

From Impact to Activities: A Persona-Driven Theory of Change Workshop for Impact-Oriented Sustainability Science

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Abstract

Impact-oriented sustainability science increasingly requires research teams to specify credible pathways from research activities to societal outcomes, while remaining responsive to complex socio-ecological systems and contested values. Theory of Change (ToC) is widely adopted for iterative planning, monitoring, evaluation, and learning, yet workshop-based ToC development often under-specifies stakeholder-specific outcomes and value propositions, limiting both plausibility and evaluability. We present an integrated workshop format combining (i) ToC logic with backward mapping from intended impact to activities, (ii) stakeholder persona development, (iii) persona enactment as a serious-game mechanism, and (iv) a stakeholder-value scaffold adapted from the business-to-business "Elements of Value" hierarchy. The format was piloted with the seven project teams of the Belmont Forum's Systems of Sustainable Consumption and Production Collaborative Research Action at the Sustainability Research and Innovation Congress 2025, in a hybrid in-person and online setting with 24 persona archetypes and approximately 30 participants. The workshop generated (a) stakeholder persona cards, (b) outcomes reformulated in stakeholder-specific terms, (c) explicit assumptions and "deal maker/deal breaker" constraints treated as falsifiable risk hypotheses, and (d) revised ToC chains linking impact to activities. Our central process observation is that persona construction itself acted as a reflexive intervention, during which teams surfaced hidden assumptions about stakeholder motivations before any stakeholder contact, so that persona development functioned as pre-engagement strategy work. We provide a conceptual framework, a facilitation protocol, a persona canvas template, and sample large-language-model (LLM) prompts with bias-mitigation safeguards. Because the complete persona and ToC corpora are not yet assembled, we make no empirical claims about persona distributions or cross-team outcomes and thus all findings are formative and hypothesis-generating. We discuss ethical and methodological risks (persona stereotyping, representational harms, LLM fabrication, privacy), limitations, and conditions for transfer to other transdisciplinary research programs.

Keywords

Theory of Change; transdisciplinary research; knowledge co-production; stakeholder engagement; stakeholder personas; serious games; role-play simulation; research impact evaluation; generative AI governance

Introduction

Sustainability science has evolved from a primarily analytical discipline toward a transformation-oriented field seeking to address complex socio-ecological challenges (Clark & Harley, 2020; Kates et al., 2001). Funding agencies increasingly require explicit articulation of impact pathways, stakeholder engagement strategies, and societal relevance. This demand is exemplified by collaborative research programs such as the Belmont Forum's Collaborative Research Action (CRA) on Systems of Sustainable Consumption and Production (SSCP), launched in 2022 with support from MOST, DFG, JST, RCN, Formas, PMU-B, TÜBİTAK, and NSF (Belmont Forum, n.d.). This CRA explicitly called for transdisciplinary research to support transitions toward green economies and sustainable systems of consumption and production, addressing sustainable and resilient industries, social inequality and environmental justice,

and the integration of new technologies, policies, and practices into everyday life. Yet, many research proposals remain activity-driven rather than impact-driven. Outputs are described, and transformation mechanisms are assumed.

This disconnect reflects a structural challenge: sustainability research operates in complex adaptive systems characterized by uncertainty, contested knowledge, and heterogeneous actor motivations (Cash et al., 2003; Lang et al., 2012). Designing research that contributes to societal change requires not only technical solutions but credible pathways linking research outputs to stakeholder behavior and institutional transformation.

The seven project teams funded under the SSCP CRA, Circularity³, JustGrow, SuperSustain, DISCo, AquaponicsOpti, BEDROCK, and Co-SFSC, represent precisely this challenge. Each project is an internationally distributed, multi-actor initiative pursuing systemic change across food systems, the circular economy, digital consumption infrastructure, and supply chain governance, each requiring a coherent stakeholder-level impact logic.

Theory of Change (ToC) frameworks attempt to structure such pathways by articulating causal sequences from activities to impacts (Belcher et al., 2020; Claus & Belcher, 2020). However, ToC exercises often remain abstract and researcher centered. Stakeholder engagement, in turn, risks becoming procedural rather than strategic, fulfilling formal requirements without systematically analyzing stakeholder motivations, constraints, and value logic.

This paper introduces and evaluates a structured workshop format developed and piloted with the seven SSCP project teams at the Sustainability Research and Innovation Congress 2025 (SRI25), held in Chicago in June 2025 (Belmont Forum et al., 2025). The format integrates:

1. Theory of Change logic,
2. Stakeholder persona development,
3. A serious gaming enactment format, and
4. A modified Elements of Value (EoV) hierarchy to differentiate stakeholder motivations.

The central research question (RQ) is:

RQ: How can a persona-driven, serious game approach improve the specificity and plausibility of stakeholder-specific outcomes in Theory of Change development for sustainability research?

The contribution is methodological and conceptual. The SSCP program provides both the empirical basis and a transferability test case. In the pilot, all seven teams revised their ToCs in decision-relevant ways. Piloting across teams operating in distinct sectoral and geographic contexts offers an initial test of transferability to analogous transdisciplinary programs; generalizability beyond this setting remains to be established.

Conceptual Framework

This workshop method is positioned at the intersection of four research approaches.

Impact-Oriented Sustainability Science

Sustainability science aims to generate actionable knowledge for navigating complex socio-ecological systems (Kates et al., 2001). Increasingly, it emphasizes transformation and societal impact (Clark & Harley, 2020). Transdisciplinary approaches seek to co-produce knowledge with stakeholders (Lang et al., 2012; Norström et al., 2020), acknowledging that practical relevance depends on legitimacy, credibility, and salience (Cash et al., 2003).

Researchers pursue this transdisciplinary cooperation, cocreation, and coproduction with relevant stakeholders, rather than in isolation. These stakeholders are often non-scientists who are nevertheless experts in the real-world problems addressed. They possess the contextualized knowledge vital to overcoming complex challenges in dynamic environments and adverse conditions, which is often the case with sustainability issues. Conducting research in such contexts requires continuously reflecting on how to allocate limited resources most effectively. However, co-production does not automatically generate impact. Without structured reasoning about causal mechanisms and stakeholder incentives, engagement can remain symbolic. The aim of impact-oriented sustainability science is to effect change in the issues it addresses. Theory of change is one potential way of operationalizing this change.

Theory of Change

Theories of change help to ensure that all activities and outputs are aligned with clearly defined outcomes. They support the strategic organization of project resources to maximize societal impact. Furthermore, they provide a valuable tool for monitoring and evaluating the effectiveness of our research initiatives. When developing a theory of change, the first step is to clarify the intended impacts. This involves asking what the research shall ultimately achieve and identifying the specific sustainability problems to address. Articulating these overarching goals provides the orientation for all subsequent considerations. The second step focuses on the outcomes that must be realized to make these impacts possible. Such outcomes may involve changes in knowledge, attitudes, skills, relationships, or behaviors among relevant actors. It is equally important to consider when these changes are expected to become observable, whether during the course of the project, at its conclusion, or only after some time has passed. Once the desired outcomes are clear, the activities and outputs required to achieve them can be defined. This includes specifying the research products, goods, and services that need to be generated, as well as the actions, processes, instruments, and strategies employed. It also entails clarifying who needs to be involved, and in which roles, to ensure that the necessary expertise, perspectives, and resources are brought into the process. A well-developed theory of change makes explicit how and why specific outputs contribute to the desired outcomes, and in turn, how these outcomes are expected to lead to the intended impacts. In doing so, it provides a logical and evidence-informed framework that links the project's concrete activities to its broader transformation goals.

A Theory of Change logical chain can be visualized as seen in Figure 1.

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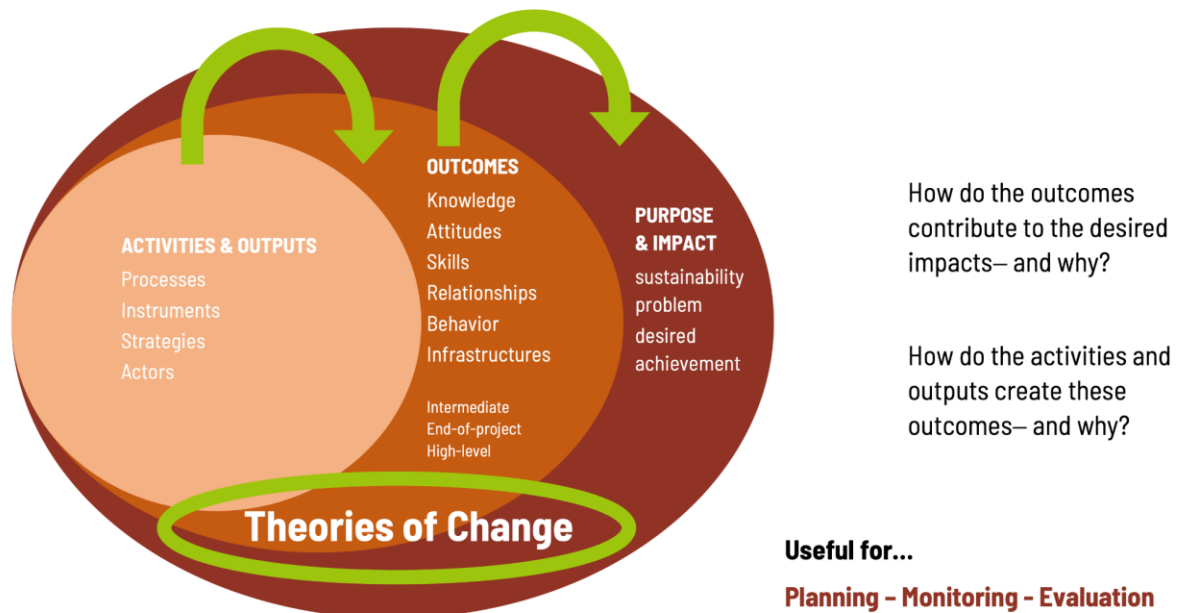


Figure 1 Developing Theories of Change step by step, from desired impact to research activities and vice versa

The purpose of ToC is to make explicit the assumptions linking project actions to societal change (Claus & Belcher, 2020). In complex systems, a ToC provides a structured hypothesis about transformation pathways rather than a deterministic prediction.

The practical value of a ToC extends across all stages of a research project. In the planning phase, it helps align all activities and scientific outputs with the intended impacts. During implementation, it serves as a tool for monitoring progress, reflecting on assumptions, and making necessary adjustments. Upon completion, it supports learning by enabling systematic assessment of activities and outputs, helping identify both successful strategies and areas for improvement in future research.

Effective ToC development requires:

- Explicit articulation of intended impacts
- Identification of actor-specific behavioral changes
- Specification of necessary intermediate outcomes
- Continuous reflection on assumptions

A persistent bottleneck is that many ToC workshops remain “inside-academy” exercises, with real stakeholders' engagement limited, often due to insufficient resources allocated, except for some impact- and good-cause-driven stakeholders. They surface project teams' intended narratives but do not robustly simulate stakeholder constraints, competing value logics, or realistic engagement friction. This can lead to ToCs that have the superficial structure of causal chains yet remain weakly grounded in stakeholder decision contexts, limiting adaptive management value and undermining later evaluation (Deutsch et al., 2021).

To ensure different perspectives of different stakeholders are covered, a systematic stakeholder differentiation is important.

Stakeholder Motivation and the Elements of Value

Conventional stakeholder mapping categorizes actors by sectoral affiliation (industry, government, NGOs, academia). This classification is a useful starting point. Cooperation is rarely motivated by sector identity alone, but by alignment of needs across functional and motivational levels.

Almquist et al. (2018) propose a B2B Elements of Value framework structured hierarchically, from functional to inspirational value, analogous to Maslow's hierarchy (Maslow, 1943). We adapt and extend this logic to sustainability research stakeholder engagement. Five levels are distinguished:

1. Table Stakes (credibility, compliance, trust)
2. Functional Value (performance, efficiency, risk reduction)
3. Ease of Engagement (process facilitation, network access)
4. Individual Value (career goals, recognition, learning)
5. Inspirational Value (societal mission, ethics, transformation)

Failure at lower levels undermines alignment at higher levels. This layered differentiation allows structured persona construction beyond stereotypes.

Persona-Driven Serious Gaming

Personas are fictional but evidence-informed archetypes representing user or stakeholder types (Pruitt & Adlin, 2006). Unlike real stakeholder participation, persona enactment enables controlled perspective switching without political sensitivity. In design research, they structure empathy and reduce abstraction. Personas are used as a designed representation of stakeholder types to support perspective-taking and decision relevance during planning. Pruitt and Adlin (2006) caution that personas can reinforce stereotypes when demographic cues are overemphasized or when persona artifacts are treated as evidence rather than as designed representations. Persona design and visualization choices therefore require explicit care during design.

Serious gaming is treated as a distinct discipline organized around structured experience and debriefing (Crookall, 2010). In sustainability contexts, controlled role-play enables examination of conflicting interests without direct political exposure. Role enactment is treated as a serious-game mechanism to foster learning and engagement by generating structured interactions under rules and constraints. Role-play simulations have been shown to improve stakeholders' adaptation literacy and to enable social learning in climate-related contexts (Rumore et al., 2016). More broadly, meta-analytic evidence indicates that serious games yield modest but robust gains in learning and retention relative to conventional instruction (Wouters et al., 2013).

The contribution is a compositional method that uses personas as a mechanism for constraining ToC claims through stakeholder value logics ("what counts as success" and "what triggers disengagement"), which are then translated into stakeholder-specific outcomes and engagement strategies that can be evaluated as intermediate outcomes. The approach treats

“deal makers” and “deal breakers” as explicit risk hypotheses and boundary conditions for causal claims in the ToC (Anderson, 2004).

The innovation of this workshop lies in combining:

- Theory of Change (ToC) backward reasoning,
- Persona-based perspective immersion,
- Elements of Value (EoV)-based motivation differentiation,
- Structured group synthesis.

Methodology

Design

The workshop is designed as a structured plenary-plus-breakout sequence, starting with a shared introduction to ToC concepts and workshop tasks, followed by group work on persona development, stakeholder role-play, and ToC back-mapping and revision. The session plan explicitly includes an individual silent phase (“individual thinking”) to reduce early anchoring and dominance effects, then structured sharing and synthesis phases.

Setting and format

The workshop was executed in a hybrid setting aligned with the 2025 Sustainability Research and Innovation Congress, held in Chicago from June 16-19, 2025, with in-person participation at the Sheraton Grand Chicago Riverwalk and parallel online participation.

Participants

The workshop involved seven project teams associated with a sustainability-focused collaborative research action under the Belmont Forum’s Collaborative Research Action (CRA) Grant: Systems of Sustainable Consumption and Production (SSCP). The teams were:

- Circularity³
- JustGrow
- SuperSustain
- DISCo
- AquaponicsOpti
- BEDROCK
- Co-SFSC

In preparation for the workshop, the project teams developed 24 fictional stakeholder persona archetypes. 30 conference participants took part in the workshop, online and in person, including the serious-game stakeholder enactment.

Persona Archetype Development

The creation of personas can be based on persona creation methods like the ones developed by Pruitt & Adlin (2006) or Durst (2025).

The goal of creating stakeholder persona cards is comparable to creating buyer or other persona canvases. In this case, the main goal was to brief workshop participants on how to best impersonate stakeholders in the serious game. Overall goals can be:

1. (Research) project development in line with the target group/stakeholders.
2. Providing real benefit and not only “nice to have, but not important” information.
3. Having relevant information on how to decide if the stakeholder process is successful or not.

Each project research team:

- Identified key stakeholder archetypes.
- Collected observational insights from prior stakeholder interactions.
- Structured persona information using a predefined canvas.
- If needed, completed and harmonized profiles using an LLM under strict non-disclosure and anti-stereotyping guidelines.
- If needed, generate fictional images to enhance immersion.

Personas included the following classical stakeholder categories:

- Industry/Business actors,
- Government representatives,
- Researchers,
- NGOs and policy advisors.

Bias mitigation steps that were introduced were:

- No use of identifiable personal data
- Cross-team review to avoid stereotypes, esp. when working with LLMs (cf. Nguyen et al., 2026)
- Explicit reflection on implicit assumptions

Persona cards should include information about the following:

- Demographic background (esp. knowledge-wise)
- Position in the organization/company
- Responsibilities in the organization/company (decision-making)
- Current or situational challenges in the organization/company
- Motives and concerns for taking action in the stakeholder process
- Communication or collaboration preferences
- Personal interests

Stakeholder persona development and stakeholder engagement should address all five EoV levels. Even when stakeholders might be interested in participating and cooperating on an individual or inspirational level, if lower levels, such as table stakes or functional value, remain unmet, cooperation can fail (Almquist et al., 2018).

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Hint:

By giving the persona a fictional name and profile picture, the identification of workshop participants with “their” stakeholder gets more realistic. It is easier to ask “What would Marie think of this?” compared to “What would a person from an NGO think of this?” (Durst, 2025).

Personas are not designed to describe every single stakeholder, but rather to represent stakeholder groups (Lee et al., 2021). Moreover, the number of personas should be manageable and aligned with the number of workshop participants.

The research project stakeholder archetype personas can be grouped into the following 4 stakeholder archetype categories:

1. Industry / Business
2. Government & governmental bodies
3. (Other) Researchers
4. NGOs & Policy Advisors

Figure 2 demonstrates one example of a persona card used in the workshop for an industrial stakeholder for the Circularity³ research team.

	Demographics Name: Julia Kramer Title: Sustainability Innovation Manager Function: Industry / Business Age: 40 Location: Germany	Personality Extrovert: [X] Introvert: [] Thinking: [X] Feeling: [] Control: [X] Experimental: [] Practical: [X] Visionary: [] Conservative: [X] Innovative: []	Motivation Incentive: Future funding & rewards, Usable (research) results e.g. market research Fear: Telling corporate secrets Achievement: Recognition & PR for company Growth: Personal learning, market scenarios Social: Networking, personal contribution to sustainability purpose	Preferred Media Face2Face: [] Online Meeting: [X] Email&Phone: [X] Questionnaires: [] other: []
	Works at a mid-sized consumer electronics manufacturer. Background in mechanical engineering and ten years of experience in circular design, advocates for integrating CE into scalable product strategies.			
Interests What are the personal interests of the persona? (e.g. sports, hobbies, etc.) Eco-design, green innovation hubs, mentoring startups, doing fitness (gym)		Goals What are the professional goals and needs of the persona? Scaling product-as-a-service models, gaining CE certification, and influencing B2B supply chain partners		Pains What are the professional pains and fears of the persona? Uncertainty about upcoming regulations, difficulty quantifying real CE impact, interoperability barriers in cross-country value chains
Quote What quote would best describe the persona? "If we can't measure circularity in business terms, it won't scale."	Key reason to participate Access to science-based insights and benchmarks for CE innovation within the domestic value chain	Deal maker What would make the project a success for the stakeholder? A roadmap aligning CE performance with regulatory and customer KPIs	Deal breaker What would fail the project for the stakeholder? Unclear benefits or impractical academic outputs	

Figure 2 Example of a persona card from the Circularity³ research project for an industry stakeholder

The cards were produced based on the following pre-designed template in Figure 3 (Hillenbrand, 2025). Teams drafted the persona cards with assistance from a large language model (LLM), OpenAI's ChatGPT, using the model versions available up to June 2025, most recently OpenAI o3 (OpenAI, 2025).

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	Demographics Name: Lorelpsum Title: Lorelpsum Function: Lorelpsum Age: Lorelpsum Location: Lorelpsum	Personality Extrovert ——— Introvert Thinking ——— Feeling Control ——— Experimental Practical ——— Visionary Conservative ——— Innovative	Motivation Incentive: Lorelpsum Fear: Lorelpsum Achievement: Lorelpsum Growth: Lorelpsum Social: Lorelpsum	Preferred Media Face2Face: ☐ Online Meeting: ☐ Email&Phone: ☐ Questionairs: ☐ other (conferences, workshops): ☐
	Biographie 			
Interests What are the personal interests of the persona? (e.g. sports, hobbies, etc.)		Goals What are the professional goals and needs of the persona?		Pains What are the professional pains and fears of the persona?
Quote What quote would best describe the persona?	Key reason to participate Lorelpsum	Deal maker What would make the project a success for the stakeholder? Lorelpsum	Deal breaker What would fail the project for the stakeholder? Lorelpsum	
Project Name				

Figure 3 Template of stakeholder persona cards for the workshop at the SRI25 conference (Hillenbrand, 2025)

The general prompts used to generate the persona cards are shown in Figure 4.

ChatGPT / Gen AI prompt to generate personas (as a first starting point if you are struggling with defining them)

Please create a detailed persona cards for key research stakeholders involved in [Project/Research Name]. Use the following structure to capture each stakeholder's background, communication preferences, motivations, and potential challenges. Please stay scientific and follow the layout structure.
<Copy&Paste layout structure from the right>

Please give me one profile picture in pixar comic style for this stakeholder

- 1.Demographics**
 1. Name (fictional but realistic)
 2. Job Title
 3. Functional Area (e.g., policy, academia, NGO, industry)
 4. Age (approximate range)
 5. Location (country/region)
 6. Short Bio (e.g., background, experience, role in the project)
- 2.Personality**

Use sliders or tags to rate/describe:

 1. Introvert ↔ Extrovert
 2. Thinking ↔ Feeling
 3. Control ↔ Experimental
 4. Practical ↔ Visionary
 5. Conservative ↔ Innovative
- 3.Motivation**

Rank or select key drivers for their engagement:

 1. Incentive (funding, rewards)
 2. Fear (regulation, competition)
 3. Achievement (recognition, results)
 4. Growth (learning, expansion)
 5. Power (influence, leadership)
 6. Social (networking, purpose)
- 4.Preferred Media**

Check boxes for preferred communication channels:

 1. Face-to-Face
 2. Online Meetings
 3. Email & Phone
 4. Surveys/Questionnaires
 5. Other (specify)
- 5.Interests**

What personal interests or hobbies influence their perspective or engagement?
- 6.Goals**

What are their professional goals and expectations from the project?
- 7.Pains**

What are their professional frustrations, fears, or blockers?
- 8.Quote**

What quote (real or imagined) best reflects their mindset?
- 9.Key Reason to Participate**

What is their primary motivation for engaging with the project?
- 10.Deal Maker**

What would make the project a success from their point of view?
- 11.Deal Breaker**

What would cause them to disengage or consider the project a failure?

Figure 4 Instructions for the LLM (ChatGPT) aided generation of stakeholder persona cards for the workshop at the SRI25 conference. Hillenbrand (2025) contains the template, instructions, and other stakeholder persona cards from the Circularity³ team

Workshop Procedure

The workshop follows a three-stage logic aligned with ToC guidance:

- clarify intended impacts,
- specify intermediate outcomes in actor terms, and
- derive outputs and activities that plausibly contribute to those outcomes, while making assumptions explicit (Claus & Belcher, 2020).

The workshop timeline is shown in the Appendix in Table 1.

Participants created or refined personas representing stakeholder archetypes, then enacted stakeholder roles to interact, discuss, and answer the following guiding questions:

- What must I know to contribute?
- What must I do differently?
- With whom must I cooperate?
- Why are these outcomes necessary?

Results were clustered around ToC templates that link stakeholder outcomes to project impacts. The results were further used by each research team in their respective projects.

Results

Persona Development as Reflexive Intervention

Surprisingly, the development of persona cards within the research teams sparked a constructive debate about the different stakeholder types, their needs and goals, and proved to be productive and insightful. Post-workshop reflection pointed to two refinements, a more deliberate persona canvas layout and a more detailed treatment of individual stakeholder characteristics. Both may strengthen how research teams plan their subsequent stakeholder interactions. Developing personas before approaching potential stakeholders can also help teams design engagement and recruitment strategies aligned with the needs and constraints of each archetype, transferring a logic well established in marketing, where buyer-persona work serves customer-acquisition and relationship design.

The teams have identified the following aspects as particularly valuable:

- Hidden assumptions about stakeholder motivations.
- Overestimation of inspirational alignment.
- Underestimation of functional constraints.
- Missing articulation of deal-breakers.

The act of constructing personas functioned as pre-engagement stakeholder strategy development. Teams reported that it deepened their understanding of stakeholder needs and goals and informed their subsequent engagement planning. Future research could focus on measuring the impact of a prior period of reflection (e.g. through the creation of personas and the conduct of a workshop such as the one we have presented here) on the success of stakeholder engagement.

Stakeholder-Level Tensions

Across teams, recurring tensions emerged:

1. Inspirational-Functional Gap
Stakeholders shared sustainability aspirations but required concrete operational value.
2. Individual-Organizational Conflict
Personal motivation did not necessarily align with institutional constraints.
3. Table Stakes Fragility
Basic trust, compliance, and credibility were often assumed but not operationalized.

Revision of Theory of Change Pathways

Several teams revised their ToC logic during the workshop:

- Outcomes were reformulated in stakeholder-specific language.
- Activities were eliminated that lacked clear linkages to outcomes.
- Missing intermediary outcomes (e.g., capacity building, trust formation) were added.
- Actor-specific pathways were distinguished rather than assuming homogeneous uptake.

The workshop shifted reasoning from “What do we want to do?” to “What must change for stakeholders?” which is a question highly relevant for stakeholder interactions and outcome-driven research.

Hybrid Format Observations

We observed that online groups produced more structured documentation due to digital tools, while on-site groups exhibited stronger immersive enactment and dynamic debate.

Hybrid formats require careful facilitation to equalize participation intensity.

Discussion

Added Value Compared to Conventional Stakeholder Workshops

This format differs from traditional workshops in three ways:

1. Structured motivational differentiation using EoV.
2. Controlled perspective immersion without real-world power asymmetries.
3. Explicit backward reasoning from impact to activity.

These design differences are intended to reduce performative stakeholder engagement and to increase strategic alignment; whether they do so remains to be tested empirically.

Epistemic Implications

Persona-driven reasoning is a hypothesis-generating heuristic. It makes assumptions explicit and yields testable hypotheses about stakeholder behavior. It is designed to precede direct participatory processes. In situations where stakeholder involvement is not possible, or is limited, this method can be used to supplement existing contributions. However, it should always be made clear and transparent which feedback actually comes from stakeholders, to avoid bias or distortion of the underlying data.

Risks and Limitations

- Personas may oversimplify heterogeneity
- Fictionalization risks confirmation bias
- No long-term impact measurement was conducted
- Workshop participants were self-selected sustainability researchers.

Ethical and LLM Considerations

If generative AI is used to draft persona text, the ethical risk profile includes:

- fabrication (hallucinated details),
- amplification of representational stereotypes,
- leakage of sensitive information, and
- opacity of provenance.

These risks are well documented in the LLM ethics literature (Bender et al., 2021). They should be addressed through a structured risk-management process: the NIST AI Risk Management Framework, organized around the four functions of govern, map, measure, and manage, provides one widely used template for doing so (Tabassi, 2023). Publisher and editorial policies suggest two operational requirements that should also be implemented when working with this workshop approach:

1. AI systems cannot be listed as authors because accountability and consent remain human responsibilities; and
2. any use of generative AI should be transparently disclosed, with careful human verification to prevent false claims and fabricated references (COPE, 2024).

Transferability Conditions

The workshop format is transferable, where preconditions hold:

1. The research context is change-oriented and involves multi-actor pathways where “impact” is mediated by stakeholder actions and institutions. ToC is explicitly designed for such contexts.
2. The project is in the early design phase, and stakeholder involvement has been prepared but not yet implemented or if the actual stakeholders are not covering all intended stakeholder archetypes / have limited time and cannot participate in a workshop.
3. Teams can tolerate explicit articulation of assumptions and potential failure conditions (deal breakers), as this is central to ToC plausibility and later evaluation.

4. Facilitation capacity exists to prevent personas from collapsing into stereotypes, and to keep persona content decision relevant. Empirical persona research documents the risks of stereotyping and the sensitivity to representational choices.

Conclusion

Impact-oriented sustainability science requires a stakeholder-aligned transformation logic that goes beyond formal stakeholder inclusion. The integration of Theory of Change, structured persona development, and serious gaming provides a flexible instrument to strengthen impact design.

The key contribution of this approach is that it prepares researchers to work with stakeholders in a more strategic manner, aligning the stakeholder process explicitly with their needs and goals. It complements, and prepares for, direct stakeholder participation. By requiring explicit articulation of stakeholder-level outcomes and motivational drivers, the format is designed to surface hidden assumptions and to align research activities with societal impact. In the pilot, teams surfaced such assumptions during persona construction itself.

Future research should test the long-term effects on project performance, funding success, and the quality of stakeholder cooperation.

CRedit authorship contribution statement for whitepaper

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References

- Almquist, E., Cleghorn, J., & Sherer, L. (2018). The B2B Elements of Value. *Harvard Business Review*, 96(2), 72–81.
- Anderson, A. A. (2004). *Theory of change as a tool for strategic planning: A report on early experiences*. The Aspen Institute Roundtable on Community Change.
https://www.theoryofchange.org/pdf/tocli_final4.pdf
- Belcher, B. M., Davel, R., & Claus, R. (2020). A refined method for theory-based evaluation of the societal impacts of research. *MethodsX*, 7, 100788.
<https://doi.org/10.1016/j.mex.2020.100788>
- Belmont Forum. (n.d.). *Systems of Sustainable Consumption and Production (SSCP)*. Retrieved June 25, 2026, from <https://belmontforum.org/archives/previous-opportunity/systems-of-sustainable-consumption-and-production-sscp-2022/>
- Belmont Forum, Future Earth, & University of Illinois System. (2025). *Sustainability Research and Innovation Congress (SRI) 2025*.
<https://sricongress.org/sri2025/about-sri2025/>
- Bender, E. M., Gebru, T., McMillan-Major, A., & Shmitchell, S. (2021). On the Dangers of Stochastic Parrots: Can Language Models Be Too Big? *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency*, 610–623.
<https://doi.org/10.1145/3442188.3445922>
- Cash, D. W., Clark, W. C., Alcock, F., Dickson, N. M., Eckley, N., Guston, D. H., Jäger, J., & Mitchell, R. B. (2003). Knowledge systems for sustainable development. *Proceedings of the National Academy of Sciences*, 100(14), 8086–8091.
<https://doi.org/10.1073/pnas.1231332100>
- Clark, W. C., & Harley, A. G. (2020). Sustainability Science: Toward a Synthesis. *Annual Review of Environment and Resources*, 45(1), 331–386.
<https://doi.org/10.1146/annurev-environ-012420-043621>

Claus, R., & Belcher, B. (2020). *Theory of change*. Zenodo.

<https://doi.org/10.5281/ZENODO.3717451>

COPE. (2024, August 20). *Authorship and AI tools*. Committee on Publication Ethics.

<https://doi.org/10.24318/cCVRZBms>

Crookall, D. (2010). Serious Games, Debriefing, and Simulation/Gaming as a Discipline.

Simulation & Gaming, 41(6), 898–920. <https://doi.org/10.1177/1046878110390784>

Deutsch, L., Belcher, B., Claus, R., & Hoffmann, S. (2021). Leading inter- and transdisciplinary research: Lessons from applying theories of change to a strategic research program. *Environmental Science & Policy*, 120, 29–41.

<https://doi.org/10.1016/j.envsci.2021.02.009>

Durst, C. (Ed.). (2025). *B2B Digital Marketing Playbook: Strategie – Toolbox – Best*

Practices. Springer Berlin Heidelberg. <https://doi.org/10.1007/978-3-658-45379-4>

Hillenbrand, M. (2025). *Research Stakeholder Workshop Persona Canvas: Draft, GenAI-Assisted Generation Instructions, and Circularity3 Project Examples*.

<https://doi.org/10.5281/ZENODO.15828948>

Kates, R. W., Clark, W. C., Corell, R., Hall, J. M., Jaeger, C. C., Lowe, I., McCarthy, J. J., Schellnhuber, H. J., Bolin, B., Dickson, N. M., Faucheux, S., Gallopin, G. C., Grubler, A., Huntley, B., Jäger, J., Jodha, N. S., Kasperson, R. E., Mabogunje, A., Matson, P., ... Svedin, U. (2001). Sustainability Science. *Science*, 292(5517), 641–642.

<https://doi.org/10.1126/science.1059386>

Lang, D. J., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Moll, P., Swilling, M., & Thomas, C. J. (2012). Transdisciplinary research in sustainability science: Practice, principles, and challenges. *Sustainability Science*, 7(S1), 25–43.

<https://doi.org/10.1007/s11625-011-0149-x>

Lee, J. H., Kim, Y. M., Rhiu, I., & Yun, M. H. (2021). A Persona-Based Approach for Identifying Accessibility Issues in Elderly and Disabled Users' Interaction with Home Appliances. *Applied Sciences*, 11(1), 368. <https://doi.org/10.3390/app11010368>

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, 50(4), 370–396.

<https://doi.org/10.1037/h0054346>

Nguyen, I., Suresh, H., Monroe-White, T., & Shieh, E. (2026). Representational Harms in LLM-Generated Narratives Against Global Majority Nationalities. *Proceedings of the 2026 ACM Conference on Fairness, Accountability, and Transparency*, 7107–7126.

<https://doi.org/10.1145/3805689.3806452>

Norström, A. V., Cvitanovic, C., Löf, M. F., West, S., Wyborn, C., Balvanera, P., Bednarek, A. T., Bennett, E. M., Biggs, R., De Bremond, A., Campbell, B. M., Canadell, J. G., Carpenter, S. R., Folke, C., Fulton, E. A., Gaffney, O., Gelcich, S., Jouffray, J.-B., Leach, M., ... Österblom, H. (2020). Principles for knowledge co-production in sustainability research. *Nature Sustainability*, 3(3), 182–190.

<https://doi.org/10.1038/s41893-019-0448-2>

OpenAI. (2025, April 16). *OpenAI o3 and o4-mini System Card*.

<https://cdn.openai.com/pdf/2221c875-02dc-4789-800b-e7758f3722c1/o3-and-o4-mini-system-card.pdf>

Pruitt, J., & Adlin, T. (2006). *The persona lifecycle: Keeping people in mind throughout product design*. Morgan Kaufmann.

Rumore, D., Schenk, T., & Susskind, L. (2016). Role-play simulations for climate change adaptation education and engagement. *Nature Climate Change*, 6(8), 745–750.

<https://doi.org/10.1038/nclimate3084>

Tabassi, E. (2023). *Artificial Intelligence Risk Management Framework (AI RMF 1.0)* (NIST AI 100-1). National Institute of Standards and Technology (U.S.).

<https://doi.org/10.6028/NIST.AI.100-1>

Wouters, P., Van Nimwegen, C., Van Oostendorp, H., & Van Der Spek, E. D. (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology*, 105(2), 249–265. <https://doi.org/10.1037/a0031311>

Appendix

Method	Content	Materials
Plenary	Introduction: Theory of Change	Presentation
Plenary	Group work Introduction	Template, slide
Working groups	Introduction: project pitches (project goals)	Pitch presentation
Working groups	Individual thinking and noting down based on guiding questions What are my goals? Who do I need to cooperate with? Guiding questions: - <i>What do I need to know...</i> - <i>What do I need to do differently...</i> - <i>With whom do I need to cooperate...</i> <i>... in order to reach the project goals. And why?</i>	Persona profiles Guiding questions Online: digital whiteboard (Miro) In person: moderation cards, markers, ToC form Physical supplies per group (4–5 groups): easel-size sticky paper pad, multi-color markers, sticky notes
Working groups	Collection of individual perspectives; clustering and exchange noting down on template (by designed note taker) Guiding questions: - <i>Why do we need these outcomes?</i> - Understanding of differences in goals <i>Are there conflicts between outcomes from different stakeholders?</i>	Moderation cards big paper, pens
Plenary	Final reflection round: how can I use this? What does it help me in my project design? What does it mean for the project design to think from impact to activities?	

Table 1: Session plan