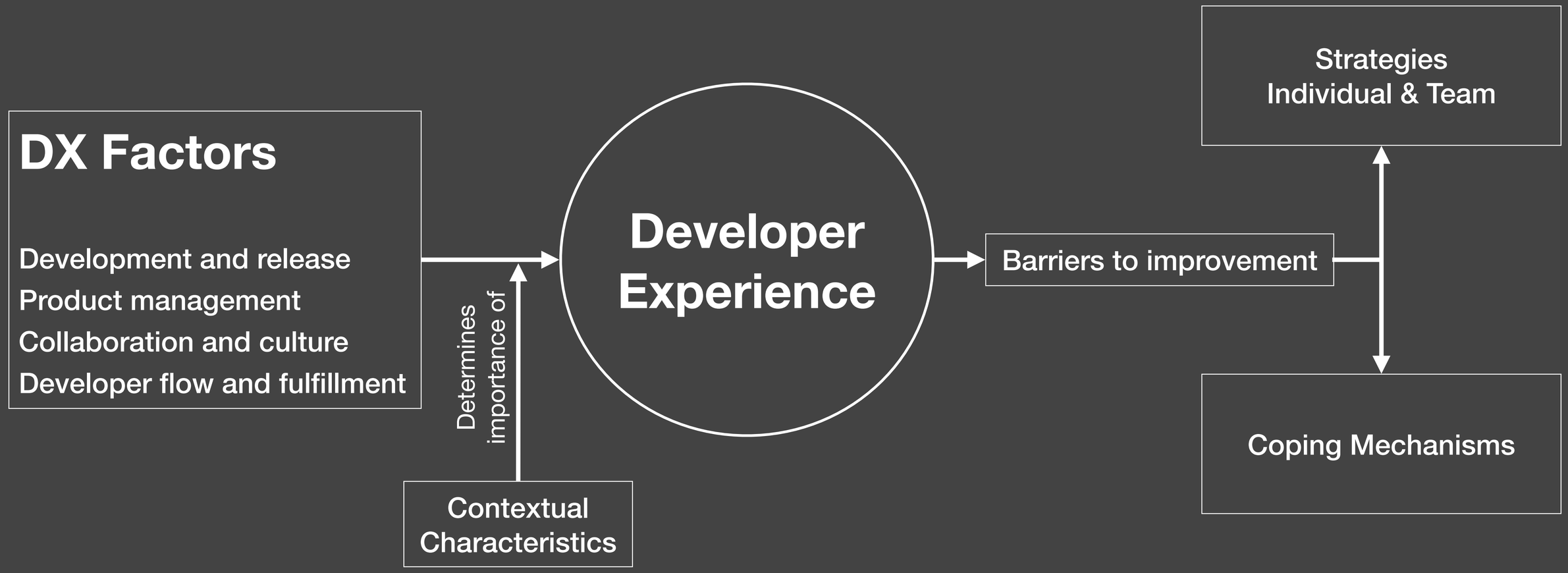
- Building bridges
- Creating transparency
- Convincing others
- Making incremental changes
- Metrics and measurements
- **Having a driver**
- Involving experts

Coping Mechanisms

- Focusing on personal projects
- **Validating negative experiences**
- Working overtime
- **No longer speaking up**
- Reduced engagement
- Gaming the system
- Leaving their job

Actionable Developer Experience Framework

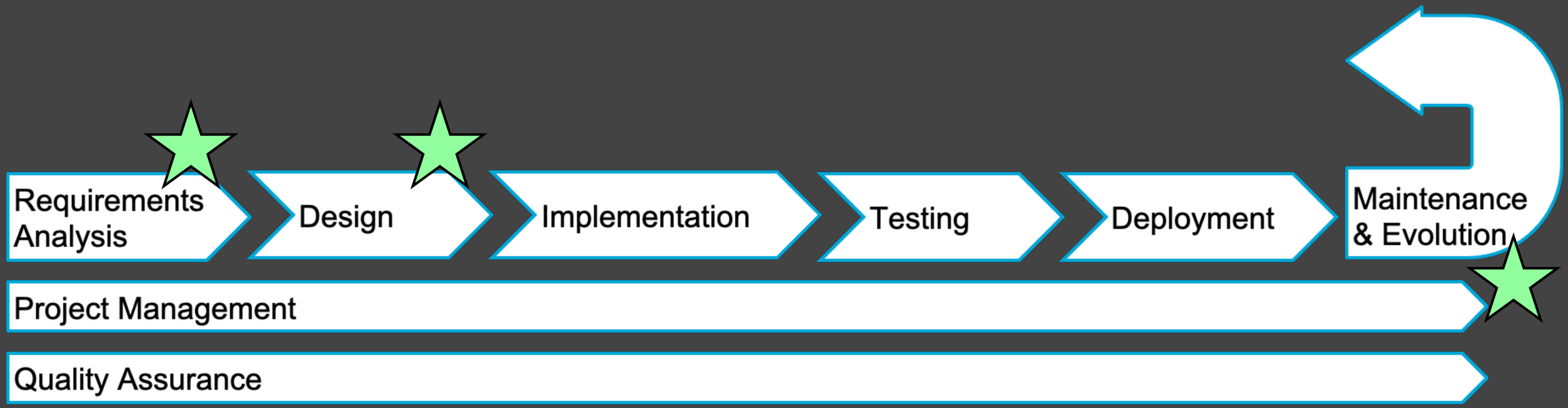
Greiler et al.



How can we put this into action in SE?

The Sustainability Awareness Framework

Where in the SE process?



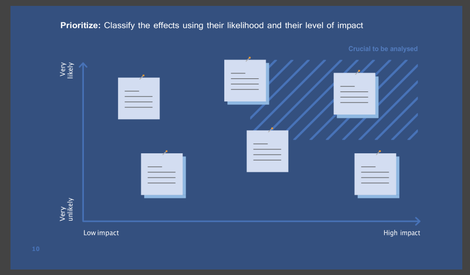
SusAF

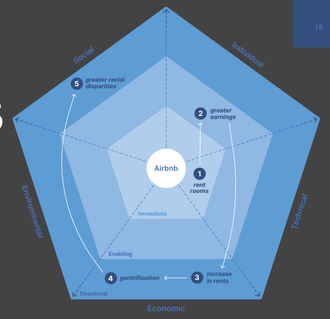
- Structured framework for creating awareness for sustainability during requirements engineering.

- Created by the people behind the  KARLSKRONA MANIFESTO FOR SUSTAINABILITY DESIGN

SusAF structure

- Brainstorm about potential effects, with the help of **question lists**
- **Prioritize** effects according to likelihood and level of impact
- Build **chains of effects** → discover causal relationships
- Identify opportunities & threats + adequate **actions**





Exercise: Applying SusAF

- **We'll do a shortened version of the workbook**: https://www.suso.academy/en/sustainability-awareness-framework-susaf/

You can identify your idea for Project 2 in this exercise! :)

Step 0: Pick an IT Product / Service

3 minutes

- Together with your neighbors / table

- Your target for project 1?
- Brightspace / Queue / Weblab / Osiris / MyTimetable
- Your project for another course

- Choose to focus on **either social or individual** sustainability

Step 1: Brainstorm alone

p. 9

5 minutes

- Read the questions for your dimension. (social: p. 11, individual: p. 12)

- **For yourself**: write down effects coming to mind
  - Consider effects of the product/service, working process and business model.
  - Consider positive and negative effects
  - Quantity over quality

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?

Social Dimension of Sustainability

Betz et al. "SusAF Workbook"
https://www.suso.academy/en/sustainability-awareness-framework-susaf/

Health means the state of a person‘s mental or physical condition.
› › How can the product or service improve or worsen a person’s physical, mental, and/or emotional health? (For example, can it make a person feel anything good or bad - e.g. (under)valued, (dis)respected, (in)dependent, or coerced?)

Lifelong learning means the use of learning opportunities throughout people‘s lives for continuous development.
› › How can the product or service affect people’s competencies?

Privacy means being free from intrusion or disturbance in one‘s private life.
› › How can the product or service expose (or help to hide) a person’s identity, whereabouts or relations?

Safety means being protected from danger, risk, or injury.
› › How can the product or service expose (or protect) a person from physical harm?
› › How can it make a person feel more (or less) exposed to harm?
› › What if used in an unintended way?

Self-awareness and Free will means the capacity of an individual to act or make decisions on their own.
› › How can the product or service empower (or prevent) a person from taking an action/decision when necessary?
› › Can those affected by the product or service understand its implications, express concerns or be represented by someone?

Individual Dimension of Sustainability

Betz et al. “SusAF Workbook” https://www.suso.academy/en/sustainability-awareness-framework-susaf/

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

Step 2: Discuss & Prioritize

p. 10 / p. 26

10 minutes

As a team:

- Cluster / Merge effects.
- Which are worth capturing?

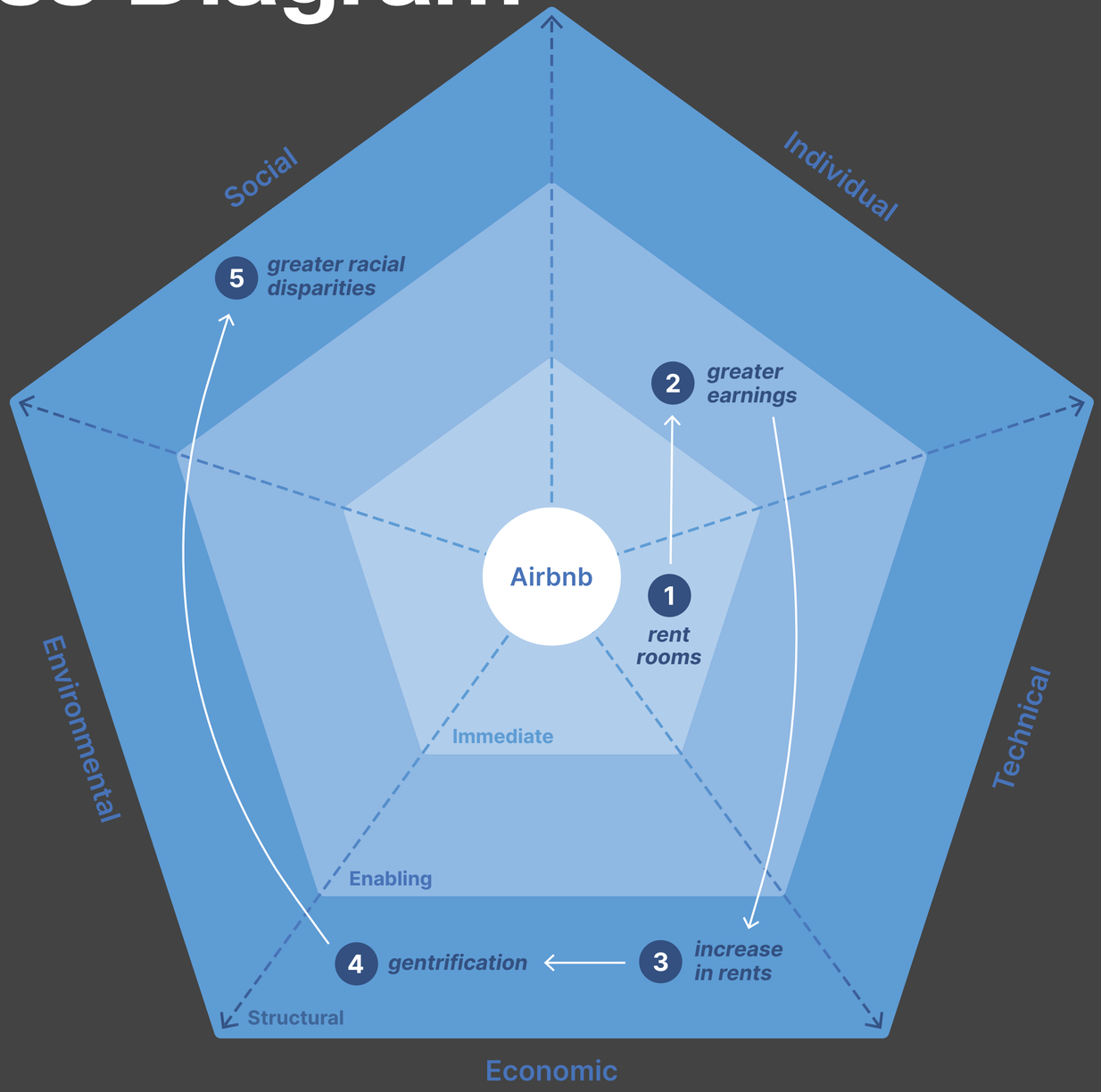
- Prioritize after likelihood & level of impact

Sustainability Awareness Diagram

Chains of effects

- Radar chart
  (5 sustainability dimensions)

- Cause & effect:
  How to get to specific effect?
  What does the effect lead to?



The three orders of effects

- **Immediate** effects are the direct impact of creating, using, and disposing of a software system, including its features and environmental impact throughout its life cycle.

- **Enabling** effects occur over time as the software system is used. Can lead to changes in resource consumption, social norms, policies, and laws.

- **Structural** effects are persistent changes observable at the macro level. Ongoing use of a new software system can lead to changes in capital accumulation, social norms, policies, and laws, and our relationship with the natural world.

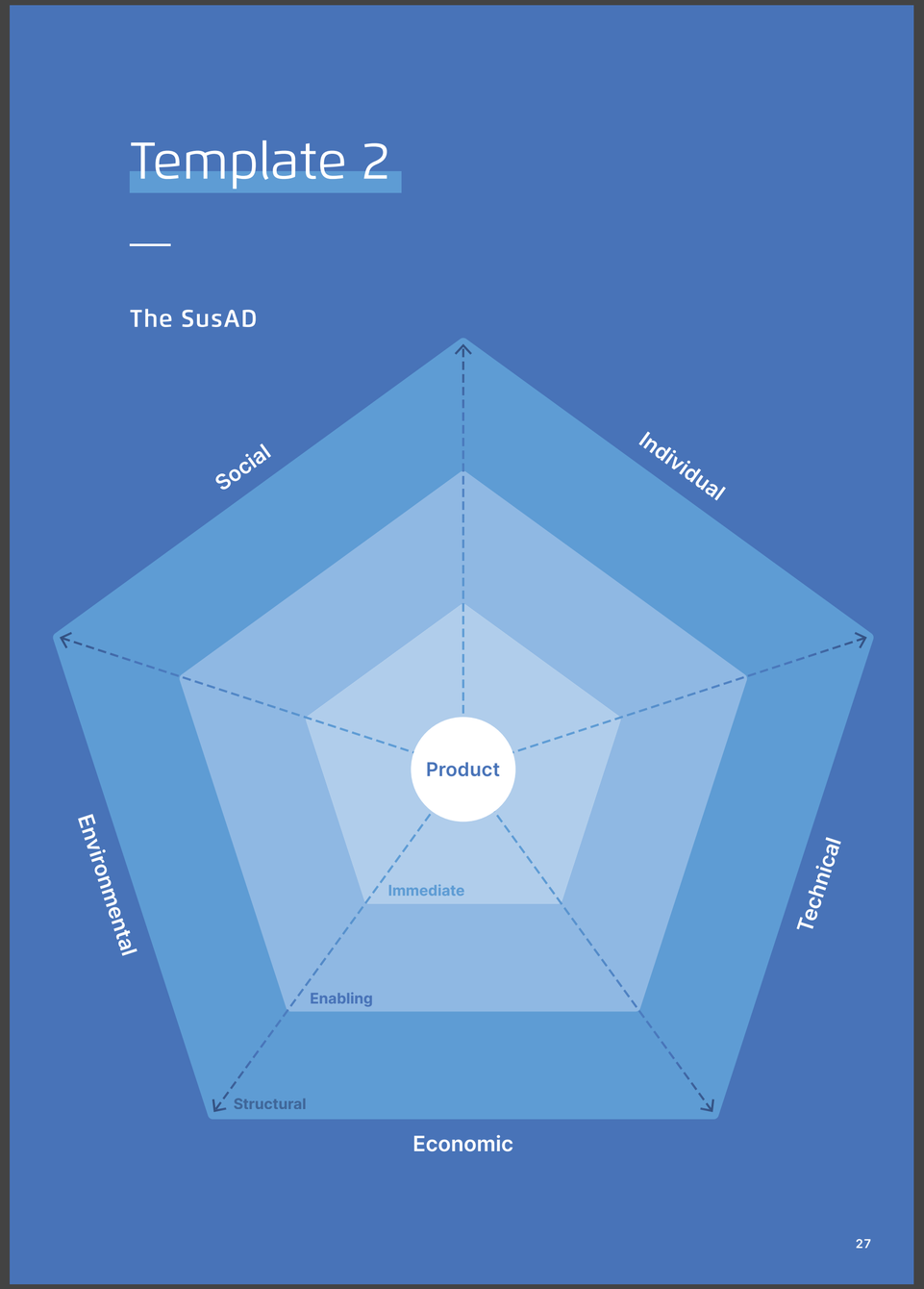
Step 3: Fill the SusAD

p. 21 / p. 27

5 minutes

As a team:

- Put effects from the matrix onto your SusAD according to dimension and order of effect.
- Imagine your IT product or service is being **used by many people over an extended period** of time.
  What consequences may this have? How do they relate?
  → Put these on the SusAD as effects too!



Identify Chains of Effects

p. 22

10 minutes

As a team:

- Draw relations between the effects that may happen **when many people use this product or service for several years**:
- Think about:
  - which second order effects stem from which first order effects, and
  - which third order effects can be a consequence of second order effects
- Effects can also **relate across dimensions**!

Synthesis: Threats, Opportunities, Actions
p.25

- Last step:
  Translate effects into opportunities & threats.
- Identify adequate measures to leverage / address these.

Recap

- Social sustainability: preserve communities, solidarity and services
  - Use Frameworks / Checklists to check biases
- Individual sustainability
  - Developer experience framework: Individual context matters
- Application: Sustainability Awareness Framework

Further Reading

Social Sustainability

- Moises de Souza et al. (2024). **“Social Sustainability Approaches for Software Development: A Systematic Literature Review”**.
- Duboc et al. (2020). **“Requirements engineering for sustainability: an awareness framework for designing software systems for a better tomorrow”**.
- https://www.suso.academy/en/sustainability-awareness-framework-susaf/
- Lago et al. (2024). **“The sustainability assessment framework toolkit: a decade of modeling experience”**.
- https://github.com/S2-group/SAF-Toolkit/tree/main

Further Reading

Individual Sustainability

- Greiler et al. (2024). **“An Actionable Framework for Understanding and Improving Developer Experience”**.

Extra Slides

- Values (social sustainability)
- Social-centered ICT subfields
- Value-Sensitive Software Development Framework (VSSD)