**Format project plan SPR 2023-2026 3e tranche**

**Computational Modelling of Social Tipping Points (COMTIP)**

**Samenvatting project (zowel NL en Engelse versie)**

**NL**

**Doel- en vraagstellingen**

Doel van het project is het ontwikkelen, integreren en toepassen van nieuwe methoden voor het modelleren van *social tipping points* (STPs). Via een samenwerking tussen RIVM en IAS brengen we wetenschappelijke kennis over complexe systemen en modelleren naar het RIVM. Methodologische ontwikkeling staat centraal in dit project, maar ieder deelproject focust op een specifiek toepassingsgebied dat relateert aan lopend RIVM onderzoek.

**Probleemstelling**

Inzicht in STP’s in de context van gezonde voedingskeuzes en de energie transitie, helpt beleidsmakers en stakeholders bij het implementeren van strategieën die kunnen zorgen voor een verschuiving in publieke percepties, gewoontes rond energiegebruik en consumptiepatronen. Hiervoor zijn interdisciplinaire aanpakken nodig. Door data van verschillende bronnen te integreren in grote agent-based modellen, kunnen we verschillende scenario’s verkennen en voorspellen hoe veranderingen in houding, gedrag of beleid de kans op tipping points kunnen vergroten of verkleinen.

**Beoogde opbrengsten**

COMTIP zal bruikbare inzichten bieden over hoe beleidsinterventies kunnen leiden tot snelle gedragsverandering en daarmee bijdragen aan de publieke gezondheid en duurzaamheid.

• Een methodologisch kader om de complexiteit van STPs te onderzoeken dat voor verschillende toepassingsgebieden kan worden benut.

• State-of-the-art tools om de complexiteit van STP te modelleren.

* Evidence-based aanbevelingen voor de ontwikkeling en implementatie van effectieve beleidsinterventies. Een visuele tool om model uitkomsten te communiceren aan beleidsmakers.

• Interdisciplinaire samenwerking en kennisdeling tussen IAS en RIVM.

**Plan van aanpak**

We ontwikkelen een nieuwe modelleer aanpak waarbij agent-based modellen (ABM) worden geïntegreerd met group model building (GMB) methoden en causale loop diagrammen. ABM’s zorgen voor een computationeel kader voor het simuleren van complexe sociale systemen en het verkennen van verschillende scenario’s en interventies. GMB faciliteert de betrokkenheid van stakeholders en validatie van het model. Het project bestaat uit een PhD en een postdoc project, die elk focussen op een specifiek toepassingsdomein. De PhD-student zal focussen op het analyseren van STP’s bij leefstijl-gerelateerde ziekten, met een specifieke focus op gezonde voedingskeuzes. De postdoc onderzoeker zal met name focussen op methodologie ontwikkeling, specifiek op het thema energie transitie.

**Project team**

Het projectteam bestaat uit onderzoekers van IAS/Uva en RIVM met expertise op het gebied van sociale complexiteit, computationeel modelleren en gedragsverandering. De RIVM onderzoekers zijn ook betrokken bij lopende SPR projecten over voedsel keuzes en energie transitie. Het volledige projectteam is beschreven in het voorstel.

**ENG**

**Objectives and research questions**

The aim is to develop, integrate and apply novel methodologies for the computational modelling of social tipping points (STP’s). Through a collaboration between RIVM and IAS we strive to bridge scientific knowledge on complex systems and computational modelling to the RIVM. While methodological development is at the core of the research, each sub-project focusses on a particular application domain which is connected to ongoing research at RIVM.

**Motivation**

Understanding STP’s in the context healthy food choices and the energy transition helps policymakers and stakeholders implement strategies that shift public perception, energy habits and consumption patterns. This requires interdisciplinary approaches. By integrating data from diverse sources into large-scale agent-based models it is possible to explore different scenarios and predict how changes in attitudes, behaviours, or policies might lead to or prevent tipping points.

**Deliverables**

COMTIP will generate actionable insights into how policy interventions can drive rapid behavioural change and improve public health and environmental sustainability.

* A methodological framework to examine the complexity of STP’s, which can be adapted to different application domains.
* State-of-the-art tools to model the complexity of STP’s.
* Evidence-based recommendations for designing and implementing effective public health strategies, and a visual tool to communicate model outcomes to policymakers.
* Cross-disciplinary collaboration and knowledge exchange between IAS/POLDER and RIVM.

**Study design /Action plan**

We will develop a novel modelling approach that integrates agent-based models (ABM) with methods from group model building (GMB) and causal loop diagrams. ABMs provide the computational framework for simulating complex social systems and exploring different scenarios and interventions, while GMB facilitates stakeholder engagement and validation of the model. We plan for a PhD student and a postdoctoral researcher who will both focus on a specific application domain. The PhD student will focus on analyzing STP’s in lifestyle-related diseases, with a specific focus on healthy food choices. The postdoctoral researcher will primarily focus on methodology development, specifically on the topic of energy transition.

**Project team**

The project team includes researchers from IAS/UvA and RIVM with expertise on social complexity, computational modelling and behavioural change. The RIVM researchers are also involved in ongoing SPR projects on food choices and energy transition. The complete project team is included in the proposal.

**Action Plan**

1. **Background**

Social tipping points (STPs) are critical junctures in societal attitudes, behaviours, and policies that have the potential to trigger significant, self-reinforcing, and rapid change (Lenton et al., 2023). These can be seen as solutions in various domains (Nyborg et al., 2016) such as addressing climate change, improving public health, and advancing scientific endeavors (Farmer et al., 2019; Otto et al., 2020; Yang et al., 2021; Macy et al., 2021; Winkelmann et al., 2022). STPs demonstrate the critical role of collective behaviour in driving societal change, and they correspond to moments when a critical mass of individuals, communities, or institutions adopt new practices, technologies, or ideologies that are amplified and create momentum for systemic change (Lenton et al., 2022). Positive tipping points can catalyze widespread acceptance and implementation of climate-friendly practices, such as renewable energy adoption or conservation efforts, foster a culture of scientific literacy and innovation, accelerate shifts in diets, from private to public transport, and in mental health, affect behaviour in response to epidemics, among others (Aschemann-Witzel, 2023; Lenton 2020; Lenton et al., 2022; Smith et al., 2023; van der Wal et al., 2021).

While STPs promise positive change, they also carry risks, particularly if they are driven by misinformation or misguided ideologies (Efferson et al., 2020). In the context of climate change, STPs influenced by misinformation or denialism can delay or undermine efforts to address the crisis effectively, highlighting the need for informed and targeted actions (Levin et al., 2021; Macy et al., 2021). Similarly, STPs driven by pseudoscience or anti-intellectualism can erode trust in scientific expertise and impede progress. Therefore, policy that is aimed at societal shifts that leverage STPs must be guided by accurate information, evidence-based research, and inclusive dialogue to ensure alignment with the goals of sustainability and scientific advancement, minimizing the potential for unintended consequences or harmful outcomes.

1. **Objectives and research questions**

This project aims to develop research focused on developing and applying novel methodologies for the computational modelling of social tipping points. Social Tipping points cover a broad class of different phenomena, many of which connect to ongoing research at RIVM. The methodological focus of the project will ensure a long-lasting impact within RIVM and help to develop a new methodological framework for existing challenges. While methodological development is at the core of the research, each sub-project is connected to a particular application domain in which the social tipping point perspective can be applied. In what follows we describe the more general objectives for this collaboration and then we further elaborate the scientific objectives and research questions within each proposed sub-project (see E. Action Plan/Study Design).

For each sub-project (work package) we envisage the phd student/postdoctoral researcher working both on methodological research and application-driven research. The current proposal requests funding for one PhD student and a postdoctoral researcher, co-financed by RIVM and POLDER (UvA). Under the proposed structure there is potential for further topics in the future.

***Objective scientific advancement***

The aim is to develop new, validated methodological approaches and tools to analyze and understand a wide range of social tipping point challenges. The method directly helps policymakers understand the effects that different regulations and policy interventions may have on behavioural change on a societal level and social tipping points.

***Objective knowledge exchange***

Through this collaboration we strive to bridge scientific knowledge on complex systems and computational modelling to the RIVM, in particular with the focus on social and behavioural sciences.

***Objectives of the two application domains***

Work package 2: Analyzing social tipping points in healthy food choices (phd topic)

* Investigate how personal, social, and urban factors contribute to healthy and unhealthy food choices (that relate to diseases like obesity and diabetes).
* Develop computational methods to find and test ways to identify social tipping points in agent-based models of dietary change.
* Test the effectiveness of various (health) campaigns focusing on food choices in the agent-based models.
* Co-design and contract the impact of multi-scale (individual to community) interventions to promote healthy lifestyle choices.

Work package 3: Methodology development on the topic of energy transition (postdoctoral researcher)

* Propose systematic methodology to integrate local contextual factors (economic, social, urban contexts) with psychological factors influencing behavioural choices as to energy transition for the Dutch context.
* Develop computational methods to find and test ways to identify social tipping points in agent-based models of behavioural change as to energy transition.
* Demonstrate the impact of various incentives on speeding up or hampering the adoption of behaviours related to energy transition.

The current proposal relates most strongly to methodological category 5 listed in SPR 2023-2026 outline: Integration of societal and behavioural science aspects. We will apply methods known as complex system approaches and use these to develop the knowledge of societal effects of behavioural choices. We will work with two use cases: food choices and the energy transition. These can be considered as societal changes that can be expected to result from combined behavioural choices in society.

1. **Societal relevance**

Understanding social tipping points in the context of lifestyle-related diseases and the energy transition holds significant societal relevance due to its potential to drive large-scale, positive changes in public health and environmental sustainability. The shifting lifestyle behaviours, sustainable energy habits, and changing diets, can substantially improve health and reduce greenhouse gas emissions, land use, and water consumption, addressing pressing environmental issues like climate change and biodiversity loss while improving people’s health. Identifying and leveraging social tipping points in this transition can accelerate these benefits.

The concept of social tipping points is particularly valuable because it focuses on the critical junctures where small, strategic interventions can lead to rapid and widespread behavioural change. Unlike gradual approaches, targeting social tipping points can trigger a cascade of positive changes through social networks, creating momentum that sustains itself and leads to lasting transformation. Understanding these tipping points can help policymakers and stakeholders develop strategies that impinge on public perception, energy choices and consumption patterns, increasing the change on the occurrence of a tipping point.

Dietary behaviour is an important modifiable determinant of lifestyle-related diseases such as obesity, diabetes, and heart disease, which are major public health concerns. Healthy diets can thus contribute to improved health outcomes and reduced healthcare costs. Dietary behaviours and choices are influenced by, o.a., social norms and environmental factors. By identifying and acting upon the critical points, where small changes can lead to widespread adoption of healthier diets, public health initiatives can more effectively promote behaviours that are important factors that lead to these diseases. This could involve targeted interventions in communities, schools, and workplaces that reshape norms around diet and food consumption.

Many solutions for the energy transition are based on technological innovations that ensure we no longer need fossil fuels. These are innovations such as heat pumps, solar panels, and wind turbines. It is still unclear what the consequences might be for, for example, safety, social interactions, and behaviour, while these factors will determine whether potential solutions are successful. A better understanding of the social tipping points may offer options for policy makers to act upon. This could involve changing regulations and offering subsidies but may also include public campaigns aimed at reshaping norms around renewable energy sources.

Furthermore, the social tipping point perspective is valuable because it emphasizes the role of collective behaviour and the power of societal influence. It highlights how changes in individual behaviour can be amplified through social networks, leading to a tipping point where a new behaviour becomes self-sustaining and widespread. This perspective can inform the design of interventions that not only target individuals but also leverage influencers, community leaders, and social media to create a broader impact.

1. **Scientific relevance**

Social tipping points manifest within complex adaptive systems, rendering them inherently challenging to understand due to the intricate interplay of multiple interconnected components and feedback loops. These systems, characterized by nonlinear dynamics, emergence, and self-organization, exhibit behaviours that are typically very difficult to predict and counterintuitive. The dynamic nature of complex adaptive systems means that small changes in one part of the system can lead to cascading effects and unexpected outcomes elsewhere. This makes it challenging to identify the precise conditions under which tipping points occur, how they propagate through the system, and if and how they persist (Milkoreit et al., 2017). Consequently, understanding social tipping points requires interdisciplinary approaches that integrate insights from fields such as sociology, psychology, economics, and computer science, as well as advanced modeling techniques that can capture the complexity and nonlinearity of social systems.

The research gap in studying social tipping points lies in the need for more comprehensive methodologies that can capture the intricate dynamics of human behaviour, social interactions, and systemic influences leading to tipping points (Andrighetto & Vriens, 2022). Traditional research approaches focused on qualitative factor analysis fall short (Crielaard et al., 2023). Computational techniques can embrace the complexity that qualifies social systems as complex adaptive systems, namely, their heterogeneity, nonlinearity, and uncertainty, and they have the potential to improve our understanding of how and why tipping points occur.

Computational models developed by IAS of the University of Amsterdam (UvA; e.g., van den Ende et al., 2024; Yang et al., 2022; Qiu et al., 2022; Helmus et al., 2022; Dignum et al., 2022) offer an approach for understanding social tipping points due to their ability to capture the complexity and dynamics of human behaviour and societal systems. These models simulate the interactions between individuals, communities, and institutions, incorporating various factors such as demographics, social networks, and cultural influences. By integrating data from diverse sources into large-scale agent-based models it is possible to explore different scenarios and predict how changes in attitudes, behaviours, or policies might lead to or prevent tipping points. Such models provide a controlled environment for testing hypotheses, assessing the impact of interventions, and identifying leverage points for fostering positive societal change. The models naturally incorporate uncertainty and variability into their analyses, providing a more realistic understanding of the dynamics of social systems. By accounting for stochastic processes and exploring a range of possible futures, these models help decision-makers anticipate and prepare for potential tipping points, enhancing resilience and adaptive capacity.

Navigating towards positive societal shifts necessitates a nuanced understanding of the mechanisms underpinning social tipping points, underscored by empirical evidence, theoretical insights, and policy needs (Milkoreit, 2023). Research, including that presented in the latest IPCC reports, highlights the complex interplay between social networks (Centola et al., 2018; Andrighetto et al., 2024), individual behaviours, and institutional policies in facilitating these transitions (Otto et al., 2020; Creutzig et al., 2022). These studies provide a foundational framework to develop complex models (Gavrilets et al., 2024) that can be tested empirically (Efferson et al., 2020; Andreoni et al., 2021) and be used to understand how social conventions can evolve rapidly through strategic interventions in key socio-economic domains (Nyborg et al, 2016). The evidence underscores the potential of social tipping points to stabilize the Earth’s climate and transform public health landscapes by 2050 (Farmer et al., 2019; Otto et al., 2020; Winkelmann et al., 2022), illustrating the critical role of collective behaviour in driving societal change (Bak-Coleman et al., 2021).

Important work by the RIVM is to assess effectiveness of policy measures. The institute has experience with cost-effectiveness analyses of interventions and with societal cost benefit analyses. These models are valuable but limited in their scope on behavioural mechanisms. The current project will provide a tool to asses societal consequences of policies, through better understanding of underlying behavioural mechanisms and the transitional effects of individual behavioural choices on societal level transformation. An important expected benefit of this project will lie in an increased understanding why particular interventions vary in (occurrence of) effects.

If the RIVM would not invest in this project, she will be less able to respond to questions from clients to include behavioural aspects in their knowledge questions. The current project cannot be realized as a regular project because gaining experience with the methods, by cooperating with IAS, is an important element of the project.

1. **Action plan/study design**

We propose to develop an RIVM-IAS joint research hub around a novel modeling approach that integrates agent-based models (ABMs) with methods from group model building (GMB) and causal loop diagrams.

ABMs excel at capturing the complexity and heterogeneity of human behaviour and interactions, allowing researchers to simulate the emergence of tipping points from the bottom up (Bonabeau, 2002, and Poledna, 2023). By representing individuals as autonomous agents with diverse attributes and decision-making processes, ABMs provide a fine-grained understanding of how local interactions give rise to global phenomena. At IAS/UvA we have developed empirically grounded agent-based models that utilize real-world microdata to understand social phenomena (e.g., segregation and EVs, Helmus, 2022; Dignum et al., 2022). These models, together with data from CBS Netherlands, are offering the first glimpse into what large-scale empirical models can do for public policy understanding.

In the absence of complete data, GMB provides an ideal way to enhance the validity and relevance of models by including stakeholder participation in the modeling process (Scott et al., 2016; Nespeca et al., 2024). At IAS, the GMB approach has been used to elicit expert knowledge within and across specific domains and identify which factors of the individual and their environment mitigate or promote the transmission of ideas and hence social tipping points (Crielaard et al., 2022). By bringing together individuals from diverse backgrounds and perspectives, GMB ensures that the model reflects the complexities, scales, and leverages of the real-world system under study and ensures relevance to policy challenges (Nespeca et al., 2024).

By combining ABMs and GMB, we develop a novel approach that leverages the strengths of both methodologies. ABMs provide the computational framework for simulating complex social systems and exploring different scenarios and interventions, while GMB facilitates stakeholder engagement and validation of the model. This integration enables researchers to develop more realistic, process-based, and robust models of social tipping points, capturing the intricacies of human behaviour, social interactions, and systemic influences.

**Use case**

COMTIP will place significant emphasis on the development and knowledge exchange of fundamental modelling techniques (and associated methodologies) for complex systems and social tipping points. This broad class of problems connects to many of the strategic directions of RIVM. We plan for one PhD student hired at RIVM to work on a specific use case, including data collection and methodology development. This project is outlined below. We will also hire a post-doc (at the UvA) to primarily focus on methodology development and the application of social tipping points to an existing RIVM use case, the plan for this is also outlined below. Under the proposed structure there is potential for further topics in the future.

**Work package 1: Project management**

**Work package 2: Analyzing social tipping points in healthy food choices**

*PhD, employed at RIVM*

**Work package 3: Methodology development on the topic of energy transition**

*Postdoctoral researcher, employed at UvA*

**Work package 1: *Project management***

The core team that will manage the project on RIVM site will consist of Dr. Mattijs Lambooij, Dr. Liesbeth Claassen and Dr. Saskia Euser. Dr. Mattijs Lambooij will be the principal investigator for work package 2 and the daily supervisor and co-promotor of the phd student (appointed at RIVM). Dr. Liesbeth Claassen will be principal investigator for work package 3 and will be the RIVM supervisor for the postdoctoral researcher (appointed at IAS). Dr. Saskia Euser will be project leader. They will collaborate in both work packages with Prof. dr. Michael Lees and Dr. Vitor Vasconsales from IAS. Together, they are responsible for the progress and results of the projects. They will meet at least monthly for an update meeting or more frequently when needed.

**Deliverables**

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| **Deliverable/product number** | **Title** | **Short description** | **Month to be delivered** |
| D1.1 Periodical project meetings | Project control | Meetings to evaluate and monitor progress | Continually |
| D1.2 Periodical progress reports | reports | Reports to SPR on progress | In coordination with SPR program lead |

**Work package 2: *PhD Project: Analyzing social tipping points in healthy food choices***

**Background**

STPs in addressing food choices that contribute to lifestyle-related diseases such as **obesity** and **type 2 diabetes** are likely to contribute to significant shifts in public health strategies and individual behaviours towards healthier food choices. These tipping points are influenced by public health campaigns, changes in food industry practices, healthcare policies, and community support systems that promote physical activity and balanced diets. Dietary habits and habits concerning physical activity are both relevant behavioural sets related to obesity and other non-communicable diseases. They have a number of behavioural relevant aspects in common and also differ in other aspects. They have in common that the behaviours will be repeated daily or weekly, demanding behavioural decisions in a repeated sense. They also entail deliberate choices: people will decide what to eat and when, and also to exercise or not in a deliberate manner. For both sets it is also clear what the unhealthy and the healthier options are (healthy food choices and more exercise for most people). The two sets of behaviours also differ: people need to eat on a daily basis, and people do not need to exercise on a daily basis. A second important difference is that most food needs to be purchased and the variety is large, while exercise can be done functionally and people may be able to exercise without having to purchase anything. This increases the chance to acquire more data, since the behavioural chain for food choices (steps to realise the goal behaviour) is longer. We also find that food choices are strongly embedded in social and cultural context, making it a social and complex problem. With rising healthcare costs and the increasing prevalence of these conditions, there is an urgent need for interventions that can shift societal norms and behaviours at scale. These social tipping points could lead to widespread adoption of healthier lifestyle choices among a larger population group, potentially reversing trends in obesity and diabetes rates, and culminating in improved public health outcomes and reduced healthcare costs. There are strong synergies between healthy lifestyle transitions and other issues, such as the protein transition, as well as potential conflicts in terms of the solutions.

Previous projects aimed to include both dietary choices and physical activity in their projects. When the project developed, it became clearer that to fully understand and analyse one type of behaviour using complex system methods takes up the resources of four years. We therefore opt to focus on one behaviour set: food choice. This choice is guided by practical considerations. The researchers involved in the current project are also involved in other projects on food choice (BEDOELD). Enabling to build further on the experience from that project and use the CLD from that project as a starting point, avoiding work being done twice and gaining a year time that can be spend on methodological development. We do need to make sure that the CLD is suitable for our research question. Where BEDOELD focusses on capacity to act of citizens (micro level), in COMTIP we focus on the transformation rules from micro to macro and the subsequent societal effects. We therefore will organize a Group Model Building (GMB) session with the CLD from BEDOELD as starting point. The aim of that GMB session will be to establish which factors in de CLD of BEDOELD need to be changed to enable and accurate model to understand healthy food choice.

Research question: “How can social tipping points contribute to significant shifts in public health strategies and individual behaviours towards healthier lifestyles, particularly healthier food choices, and what roles do public health policy interventions, societal influences in the private realm and community support systems play in this context?”

We plan to leverage existing datasets and initiatives at RIVM and UvA to focus on eating behaviour and the social influence peers have on eating habits. There are existing models that examine the spread of obesity and diabetes (Christakis, N. A., & Fowler, J. H. (2007), Hill-Briggs et. Al (2021)) within social networks.

**Project Focus and Objectives**

The primary focus of this PhD project is to develop and apply innovative computational methodologies for understanding social tipping points in the context of lifestyle-related diseases—critical moments when small policy changes can lead to rapid, large-scale public health improvements. This project will build robust, data-driven models to analyze how personal, social, and urban factors influence behavioural dynamics, particularly shifts in eating patterns that contribute to conditions such as obesity, diabetes, and heart disease. This aligns well with current SPR initiatives (e.g., BIG FOOD, GLOW, BEDOELD)

**Objectives**

1. **Application-Driven Research:**
   1. **Contextual Modeling:**Develop and refine agent-based models that integrate quantitative data (e.g., CBS datasets) with qualitative insights (e.g., group model building outputs) to capture the causal factors affecting dietary choices.
   2. **Data Collection and Integration:**Design surveys and/or experiments—such as discrete choice experiments—to directly assess how participants make decisions based on policy properties, place-based factors, and social influences identified in the literature review and group model building. Integrate these new data sources with existing datasets to build a comprehensive behavioural change model.
   3. **Intervention Analysis:**Assess the impact of various public health interventions (e.g., health campaigns, community support strategies) using simulation experiments to identify potential tipping points that result in healthier behaviour.
2. **Methodological Advancement:**
   1. **Tool Development:**Contribute to developing computational methods and curated datasets that bridge the gap between quantitative data and qualitative insights, ensuring that the causal relationships driving behavioural shifts are captured accurately.
   2. **Collaborative Integration:**Work closely with the postdoc (developing the overarching methodological framework) so that the specific application to lifestyle-related diseases benefits from—and informs—the generalized approach.

Through these objectives, the PhD research will generate actionable insights on how targeted interventions can foster rapid shifts in public health, informing policy and methodological innovation.

**Methodological Approach**

1. **Integration of Modeling Techniques:**
   1. **Agent-Based Modeling (ABM):**Utilize advanced agent-based modeling techniques to simulate individual and community behaviours.
   2. **Qualitative Data Incorporation:**Integrate outcomes from group model-building sessions and causal loop diagrams to enrich simulation models with stakeholder-driven insights.
   3. **Data Creation and Synthesis:**Combine quantitative datasets (e.g., population health records and CBS data) with newly designed surveys or experiments that directly capture decision-making processes related to key factors. This holistic data integration will support the development of comprehensive models of dietary choices.
2. **Interaction with the Postdoc Project:**
   1. **Collaborative Method Development:**Engage in regular exchange sessions with the postdoc developing the broader methodological framework so that the case-specific tools for lifestyle-related diseases are both robust and transferable.
   2. **Joint Research Activities:**Participate in coordinated research activities on model design, data integration, and simulation analysis across both projects.

**Milestones and Deliverables**

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| **Deliverable/product number** | **Title** | **Short description** | **Month to be delivered** |
| D1.1 | Detailed literature review and stakeholder mapping report | This will be highly informed by the research already performed at RIVM. Manuscript ready for submission to international journal. | January 2026 |
| D1.2 | Data collection tools | A report detailing the data collection instruments' design, pilot testing, and refinement | July 2026 |
| D1.3 | Initial agent based model | An initial version of the agent-based model with documented integration of quantitative and qualitative data, including the new empirical dataset | April 2027 |
| D1.4 | Manuscript on the model methodology, simulation results, and initial dataset analysis | Manuscript ready for submission to international journal | July 2027 |
| D1.5 | Dataset | A documented and curated dataset from the experiments/surveys | April 2027 |
| D1.6 | Manuscript summarizing simulation results and recommendations for effective interventions | Manuscript ready for submission to international journal | January 2028 |
| D1.7 | Workshop summary report | A workshop summary report and an updated, validated model framework with an accompanying dataset | July 2028 |
| D1.8 | Operational science-policy interface | A visual tool to communicate model outcomes and dataset insights to policymakers | April 2029 |
| D1.9 | Manuscript on the creation, analysis, and applications of the dataset generated from the experiments/ surveys | Manuscript ready for submission to international journal | April 2029 |
| D1.10 | PhD thesis | The finalized PhD thesis | July 2029 |

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| **Milestone for products** | **Short description** | **Connected Deliverable number** | **Month to be delivered** |
| M1.1 Preliminary research and stakeholder mapping | Conduct a comprehensive literature review and stakeholder mapping | D1.1 | January 2026 |
| M1.2 Design of data collection instruments | Develop new data collection tools that capture decision-making processes related to key factors. | D1.2 | July 2026 |
| M1.3 Initial model development and data integration | Construct the initial agent-based model and integrate qualitative inputs with existing datasets and the new empirical data. | D1.3 | January 2027 |
| M1.4 Preliminary validation via targeted simulations and empirical dataset analysis | Validate the model and perform an initial analysis of the newly collected dataset. | D1.4 & D1.5 | July 2027 |
| M1.5 Intervention analysis and model refinement | Test and refine the model by simulating various public health interventions. | D1.6 | January 2028 |
| M1.6 Policy relevance and model validation | Further refine the model through stakeholder engagement and validate its policy relevance. | D1.7 | July 2028 |
| M1.7 Science-policy interface | Develop a user-friendly science-policy interface and finalize the PhD thesis. | D1.8, D1.9 | January 2029 |
| M1.8 Thesis finalization | Finalize the PhD thesis | D1.10 | July 2029 |

**Overall Impact**

The PhD project is integral to generating actionable insights into how lifestyle-related interventions can drive rapid behavioural change and improve public health outcomes. By combining rigorous computational modeling with both qualitative insights and newly acquired data from surveys or experiments, the project will:

* **Advance Scientific Understanding:**Develop state-of-the-art modeling tools that capture the complexity of social tipping points in public health, enabling precise predictions of intervention outcomes.
* **Inform Public Health Policy:**Produce evidence-based recommendations for designing and implementing effective public health strategies.
* **Foster Cross-Disciplinary Collaboration:**Create a strong synergy with the postdoc project at IAS/POLDER and RIVM, ensuring that methods are robust, transferable, and innovative across various domains.
* **Enhance Societal Well-Being:**Deliver a comprehensive framework that supports targeted interventions to reduce obesity, diabetes, and other lifestyle-related diseases, ultimately contributing to improved community health.

**Work package 3: *Methodology development on the topic of energy transition***

**Background**

Our objective is that the post-doc will play a primary role in the methodology (and software) development. Given that the position is for 2-years it is imperative that he/she is able to work on use cases that already have a basis (e.g., data, experts and research questions). The person will work with the PhD on the methodology development in work package 2, but also connect the methodology development to existing initiatives at RIVM and at the UvA. The ambition is that the post-doc can work on two use cases, however this depends on the availability of data and how quickly he/she can review the necessary literature for the use cases. The primary (first) use case is outlined below, for potential second use cases please see the appendix – the final decision as to if a second use case will be developed will be made by the research team after year 1.

Use case one for the postdoc will focus on the energy transition. STPs in the energy transition reflect pivotal shifts in societal attitudes, behaviours, and policies towards sustainable energy solutions, such as renewable energy sources and energy-efficient technologies. These STPs mostly focus on demand-side responses and are driven by a mix of environmental awareness, economic incentives, regulatory changes, and advancements in energy technology. As societies become more conscious of the impacts of climate change and the finite nature of fossil fuels, there is a growing movement towards energy systems that are not only sustainable but also resilient and equitable. These tipping points can trigger substantial changes in the energy market, encourage shifts in consumer behaviour, and stimulate large-scale investment in green technologies, thereby reducing the carbon footprint and enhancing energy security.

**Project Focus and Objectives**

The primary focus of the postdoc’s project is the development of innovative theoretical and computational methodologies to analyze social tipping points—critical junctures at which small interventions can lead to rapid and large-scale societal change. This work builds on the outcomes of the SPR-project CHANGE and centers on developing robust, data-driven models that integrate diverse qualitative and quantitative inputs, incorporating local contextual factors (economic, social, urban) and psychological factors to capture the complexity of behavioural dynamics.

**Objectives**

1. **Methodological Innovation:**
   1. Develop and refine advanced agent-based modeling techniques combined with qualitative methods (e.g., group model building and causal loop diagrams).
   2. Create systematic approaches for integrating diverse data sources and local contextual factors into behavioural change models (including causal discovery and outcomes from discrete choice experiments).
   3. Formulate computational methods that blend both qualitative insights and quantitative data to detect, analyze, and test social tipping points.
2. **Application as a Testbed:**
   1. Validate and demonstrate the new methodological framework by applying it to a concrete domain. The project offers flexibility to focus on either the energy transition—examining how incentives and other policy measures can stimulate sustainable behaviour (starting with technology adoption e.g., shifts in consumer food-related behaviours or).
   2. Use the selected domain(s) as a test case(s) to showcase the adaptability and robustness of the new methodologies, ensuring generalizability.
3. **Collaborative Integration:**
   1. Work closely with a PhD researcher whose project applies to public health challenges (e.g., modeling influences on eating habits related to obesity and diabetes).
   2. Facilitate a reciprocal knowledge exchange between POLDER/IAS and RIVM.

Through these objectives, the postdoc’s work aims to create a transferable framework that advances our understanding of social tipping points. This will ultimately contribute to the scientific discussion of social tipping and provide policymakers with new tools for designing effective interventions that drive positive and scalable societal changes.

**Methodological Approach**

1. **Method Integration:**The project is designed to combine advanced agent‐based modeling (ABM) techniques with inputs from causal loop diagrams and available data. The goal is to merge quantitative simulation with data and qualitative stakeholder insights, thereby ensuring the method’s relevance and practical applicability.
2. **Interaction with the PhD Project:**
   1. **Collaborative Methodology Development:**The postdoc will work closely with a PhD student whose project focuses on lifestyle-related diseases. While the PhD’s work applies similar methods to public health challenges (e.g., modeling social influences on eating habits and obesity/diabetes), the postdoc’s role is to develop the underlying methodological framework that can be generalized.
   2. **Joint Use of Techniques:**The two researchers will exchange insights on agent-based model design, group-model-building outcomes, and how to best integrate qualitative data into computational frameworks. As the PhD develops case-specific tools, the postdoc will incorporate insights from these applications to refine the tools further, ensuring that the framework is robust, transferable, and adaptable across different domains.

**Milestones and deliverables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Deliverable/**  **product number** | **Title** | **Short description** | **Month to be delivered** |
| D2.1 | Report on initial framework and data mapping | A foundational report outlining the initial framework and data mapping | December 2026 |
| D2.2 | Dataset repository and testing environment | A documented dataset repository and an ecosystem plan for method testing. | June 2027 |
| D2.3 | Manuscript (review paper) summarizing the literature review and proposed methodological advances. | Manuscript ready for submission to international journal | September 2027 |
| D2.4 | A detailed report (manuscript) and simulation results that validate the functionality and robustness of the methods. | Manuscript ready for submission to international journal | March 2028 |
| D2.5 | Software package | A software package for engaging in simulation constrained by place-based data. | March 2028 |
| D2.6 | Workshop summary report | A workshop summary report along with a validated methodological framework, and plans for subsequent research or application domains. | July 2028 |

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| **Milestone for products** | **Short description** | **Connected Deliverable number** | **Month to be delivered** |
| M2.1 Establish the methodological framework. | Conduct literature review, map available datasets, knowledge exchange with relevant RIVM projects and establish synergies with stakeholders | D1.1 | December 2026 |
| M2.2 Build the data ecosystem and refine the methodological framework. | Develop new data collection tools that capture decision-making processes related to key factors. | D1.2 | June 2027 |
| M2.3 Develop and validate preliminary computational methodologies | Construct the initial agent-based model and integrate qualitative inputs with existing datasets and the new empirical data. | D1.3 | September 2027 |
| M2.4 Test and refine the developed methods in a controlled simulation environment | Validate the model and perform an initial analysis of the newly collected dataset. | D2.4 & D2.5 | March 2028 |
| M2.5 Consolidate and disseminate findings | Consolidate findings and disseminate the developed methodologies in a workshop with additional stakeholders and gather feedback for further refinement, and identify potential extensions for future use cases. Apply the refined methodologies to the domain energy transition | D2.6 | June 2028 |

**Overall Impact**

The postdoc’s work is pivotal in developing a robust, transferable, and scientifically validated, data-driven methodological framework for analyzing social tipping points. By centering on methodological innovation, this project will:

* **Advance Scientific Understanding:**Provide new tools that model the dynamics of complex social systems, facilitating accurate predictions of how small interventions can trigger large-scale behavioural changes. This framework is designed to be flexible, enabling its application across multiple domains—from the energy transition to the protein transition and beyond.
* **Inform Evidence-Based Policy:**Equip policymakers with advanced analytical tools to assess the impact of regulations, incentives, and community-based interventions, thereby supporting the design and implementation of effective, evidence-based policy initiatives.
* **Foster Cross-Disciplinary Collaboration:**Integrate insights from computational modeling, systems science, and qualitative analysis, while also creating a strong collaborative bridge with the PhD research on public health (lifestyle-related diseases). This cooperation ensures that the developed methods are not only scientifically rigorous but also broadly applicable and adaptable to various societal challenges.
* **Enable Method Transferability:**Establish a framework that can be readily transferred and adapted to different application areas, enhancing the overall impact and longevity of the research beyond any single use case.

**GANTT chart**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2025** | | **2026** | | | | **2027** | | | | **2028** | | | | **2029** | | |
|  | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 |
| **WP1 Project Management** | | | | | | | | | | | | | | | | | |
| D1.1 Periodical project meetings |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D1.2 Periodical progress reports |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **WP2 Lifestyle-related diseases** | | | | | | | | | | | | | | | |  |  |
| D1.1 Manuscript 1 (literature review) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D1.2 Report on data collection tools |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D1.3 initial agent based model |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D1.4 Manuscript 2 (initial dataset analysis) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D1.5 Documented and curated dataset |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D1.6 Manuscript 3 (simulation results) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D1.7 Workshop summary report |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D1.8 Operational science- policy interface |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D1.9 Manuscript 4 (application of dataset) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D1.10 Phd thesis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M1.1 Preliminary research and stakeholder mapping |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M1.2 Design of data collection instruments |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M1.3 Initial model development and data integration |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M1.4 Prelim validation via targeted simulations and empirical dataset analysis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M1.5 Intervention analysis and model refinement |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M1.6 Policy relevance and model validation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M1.7 Science-policy interface |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M1.8 Thesis finalization |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **WP3 Methodology development and energy transition** | | | | | | | | | | | | | | | | | |
| D2.1 Report on initial framework |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D2.2 Dataset repository + testing environment |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D2.3 Manuscript 1 (literature review) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D2.4 Manuscript 2 + simulation results |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D2.5 Software package |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D2.6 Workshop summary report |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M2.1 Establish the methodological framework |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M2.2 Build the data ecosystem and refine the methodological framework |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M2.3 Develop and validate preliminary computational methodologies |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M2.4 Test and refine the developed methods in a controlled simulation environment |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M2.5 Consolidate and disseminate findings |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

1. **Additional assessments**

We don’t envisage any particular requirements for ethical approval as we don’t plan any experiments with human subjects. If the research eventually will involve human participants, either through surveys, interviews, or behavioural observations, necessitating approval from the ethical review board of RIVM and/or UvA. This approval ensures that participants' rights and welfare are protected, including informed consent, confidentiality, and the minimization of harm. If any part of the study involves sensitive topics, such as societal change, economic disparity, or political instability, additional scrutiny may be required to assess potential risks. The approval process also needs to consider how the findings might be used, ensuring that they do not contribute to manipulation or unintended negative consequences within society.

The project will adhere to Open Science initiatives in three areas, data sharing, software and publications. More specifically:

**Data Sharing:**

**Public repositories:** All datasets generated during the project will be made available in publicly accessible repositories (e.g., Zenodo, Open Science Framework). Data will be anonymized to protect participant privacy where applicable.

**Data transparency:** Detailed metadata will accompany datasets to ensure clear understanding of data sources, variables, and methods of collection or simulation.

**Open code:**

**Open Access to Code:** All computational models, scripts, and algorithms will be shared through platforms like GitHub, with appropriate documentation to ensure reproducibility.

**Version Control:** Code will be versioned and maintained with clear changelogs to track updates and modifications throughout the project.

**Open Access Publications:**

**Preprints:** Manuscripts will be submitted to open-access preprint servers (e.g., arXiv) to facilitate early dissemination of findings.

**Open-Access Journals:** Final papers will be published in open-access journals or under open-access licenses to ensure unrestricted access.

1. **Project team members and other costs**

**Research team**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Institution** | **Role in project** | **Expertise** |
| Dr. Michael Lees | UvA Institute for Informatics | Promotor, Principal investigator WP1 & WP2 | Social complexity and computational modelling |
| Dr. Vítor V. Vasconcelos | UvA Institute for Informatics | Copromotor, Principal investigator WP1 & WP2 | Social complexity and computational modelling |
| Dr. Mattijs Lambooij | RIVM | Copromotor & daily supervisor of PhD at RIVM; Principal investigator WP1 | Behavioural change, Sociology, interdisciplinary research, mixed methods |
| Dr. Liesbeth Claassen | RIVM | Principal investigator WP2 | Social psychology, transdisciplinary research, modelling behavior in ABM |
| PhD (vacancy) | RIVM | PhD Researcher, appointed at RIVM, promoted at UvA | Application in lifestyle diseases |
| Postdoc (vacancy) | UvA Institute for Informatics | PD Researcher, appointed at UvA | Methodological development |
| Rob Belleman | UvA Visualisation lab | Project manager visualisation | Visualisation of scientific knowledge. |
| Dr. Saskia Euser | RIVM | Project leader | Social scientist, behavioural change, project management |
| Dr. Marga Ocke | RIVM | Advisor | Food consumption and Protein transition |

An overview of the budget is provided in a separate Excel file.

1. **Dissemination**

The main target group for knowledge dissemination are researchers and other staff members of the RIVM. Additionally, dissemination is targeted at academics, policymakers, and the general public. Deliverable D1 specifically addresses the necessity of knowledge exchange and dissemination of the research results among stakeholder groups. We have identified four key activities that enable us in achieving the desired deliverable.

**Secondment**

The foremost mode of exchange in this project will be through secondment of personnel. The PhD hired by RIVM will spend time at the IAS and IvI for at least one day per week and preferably more during the project period. The Postdoc will be hired at UvA and will also work within the scope of this collaboration and thus work at RIVM for at least one day per week and preferably more during the project period. This Postdoc will closely collaborate with the PhD hired at RIVM and the respective PI’s at both RIVM and UvA.

The PhD student and Postdoc will bridge the knowledge from the IAS into the RIVM. To do so, they will also collaborate/exchange knowledge with the RIVM IAS fellow who will be appointed. Moreover, the PI’s will actively contribute to the knowledge exchange at joint events of the RIVM and IAS.

**Scientific Publications**

The PhD student and Postdoc will produce scientific publications that are published with researchers from the UvA and RIVM. The papers of the postdoc will have a more fundamental emphasis and the other papers will more closely focus on the use cases.

**Group model building sessions**

A group of stakeholders and domain experts will be invited to lay down mental models of the causal structures involved in addressing each case study’s research questions. An immediate and testable outcome of the sessions is cross-disciplinary learning by participants, and this process feeds towards quantitative model co-creation.

**Seminars and workshops**

In support of the work done by the PhD student and Postdoc we suggest organizing an annual in-house seminar at the RIVM. This seminar will be hosted by the PhD student in collaboration with the PIs of this project. This will help further spur the knowledge dissemination among researchers at RIVM. In a similar fashion an annual event will be organized at IAS to invite academics, policymakers, and other stakeholders. In this way we ensure a fruitful exchange of knowledge between the institutes.

**Science-policy user interfaces**

Beyond merely producing scientific publications in this project attention will be given to design a science-policy interface that support the dissemination of knowledge to (public) stakeholders of the respective use cases.

The UvA visualization lab will support the PhD’s with their expertise in designing the respective science-policy interface. However, it could results that they do not support the desired interface, in that case the assignment might be given to a different organization. Interface could range from interactive online dashboard to animated videos or virtual reality experiences. This is set to be explored with the engaged project members.

1. **Mitigation of risks**

A first risk is related to project members, specifically the phd student and postdoctoral researcher.Cooperation with a PhD student entails the risk of not finding a suitable candidate, or not finding a candidate on time to start. Another risk is that he or she may be delayed some months because of work related or private incidents. If relevant, we may need to ask permission to reserve a part of the PhD budget for the second part of the year 2029. In addition, the appointments of the phd student and postdoc researcher are temporarily. This is a risk given one of the aims of the project, which is bridging knowledge from IAS to RIVM and gaining experience with the methods at RIVM. When the PhD student starts another job at the end of the project, there is the risk of knowledge and experience being lost. This risk will be mitigated in two ways. First, the PhD student will collaborate and exchange knowledge with the IAS/RIVM research fellow who will be appointed. This research fellow will work on embedding the knowledge within RIVM. Second, the connection of COMTIP with ongoing RIVM projects, where the PIs are also actively involved, will help in knowledge transfer to other RIVM researchers.

Another risk relates to the available data and causal loop diagrams. To have more time in the project for quantification and implementation of the model, we will use already available datasets and developed causal loop diagrams. Even though we can collaborate with several SPR projects to gain access to these resources, it is still uncertain which specific datasets can be used. At least for the phd project this risk is partly mitigated, since we already decided to use the CLD on protein transition that was developed in BEDOELD (see below) as a starting point.

**Connection with other RIVM assignments**

GLOW: sharing insights on lifestyle diseases use case. GLOW's ambition is to gain more insight into how the design of the physical environment as a whole affects our health, with a focus on the role of behaviour. We focus on the interactions between design, behaviour and the topics of exercise-friendly environment, green space and food environment. Lambooij participates as advisor in GLOW and will use lessons from GLOW to COMTIP.

BIG FOOD applies data science methods and make them available for analysis and integration of food and nutrition data within and outside RIVM. How can data sources from different steps in the food chain be used by applying data science methods to gain more insight into the effects of strategies to stimulate the protein transition.

BEDOELD: protein transition, particular interaction individual and context: extent to which context of people enables them to change their diet structurally to reduce meat consumption

The BEDOELD projects focusses on “Capacity to act” of citizens to act in line with the policy goals of the protein transition. Both Lambooij and Ocké are involved in BEDOELD. This enables a quick start for this project, as we agreed to use the already developed CLD from BEDOELD as a start for the current project.

SHIFT DIETS: The aim of the SHIFT-DIETS project was to gain more insight in determinants of dietary behaviour of young adults for developing effective food policy measures and interventions that stimulate the transition to a dietary pattern rich in plant-based foods and with few animal-based foods. The project primarily focused on reducing meat consumption. Within the project an agent-based model was built that aims to explain consumers’ meat-related food choice on a macro level and to make recommendations on which policies are most effective at reducing Dutch consumers’ meat consumption. The SHIFT-DIETS project also co-financed the NWO funded project Tipping the balance of dietary change. In this project an ABM was developed to investigate to what extent spillover effects occur beyond dietary interventions, focusing on spill-over effects to dinner time of interventions that increase the availability of plant-based meals at workplace canteens during lunchtime. Some principles of these existing ABMs could be used in COMTIP.

CHANGE (aCtionable Hotspot identificAtion and impact iNteGration for the Energy transition) is aimed at a better understanding of the energy transition and its potential consequences and developing a new analytical tool, combining LCA with ABM. This approach integrates both the technological development and its associated impact on human and environmental health (LCA), as well as the dynamics between behaviour, technology, and the environment. Liesbeth Claassen is workpackage leader on building the ABM.

ENABLE (ENergietrAnsitie en BinnenmiLiEu: development of a risk assessment method for combined exposures) is aimed at assessing the health impact of measures to make houses more sustainable. It integrates methods for assessing risks from chemistry, biology, and radiation research with psychological assessments. Liesbeth Claassen participates in the study as a researcher.

**Collaboration**

Collaboration is a key aspect of this project, and following discussions between the Institute for Advanced Study (IAS) and the RIVM, we have concluded that the collaboration within the SPR program should meet the following criteria:

* *Build in-house capacity at the RIVM to apply complexity science methods, particularly in the area of computational modeling and Complexity Science.*
* *Integrate more than one of the knowledge domains of the RIVM.*
* *Strengthen the relationship between IAS and RIVM.*

Furthermore, when writing this proposal, we will ensure that it conforms to the general categories under the SPR as set out on the RIVM website:

1. *Methods and techniques to measure and monitor data collected through fieldwork, laboratory research and/or epidemiology.*
2. *Methods and techniques to analyze large and combined data files, integrate data streams (local to global) and bring information together in real time.*
3. *Methods, models, and techniques to be able to make integral considerations. These will also improve process and outcome indicators that are used to calculate social benefits and make them visible.*
4. *Methods to let citizens help with data collection, make it easier to unlock data and explain the effects of interventions to citizens and policymakers.*
5. *Methods and techniques to integrate social and behavioural science aspects in RIVM research in order to improve public health, safety and sustainability.*

Given the expertise of the IAS and in particular the POLDER initiative, we believe that the greatest added value can be achieved in categories two, three, four and five. However, the involvement of citizens in data collection is considered beyond the scope of this proposal.

**Product types**

1. Manuscript preprint and/or scientific publication for peer reviewed international journal
2. Articles in Dutch journals or magazines
3. New research method or technique (protocol)
4. FAIR database for research
5. ICT instrument or digital tool
6. Input at scientific congress or symposium
7. Meeting or course for knowledge transfer within RIVM
8. Communication citizens or professionals
9. RIVM report
10. Other

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