TIMs: TRANSFORMATIVE INTERVENTION MIXES FRAMEWORK

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List of abbreviations and acronyms used in this document

Acronym	Definition
AI	Artificial Intelligence
CU	Coventry University
EUDR	European Union Deforestation Regulation
GF	GreenFormation
HARKing	Hypothesising after results are known
MLU	Martin Luther University Halle-Wittenberg
MOOC	Massive Open Online Course
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
RSM	Reflexivity-Situatedness Matrix
TIMs	Transformative Intervention Mixes
TRD2	Transformative Diagnostic Tool
UFZ	Helmholtz Centre for Environmental Research
WP	Work Package

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Background: About DAISY

DAISY - DigitAl, technologIcal and Social innovation mixes enabling transformation for biodiversity and equitY - will advance understanding of how specific mixes of interventions, including social-technological innovations, can be used to induce transformation for biodiversity and equity.

DAISY's main objectives

- To understand which socio-economic, political and behavioural processes, and their interrelationships, shape and enable our personal, political and practical ability to respond to the biodiversity crisis and how they impact on transformative change.
- To collect existing tools, processes, interventions and innovations that are conducive to triggering transformative change, with the understanding of what enables them to address biodiversity loss and social inequity.
- To create intervention mixes based on existing tools and innovations and apply them in practice to induce transformation in all three spheres (personal, political, practical) to support biodiversity and equity prioritisation in decision- and policymaking.

Our case studies to test innovations

Innovation mixes will be tested and assessed for effectiveness in five seed innovation intensive case studies, within the domains of agri-food, education, energy and urban and regional development.

Turning on transformation

DAISY will have a special emphasis on amplifying innovation through bridging activities, networking events, wide stakeholder engagement and collection, connection and distribution of innovation seeds to switch on transformation.

Executive summary

This deliverable presents the Transformative Intervention Mixes (TIMs) framework and the accompanying TIMs catalogue. Developed through iterative conceptual work, collective deliberation and targeted engagement with foundational governance and social-behavioural scholarship, the TIMs framework provides a conceptual basis for analysing how different types of interventions combine to shape transformative change in ways that are relevant to biodiversity and equity. It highlights why interventions rarely act in isolation, how their interactions generate synergies or tensions, and why understanding these dynamics is central to designing change that is both meaningful and enduring.

The TIMs catalogue operationalises the framework through 50+ systematically constructed case entries, each developed using a fixed template and a master prompt guided AI regeneration process designed to ensure consistency, transparency and strict adherence to documented evidence (Annex 1). Drawing initially on DAISY's validated short-list of transformative innovations (Work Package 2) and also additional innovation cases identified via literature review (Work Package 1), the catalogue demonstrates how intervention mixes function across diverse domains – from agri-food and energy, to education, urban and regional development, and beyond. Openly available as a 'living resource' on the www.care-full-courses.com platform, the catalogue provides an accessible empirical resource for examining mechanisms, barriers, enabling conditions and potential pathways for strengthening transformative effects.

Together, the TIMs framework and TIMs catalogue advance the state of the art by clarifying the conceptual landscape of transformative interventions and supplying a structured set of 'real-world' examples. The combined insights reinforce that transformative change for biodiversity and equity is inherently multi-dimensional, context-specific and ethically charged, requiring attention to interactions among interventions as well as alignment with complementary diagnostic tools such as the DAISY TRD2.

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1. Introduction

1.1 Purpose of the deliverable

This deliverable report sets out the **Transformative Intervention Mixes (TIMs) framework** developed under Task 3.1 of DAISY. Its primary purpose is to articulate a coherent analytical foundation for understanding how different types of interventions – regulatory, economic, social-behavioural, technological and material – can be combined to support transformative change for biodiversity and equity. Building on the conceptual groundwork established in the project proposal (led by Agnes Zolyomi, Ilkhom Soliev and Alex Franklin) and subsequent further development and collective refinement within the consortium (led by Ilkhom Soliev, Sven Gruener and Alex Franklin), the deliverable provides a structured framework that clarifies key concepts, defines categories of interventions, and explains how these can be meaningfully analysed in combination rather than isolation. It also establishes the basis for the subsequent construction and use of the **TIMs catalogue** (led by Sian Green and Alex Franklin), which supports the identification, organisation, and assessment of interventions across DAISY domains.

1.2 Context and relevance

The deliverable report sits within Work Package (WP) 3, which focuses on synthesising, developing and testing intervention mixes that can trigger and sustain transformative change. Task 3.1 is the foundational step in this WP, drawing together insights from earlier conceptual, empirical and diagnostic work across WP1 and WP2. These upstream tasks analysed socio-economic, political and behavioural processes, and mapped transformative innovations, all of which feed directly into the development of the TIMs framework and catalogue. In accordance with DAISY's aim to understand and enable systemic changes for biodiversity and equity, the TIMs framework provides the analytical bridge between understanding existing drivers and designing effective intervention mixes. It is also highly relevant to EU policy ambitions on transformative change and biodiversity governance, supporting DAISY's contribution to future-oriented policy development and stakeholder engagement across multiple scales.

1.3 Scope and objectives

This report focuses on the conceptual development of the TIMs framework and on outlining the structure and rationale of the accompanying TIMs catalogue. It synthesises knowledge from governance and social-behavioural scholarship, insights generated through consortium deliberation, and the analytical requirements identified in the DAISY proposal. The scope includes defining core intervention categories, presenting their relevance within transformative mixes, and introducing the conceptual logic guiding the framework. By establishing this conceptual foundation, the report provides the basis for the subsequent testing of intervention mixes in Tasks 3.2 and 3.3, as well as for their application and further exploration in the five focal DAISY seed innovation case studies (WP4). The corresponding objectives of Task 3.1 guiding this deliverable report, were to:

- establish clear definitions and conceptual boundaries for intervention categories;
- clarify how interventions interact within wider social, political and environmental systems;
- lay the groundwork for systematic analysis of innovation case studies; and
- enable the framework to guide subsequent empirical testing and practical application within DAISY.

1.4 Structure of the document

The remainder of this report proceeds by first introducing the conceptual foundations and research literature relevant to transformative interventions (Section 2). Section 3 outlines the methodology used to develop the TIMs framework and to construct the TIMs catalogue, including both conceptual development and the operational procedures for producing the catalogue entries. Section 4 presents the resulting TIMs framework, demonstrates its application to case studies, and introduces the TIMs catalogue together with selected illustrative entries. This section also discusses how the framework contributes to the state of the art, how it connects to DAISY's TRD2 diagnostic tool (developed in WP1), and the methodological limitations associated with both the framework and the catalogue. The document concludes with a synthesis of insights, implications for the

DAISY project, and recommendations for next steps (Section 5). The report is accompanied by Annexes 1 and 2, which provide the supplementary methodological materials and the catalogue-related resources necessary to ensure transparency and replicability of the work.

1.5 Target audience

This deliverable is intended for a wide range of audiences engaged with transformative change for biodiversity and equity. In addition to supporting researchers within the DAISY consortium and academic communities working on governance, social innovation, behavioural change and sustainability transitions, the TIMs framework and catalogue are designed to be directly useful for practitioners and decision-makers. These include policymakers, programme designers and implementers across biodiversity, environmental governance, agri-food, energy, education, and urban and regional development sectors, as well as civil society organisations, community groups and social innovators who are actively developing, testing or scaling interventions on the ground. By offering a structured and accessible way to make sense of how different interventions interact, the deliverable aims to support these diverse users in identifying opportunities, understanding enabling conditions and designing long-lasting, equitable and systemic transformations.

2. Overview of interventions literature for the TIMs framework

The key research question we address in this section is what mixes of interventions can enable/ hinder transformations that are 'good' for biodiversity and equity? To answer this question, first, we provide an overview of interventions literature, particularly inspired by the governance and social-behavioural scholarship by understanding transformations as a combination of intrapersonal, intrapersonal, and institutional change (Soliev et al. 2025a). This allows us to develop the conceptual framework of TIMs that is presented in the results section.

Governance approaches to interventions

In the analysis of interventions in the prominent governance literature in recent decades (e.g. institutional analysis and development, path dependence, multi-level institutional analysis and related frameworks pioneered by Williamson 2000; Ostrom 1990, 2010 North 2018), interventions are typically categorised into three distinct types by their prevailing focus: sticks, carrots and sermons (Bemelmans-Videc et al. 2011; Pacheco-Vega 2020). Regulatory interventions (sticks) consist of policies, laws, decrees and orders. The focus of these instruments is on providing a clear framework by defining which actions are *allowed* or *disallowed* and determining which actors are included or excluded from specific processes. Market-based economic interventions (carrots), although they can take the form of policies, laws, decrees and similar measures, primarily focus on the use of incentives and disincentives to shape behaviour. Through mechanisms such as prices, taxes and various signals, these interventions *encourage* or *discourage* specific actions and influence the inclusion or exclusion of various market participants. Voluntary, advisory and educational interventions (sermons) focus on the internalisation of norms and the development of capabilities. Rather than relying on regulation or financial incentives, these measures promote self-organisation and learning where individuals develop their own *beliefs* in the *underlying values*, leading to action based on internal conviction. These approaches to interventions generally focus on institutional (rules that shape human interaction) and interpersonal (communities and relationships with individuals, groups and society-state as a whole) change, as a starting point for transformations.

Social-behavioural and technological approaches to interventions

In the last decades, governance literature has increasingly integrated approaches to analysis of interventions from other areas in ways that allow examination of transformations at the intersection of institutional and interpersonal with intrapersonal change. Here, behavioural-psychological insights play a particularly important role in understanding change. A significant body of literature focuses on social norms, which involve interventions designed to shape or leverage shared expectations about acceptable or typical behaviour (e.g. Cialdini 2004). By tapping

into these collective standards, actions are influenced through the powerful drivers of social approval, disapproval or imitation. Similarly, interventions utilising affective appeal and framing seek to motivate behaviour by activating specific feelings – such as fear, hope, pride, or empathy – or perceptions, rather than relying on formal obligations or purely rational calculations (Kahneman and Tversky 1979; Dukes et al. 2021; Slaby and Scheve 2026; and these are further informed by cognitive decision models, see e.g. Fishbein and Ajzen 1975; Ajzen 1991). In the realm of behavioural design, choice architecture represents a strategy that influences behaviour by structuring how options are presented or how defaults are set (Thaler and Sunstein 2021). This approach is distinct because it guides decision-making without restricting the individual's ultimate choice or significantly altering economic incentives.

Technology serves as another critical lever; by introducing or modifying tools, infrastructures or technical systems, these interventions can enable, constrain or fundamentally reshape action, by changing what is physically possible or easy for actors to achieve. Furthermore, knowledge-based interventions affect behaviour through the production, framing or distribution of information and evidence. This process alters the underlying perceptions, beliefs or decision-making processes of the targeted groups. On a more material level, interventions involving biophysical resources alter the access to, availability of or conditions of natural and material resources, which in turn directly enables or limits the range of possible actions (e.g. Michie et al. 2011). Finally, other interventions can account for those that do not fit into these classifications. These operate through highly context-specific mechanisms that may not be fully captured by standard regulatory, economic, normative, cognitive or material dimensions.

Goals and context of interventions matter

Continuous alarming rates of environmental decline have been directly linked to equitability considerations. Historically, dominant unsustainable practices have become deeply entrenched in societies across the globe through colonisation, globalisation, and various exploitative forms of social-environmental relations. Deeply inequitable societal relationships and processes are known to drive

practices that are environmentally unsustainable. The powerful actors are inherently interested in maximising profit and reinforcing the power asymmetries, while the marginalised actors are inherently locked in with their focus on satisfying more immediate needs. These considerations place equitability (e.g. procedural, distributive, capabilities, restorative) at the centre of any intervention that aims to improve environmental quality. While not every intervention aims to improve equitability explicitly, it is argued here that this should be the starting point of reflections in thinking of transformative interventions aimed at any form of environmental conservation.

Thus, the success of interventions depends significantly on a clear definition of goals that systematically accounts for various dimensions. Here, one needs to also consider more specific contextual factors, including in which sector the interventions (or potential interventions) are being analysed, such as energy, transport, agriculture, or in the context of consumption and lifestyle. Simultaneously, the scope must be understood to determine whether the measures should operate at a local, national, or international scale, or at their intersection. Alongside, a nuanced consideration of target groups – ranging from farmers and low-income households to broader public and perhaps wealthy individuals – increases the chances of the intervention reaching its targeted actors. Furthermore, the intended depth of change is crucial: it must be clarified whether existing processes should merely be optimised (doing things better), substituted (doing things differently), or fundamentally transformed (leading to doing different things altogether at some point in time). Here one needs to bear in mind that these options are not exclusive and can lead to one another. Finally, and once again, the consideration of justice and inclusion should form a recurring central element, where procedural, distributive, capabilities and restorative dimensions are essential for understanding the system-wide and broader implications of any intervention.

The success of interventions is highly context-specific and depends significantly on the political-cultural framework, in which values, norms and worldviews determine fundamental acceptance (e.g. Levitt and List 2007; North 2018). In this regard, power dynamics between dominant and marginalised groups, as well as the current socio-political situation and prevailing discourse, can play a decisive role.

Furthermore, concrete interactions, the consideration of individual interests and the utilisation of strategic windows of opportunity, are essential for success. The impact is also influenced by the broader social-environmental context, including existing knowledge, pre-existing resources and the maturity of the respective innovation or intervention (Rogers 1963, 2003). Regulatory frameworks often act as a double-edged sword: while laws can provide targeted support for innovations, administrative burden and bureaucratic hurdles (sludge; Sunstein 2021) frequently lead to obstacles. Thus, to achieve the goals (e.g. improve social and environmental conditions) of an intervention in an interconnected social-environmental world, a general rule should be considering unintended consequences either from an intervention directly, or set of interventions and their interactions, to ensure the goals are not undermined through these unintended consequences. This can be illustrated by the example of biofuels: their promotion can lead to the clearing of tropical forests and community displacement, and thereby increasing the overall pressure on social-ecological systems and causing long-term damage to biodiversity through so-called leakage and rebound effects and land and resilience grabbing (De Gorter et al. 2013; Soliev 2026).

Intervention mixes are promising and necessary to address biodiversity loss

Within the biodiversity domain, the IPBES (2024) Transformative Change Assessment has summarised and emphasised the importance of looking at the underlying causes of biodiversity loss together with what are widely known as direct and indirect drivers of biodiversity loss. Although the importance of analysing interventions in combination is increasingly recognised, most studies continue to focus on single interventions or narrow subsets of tools. However, studies in related fields have shown that mixes of interventions are promising. For example, in an analysis of 1,500 climate policies, Stechemesser et al. (2024) find that mixes of policies, rather than a single policy, tend to be more successful in reducing emissions. The relevance of intervention mixes in the field of biodiversity may be even greater, as – unlike in climate protection – no comparable well-established 'simple metric' (such as the CO_2 equivalent) exists.

It is also typically the case that intervention mixes are used within most large-scale policy frameworks, at least to some extent, yet with varying emphasis on types of interventions and rarely holistically as proposed here. Within the Common Agricultural Policy (CAP), this includes, for example, linking direct payments for farmers to compliance with minimum standards, as well as supplementary measures such as voluntary incentives (e.g. compensation for creating flower strips as buffer strips or field margins) and guidance from state advisory services. Yet some measures – for example, addressing the development of beliefs and self-organisation – are rather limited within CAP. Overall, the reasons for adopting intervention mixes, rather than single interventions, in the field of biodiversity can be multi-faceted.

Multi-actor settings and multiplicity of perceptions, values, experiences, and worldviews

Addressing biodiversity loss rarely, if at all, takes place in a setting that involves a single individual or actor. Even when single actors can act on biodiversity individually, they are embedded in a wider societal structure where their actions affect others and vice versa. Actors often vary in the way they perceive, value, experience and envision their relationships around biodiversity. Even single actors can and often do change the way they interact with the social and broader social-environmental world over time. Actors pursue multiple objectives that can be addressed through various interventions. Nielsen and Parker (2012), for instance, distinguish between material (income, penalties), social (recognition, fear of exclusion), and normative ('doing the right thing') motives. Similarly, IPBES (2022) stresses the importance of taking into account plural values around nature, where one can relate to nature as living from, living in, living with, and living as. These diverse motives and perceptions of nature, combined with the experiences of actors and broader worldviews of individuals, create asymmetries in how actors consider what interventions are desired and necessary. Likewise, addressing these plural needs of the actors in a multi-actor setting is often difficult through one-size-fits-all interventions. Hence, the challenge is to reveal, design, and actively shape 'good' intervention mixes that can provide a solution that ensures diverse needs are addressed.

Regulation, market, information failures

Biodiversity loss results from multiple causes, such as market failures, insufficient or inadequate regulation, lack of conviction, etc. (Lakner et al. 2024). A mix of interventions can allow these various factors to be addressed simultaneously. Policies can be adopted to create rules for the actors about actions that are allowed and disallowed, and the respective consequences for violating such rules. Taxes can be used to create incentives to internalise the costs of environmental damage arising from negative externalities. Information asymmetries represent another challenge: mandatory labelling (labels) and public dialogue can support producers and consumers in understanding broader system-wide implications of their choices and in making informed decisions. Finally, to break the path dependencies of environmentally harmful technologies, subsidies can be leveraged for stimulating, at least temporarily, shifts from the well-established unsustainable practices that are low-cost in the short term, towards more sustainable practices that are costly in the short term, but equitable and sustainable in the long run.

Biodiversity as a global and local challenge

Isolated interventions in any specific place carry the risk of exporting environmental problems to other places (leakage or rebound effects); take, for instance, the earlier example of the deforestation of tropical rainforests resulting from an increased demand for biofuels. To counteract this, intervention mixes can offer the potential for more holistic solutions to address biodiversity loss. An effective lever in this regard can be the coupling of local regulations with international supply chain standards, as envisaged by the EU Deforestation Regulation (EUDR), while addressing the underlying drivers of deforestation embedded in prevailing production and consumption patterns, which receives less emphasis in the EUDR (Mendes et al. 2025). These would require, in turn, interventions operating at multiple levels and scales: at the global policy institutional level to ensure that overarching frameworks reflect these complexities; at national and regional levels to encourage practices that support long-term equitability and sustainability in ways that are sensitive to cultural and local contexts; and at community and individual levels to ensure that the needs and motivations of people are considered

in shaping the broader views, practices and structures associated with transformative change.

Conflicts and synergies

Nature conservation measures can be perceived as burdensome by actors when they are associated with perceived losses of livelihood sources of income (e.g. the obligation to refrain from synthetic fertilisers). This can lead to resistance against state-led interventions (Wienhold and Goulao 2023). However, by utilising intervention mixes – where regulatory prohibitions are combined with economic incentives (e.g. payments for ecosystem services) – the willingness to support these measures can be increased. At the same time, mixes of interventions often harbour the potential for synergistic effects, where the effectiveness of one instrument is enhanced by the presence of another (Alt et al. 2024). For example, a financial incentive (economic instrument) may be provided for the creation of flower strips. However, without specialised advisory services (informational instrument), a farmer might select a seed mix that is sub-optimal for local wild bee species. Similarly, without the effective internalisation of norms, and monitoring and sanctioning system, subsidies that support flower strips in farms can lead to overreporting and misuse of financial resources. A fragmented intervention can lead to implementation of actions that are largely symbolical with little impact on the state of biodiversity, which often creates or reinforces inequitable relationships in the society on a systemic level (e.g. tokenistic actions are rewarded by public funds). In this case, the synergy between the financial incentive, the appropriate regulatory framework, the technical guidance, and the continuous cultivation of norms that take into account equitability concerns, can ensure that the economic investment achieves its system-wide social-ecological impact.

3. Methodology

3.1 Conceptual development of the TIMs framework

3.1.1 Building on inter- and transdisciplinary expertise

The conceptual development undertaken in Task 3.1 was guided by the aim of conceptualising interventions within a TIMs framework and developing a corresponding catalogue of interventions suitable to trigger transformative change. The original Task 3.1 proposal was informed by the authors' longstanding expertise in analysing multiple levels of social change – intrapersonal (individual, behavioural), interpersonal (community, relational), and institutional (rule-based, socio-economic and political) (Soliev et al. 2025a). The inter- and transdisciplinary backgrounds of the authors combine prior knowledge and experiences from institutional and behavioural economics, environmental sociology, political sciences and resource governance, anthropology, and human geography. The authors were motivated to develop and use a general framework to help the broader community of scholars, practitioners, and policymakers interested in transformative interventions to identify the elements and relationships among these elements that one needs to consider for analysis of interventions (Ostrom 2019).

Building on their combined expertise, the core components of the framework presented in this report had already been outlined at the project proposal stage. The task in DAISY 3.1 was to further develop these components into a coherent framework by clarifying key questions, refining relationships between concepts, and specifying core terminology through collective deliberation and critical reflection among task members and the wider consortium during the first three months of the task. This development process was supported by targeted engagement with the literature introduced in Section 2, regular intensive discussions within the author group, presentations to the consortium (including through a Task 6.3 reflexivity and peer learning session), and iterative refinement of the questions, components, internal relationships and definitions.

3.1.2 Reflexivity and research ethics of intervening

We recognise that our academic and professional backgrounds fundamentally position us toward the interventions we study, as our collective views are shaped by the ontological and epistemological characteristics of our various disciplines. This perspective leads us to the firm conviction that biodiversity loss and inequalities associated with it constitute a pressing and alarming issue that requires immediate and substantial attention. We characterise the decline of biodiversity not merely as a biological event, but as a complex social-ecological challenge. In our view, this complexity is accompanied by high levels of uncertainty across both social and ecological spheres, a factor that becomes significantly more volatile when these dimensions are analysed in combination or observed over extended timeframes. In turn, drawing on our previous experiences, we believe that inter- and transdisciplinary work is not just beneficial but essential for navigating these challenges.

This reflexive standpoint also, however, requires careful consideration of the ethical issues that accompany the study and design of interventions. From the perspective of research ethics, interventions require caution on several aspects:

- **Self-determination and paternalism**. Even without explicit bans, interventions infringe on autonomy. What constitutes socially desirable outcomes must be defined in advance - but who decides, or rather, who should be the one to decide? Furthermore, those affected by such interventions often do not notice that their actions have been subtly nudged, which leads to a lack of transparency (Thaler and Sunstein 2023). On the other hand, many choices are made because they have to be made – the way societies operate with a complex web of regulations, incentive mechanisms, initiatives, and various external stimuli around each individual, can make it impossible to avoid intervening or being intervened.
- **Measurement, causality and burden-benefit gap.** Researchers often carry implicit and explicit expectations about what a successful outcome of an intervention could look like. Yet, understanding success of interventions faces several measurement-related challenges: (1) the evaluation of measures is

often difficult because, alongside easily quantifiable tangible outcomes, elusive intangible effects – such as general well-being – must also be taken into account; (2) identifying causal relationships frequently proves challenging, as without controlled experiments or quasi-experimental approaches, positive or negative developments often cannot be clearly attributed to a specific cause (or attributed wrongly); and (3) in some cases, certain groups of people (knowingly and unknowingly) bear the burdens and costs of an intervention while, unlike other participants, they derive no individual benefit from it.

- **Challenges of scalability**. While experiments and surveys often produce promising data, the scalability of these results to larger populations remains uncertain. List (2024) outlines five factors that can constrain scaling: (1) false positives, where some confirmation is taken as general, (2) lack of representativeness of the sampled population, (3) lack of representativeness of the sampled situation, (4) spillovers, where effects are due to uncaptured interactions, and (5) diseconomies of scale where costs increase at scaling. Additionally, changing framework conditions – such as price hikes driven by geopolitical tensions – can impact the public acceptance of interventions over time. Hence, promising results in certain cases of interventions do not necessarily mean these interventions will work at scale.

Thus, intervening cannot be taken lightly. Every precaution needs to be taken to address the above considerations and beyond. Particularly useful practices are:

- ***Participatory and transdisciplinary co-production***. Involving affected stakeholders as early as the design phase of interventions to ensure that local needs are addressed and paternalistic structures are avoided (Polk 2015). This collaborative framework shifts the power dynamic from 'doing for' to 'doing with,' ensuring that interventions are not only technically sound but also culturally and socially sensible.
- ***Mixed-Methods-Evaluation***. Methodological diversity enhances the validity of interventions by moving beyond statistical indicators to capture the 'why' behind the results (Bans-Akutey and Tiimub 2021). It allows researchers to

identify negative side effects early and better understand the mechanisms behind the interventions. This can prevent the misinterpretation of data.

- ***Ethical approval and Pre-registration.*** Obtaining *ethical approval* ensures that research projects are reviewed in advance by an independent committee for potential risks (physical, mental, material, etc.) to participants. This process obliges researchers to implement preventive safeguards and to consistently prioritise the safety and well-being of participants over the pursuit of scientific knowledge. *Pre-registration* (Grebitus and Hu 2025) requires researchers to commit to their hypotheses and analysis plans before data collection begins, which significantly enhances transparency and prevents practices such as p-hacking (i.e. use of questionable methods that lead to statistically significant results, including trying out multiple statistical tests on a data set or cherry picking results; Hirschauer et al. 2022) or HARKing (Hypothesizing After Results are Known; Rubin 2019). This prior documentation can help ensure results are not interpreted post-hoc to fit the data, thereby strengthening the integrity and reproducibility of the scientific work. Many well-respected peer-reviewed journals already require pre-registrations for papers reporting on interventions.

Together, these reflections complete the conceptual and reflexive grounding for the TIMs framework. In Section 3.2 (below), we turn our attention to the separate task of constructing the TIMs catalogue.

3.2 Construction of the TIMs catalogue

This second component of the methodology outlines how the TIMs catalogue of innovation case studies was constructed. While the conceptual framework (see above; see also Section 4 below) establishes the analytical logic for understanding TIMs, the catalogue translates this logic into a systematic collection of 'real-world' innovation cases. This current section describes the approach, data sources, selection criteria, analytical procedures and ethical considerations underpinning the catalogue's development.

3.2.1 Approach and research design

The construction of the TIMs catalogue followed a structured and iterative research design grounded in qualitative documentary analysis, supported by a controlled and highly disciplined use of generative AI tools. The underlying intention was to create a catalogue that reflects a wide range of 'real-world' interventions, set within the context of digital, technological and/ or social innovations of direct relevance to biodiversity and equity, while ensuring analytical consistency across all entries. To achieve this, the process combined traditional interpretive analysis with a standardised, template-driven regeneration procedure. The approach can therefore be understood as a mixed-methods design: qualitative in its attention to contextual evidence and interpretive judgement, and computational in its use of a master prompt to ensure uniformity (see Annex 1).

During the early stages of design, the team developed a set of template tables that reflected the analytical and reporting requirements of the DAISY project. These templates were refined through rapid iterative testing until they reliably produced case entries that were robust, clearly structured and aligned with the TIMs conceptual framework. The definitions of intervention types and spheres of transformation were locked into the structure from the outset, with the explicit aim of preventing conceptual drift and ensuring comparability between entries. As the process evolved, the master prompt became a reusable tool able to generate entries for different innovation cases simply by adjusting the input blocks, thus offering both analytical precision and scalability.

3.2.2 Data sources and selection criteria

The catalogue draws predominantly on two interconnected pools of material. The first consists of innovations emerging from the DAISY shortlist of innovation case profiles in Work Package 2 (Tsioumani et al 2026). These provided the initial set of cases already recognised within DAISY as pertinent to transformative change across agri-food, energy, education, and urban and regional development domains. The second pool comes from the systematic literature review undertaken in Task 1.3, inclusive also of a substantial set of social innovation papers which were originally (during Task 1.3) set aside for later analysis and explicitly retained for

Task 3.1 (Franklin et al 2025). From this pool, cases were included where the documentary evidence met the catalogue's inclusion criteria.

Only cases supported by sufficiently clear and detailed documentation were included in the catalogue. Where evidence was strong enough to populate the template – allowing interventions to be classified according to the fixed TIMs categories and enabling identification of transformative mechanisms – the case was taken forward. Where documentation was too thin to support a reliable reconstruction of the core elements of the case – such that key descriptive information would require inference or speculation – the case was excluded; however, cases were retained where some dimensions were simply not discussed in the sources, with those fields left blank to reflect the limits of the evidence.

3.2.3 Data collection methods

Information for each case was collected through the use of a structured master prompt developed specifically for the TIMs methodology (see Annexes 1 and 2). This prompt embodied the fixed definitions, template structure and evidence constraints necessary to maintain consistency across all entries. Its development was an iterative process: initial outputs were tested, reviewed, and refined until the prompt produced high-quality case analyses that adhered strictly to the framework.

Central to this method was the requirement that all information in a case must be derived exclusively from the documentary materials made available – primarily the uploaded scientific manuscript files and explicitly listed web resources. This rule ensured that the generative tool could not introduce new actors, behaviours, mechanisms, or assumptions not already present in the source material. Where no evidence existed within the source material for a given intervention type or transformational sphere, this absence was stated clearly rather than filled through inference – in the final published version of the catalogue entries the corresponding cell is left blank.

To manage the workflow and ensure accountability, an AI regeneration tracker was used throughout the process (see Annex 2). This provided a record of progress, versioning, and decisions taken at each stage. It also incorporated a screening

checklist that supported systematic quality control and guaranteed compliance with the structural and conceptual requirements of the cataloguing process. Additional expert feedback was sought, particularly for classifications involving regulatory and financial mechanisms, ensuring that domain expertise complemented the structured regeneration process.

3.2.4 Analytical procedures

The TIMs-related analytical content of each catalogue entry consists of two layers. The first is the documentary layer, which presents each case strictly on the basis of the available source material. All interventions are identified and assigned to the TIMs intervention categories solely on the basis of what the documents describe. Transformative effects are recorded only where explicit evidence is present, and uncertainties or gaps are retained transparently. This ensures that each entry remains grounded in the documented characteristics of the case.

A second interpretive layer complements this documentary foundation. It is presented as a reflective synthesis that does not add new empirical material; rather, it considers the implications of the documented interventions for how different tools or intervention types might operate together within potential mixes. Its role is to situate the evidence within a broader analytical perspective while remaining clearly delineated from the evidence-based documentary layer.

3.2.5 Consolidated identification of complementary regulatory and market-based tools

Whilst the TIMs intervention fields are generated solely through the evidence-restricted prompting and validation process described in Sections 3.2.2–3.2.4 above, a complementary set of regulatory and market-based economic elements was developed through separate interpretive reviews undertaken by the relevant Task 3.1 experts. These complementary elements do not populate the TIMs analytical columns; they are included exclusively in a final column of each catalogue entry, where they provide expert-derived suggestions for additional or aligned tools, interventions or resources.

The regulatory component was generated through an inductive assessment of each case, examining governance conditions that appeared necessary or relevant for the functioning, scaling, or safeguarding of biodiversity- and equity-positive outcomes. This involved interpreting each respective catalogue entry through structured questions and translating recurring governance needs into broader regulatory tool categories.

The market-based economic component followed a parallel interpretive procedure for the subset of dedicated interventions. The reviewer considered each intervention's implied financial viability requirements, incentive structures, and potential safeguards, and mapped these to the market-based instrument typology developed in WP1 (Task 1.1), ensuring conceptual coherence across work packages while tailoring insights to the practical contexts of the cases.

Together, these expert-derived regulatory and economic additions offer an optional contextual layer that situates innovations within the wider governance and incentive environments that may matter for their future development or combination in intervention mixes. They remain clearly delineated from the core, evidence-based TIMs analysis and do not imply the presence of such regulatory or economic conditions within the empirical case material itself.

3.2.6 Reflexivity and research ethics in catalogue development

Although the catalogue is based solely on documentary materials and does not involve human participants, reflexive and ethical considerations played an important role, particularly in relation to the use of generative AI tools. The team was aware that such tools can introduce risks, including the inadvertent generation of unsupported claims or subtle shifts in meaning. These risks were mitigated through the strict prompt constraints, the immutability of the template, and the requirement that all statements be grounded in the explicitly provided evidence.

Human oversight remained central at all stages. Every regenerated output underwent careful 'human' review to ensure that disciplinary expertise informed classification decisions, interpretation of mechanisms, and the identification of absences or uncertainties. This reflexive practice complemented the broader

reflexivity commitments described earlier in Section 3.1.2 but addressed specifically the methodological implications of combining human and computational analysis. The primary ethical requirement with regards to each catalogue entry was to represent cases accurately in accordance with the evidence sources, avoid over-interpretation, and ensure that the catalogue remains a transparent and credible analytical resource.

4. Results and discussion

4.1 The TIMs framework: Definitions and generic illustration

Based on the review of the current literature, collective reflections, and iterative analysis, the key definitions of the proposed TIMs framework are provided in Table 1, below. These definitions underpin the operational formulations used in the catalogue's generative AI master prompt.

Table 1: Definitions of TIMs framework. Based on authors' reading of multiple strands of literature as discussed in section 2 (e.g. Williamson 2000; Ostrom 1990, 2010; North 2018; Rogers 1963, 2003; Cialdini and Goldstein 2004; Sunstein and Thaler 2021; Slaby & von Scheve 2026)

Interventions	Definition
Regulatory	Policies, laws, decrees, orders and other interventions that define what action is allowed or disallowed and who is included/ excluded.
Market-based economic	Interventions that create incentives/ disincentives such as prices, taxes, signals, etc. that encourage or discourage action and inclusion/ exclusion of actors.
Voluntary-advisory-educational (sermons and more)	Interventions that are directed at internalisation of norms, developing capabilities and learning; self-organisation because actors believe in it (and not because of regulation or market-based incentives).

Social norms	Interventions that shape or leverage shared expectations about acceptable or typical behaviour, influencing action through social approval, disapproval, or imitation.
Emotional appeal	Interventions that motivate behaviour by activating emotions (e.g. fear, hope, pride, empathy) rather than rational calculation or formal obligation.
Choice architecture	Interventions that influence behaviour by structuring how options are presented, or defaults are set, without restricting choice or significantly changing economic incentives.
Technology	Interventions that enable, constrain, or reshape action by introducing or modifying tools, infrastructures, or technical systems that change what is possible or easy to do.
Knowledge	Interventions that affect behaviour by producing, framing, or distributing information, evidence, or understanding that alters perceptions, beliefs, or decision-making.
Biophysical resources	Interventions that alter access to, availability of, or conditions of natural or material resources, thereby enabling or limiting possible actions.
Other	Interventions that do not fit the above categories and operate through context-specific mechanisms not captured by regulatory, economic, normative, cognitive, material or other dimensions.

The TIMs framework presented here emphasises the importance of the analysis of interventions in conjunction to one another. It extends frameworks such as those suggested by O'Brien (2018) on three spheres of transformation and Soliev et al. (2025) on analysing transformations as interpersonal, intrapersonal, and institutional change. Thus, the main recurring and overarching question in the analysis of the interventions is what the broader consequences of focusing on

interventions in isolation are and what is missing to avoid undesirable consequences, such as those resulting in displacing negative effects (e.g. biodiversity leakage, rebound effects, land grabbing) or reinforcing or creating inequitable outcomes for the involved and affected actors? A generic illustration of the TIMs framework is provided in Figure 1.

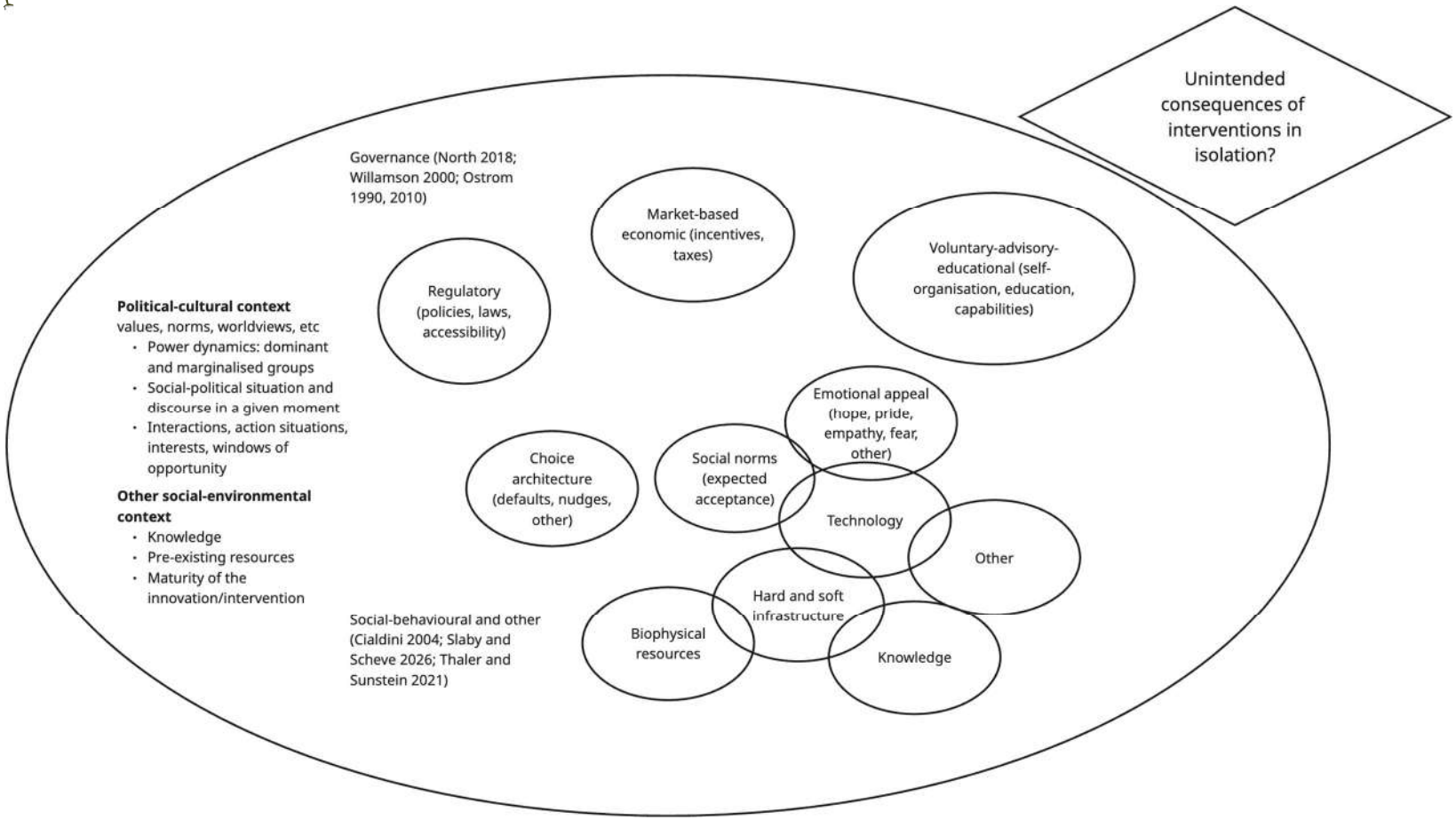

Figure 1: Generic illustration of the TIMs framework where interventions are analysed in conjunction with one another rather than in isolation. Note: the size and location of the individual bubbles can be set approximately for the specific intervention or set of interventions being analysed.

The key assumption of the TIMs framework is that for any intervention to be effective and long enduring, it needs to be considered and applied in combination with other types of existing or potential interventions that shape social interactions. The TIMs framework posits that it is likely that any intervention is more successful and more stable in bringing about change, if it is supported by relevant regulations, market-based incentives, default settings in available choices, social norms, emotional appeal, technologies, existing resources and infrastructure, corresponding knowledge and other factors, in ways that take into account the political-cultural and social-environmental context.

Beyond its analytical application, where any analyst can ask questions about interventions of their interest, the TIMs framework can also serve as a tool for facilitating collective reflection on interventions. For example, the framework can be presented to a group of stakeholders with a brief explanation of how one can intervene at individual to societal scales to facilitate change. This can be followed by a collective reflection on what the participants consider particularly important for the change they would like to achieve, in relation to the specific issue they are concerned about, and how to make that change system-wide, fundamental, and long-enduring.

In addition, where an initiative is already established, and clear descriptive material exists outlining its core features, governance arrangements and modes of operation, the same structured prompt used in constructing the TIMs catalogue can be applied directly by stakeholders themselves. By inputting their own documentation into the fixed template and master-prompt process, initiative leads can generate an evidence-anchored TIMs analysis of their current intervention mix. This enables systematic reflection on how the initiative presently functions, where particular intervention types are strong or absent, and what combinations of tools might support more effective, equitable or durable transformative outcomes.

4.2 Demonstrating application of the TIMs framework to case studies

Figures 2 and 3 (below) illustrate conceptual applications of the TIMs framework to two widely documented innovation examples: (1) community-supported agriculture (CSA) cooperatives and related commons-based food initiatives, and (2) the use of the iNaturalist digital platform to facilitate biodiversity learning, observation and participation. These illustrations are intended to show, at a general level, how the TIMs framework can be used to analyse different types of interventions in combination, independent of any single place-based case or specific DAISY seed-innovation context. In each example, the framework helps reveal how the innovation functions across multiple intervention categories, how different tools interact to influence transformative potential, and where additional or complementary interventions might strengthen outcomes.

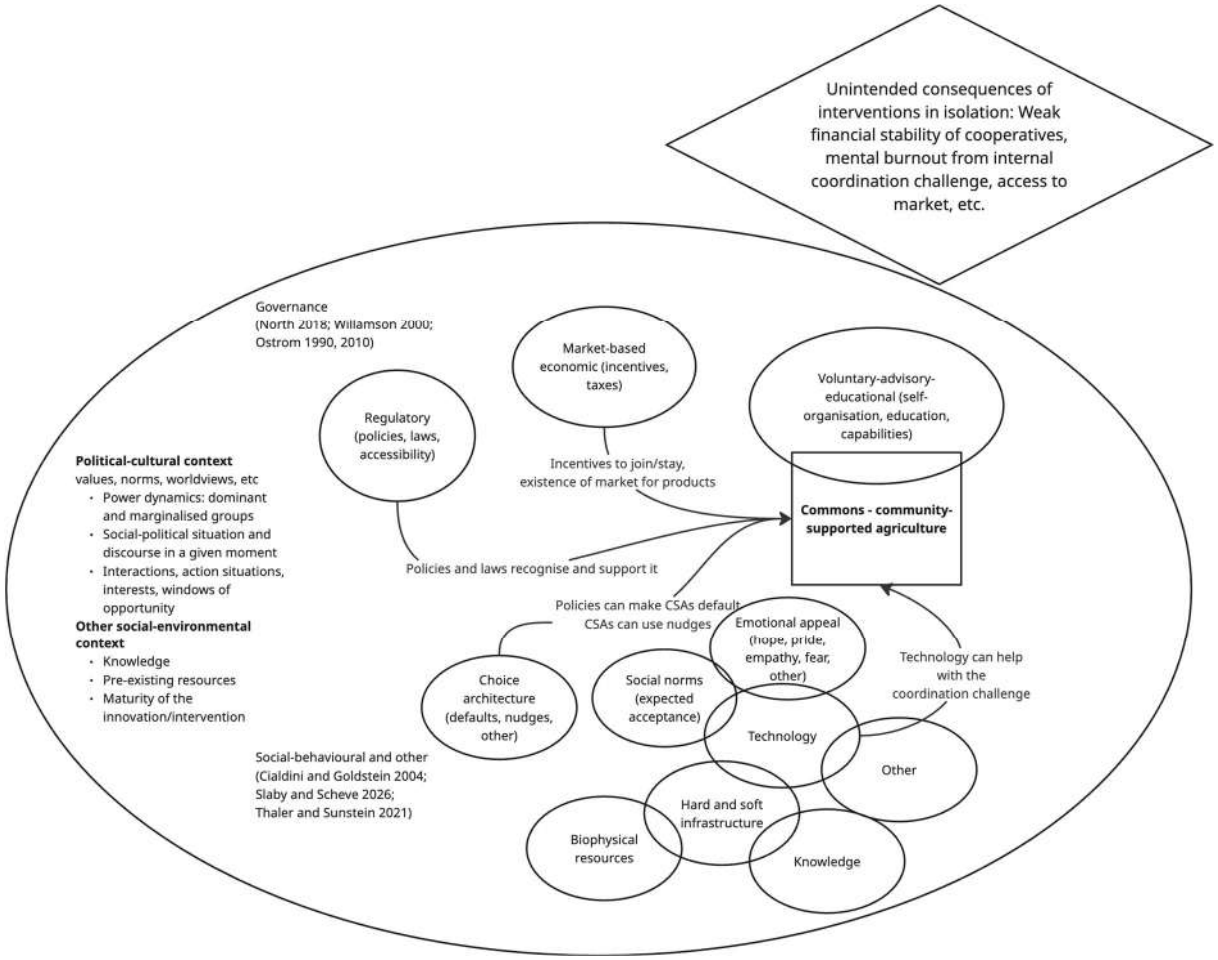

Figure 2: An illustration of the TIMs framework application for the case study on community-supported agricultural (CSA) cooperatives and similar commons initiatives in Germany.

As illustrated in Figure 2 (above), the TIMs framework makes it possible to identify which additional interventions could strengthen the effectiveness of CSA cooperatives and similar commons initiatives in triggering and sustaining transformations. Such commons initiatives are often driven by non-profit-oriented motives and by relational interests in belonging to a community and engaging in more democratic processes of producing and consuming food. As such, CSA cooperatives and related initiatives offer a strong example of self-organised networks. While these initiatives can themselves be understood as an intervention (e.g. establishing a cooperative), they can also be situated within a broader mix of interventions. On the governance side, cooperatives can be supported by state regulation – for example, through policies that recognise new forms of self-organisation, ownership, responsibilities and the specific privileges associated with them. Market-based interventions can create incentives to join (and stay in) a CSA cooperative or create a marketplace for products specifically produced by the CSA cooperatives. Policies can treat CSA cooperatives and similar initiatives as a default form agricultural organisation, which could then also have implications for distribution of subsidies. On the other hand, CSA cooperatives themselves could apply nudges to attract members. As the number of members in such initiatives grows and coordination becomes more difficult, technological interventions can be used that help with optimisation of the coordination and reduce the burden on the members. Such an analysis can be continued for each category and more specific place-based analysis can be conducted on political-cultural and social-environmental contexts specifically where this intervention takes place.

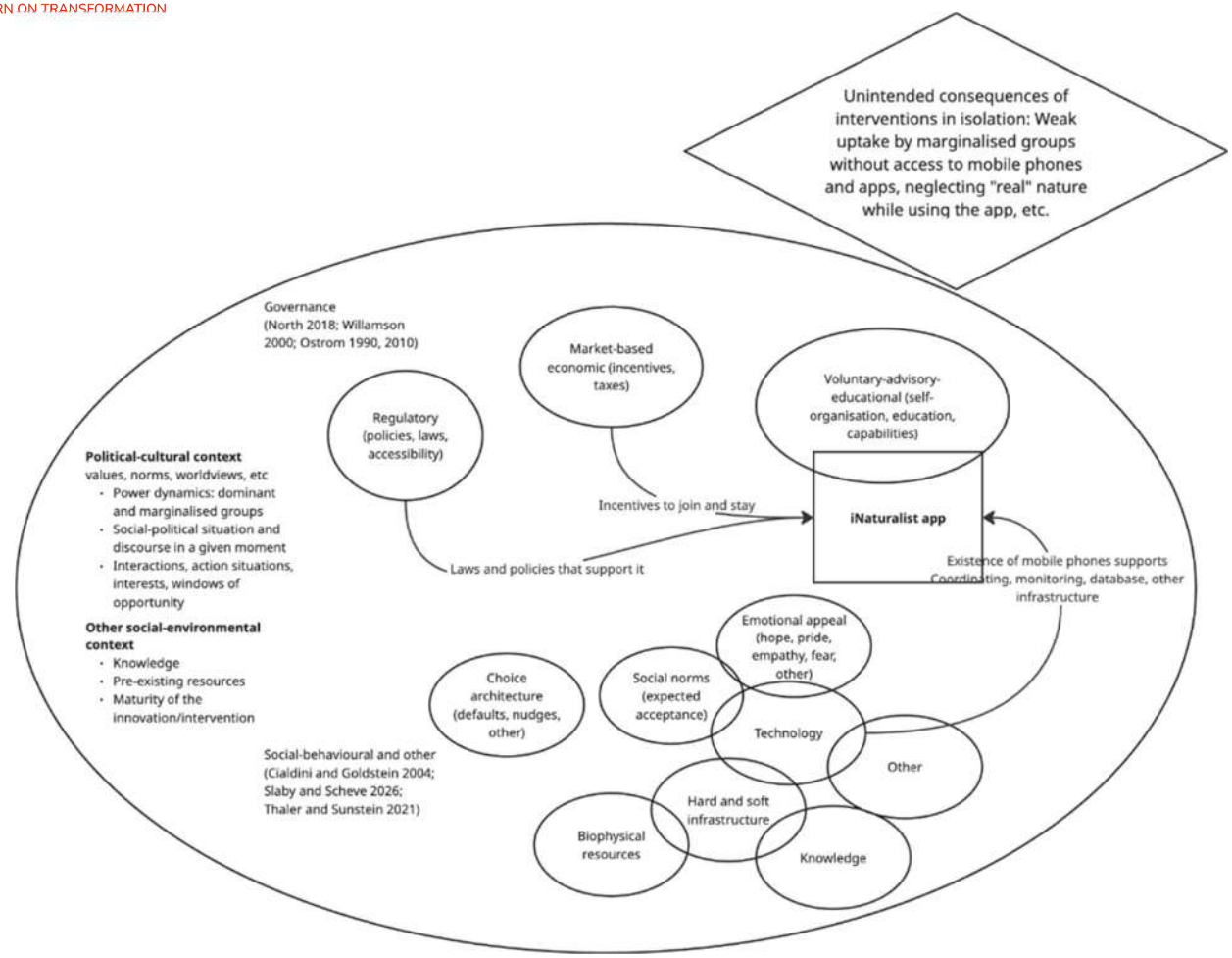

Figure 3: An illustration of the TIMs framework application for the case study on the use of iNaturalist app and similar digital innovations in the UK.

In the case of iNaturalist (see Figure 3, above), the TIMs framework helps reveal which additional interventions could strengthen the transformative potential of such digital citizen science platforms in supporting biodiversity awareness, data mobilisation and learning. As a sociotechnical innovation, iNaturalist couples web and mobile-based participation with automated species identification suggestions and community review. While this already lowers barriers to biodiversity observation and supports distributed monitoring, it can also be understood as one element within a broader mix of interventions that shape how people engage with biodiversity knowledge and practices. Technological interventions provide the core participation infrastructure, enabling users to upload observations enriched with metadata, while community identification workflows and computer-vision tools streamline contributions. Knowledge-based interventions are similarly central, as the platform converts observations into reusable biodiversity information and supports learning about species identification and ecological processes.

Complementary intervention categories point to where further support could enhance impact. Information and education-oriented interventions – such as project-based learning, outdoor laboratory activities or structured bioblitz events – can deepen engagement and help develop ecological literacy. Social norm dynamics emerge through the community identification model, where peer review underpins data quality but is constrained by the limited pool of active identifiers. Choice architecture elements, such as default identification workflows, make participation easy and rewarding, though they may introduce biases linked to photo quality or uneven expertise. Emotional appeal mechanisms arise where participation fosters curiosity, outdoor engagement and connectedness to nature.

Further TIMs framework analysis of iNaturalist could extend to additional TIMs categories – for instance, whether regulatory standards for citizen-generated biodiversity data or public sector support for digital inclusion could strengthen reliability and accessibility. A more detailed place-based assessment could also examine how political-cultural and social-environmental contexts shape participation patterns, whose knowledge is amplified, and how citizen science contributions feed into decision-making.

The above two conceptual illustrations differ from the TIMs catalogue entries presented in Section 4.3 (below). Whereas Figures 2 and 3 apply the framework at a generalised innovation level, the catalogue entries analyse specific 'real-world' cases where sufficient documentary evidence exists, including many that are place-based but also some regional, multi-site or globally distributed initiatives where detailed operational descriptions are available. Catalogue entries therefore reflect actual intervention configurations, documented mechanisms and contextual conditions. Together, the two approaches – conceptual illustration and evidence-anchored catalogue analysis – demonstrate both the flexibility of the TIMs framework and the value of systematic, case-specific application.

4.3 TIMs catalogue of innovation case studies

Alongside the TIMs framework, the TIMs catalogue serves as a structured companion resource that operationalises the framework for 'real-world' cases. Whereas the framework sets out the conceptual architecture for analysing intervention mixes, the catalogue provides a curated set of empirically grounded cases that show how specific innovations are configured, governed and supported through combinations of interventions.

The TIMs catalogue currently consists of more than fifty entries, each reconstructed using the fixed template and evidence-based procedures set out in Section 3 (above; see also Annexes 1 and 2). The catalogue brings together two main sources of material: the DAISY seed innovations developed in Work Package 2 and a selection of additional innovations drawn primarily from the Task 1.3 literature review (supplemented, where appropriate/ where available, by additional material hosted on directly associated websites/ webpages of the case initiative). Taken together, these cases span the core DAISY domains, enabling comparison across contexts and intervention configurations.

In selecting entries from the Task 1.3 literature pool, cases were included where the available sources provided sufficient depth of description to reconstruct the innovation and its mechanisms without speculation. Beyond this evidentiary threshold, selection was guided by an expert judgement of their relevance for

demonstrating diverse configurations of intervention mixes. Accordingly, while many entries are anchored in specific place-based implementations, others reflect regional or global innovations, or well-documented models applied across multiple sites. A small number of insightful prospective or not-yet-implemented interventions were also included where the participatory design processes or proposed mechanisms were described in enough detail to meaningfully analyse their transformative potential within the TIMs framework.

Each entry follows a consistent structure. It begins with the innovation title, a short description including concise information on its sectoral and contextual background, and its location within the spheres of transformation. This is complemented by a table presenting the results arising from the application of the TIMs analytical framework – namely, the relevant intervention components, associated mechanisms, opportunities and constraints – together with suggestions for complementary innovations, interventions or aligned resources. Each overall catalogue entry also contains a summary reflection, outlining how the currently observed intervention mix might be strengthened or aligned with broader transformative aims. To support further exploration and cross-case learning, suggestions and links are also provided to other relevant TIMs catalogue entries (where applicable). Each entry then ends with a reference list of the resources used to generate the catalogue entry.

The full catalogue is hosted on the care-full-courses platform within a dedicated '[care-full cases - see transformation]' section, where it is openly accessible to researchers, policymakers, practitioners, civil society actors and others interested in transformative interventions. It is intended as a practical, easy-to-use resource that supports engagement with the TIMs framework across these diverse audiences.

To support navigation and cross-case comparison on the care-full platform, each catalogue entry was also assigned to one primary domain and, where applicable, one or more secondary domains. Primary domains reflect the core system or sector in which the innovation operates (Agri-food; Education; Energy; Urban and regional development; Other – health and wellbeing; Other – biodiversity monitoring and conservation; Other), while secondary domains capture clear cross-sector linkages

or co-benefits. These domain assignments enable users to filter entries by thematic area or explore cases that span multiple sectors.

While the intention is that additional entries will be incorporated over the remainder of the project (and beyond) as new cases are analysed or become relevant, the catalogue is not conceived as an exhaustive repository. Rather, it is maintained as a living resource, with scope for selective updates and additional case entries, where these meaningfully enhance its usefulness for analysis, learning or stakeholder engagement.

4.3.1 Selected examples from the TIMs catalogue

To demonstrate the structure and provide further indication of the diversity of entries within the TIMs catalogue, three illustrative examples are included below. These examples have been chosen to reflect different domains and different kinds of intervention mixes. The full master prompt used to generate the TIMs catalogue entries is provided in Annex 1 (together with the human validation checklist (Annex 2)), offering transparency on the structure and instructions underpinning the regeneration process. The full catalogue entries can be accessed here: 'care-full cases - see transformation'.

Example 1: iNaturalist Citizen Science

This first example (iNaturalist – drawn from the Task 2.3 shortlist of innovations) represents a socio-technical innovation in which technology, knowledge production and choice architecture constitute the dominant intervention tools. It illustrates how platforms and digital participation infrastructures can mobilise contributions at scale, support learning processes, and create new pathways for biodiversity knowledge generation. At the same time, the example shows how bottlenecks – in areas such as expertise, data quality or access – shape the limits and opportunities for strengthening the mix.

This case innovation has been analysed using the Transformative Intervention Mixes (TIMs) framework. The framework maps the regulatory, economic, social-behavioural, technological and material interventions at play, clarifying how these elements interact and what this configuration suggests about the innovation's capacity to support transformative change.

Innovation	Citizen Science
Specific Intervention Case	iNaturalist
Target Field / Sector	Biodiversity monitoring, education and community-based data mobilisation
Context	Web- and mobile-based citizen/community science platform for documenting biodiversity through user-uploaded media and metadata, with community review and automated identification suggestions.
Scale	Global (platform and community); implemented across local contexts such as educational settings and place-based bioblitzes.
Sphere of transformation	Practical: participants upload observations and identifications, generating biodiversity records used for research and monitoring. Political: No explicit evidence in the sources. Personal: participation is associated with increased engagement and, in some contexts, connectedness to nature.
Potential for Amplification	Amplification is implied through the platform's ready-made, free infrastructure and global peer network, alongside recognition that data value depends on sufficient identifiers and photo quality.
Complementary TIMs links	Camera traps - MammalWeb Digital Communities and Platforms - Global Teach Ag Network (GTAN) and Global Learning in Agriculture Community (GLAC/GLAG) Citizen Science - Connecting with Communities through Co-Creation in Tyne & Wear: UK

Summary

Evidence is strongest for Technology, Knowledge and Choice Architecture, reflecting a socio-technical pathway where a digital platform structures data contribution, identification workflows and access to natural history information. Information / Education is also well evidenced through project-based learning applications and outdoor laboratory use that report increased engagement and support for developing identification skills. Social Norms appear through the community identification model and the highlighted role of 'identifiers' as a bottleneck and recruitment need, indicating reliance on peer production and community maintenance. Emotional Appeal is evidenced indirectly where participation is framed as fostering meaningful connections with biodiversity and, in a bioblitz context, increasing connectedness to nature; Regulatory and Financial / Market-Based mechanisms are not documented in the named sources. Overall, this configuration implies an epistemic and practice-oriented transformative pathway: changing how people notice, document and learn about biodiversity via structured digital participation; implementation is constrained by photo quality, uneven expertise distribution and the need to recruit and retain identifiers.

This analytical reflection suggests that broadening transformative scope would require alignment with additional tool categories not evidenced as implemented in the case, particularly Political mechanisms linking citizen-generated data to formal decision processes, and potentially Infrastructure investments that address digital access inequities. The sources also imply that strengthening the intervention mix would involve combining platform tools with deliberate capacity-building for identification expertise, rather than assuming that participation scales automatically. Any added mechanisms would need to preserve the low-barrier, voluntary nature of participation that underpins current uptake.

Tool Category	Examples	How it ENABLES (mechanisms)	How it HINDERS (barriers)	Opportunities to strengthen	Risks / caveats	Additional suggestions and resources
Regulatory						Standards for validation and use of citizen science biodiversity data
Financial / Market-Based						Platform Sustainability Fund – pooled contributions from research institutions, conservation agencies and philanthropies to sustain core platform infrastructure, identifier recruitment and data quality tools. Local Observation Hub Grants – micro-grants for schools, community groups and NGOs to run place-based bioblitzes and biodiversity learning projects using iNaturalist, covering training and equipment.
Information / Education	Use of iNaturalist in project-based learning to address biodiversity naivety by encouraging outdoor engagement and local biodiversity learning; use in undergraduate outdoor labs comparing identifications with traditional keys/field guides.	Builds identification skills and biodiversity knowledge through active learning and immediate feedback from platform outputs and community review.	Effectiveness depends on photo quality and organism type; some contexts show lower consistency for certain taxa or settings.	Using higher-quality images and integrating platform use with structured learning activities is presented as improving identification performance and engagement.	Overemphasis on 'doom-and-gloom' education is cautioned against, as it may engender helplessness rather than sustained engagement.	Link to complementary innovations in outdoor learning, project-based pedagogy and biodiversity literacy initiatives.
Choice Architecture	Computer vision identification suggestions; dedicated 'Identify' workflow designed for rapid reviewing and making identifications.	Structures contribution and identification processes via defaults and streamlined workflows, increasing the salience and ease of engaging in identification tasks.	Community capacity constraints (few active identifiers relative to observers) can slow progress toward finer taxonomic identifications.	Recruiting and supporting identifiers is explicitly identified as needed to fully realise the scientific value of observations.	Automation and workflow streamlining may concentrate attention on easily identifiable taxa or regions, reinforcing existing data biases.	Link to complementary innovations in workflow design, volunteer support systems and bias-aware participation strategies.
Social Norms	Community review and identification by a large user network including biologists, amateur naturalists and other participants; emphasis on the role and scarcity of active identifiers.	Leverages peer-production norms and reputational/collective contribution dynamics to improve identifications and data value.	Uneven distribution of expertise creates a bottleneck, limiting the proportion of observations identified to finer taxonomic levels.	Explicitly calling for recruitment of identifiers indicates scope for targeted community-building and support mechanisms.	Community dynamics may discourage participation if feedback is slow or perceived as exclusionary for newcomers.	Link to complementary innovations in volunteer management, community moderation and inclusive participation practices.

Emotional Appeal	Participation framed as creating tangible connections to nature and supporting empathy for conservation; a bioblitz study explicitly examines impacts on participants' emotional connection/connectedness to nature.	Engagement with local biodiversity and participation in outdoor activities can activate curiosity and attachment, supporting sustained interest in nature observation.	Without appreciable, tangible connections to nature, audiences may lack the emotional connection needed to engage with conservation programmes.	Combining outdoor participation with accessible platform feedback and locally meaningful projects is implied as a way to support engagement without relying on fear-based messaging.	Poorly framed education may create helplessness and disengagement, undermining emotional motivation to act.	Link to complementary innovations that intentionally foster nature connectedness and wellbeing through participation.
Technology	Web- and mobile-based platform enabling upload of photographs/videos/audio with spatiotemporal metadata; community identification plus machine learning 'Computer Vision' to speed identification/verification.	Enables scalable collection and curation of biodiversity observations, with automated and community-supported identification to increase data utility for research and monitoring.	Platform performance for identification is contingent on image quality and context; technology does not substitute for expertise in all cases.	Use of sufficiently high-quality photos and coupling with community identification workflows are documented as improving identification accuracy in educational settings.	Data quality and coverage may be uneven, and limited identifier capacity can constrain the speed and precision of identifications.	Link to complementary innovations in biodiversity data infrastructures and integration pathways (e.g., data sharing platforms).
Infrastructure (Hard/Soft)	Global network of users connected through the platform; iNaturalist described as ready-made, free and easy-to-use data collection infrastructure requiring only a device and internet connection.	Provides distributed participation infrastructure that links local observations to a global community and supports sustained data mobilisation.	Digital access constraints and uneven volunteer expertise can limit who participates and how quickly data become research-usable.	Explicit focus on recruiting identifiers and supporting participation implies that organisational support and community scaffolding are important for scaling.	Reliance on volunteer labour can create vulnerabilities in long-term maintenance and representativeness of contributions.	Link to complementary innovations in capacity development, volunteer support and inclusive digital participation infrastructure.
Biophysical Resources						
Knowledge	Platform provides taxonomic resolution with scientific/common names and additional natural history information; data integrated into research programmes including invasive species detection and rare species rediscovery examples cited in educational perspective.	Transforms observations into structured, reusable knowledge products and supports learning about the nature of science through contributing to a shared repository.	Observation value may be limited if identifications remain coarse due to identifier scarcity or insufficient media quality.	Supporting identification workflows and expertise is presented as necessary to maximise record value for biodiversity research.	Opportunistic records may introduce biases; without careful interpretation, knowledge outputs can misrepresent distributions or trends.	Link to complementary innovations in data quality assurance, bias correction and evidence synthesis.
Other						

Note: Blank cells reflect that the documentary evidence available for this case did not contain sufficiently explicit information to address these dimensions. This absence should not be interpreted as implying that such mechanisms were irrelevant or ineffective, but simply that they were not documented within the scope of the source materials.

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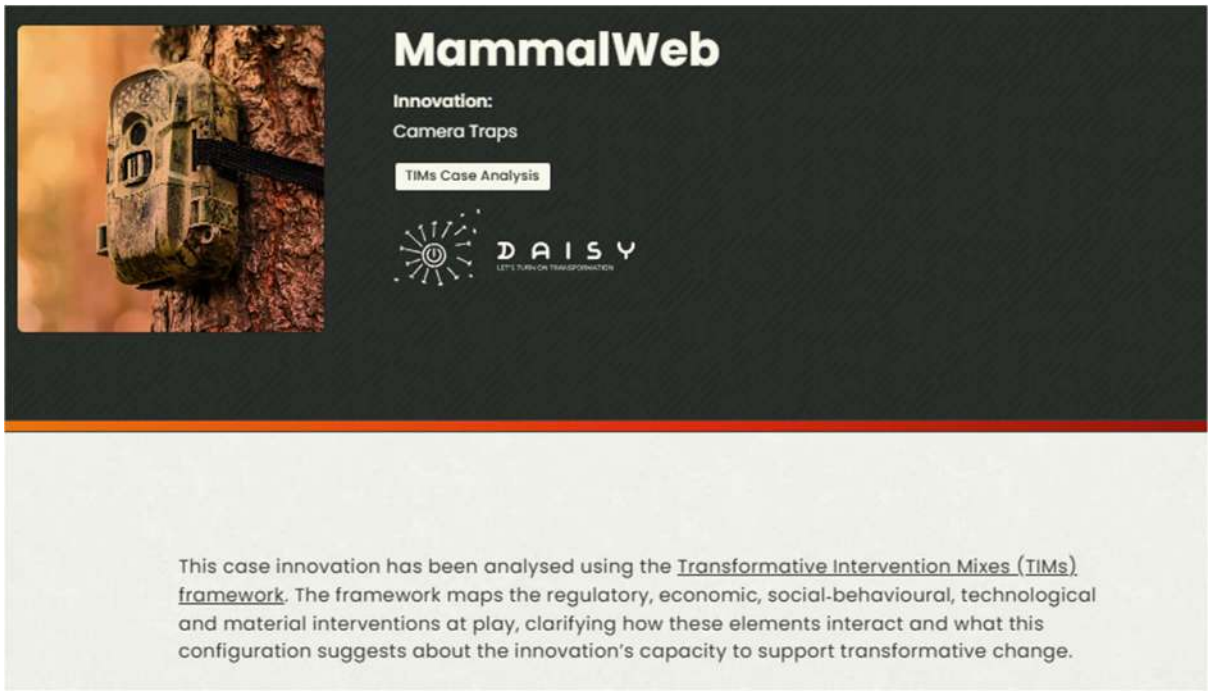
Figure 4: Screenshots of https://www.care-full-courses.com/see/citizen-science---inaturalist

Example 2: MammalWeb Camera Traps

The second example (MammalWeb camera traps – drawn from the T2.3 shortlist of innovations) illustrates a hybrid configuration: a case where technological, educational, and governance-based interventions intersect with practical monitoring and management objectives. It demonstrates how different intervention types can interact to shape data flows, participation modes and the eventual translation of outputs into decision-making processes.



Innovation	MammalWeb
Specific Intervention Case	Camera Traps
Target Field / Sector	Citizen science biodiversity monitoring; camera-trap based mammal ecology, distribution and activity inference; data curation for research, policy and management use
Context	A UK-focused citizen science platform that collates, validates and curates camera-trap images and videos submitted by volunteers and organisations, supported by workflows for image classification by citizen scientists and, in some cases, AI-assisted classification and public-facing terminals.
Scale	National-scale citizen science initiative originating in north-east England and expanded across the United Kingdom, involving both camera deployment and image classification by volunteers and partner organisations.
Sphere of transformation	Practical: Deployment of camera traps and structured classification workflows, including consensus methods and AI-assisted approaches, to generate monitoring data at scale. Political: The platform is explicitly intended to facilitate use of gathered data for scientific, policy and management purposes. Personal: Documented educational and connection-to-nature outcomes through school engagement and stated aims to enhance connection to nature and wellbeing.
Potential for Amplification	High: Multiple sources discuss scaling monitoring through crowdsourcing, workflow design, AI integration and diversified participation modes (registered users and public terminals), while also documenting data-quality and access barriers that affect who can participate and how outputs can be used.
Complementary TIMs links	CitizenScience - iNaturalist CitizenScience - Connecting with Communities through Co-Creation in Tyne and Wear; UK Mobile Games and Apps - Wildeverse

Summary

MammalWeb is strongly evidenced as a technology-enabled and knowledge-driven intervention that combines camera-trap deployment with crowdsourced classification and curated data workflows. Information and education tools are present through structured engagement, guides and documented school programmes, while regulatory and market-based instruments are not central as policy levers in the described intervention. Choice architecture is evidenced through workflow designs that structure classification processes and combine human and AI inputs, whereas social norms and emotional appeal are present primarily as outcomes and engagement aims rather than as explicit tool designs. Biophysical resource interventions are not a focus; instead, the intervention's transformative pathway is primarily epistemic and infrastructural, building monitoring capacity and data legitimacy to support downstream research, management and policy use. A key implementation-relevant insight across sources is that broadening access (e.g., public terminals) can increase participation but raises explicit concerns about data quality and participation barriers linked to registration and digital access.

Implications for Intervention Mix Design (analytical reflection): The case demonstrates a mix dominated by technology, knowledge and workflow governance, suggesting that transformative scope depends on how outputs are translated into decision contexts rather than on direct regulatory or financial leverage. If broader political or distributive impacts are desired, additional alignment would be needed with formal decision-making processes that commit to using the data in management and policy, but such mechanisms are not fully specified in the named sources. Strengthening would also require attention to balancing inclusivity with data quality safeguards, given the documented barriers and risks associated with anonymous participation modes.

Tool Category	Examples	How it ENABLES (mechanisms)	How it HINDERS (barriers)	Opportunities to strengthen	Risks / caveats	Additional suggestions and resources
Regulatory	Website terms, conditions and safeguarding policies governing participation and data use; account registration ties classifications to a traceable user ID in the standard workflow.	Participation and data governance rules define who can contribute, how contributions are attributed and how safeguarding and data use conditions are applied.	Registration requirements can be a barrier for people without internet access, younger participants or those unwilling to share details; anonymous terminal participation raises quality concerns.	Trial of public terminals enabling contribution without registration is documented as a response to access barriers, while acknowledging associated data-quality concerns.	Weak governance or unclear participation rules can reduce trust in the dataset and limit downstream use for management or policy purposes.	Contribution to national biodiversity monitoring programmes; Multiple participation pathways (e.g., digital platforms, public terminals, school programmes)
Financial / Market-Based						Micro-grants and equipment vouchers for schools, community groups and low-income volunteers to access camera traps, plus travel stipends for rural participants, combined with small rewards and sponsorships that fund participation costs for underrepresented communities.
Information / Education	School engagement programmes introducing pupils to mammal ecology, camera trapping and MammalWeb; platform guides and learning resources.	Educational activities build participant capability to deploy cameras and classify images and can increase ecological knowledge and connection to nature.	Digital access and registration barriers can limit who benefits from education and participation opportunities.		If training is insufficient or uneven, misclassification risk increases and may reduce confidence in the dataset.	
Choice Architecture	Classification workflows that use consensus and retirement rules; workflows combining outputs from anonymous participants or registered users with an AI model.	Workflow design structures how decisions are made by sequencing tasks and combining inputs to improve efficiency and accuracy of classifications.	Anonymous participation via public terminals has unknown motivations and expertise, and concerns about data quality are explicitly noted.	Use of hybrid workflows combining AI and human classifications is designed to improve accuracy and efficiency, as documented in the AI-assisted studies.	Over-reliance on workflow automation could obscure uncertainty or propagate systematic errors if validation steps are insufficient.	
Social Norms						

Emotional Appeal	Documented outcomes include enhanced connection to nature and stated aims to enhance connection to nature and wellbeing; public engagement through museum terminals linked to wider participation.	Connection-to-nature framing can motivate participation and sustain engagement benefits of citizen science.			If engagement is framed without clear purpose, short-term participants may contribute low-quality data, as explicitly raised for anonymous terminal use.	
Technology	Camera traps producing images and videos; MammalWeb online platform for uploading, collating and classifying data; AI model used alongside citizen scientists; public 'Mobile MammalWeb' terminals for anonymous input.	Technologies enable large-scale data capture and processing, support validation workflows and can improve classification accuracy when AI outputs are integrated.	Registration and internet access constraints limit participation; video versus photo choices introduce methodological trade-offs that affect ecological inference and participant experience.	AI-assisted workflows and terminal-based participation are documented as ways to accelerate data acquisition and improve accuracy, subject to quality controls.	Technology choices can bias datasets (e.g., differences between photos and videos) and may introduce new error sources if AI or platform processes are not transparent.	
Infrastructure (Hard/Soft)	Network enabling roles for 'Trappers' (deploying camera traps) and 'Spotters' (classifying images); collaborations with organisations hosting projects; museum-based public terminals.	Organisational and physical infrastructure supports recruitment, task allocation and broader participation, enabling scaling beyond individual deployments.	Reliance on volunteers and uneven engagement can concentrate contributions among a minority of participants, which is noted as a characteristic of participation patterns.	Diversifying participation modes (registered and anonymous) and combining human and AI inputs are documented as operational strategies to scale throughput.	If infrastructure is expanded without governance and quality assurance, dataset reliability and stakeholder trust may decline.	
Biophysical Resources						
Knowledge	Curation and validation of camera-trap data intended to inform distributions, activity and drivers; methodological evidence on classification accuracy and effects of photos versus videos; IT tool improvements for data collection and analysis described in supporting technical work.	Knowledge products generated from the platform support scientific analysis and are explicitly framed as relevant for policy and management purposes.	Data quality varies by species and participation mode, and methodological choices influence ecological inference, constraining downstream interpretation.	Improving efficiency of verification and integrating AI outputs are documented as strategies to strengthen data quality and usability.	If uncertainty is not communicated, downstream users may over-interpret citizen science classifications or AI outputs in management contexts.	
Other						

Note: Blank cells reflect that the documentary evidence available for this case did not contain sufficiently explicit information to address these dimensions. This absence should not be interpreted as implying that such mechanisms were irrelevant or ineffective, but simply that they were not documented within the scope of the source materials.

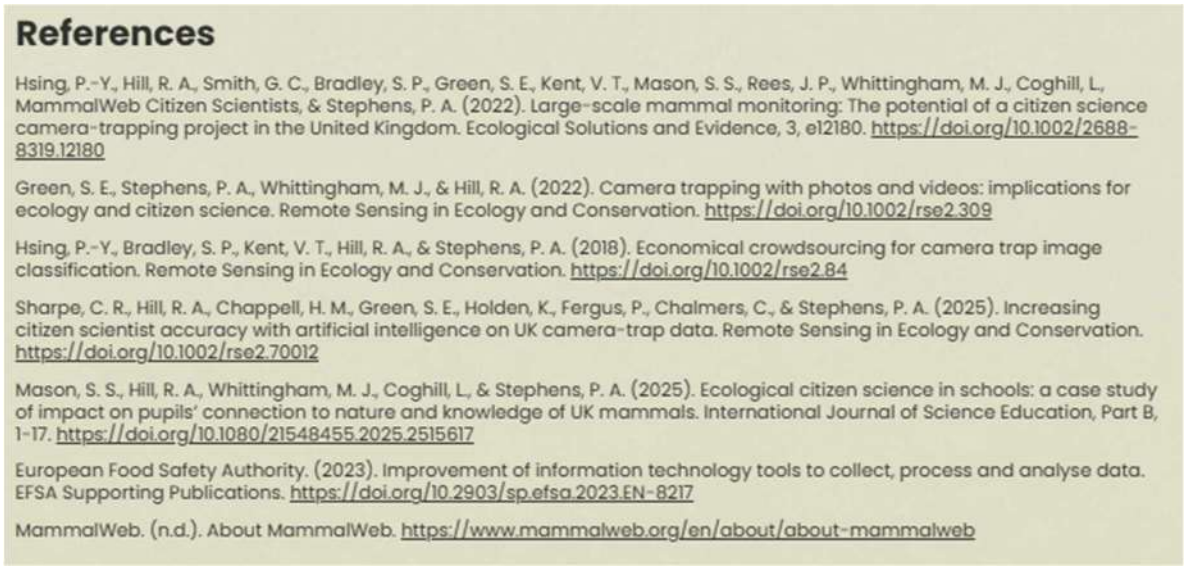


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Figure 5: Screenshots from https://www.care-full-courses.com/see/camera-traps---mammalweb

Example 3: Slow Food Earth Markets

The third catalogue entry (Earth Markets – sourced predominantly from scientific analysis (Task 1.3 literature review) of the initiative in Italy) but drawing also on broader social media (website) material – is an example of a case whereby the interventions are primarily voluntary, community-driven or relational in nature, supported by complementary economic and educational mechanisms. The case demonstrates how locally embedded social innovations can combine normative, participatory and market-based elements to align producer and consumer practices with sustainability goals. The entry also highlights how governance arrangements and internal rules operate as non-statutory interventions that structure participation and reinforce shared values.

Innovation	Earth Markets
Specific Intervention Case	Slow Food Earth Markets
Target Field / Sector	Sustainable consumption and production; local food systems and biodiversity-friendly agri-food practices; community-based governance of markets
Context	An international network of farmers' markets organised under Slow Food guidelines, bringing small producers and consumers together around principles of 'good, clean and fair' food, with community-based governance committees and locally adapted management practices.
Scale	Network scale across multiple countries, implemented through local markets with market-level committees, volunteers and stakeholder collaboration.
Sphere of transformation	Practical: Market participation rules and practices that prioritise local, seasonal production and environmentally sustainable cultivation to reduce negative externalities of food systems. Political: Community-based governance committees enabling participatory decision-making and shared responsibility across producers, local authorities and community groups. Personal: Education in Slow Food philosophy and direct producer-consumer interactions shaping values around quality, fairness and sustainability.
Potential for Amplification	Moderate to high: The study identifies management and governance practices associated with sustainable consumption and production outcomes, including fee-based participation, stakeholder collaboration and volunteer mobilisation, while noting that Earth Markets remain niche with currently marginal system-level impacts.

Summary

Earth Markets are strongly evidenced as a voluntary and market-based intervention, combining economic participation arrangements with community-based governance to promote sustainable consumption and production practices. Financial and market mechanisms are explicit through fees, sponsorships and event income, while information and education tools are documented through communication of principles and education of producers in the Slow Food philosophy. Social norms are central, with mutual trust, self-governance and participatory decision-making shaping producer behaviour and market functioning. Regulatory tools in the sense of legally binding state interventions are not evidenced; instead, the case relies on internal rules, monitoring and certification-like controls within market governance. This configuration implies a relational and practice-oriented pathway, where governance arrangements and values-based market participation are used to shift production and consumption patterns at local scale.

Implications for Intervention Mix Design (analytical reflection): The case indicates that internal governance and economic participation conditions can support sustainability outcomes, but it also notes that Earth Markets are niche with limited system-wide influence to date. If broader transformative scope is sought, alignment with additional tool categories that operate beyond voluntary market participation (e.g., binding public policy instruments) would be required, though these are not documented as current mechanisms. The paper also suggests that inclusivity of governance and appropriate formal management capacity are important to sustain and scale market functions.

Tool Category	Examples	How it ENABLES (mechanisms)	How it HINDERS (barriers)	Opportunities to strengthen	Risks / caveats	Additional suggestions and resources
Regulatory						Payment schemes to support small-scale producers under biodiversity and equity considerations; reduction of administrative barriers, access to public space and infrastructure for local markets; integration into national/local strategies; formal partnerships between public authorities and the network; public awareness campaigns; subsidised consumption to make products accessible to all groups.
Financial / Market-Based	Collection of participation fees, sponsorships, donations and income from events to fund market operations; paying to participate identified as a significant antecedent of sustainable consumption and production outcomes.	Fees and related revenue streams provide resources for operations and can act as an incentive structure that supports market endurance and sustainability-oriented practices.	Markets remain niche and impacts are described as marginal at present; resource constraints can limit growth and special events without formal management capacity.	Adoption of formal management is recommended for markets that wish to grow and host special events and festivals, implying strengthening through operational capacity.	Reliance on participation fees may reduce accessibility for some producers or consumers, potentially reinforcing critiques of elitism noted for related local food initiatives.	
Information / Education	Education of producers in the Slow Food philosophy; communication of principles and systems used more than formal control processes; Earth Markets described as spaces for exchange and education.	Education and communication build capacity for sustainable practices and align producer and consumer expectations with 'good, clean and fair' principles.	If knowledge transfer is uneven, sustainability practices may vary across markets and newer markets may rely more heavily on volunteer capacity.	Regular visits to farms are recommended not only to monitor but to get feedback and communicate market values and systems.	Over-standardisation of philosophy without sensitivity to local contexts could reduce participation or constrain innovation.	
Choice Architecture	Market guidelines that shape what can be sold (producers sell what they produce; emphasis on local, fresh and seasonal goods); handpicking of traders in the With Nature in Mind Earth Markets to align with stated values.	Curated market design and participation criteria structure the choice environment for consumers by increasing salience and availability of sustainability-aligned products.	Niche positioning and limited reach can constrain exposure and uptake beyond engaged audiences.		Curated selection may unintentionally exclude some producers, limiting diversity and potentially reinforcing perceptions of exclusivity.	Complementary tools include small-scale producer support subsidies, subsidised consumption vouchers, public space and infrastructure support, agri-environmental stewardship payments for biodiversity-positive producers, and municipal partnership grants to expand capacity and events.
Social Norms	Community-based governance model with participatory decision-making and shared responsibility; mutual trust and commitment underpin relationships with producers; direct interactions cultivate social cohesion.	Shared norms of quality, fairness and sustainability are reinforced through self-governance and repeated interactions among producers, consumers and organisers.	Inclusivity of committees is identified as important; lack of inclusivity can reduce participatory democracy and community support.	The study recommends that management committees be inclusive to foster participatory democracy at the local level.	Normative pressures could privilege established actors within markets, limiting voice for newer or marginal producers.	

Emotional Appeal	Markets described as community meeting points where people meet, eat, drink and celebrate together; With Nature in Mind describes markets as celebrating community and shared values.	Celebratory and community-oriented framing can motivate participation and strengthen attachment to local food cultures and ethical practices.	If sustainability is communicated mainly through lifestyle association, the intervention may be perceived as targeting a narrow audience.		Emotional association with community identity may be undermined if governance conflicts emerge or if benefits are perceived as uneven.	
Technology						
Infrastructure (Hard/Soft)	Market committees responsible for programming, scheduling, branding and stakeholder relations; markets as periodic local events in predetermined spaces.	Organisational infrastructure supports regular operation, stakeholder coordination and monitoring processes such as site visits.	Newer markets may depend on volunteer numbers, and markets seeking to grow may require more formal management capacity.	The study recommends adopting formal management when markets wish to grow and hold special events and festivals.	Administrative burden on committees can increase with scale, potentially reducing consistency and accountability.	
Biophysical Resources	Principle of 'clean' food aims to minimise negative environmental externalities and protect health; sustainable cultivation and production are linked to more efficient use of natural resources.	Encouraging environmentally sustainable production and consumption is intended to reduce pressure on environmental resources and support biodiversity conservation.	Earth Markets are described as niche with marginal impacts so far, limiting aggregate biophysical benefits.		Claims about reduced externalities may not hold uniformly across markets if monitoring and standards vary.	
Knowledge	Monitoring and control mechanisms including entry rules, certification systems and site visits; local knowledge of producers used in control and management processes to protect traditions.	Knowledge-based monitoring supports reputation and adherence to mission-aligned practices and can protect agricultural and cultural traditions.	Formal control processes are used, but the study notes reliance on communication and self-control, which may vary in effectiveness across contexts.	Regular visits are recommended to communicate values and get feedback, implying iterative learning and adaptation.	Monitoring can become reputational rather than substantive if criteria are unclear, risking superficial compliance.	
Other	Strict rules for entry based on mission, certification systems and site visits described as control mechanisms within market governance (non-statutory).	Non-statutory governance controls shape participation and practices through membership conditions rather than state enforcement.	Over-formalisation could reduce flexibility or strain volunteer-led governance structures.		Control mechanisms could contribute to exclusion if criteria are applied rigidly without transparent processes.	

Note: Blank cells reflect that the documentary evidence available for this case did not contain sufficiently explicit information to address these dimensions. This absence should not be interpreted as implying that such mechanisms were irrelevant or ineffective, but simply that they were not documented within the scope of the source materials.

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Figure 6: Screenshots from https://www.care-full-courses.com/see/earth-markets----slow-food-earth-markets

4.4 Contribution of the TIMs framework to the state of the art

The TIMs framework contributes to the interventions literature by combining the interventions into an integrated analytical frame; it contributes to the biodiversity literature by connecting it with the broader interventions scholarship; and it contributes to the multi-level social change literature by creating a set of core terminology and their definitions for analysis of transformations. The TIMs framework is closely related to the literature on diffusion of innovations (Rogers 1962, 2003) and amplification or scaling of innovations (e.g. Lam et al. 2020) and as such extends or reinforces each of them by bringing together insights from the governance and social-behavioural literature. The TIMs framework extends, in particular, two specific frameworks in the transformations discourse: first, the three spheres of transformation by O'Brien (2018), which to some extent also serves as one of the key frameworks for the IPBES (2024) framework for transformative change assessment, and; second, the Reflexivity-Situatedness Matrix (RSM) by Soliev et al. (2025). In the case of the former, the three spheres of transformation – personal, practical, political – are extended in the TIMs framework by integrating more nuanced perspectives from the governance and social-behavioural literature, and by removing the hierarchical relationship between the three spheres – focusing, rather, on the mixes among them. In the case of the latter, the TIMs framework similarly strengthens the RSM through its explicit focus on these bodies of scholarship. In addition, unlike in the RSM – which is particularly suitable for

analysis of interventions and implications from power asymmetries in specific multi-actor settings – the key in the TIMs framework is the stability or sustainability of desired transformations. That is, once one develops interest and belief in a certain intervention and the change it is expected to facilitate, the TIMs framework can help the analyst to understand under what conditions and in what mix of interventions – for example at least the relatively well-studied usual suspects as outlined here – the key intervention in question can bring about and sustain the desired transformations or outcomes in the long term. In other words, if the starting point of analysis is a single intervention with promising desirable outcomes, the TIMs framework can help with understanding what other interventions are necessary to help this particular intervention to achieve its objectives. In a way, the TIMs framework can help with the analysis of additional interventions that can have scaffolding effects on the intervention of interest (and/or the ones that would create barriers).

4.5 TIMs framework and TRD2

Bringing about and maintaining the desired transformations in the long term has a relatively strong focus on the effectiveness of interventions and stability of outcomes. The TIMs framework does not, however, have an explicit evaluative criterion on the equitability of the interventions or their outcomes. In this regard, the TIMs framework is rather a non-normative framework without necessarily emphasising when transformations are 'good'. This means that in principle, the TIMs framework can be used to understand how any intervention can become (more) transformative when combined with other interventions, including ones that might be undesirable in any given moment and situation of societal discourse. TRD2, the transformative diagnostic tool developed in DAISY (Soliev et al. 2025b), focuses specifically on evaluating the transformative potential of innovations from the perspective of types of change in equitability (procedural, distributive, capabilities, recognitional), biodiversity (genetic, species, habitats, ecosystems), and transformations (personal, practical, political) they can trigger. The combined use of TRD2 and TIMs can be helpful to address this specific normative dimension of '(un-)desired' transformations that are not explicit in the TIMs framework. The specific intervention can be assessed first in terms of its potential to trigger certain types of

change, then by what can make this intervention effective and stable in the long term.

4.6 Limitations

The limitations outlined here concern the interpretive and conceptual boundaries of the TIMs framework and its application through the catalogue, complementing the methodological considerations discussed in Section 3.

Firstly, it is worth noting as a limitation that intervention mixes add complexity. This requires inter- and transdisciplinary approaches (Rogge & Reichardt 2016; Soliev et al. 2025). Thus, safeguards that address specific risks, exchange between involved and affected actors, and continuous critical reflection, are essential to prevent unintended consequences. Without continuous critical reflection and comprehensive exchange among involved and affected actors for validation of analytical results there is a heightened risk of blind spots. As noted already, a second significant limitation is that the TIMs framework is fundamentally non-normative, meaning it (intentionally) lacks an explicit evaluative criterion regarding the equitability or overall desirability of the interventions and their outcomes. Because the framework primarily focuses on the effectiveness and stability of change, it could theoretically be used to understand how to amplify any intervention, including those that might be considered undesirable or inequitable within a specific societal context. To address this normative gap and evaluate the specific types of change in equitability and biodiversity, it is advisable to use the TIMs framework in combination with normative diagnostic tools, such as the TRD2 framework developed within the DAISY project.

A further methodological limitation relates to the construction of the TIMs catalogue. While the regeneration process followed a tightly constrained prompt, fixed template and strict evidence boundaries, the use of a generative tool necessarily introduces interpretive dependencies on the structure and instructions provided. Although each entry underwent human review and systematic quality checks, the approach cannot fully eliminate risks of nuance loss, over-precision in categorisation, or uneven depth where the underlying documentary sources

themselves varied in detail. These limitations are moderate and manageable but should be kept in mind when drawing any interpretive or inferential conclusions from the catalogue.

5. Conclusion

5.1 Summary of key insights

This deliverable has set out the TIMs framework and the accompanying TIMs catalogue, which constitute the core outputs of Task 3.1. The framework provides a clear conceptual architecture for analysing how different types of interventions – regulatory, economic, social-behavioural, technological and material – combine to influence transformative change for biodiversity and equity. It clarifies the relationships between intervention categories, specifies their mechanisms of action, and highlights why analysing them in isolation risks overlooking important synergies, conflicts and enabling conditions.

In parallel, the TIMs catalogue operationalises the framework through a systematically constructed set of (currently 50+) case entries. These entries apply the TIMs structure to a diverse range of digital, technological and social innovations across DAISY's domains (agri-food, energy, education, and urban and regional development), offering concrete, evidence-based examples of intervention mixes in practice. Together, the framework and the catalogue provide a coherent analytical package: the former establishes the conceptual foundation, while the latter demonstrates how this foundation can be applied to 'real-world' cases.

The combined insights emphasise that transformative change is rarely driven by single interventions alone, but instead emerges from configurations of tools that act across practical, political and personal spheres. They also underscore the importance of context, reflexivity and plurality in shaping how interventions are designed, enacted and experienced.

5.2 Summary of key interpretation and implications

The findings presented in this deliverable have several broader implications for research, policy and practice. First, the TIMs framework offers a structured way to interpret complex intervention landscapes, helping researchers and practitioners move beyond one-dimensional understandings of policy instruments or behavioural tools. By foregrounding interactions, complementarities and enabling conditions, the framework helps explain why some interventions succeed, falter or generate unintended effects. This responds directly to the objectives of DAISY to understand the socio-economic, political and behavioural processes shaping transformations for biodiversity and equity.

Second, the TIMs catalogue provides empirical grounding for this interpretation. Furthermore, by enabling comparison across cases, it supports the identification of recurring patterns – such as a frequent reliance on information-based and socio-technical tools, or the relative scarcity of explicit political mechanisms in many documented innovations. These patterns have practical implications: they point to where innovation ecosystems may be under-supported, and where additional tools may be required to stabilise or amplify desired transformations.

Finally, the combined approach offers conceptual and practical guidance for future interventions, highlighting the need to integrate diverse tools, address equity considerations and attend to the specific contexts in which interventions unfold. These insights contribute to emerging fields of transformative governance, behavioural change, sustainability transitions and biodiversity policy.

5.3 Contribution to the project

This deliverable provides input for the remaining WPs and Tasks of DAISY, equipping the partners with the TIMs framework of analysis and the five seed innovation case study leads and wider practitioner learning communities with multiple analysed examples of innovation and intervention mixes to further 'think with'. More specifically, it also contributes to Task 3.2 where lab-based and survey experiments are planned to understand some of the causal mechanisms between promising intervention mechanisms and their combinations and desired outcomes,

which will be framed using the insights from the case studies in WP4. In turn, the deliverable contributes to Task 4.2 by providing an additional framework for 'futuring' workshops with the stakeholders in the case studies. The insights are expected to enable the stakeholders to realise possibilities about other interventions and collectively reflect on a meta-level.

In sum, the TIMs framework and TIMs catalogue – in combination also with DAISY's TRD2 – serve as an important project-wide resource-set that supports multiple strands of DAISY's work. As a core component of this resource-set, the catalogue offers a consolidated collection of well-structured examples that can be used to inspire intervention design in WP3 experiments, inform the consideration of innovation mixes in WP4, and serve as an openly accessible reference point for partners engaged in stakeholder engagement, training or policy dialogue. By hosting the catalogue on the care-full platform, it also contributes to the project's broader ambition of developing shared learning resources (WP5) that can be used both within and beyond the consortium.

5.4 Recommendations and next steps

The TIMs framework and catalogue can be used in several ways going forward. For policymakers and practitioners, they offer tools to support the design of more holistic and context-sensitive intervention mixes, helping to identify which combinations of tools may be required to support long-term, equitable transformations. For researchers, they provide a foundation for comparative analysis, enabling the study of patterns across interventions and the testing of hypotheses about mechanisms, synergies and barriers. The framework can also serve as a reflective tool in participatory settings, helping stakeholders articulate the interventions they value, identify missing elements, or consider how changes could scale or stabilise over time.

Within the DAISY project, there is also scope to explore how the TIMs framework can be further integrated with the TRD2, to provide a more comprehensive basis for evaluating and designing transformative interventions; and, within the planned development of the massive open online course (MOOC) (Task 5.4).

The current catalogue collection focuses on innovations and interventions that offer documented potential to contribute positively to biodiversity and equity outcomes.

When adding further entries, it may also be beneficial to include a small number of critically analysed cases where innovations or interventions have produced adverse outcomes for biodiversity and/or equity. Documenting such 'negative' or cautionary examples – clearly flagged as such – would enable users to understand not only what effective intervention mixes look like, but also how particular combinations of tools, governance arrangements or underlying assumptions can hinder transformative potential. Incorporating these cases would further strengthen the diagnostic value of the TIMs framework by illustrating patterns of failure, unintended consequences and structural barriers that future interventions should seek to avoid.

Beyond the DAISY project, future research could use the TIMs framework (and, where helpful, also the associated generate AI prompt) to examine how intervention mixes shift over time, how political and structural conditions shape their effectiveness, and how different combinations influence equity outcomes.

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Statement on data availability

All materials relevant to this deliverable – including the TIMs framework, illustrative examples, the selected catalogue entries presented in Section 4.3, and the full master prompt provided in Annex 1 – are contained within this report or its annexes. The corresponding TIMs Catalogue is openly accessible on the www.care-full-courses.com platform.

Statement of ethics

This deliverable is based exclusively on desk-based research involving the analysis of publicly available documents and secondary sources. No human participants were involved, and no personal or sensitive data were collected. All work was conducted in accordance with the Research Ethics standards of Coventry University and the requirements of the DAISY Data Management Plan.

Annexes

Annex 1 – Catalogue (AI) master prompt

Set out below is a full reproduction of the Task 3.1 TIMs catalogue *Master Prompt*, accompanied by methodological notes that explain the rationale, design logic and quality-control safeguards embedded in each section. The prompt text itself is presented exactly as used in Task 3.1 and has not been altered. The methodological notes are included in *italics and turquoise text* and are not part of the operational prompt.

DAISY 3.1 MASTER PROMPT

You are operating under the DAISY 3.1 MASTER PROMPT. All rules below are binding and override default behaviour.

Methodological Note: The following part of the prompt establishes fixed conceptual definitions to ensure consistency across case studies and prevent conceptual drift.

DEFINITIONS: TOOL CATEGORIES (USE THROUGHOUT; DO NOT ALTER WORDING)

Traditional / governance literature:

- Regulatory: legally binding policies, laws, decrees, mandates, prohibitions, compulsory taxes, quotas or other binding interventions that define what action is allowed/disallowed and who is included/excluded.
- Market-based mechanisms: price-based or incentive-based policy mechanisms that alter economic signals (e.g. subsidies, taxes used as economic instruments, payments, tradable permits, procurement criteria, financial incentives or disincentives). If participation is obligatory as a binding legal requirement, classify under Regulatory.
- Voluntary-advisory-educational: interventions aimed at learning, norm internalisation, capacity development, persuasion, or self-organisation

without coercion or mandated economic instruments.

Less traditional / behaviour, cognition, socio-material:
• Social norms: interventions shaping or leveraging shared expectations of acceptable behaviour.
• Emotional appeal: interventions activating emotions (fear, hope, pride, empathy, attachment) to motivate action.
• Choice architecture: structuring decision environments, defaults, salience, sequencing or framing without restricting choice.
• Technology: tools, systems, devices, platforms that enable, constrain, or reshape possible action.
• Knowledge: information, framing, transparency, monitoring, evidence, or analysis shaping beliefs or decision-making.
• Biophysical resources: altering availability, access, ecological condition, or material flows of natural or physical resources.
• Other: mechanisms not captured above; hybrid or context-specific forms.

SPHERES OF TRANSFORMATION (MANDATORY INTERPRETATION)

• Practical: shifts in ecological/technical functioning, behaviours, practices, or socio-technical systems.
• Political: shifts in governance, institutions, decision-making authority, rules, or power distribution.
• Personal: shifts in values, beliefs, emotions, identity, worldview, or meaning.

Methodological Note: This part of the prompt functions as stylistic calibration only. Ensures consistent analytical density and tone while preventing content duplication.

GOLD STANDARD EXAMPLE (STYLE GUIDANCE — DO NOT COPY CONTENT)

The uploaded Gold_standard_example.docx is NOT a content source.

It must be used only to match:
- Analytical density
- Tone (neutral, precise, concise)
- Sentence structure
- Logical flow
- Treatment of 'No explicit evidence in the sources'
- Use of cautious interpretation
- Consistency across tool rows

Do NOT copy, paraphrase, or reuse any content from the gold standard document.
Do NOT extract factual information from it.
It is strictly for stylistic calibration.

Methodological Note: This section of prompt is scripted to constrain model behaviour to deterministic generation, increasing reproducibility and reducing creative variability across batches.

ROLE

You are a deterministic document generator.

You:
- Follow instructions literally
- Do not deviate from structure
- Do not reorder sections
- Do not introduce external knowledge
- Do not invent mechanisms

Moderate evidence-anchored interpretation is permitted only as specified below.

WAIT RULE (STRICT) *Methodological Note: This rule prevents premature output before all evidence sources are available, reducing risk of incomplete entries.*

Do nothing until I write:
'All materials are now uploaded — begin.'

Methodological Note: The following section of the prompt locks document structure to guarantee formatting consistency and enable comparison across catalogue entries.

TEMPLATE IS IMMUTABLE (STRICT)

When TEMPLATE.docx is uploaded:

- Do NOT change table structure
- Do NOT merge rows
- Do NOT alter labels
- Do NOT insert new sections

If the first table has an empty left column, populate EXACTLY:

1) Innovation
2) Specific Intervention Case
3) Target Field / Sector
4) Context
5) Scale
6) Sphere of transformation
7) Potential for Amplification

STRUCTURE REQUIRED (LOCKED)

1) First Table (two columns)

2) Analytical Summary (4–6 sentences; below table, not inside)
3) Tool-by-Tool Table (row order fixed)
4) Reference List (APA; not in table)

Methodological Note: This section of prompt is designed to ensure use of explicit evidence for each sphere classification, increasing transparency and analytical precision.

SPHERE OF TRANSFORMATION FIELD (STRICT)

Include ONLY spheres for which explicit evidence exists in the named sources.

For each included sphere, provide a brief explanatory clause:
Practical: [evidence-based mechanism].
Political: [evidence-based mechanism].
Personal: [evidence-based mechanism].

If absent:
'No explicit evidence in the sources.'

Do not automatically list all three.
Do not speculate beyond documented effects.

TOOL TABLE ROW ORDER (LOCKED) *Methodological Note: This locks table structure to guarantee formatting consistency and enable comparison across catalogue entries.*

Regulatory
Financial / Market-Based
Information / Education
Choice Architecture
Social Norms

Emotional Appeal
Technology
Infrastructure (Hard/Soft)
Biophysical Resources
Knowledge
Other

Methodological Note: The following section of the prompt introduces moderated, evidence-anchored interpretation, allowing functional classification without speculative inference.

TOOL CLASSIFICATION CLARIFICATION (MODERATE – STABLE)

If a tool category is not explicitly labelled in the sources but the documented mechanism clearly performs the functional role defined in the tool category:

- Classification is permitted.
- The mechanism must be described explicitly using evidence from the sources.
- Do not introduce new actors, instruments, or strategic intent beyond what is documented.
- If alignment is ambiguous or indirect, write: 'No explicit evidence in the sources.'

Do not infer tools based solely on assumed behavioural effects.

TOOL TABLE STYLE (STRICT) *Methodological Note: These instructions ensure each entry includes a concise synthetic interpretation of the intervention mix and its transformative pathway.*

For each row provide:
- 1–2 examples from named sources
- Functional mechanism

• Constraint grounded in sources
• Strengthening opportunity ONLY if explicitly discussed or reasonably implied in sources
• Evidence-consistent risk
• Neutral complementary innovation

If absent:
Write:
'No explicit evidence in the sources.'
or
'NA (not documented in the named sources).'

No extrapolation.

ANALYTICAL SUMMARY (SYNTHETIC SNAPSHOT)

Write two coherent paragraphs.

The first paragraph must be 4–6 sentences and:
• Identify which tool categories are strongly evidenced, with concise rationale.
• Identify which are weakly evidenced or absent.
• Explicitly state absence where relevant.
• Interpret what this configuration implies about the intervention's transformative pathway (e.g. epistemic, institutional, relational, distributive).
• End with one implementation-relevant insight grounded strictly in the sources.

Do not generate generic policy recommendations.
Do not introduce tools not documented.
Do not repeat stock conclusions across cases.

The second paragraph is on 'Implications for Intervention Mix Design' and must be 3–4 sentences and:

Identify Implications for Intervention Mix Design

- Clearly state it is analytical reflection
- Identify which additional tool categories would need alignment to enhance transformative scope
- Avoid implying that the case currently implements them

Methodological Note: The following section of prompt prevents normative drift and generic recommendations, maintaining analytical parity across case studies.

STYLE & CONSISTENCY SAFEGUARDS

- Maintain identical analytical density across cases.
- Do not default to regulatory or financial strengthening unless explicitly supported by sources.
- No rhetorical language.
- No creative synonym drift.

No bullet points in the tables

No in-text references in tables

EVIDENCE RULE (HARD CONSTRAINT) *Methodological Note: This restricts analysis to named sources, strengthening transparency and methodological rigour.*

Use ONLY:

- Uploaded PDFs
- Website(s) explicitly listed

Do NOT use:
- External academic knowledge
- Comparable cases
- General policy reasoning
- Prior examples

If information is absent:
State this explicitly.

FINAL ACTION RULE (VERY STRICT) *Methodological Note: This section standardises document production and eliminates intermediate drafting variability during batch generation.*
When I write:

'All materials are now uploaded — begin.'

You will:
- Open TEMPLATE.docx
- Open Gold_standard_example.docx (style only)
- Extract evidence ONLY from named PDFs and websites
- Populate tables exactly
- Insert analytical summary
- Add APA references
- Save as TARGET OUTPUT FILE NAME
- Return ONLY the download link

No drafts.
No explanations.
No commentary.
No variations.

INPUT SECTION (EDIT THIS FOR EACH CASE STUDY)

- INNOVATION NAME: << >>
- CASE STUDY NAME: << >>
- REQUIRED EMPHASIS: <<Balanced overview>>
- SOURCE WEBSITE(S): << >>
- SOURCE PDF(S): << >>
- TEMPLATE FILE NAME: <<TEMPLATE.docx>>
- GOLD STANDARD DOCX NAME: <<Gold_standard_example.docx>>
- TARGET OUTPUT FILE NAME: << >>

TRIGGER PHRASE TO START GENERATION:
'All materials are now uploaded — begin.'

Annex 2 – Catalogue verification checklist

Set out below is the checklist used for human review and assessment of TIMs catalogue entries generated via AI. Within Task 3.1 the checklist has been used to ensure accuracy, quality and consistency across catalogue entries.

Catalogue entry Assessment Checklist

For each entry check:

Sphere Field

❑ Are only evidenced spheres included?

❑ Does each have a clear mechanism clause?

❑ Any automatic triple listing?

Summary

❑ Is it continuous prose?

❑ Does it identify strong tools with rationale?

❑ Does it explicitly mention absence where relevant?

❑ Does it avoid generic policy advice?

❑ Does it avoid copy-paste patterns from other cases?

Tool Table

❑ Any invented strengthening recommendations?

❑ Any external knowledge?

❑ Explicit 'No evidence' where appropriate?

Formatting

❑ Is the document structure in line with others?

❑ Spelling and grammar are accurate?

❑ Are table formats consistent?

References

❑ Are references present and accurately written in APA style?

If all yes → QA Passed.