MAKING SUSTAINABILITY SOCIAL

Integrating Social Acceptance and Trade-Offs into Sustainable and Safe by Design (SSbD)

Despoina BRASINIKA
Ioanna STATHOPOULOU
Thomas PARISIS

APCL.

Funded by the European Union

Why Social Dimensions Matter in SSbD

- Sustainability often seen as technical and/or environmental
- Social dimensions often undervalued or added late
- Social impact and acceptance are key to real-world success
- Failure to address them = resistance, rejection or inequity

Funded by the European Union

Clarifying the terms - *Social Acceptance* and *Social Impact*

- ***Social acceptance*** **:** Degree to which technologies are resisted or embraced

Source: Wüstenhagen, R., Wolsink, M., Bürer, M.J., (2007). *Social acceptance of renewable energy innovation:An introduction to the concept,* Energy Policy Journal, volume 35 , issue 5, pp. 2684, DOI:10.1016/j.enpol.2006.12.001

Funded by the European Union

Clarifying the terms - *Social Acceptance* and *Social Impact*

- ***Social Impact*** **:** Consequences(negative/positive) on people, institutions, practices
- They are distinct but interlinked : *impact* informs *acceptance*
- Failure to address them = resistance, rejection or inequity

Funded by the European Union

Why This Matters Now : A Science and Technology Studies Perspective (STS)

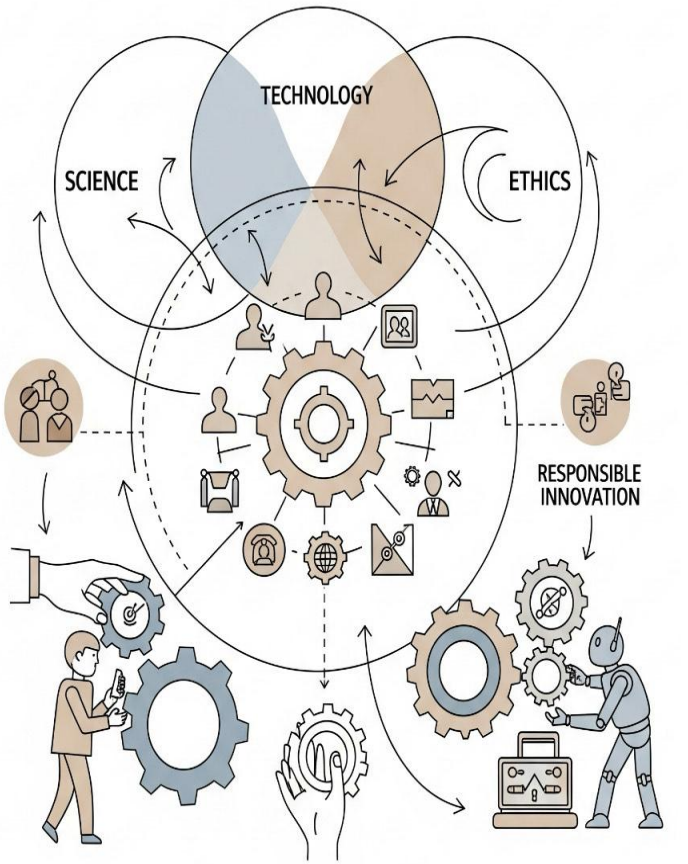
- ***STS*** => interdisciplinary field that examines how soc political, and cultural values affect scientific researc and technological innovation

  => Technologies are never neutral - they embe

  => Technology and society co-construct each

- Growing push for ***"Responsible Innovation"***

- **STS trend :** from passive adoption to co-shaping technologies (AI, clean energy, biomedical tech)



Funded by the European Union

Societal Dimensions of Sustainable Materials - From Impact to Acceptance

- Materials carry societal meanings and ripple effects
- Social impact ≠ just measurable indicators — includes perceptions, values, practices
- Measured through : interviews, discourse
- Analyzed via : sociotechnical systems, value-sensitive design

Funded by the European Union

Case Study - BIOSAFIRE

BIOSAFIRE

Nature's flame-retardant technology upgraded

Main objective : Development of new generation Safe and Sustainable-by-Design biobased flame retardants that replace current toxic alternatives with high-performance sustainable ones

Funded by the European Union

Integrating Social Sciences in BIOSAFIRE

- Ensure technologies align with societal values and expectations
- Promote user-centered design and responsible innovation
- Focus not only on technical innovation but also engagement with stakeholders to enhance social acceptance and trust
- Involve stakeholders on early stages of design process to ensure greater social acceptance

Funded by the European Union

A Social Sciences Approach to Innovation

Ensure that new technologies are not only functional but also ethical, inclusive and responsive to societal needs

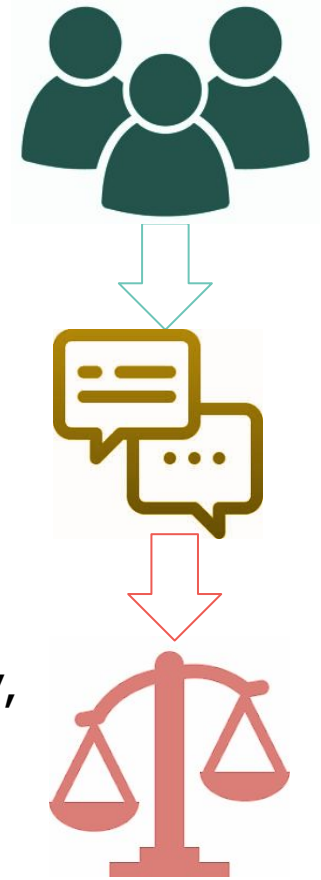
Key principles:

- Innovation is shaped by real user needs, behaviors and experiences
- Map actor perspectives and power symmetries - Inclusion of diverse voices
- Investigate societal values, norms and frictions
- Align environmental and social considerations with the developmental phases for material and product development
- Frame trade-offs between technical and societal goals

Funded by the European Union

Methodology: A Three-Phase Strategy to Map Social Impact

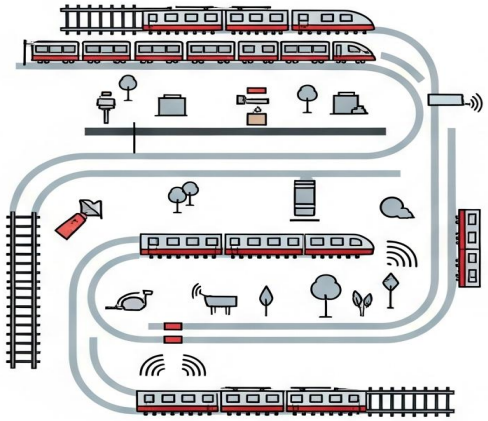
1. **Stakeholder Mapping**
   - Identify key actors who affect or are affected by the innovation
   - Include wide range of perspectives: regulators, workers, unions, consumers, industry actors
   - Understand roles, interests, and potential influence on SSbD outcomes
2. **Qualitative Interviews and Focus Groups**
   - Explore expectations, concerns, and perceived risks or benefits
   - Address social equity issues, and ethical dimensions
   - Uncover what people value and what they fear
3. **Participatory Trade-Offs Workshops**
   - Co-identify practical tensions: cost vs sustainability, safety vs usability, innovation vs compliance
   - Translate into actionable design feedback that informs SSbD design and decision-making



Funded by the European Union

Where Social Trade-Offs Emerge

1) Railway sector

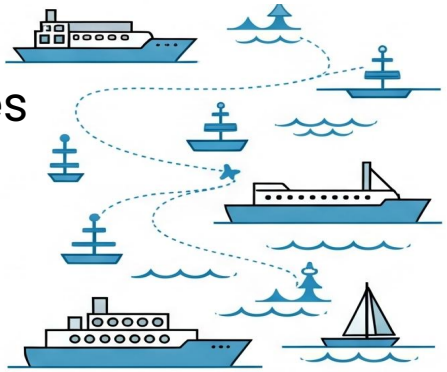


Stakeholders: manufacturers, operators, transport unions, maintenance engineers, regulatory bodies, end users

Trade-Offs:

- Enhanced fire resistance vs compatibility with existing standards
- Cost of retrofitting vs upgrade to safer materials
- Worker safety vs automation of maintenance protocols

2) Naval sector



Stakeholders: shipbuilders, operators, marine regulators, preservation bodies

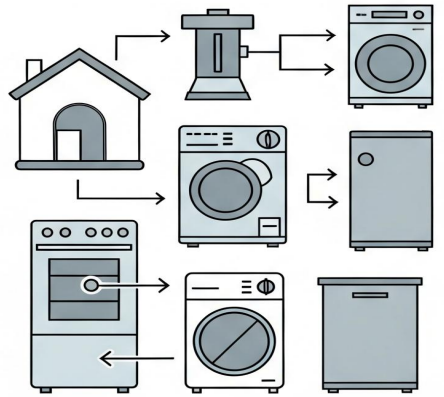
Trade-Offs:

- Bio-based materials vs risk aversion in maritime safety certification
- Environmental sustainability vs challenges with corrosion resistance/durability
- Operational efficiency vs additional maintenance demands

Funded by the European Union

Where Social Trade-Offs Emerge

3) Home Appliances

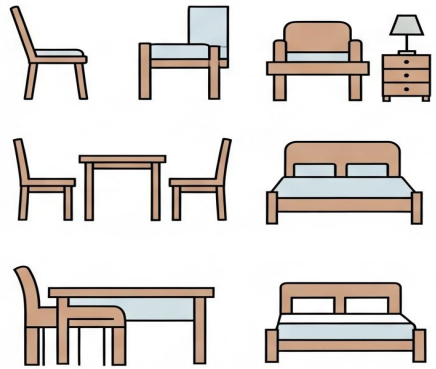


Stakeholders: manufacturers,, brands, chemical suppliers, consumer safety authorities, consumers

Trade-Offs:

- Biobased additives vs durability and performance under thermal stress
- Affordability vs compliance with evolving fire safety norms
- Innovation speed vs public trust and transparency

4) Furniture / Wood



Stakeholders: manufacturers, designers, retailers, waste handlers, consumers, adhesive suppliers

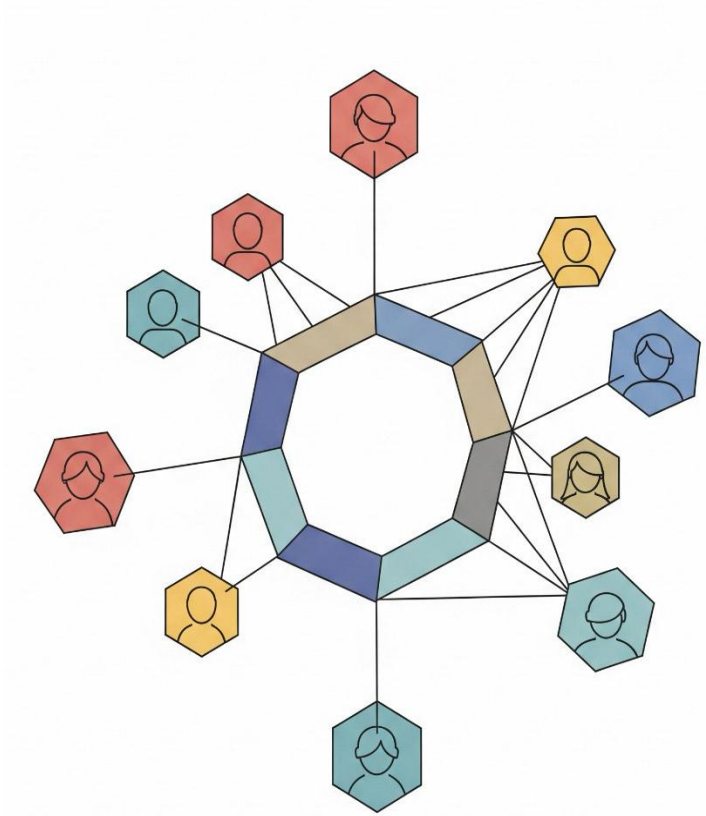
Trade-Offs:

- Eco-friendly materials vs ease of processing and cost
- Aesthetic/design freedom vs compliance with safety standard
- Product longevity vs recyclability and end-of-life handling

Funded by the European Union

Stakeholder Bias in Decision Making

- Stakeholders prioritize differently:
  - Industry actors → cost, effectiveness, scalability
  - Regulators → public safety, compliance, risk
  - Users/Consumers → price, brand trust, aesthetics
  - NGOs/Civil society → health, transparency, and ethics
- Implicit biases affect perception of risks/benefits
- Design influenced by whose voices are heard



Funded by the European Union

What guides your choice ?

What influences your decision when purchasing a home appliance?

> slido.com > code: #2040016

a) Price
b) Environmental concerns
c) Ethical production
d) Design/ User-friendly
e) Quality

Funded by the European Union

Key Societal Impact Questions

- Who benefits or loses from new materials/products?
- Do fire retardants change work routines or exposure risks? (could new substances introduce different handling challenges? Are training and protections adapted accordingly?)
- Are environmental gains offset by social burdens? (e.g. higher cost, reduced accessibility, increased labor)
- **Is the innovation perceived as fair, transparent, legitimate?** (Are value trade-offs clearly communicated?)

Funded by the European Union

Feeding Social Insight Into the Innovation Loop - Capacity Building

- **Main Objectives**:
  - **Identify red flags early** (anticipate resistance or ethical concerns before scaling)
  - **Create flexible indicators of social readiness** (to assess how ready a solution is for real-world adoption)
  - **Support ethical, inclusive decision-making** (equip teams to weigh stakeholders values and not just cost and performance
- **Practical Example:** Training scientists & engineers to consider societal impacts; Educating stakeholders on how SSbD integrates social criteria; Building interdisciplinary teams that include social scientists, designers, and community representatives.
- Social insight becomes core element of the material development process — not an afterthought.

Funded by the European Union

Collaboration Across Disciplines

- Joint interpretation of trade-offs and design feedback.
- Translating qualitative data into material performance constraints (translate social concerns into actionable design specs)
- Ensuring life-cycle assessments (LCAs) go beyond emissions and social indicators like job quality or accessibility are integrated into SSbD assessments
- Including end-users in the testing and validation phases, capturing real-world experience and trust

Design materials and products with people—not just for them!

Funded by the European Union

Closing Thoughts

- Social impact is not a soft “add-on” - It’s a strategic advantage!
- Sustainability must be co-designed to be social
- Co-design means integrating diverse voices from the start
- To build **safe, sustainable, and accepted** innovations, we must design with society in mind—not after the fact.

Funded by the European Union

Thank you for your attention!

APCL.

Despoina BRASINIKA
Thomas PARISIS
Ioanna STATHOPOULOU

https://apclinno.eu/
info@apclinno.eu

Funded by the European Union