BioSTEP

Actors and network activities in the bioeconomy: Reflections on guidelines for participatory approaches

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EXECUTIVE SUMMARY

This report reflects on the actors and network activities in the bioeconomy domain that were identified in the BioSTEP report examining bioeconomy strategies at regional and national levels (Deliverable 2.3). Chapter 2 discusses these strategies and considers general guidelines for the further work in BioSTEP. Chapter 3 takes a closer look at the concept of public engagement. Chapter 4 reflects on the Technological Innovation Systems approach on which Deliverable 2.3 was based. It is argued that this approach was useful for identifying the main actors and network activities in the bio-economy domain, but that it should be complemented or combined with participatory stakeholder dialogue methodologies. This chapter also points at some tools and an instructive framework (TranSTEP: https://transtepapproach.wordpress.com/) that could be helpful for opening up debates in the developing bioeconomy.

The following reflective questions on public engagement and guidelines are proposed for the further development of national and regional case studies in BioSTEP.

Reflective questions on public engagement

> 1. *Who are the publics we are engaging with (i.e. what is our understanding of these publics)? If we categorise them, are we able to explain the relevance of such a categorisation in our work?*
> 2. *Based on which criteria (informed by a set of assumptions or context) are we selecting / inviting publics? Are we open to reassess these assumptions?*
> 3. *What are our motivations to engage with publics, within the remit of the project?*
> 4. *How are we engaging and how would we classify the different activities we are promoting in the participation spectrum?*
> 5. *What do we expect in terms of impact from our engagement activities (what are the changes we are hoping for)?*

Guidelines for the case studies of BioSTEP

> 1. The workshops should pay attention to different innovations within the bioeconomy, e.g. not only sectors and issues of the 'old' bioeconomy should be covered, but also sectors featured by knowledge-based innovations related to bioeconomy applications with a high degree of added value. Prominent societal and political debates on specific issues should be recognized, but also other applications of the bioeconomy that have met less public opposition and are relatively unknown.
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> 2. Given the observation that the involvement of other publics (e.g. civil society) in the bioeconomy has just started, the selection of interesting cases should also be guided by the existence of actors and networks that are willing to open up debates with the publics and/or with Civil Society Organisations (CSOs). This pragmatic criterion is particularly relevant for the workshops that focus on regional bioeconomy clusters.
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> 3. Beyond the wider priority to facilitate dialogue as a goal in itself, public education dominated by one-way communication that focuses on the benefits of new technologies will not be enough to gain public support. Interaction with a broad group of stakeholders and publics, either by public dialogue and participation or public co-production of knowledge, is critical to increase mutual understanding and exploring the value conflicts that may be difficult to solve. In the wide range of available tools for participatory stakeholder dialogue the framework of TranSTEP (an integrated technology assessment 'roadmap' for examining options) could offer BioSTEP a helping hand.

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Abbreviations

BbD	Biobased Delta
CSOs	Civil Society Organisations
IS	Innovation Systems
NGOs	Non-Governmental Organisations
SMEs	Small and Medium Enterprises
SI	Societal Incubator
STS	Science and Technology Studies
TA	Technology Assessment
TIS	Technological Innovations Systems

1 Introduction

This report builds on previous deliverables of Work Package 2 (WP2) of the BioSTEP project. BioSTEP draws on the idea that a participative governance of the bioeconomy helps connect the developing bioeconomy more strongly to society. More precisely, this report builds on a database that provides an overview of existing bioeconomy products and processes and an assessment of their social, environmental and economic impacts (Deliverable 2.1), a report that analyzes and summarizes this information (Deliverable 2.2), and an overview of national and regional bioeconomy strategies across Europe (Deliverable 2.3). In particular, it is complementary to the latter Deliverable by providing a reflection on the actors and network activities in the bioeconomy domain that have been mapped and analysed in this overview of bioeconomy strategies in WP2.

In this report we will reflect on the actors and network activities in the bioeconomy domain that were identified in Deliverable 2.3 and consider how to move forward with the further development of national and regional case studies in BioSTEP. In this context, we will also discuss the concept of public engagement in more depth.

Chapter 2 discusses national and regional bioeconomy strategies and proposes three guidelines for the further development of case study workshops in BioSTEP. Chapter 3 takes a closer look at the concept of public engagement. It discusses the policy context of public engagement, different types of stakeholders and publics, motives and justifications for engagement, the different forms of engagement and at which level they operate. Chapter 4 reflects on the Technological Innovation Systems approach that we used in the mapping and analysis of bioeconomy strategies across Europe. We argue that this approach was useful for identifying the main actors and network activities in the bio-economy domain, but that it should be complemented with participatory stakeholder dialogue methodologies for further development of national and regional case studies in BioSTEP. Chapter 5 summarizes the questions and guidelines for the further development of national and regional case studies in BioSTEP in which public engagement will be a pivotal issue in the analysis.

1.1 Accessability

The Convention on the Rights of Persons with Disabilities (CRPD) was ratified by the United Nations General Assembly in 2006 and came into force in 2008. The European Union has signed the CRPD and recognizes that it is "essential that the Web is accessible in order to provide equal access and equal opportunity to persons with disabilities" (European Union 2014). To ensure web accessibility, the European Union adheres to the Web Content Accessibility Guidelines 2.0. The following evaluation report (D2.4) of the BioSTEP project has been structured along these Accessibility Guidelines:

- All non-text content has a text alternative
- The document makes use of regular headings and subheadings, which provide structure and help to navigate through the document
- Unnecessary spaces have been deleted in the text for better audio use
- Hyperlinks have been added to help users find the content referred to in the text
- Cross links have been added to help users find the figure or table referred to in the text

The goal is to make the evaluation reports of Work Package 2 and 3 available in a structured and easily searchable way. The reports 2.2, 2.4 and 3.3 are referred to as "evaluation reports", because they build on earlier BioSTEP reports and draw conclusions from prior findings. They were selected for an additional accessibility check as they contain especially valuable information for the general public, namely information on the potential impacts of the bioeconomy, the necessity for public involvement and good practice guidelines for this involvement. In general, however, it has been paid attention that all BioSTEP Deliverables are designed in a very structured and comprehensive manner.

2 Actors and network activities

Deliverable 2.3 ('Review of bioeconomy strategies at regional and national levels') provided an overview and analysis of national and regional bioeconomy strategies across Europe. National strategies were understood as more closely related to bioeconomy policy-making, while regional strategies may be developed by bioeconomy clusters and tend to be shaped by several actors and networks in a specific region, often in less formal ways.[1] In this chapter we reflect on the findings of this report and highlight a few regional case studies to illustrate the nature of the actors and networks and the activities regarding participative governance.

2.1 National bioeconomy strategies

Though the results of the analysis (Deliverable 2.3) indicate that the involvement of broader publics (e.g. civil society) in the bioeconomy is rare with a limited number of cases emerging. Of the limited examples of participative governance within national bioeconomy strategies, these are interesting because they indicate explicit strategies and guidelines that encourage public participation. These strategies can be traced and this also applies to the main actors that are involved. Particularly interesting here is the (possible) interplay between (inter)national organizations and regional stakeholders and the evolvement of interlocutors that align national and regional strategies. In the case of the bioeconomy clusters that we have examined, the Lombardy Green Chemistry Association (Italy), the Norwich Research Park (UK), the Chemical Biotechnology Process Centre in Saxony-Anhalt (Germany), and the Ghent Bioeconomy Valley (Belgium) were identified as examples in this direction, playing a considerable role in the promotion of the bioeconomy within countries.

In general national strategies seem influenced by or are in aligment with the EU policy on the bioeconomy that calls for participatory models that engage citizens and end-users. Take, for example, the Communication from the Commission to the European Parliament and other bodies that presents a bioeconomy action plan "to pave the way to a more innovative, resource efficient and competitive society that reconciles food security with the sustainable use of renewable resources for industrial purposes, while ensuring environmental protection" (European Commission, 2012: 8). The Commission emphasizes that a significant information gap between science and society still exists, and points out that citizens need to be engaged in an open and informed dialogue throughout the research and innovation process, and that they need to be provided with reliable insight into the benefits and risks of innovative technologies and existing practices (European Commission, 2012: 12-13). According to the Commission, more ample opportunities to debate new findings and their implications should be provided and countries like Germany and the UK seem to have responded to this appeal and launched efforts to start a dialogue with societal stakeholders.

The encouragement of public engagement on a national level will probably result in more general debates on the bioeconomy and may revolve around well-known issues such as the 'food-versus-fuel' debate or the controversial use of biotechnology. Whether this is for better or for worse, is not

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[1] In the Deliverable we focused on the cases of 14 regional 'bioeconomy clusters' across 10 different countries: Stara Zagora (Bulgaria), Veneto Porto Marghera bio-refinery (Italy), Lombardy Green Chemistry cluster (Italy), Norwich Research Park (UK), York Biovale (UK), North Rhine-Westphalia (Germany) , Saxony-Anhalt (Germany), Northeast (Netherlands), Biobased Delta (Netherlands), Industries and Agro Resources (France), Food+i La Rioja (Spain), Satakunta (Finland), Västra Götaland (Sweden), and Ghent Bioeconomy Valley (Belgium).

something to be discussed here, and though it seems that until now controversies are absent or rather limited, it is something to take into account for the further development of case study workshops in BioSTEP. The point here is that the discussion on the bioeconomy at the national level will be shaped differently when compared to the regional level, because of the actors and networks involved, and that it is important to recognize the influence of public opinion on the issues that will be put forward in a more general and national debate. In addition, it is possible that 'new' knowledge-based innovations in the bioeconomy, with greater potential for sustainability, currently receive only limited attention in the media because they are regarded as less controversial than examples of other well-established bioeconomy-related products, such as first generation biofuels (that could already be called conventional or 'old') that are often the subject of public criticism.

2.2 Regional bioeconomy strategies

As we concluded in our overview (Deliverable 2.3), strategies at the regional level are less easy to trace, because explicit strategies and guidelines are lacking or are not publicly available. Engagement activities in bioeconomy clusters that we examined are limited both in number and in terms of their main objective, i.e. that of raising public awareness by providing information. Most activities for open dialogue could be identified in the Biobased Delta in the Netherlands (BbD), Satakunta in Finland, Västra Götaland in Sweden, and (more indirectly) Norwich Research Park (NRP) in the UK (through regional and local development strategies that can be linked to the bioeconomy). In the case of Satakunta, our desk research did not reveal information on direct engagement of the public, but it shows determination to move towards participative governance. To illustrate the nature of the actors and networks and the activities regarding participative governance, infobox 1 and 2 offers a more detailed representation of the organizations involved in the Biobased Delta and the Satakunta's Regional Innovation Strategy.

Infobox 1: Illustration: actors and networks activities in Biobased Delta (BbD)

Governmental bodies: the provinces Brabant, Zeeland, and (since 2014) Zuid-Holland, in particular the economic departments; the regional development companies Impuls! (Zeeland), REWIN (West Brabant), BOM (Brabant) and Innovation Quarter (South Holland); a number of individual municipalities, including Bergen op Zoom and Terneuzen.

Knowledge institutes and expertise centres include, among others: Technical University of Delft, Center of Expertise Biobased Economy Breda; Wageningen University and Research Centre, University of Eindhoven (cooperating with industry); Green Chemistry Campus in Bergen op Zoom, Be-Basic (Delft) and BioBase Training Center. Furthermore, there are laboratory, pilot and demo facilities included.

Companies of all sizes are already included in the mature agro and chemistry sectors. The SMEs – mostly farmers – are well organised in their sector organisation ZLTO (The Southern Agriculture and Horticulture Organization), which actively looks for e.g. waste stream valorization opportunities for its members in the BbD. Large cooperations like Royal Cosun (sugar beet), Cargill (mostly wheats), Lamp Weston Meijer and McCain (both mostly potatoes) are very important innovators for non-food applications. The downstream subsectors chemicals & polymers and biofuels & bioenergy mainly consist of large and medium sized industries that are interested in the possibilities to use biomass in their processes and products. Many of the involved companies are direct members of the BbD. Furthermore, the relevant port authorities are included, and many SMEs involved in the bioeconomy.

Consumers and civil society networks are absent. However, there is some urgency created to use less fossil fuels. The provincial environmental NGO ZMF (Zeeuwse Milieu Federatie) has bilaterial contacts with the biggest chemical company DOW Chemical to enhance more carbon neutral innovations. Furthermore, ZMF aims to get a more environmentally friendly economy in the Zeeuwse-Vlaamse Kanaalzone.

Infobox 2: Illustration: actors and networks activities in Satakunta

Satakunta's Regional Innovation Strategy states that the design and implementation of regional strategies involves not only businesses, policy-makers, research and higher education institutions, but also social partners, end-users, consumers and citizens.

The regional strategic plan was prepared through a bottom-up process involving up to 2000 participants, and including the following methods: street polls, forums for youth, interviews among unemployed people, children's crafts, internet inquiries and stakeholder/expert workshops. Similarly, the plan's implementation involves social and cultural societies, local action groups and residents' associations. In addition, consultations with regional stakeholders and the public (through workshops/events/internet) informed the strategic choices of the Regional Programme. The draft Climate and Energy Strategy was presented at four public events and was open to public comment. Two overarching themes of the core regional strategies ("Encouraging community" and "People-oriented solutions") aim to increase the ability of the people of Satakunta to participate in regional decision-making, planning and implementation activities.

The Regional Innovation Strategy foresees continuous dialogue with all parties and suggests that innovations and their effectiveness should be evaluated by target groups and stakeholders in different forums (including public debate, social media and workshops) and that a feedback system should be developed to measure the progress.

The four regional bioeconomy clusters, mentioned above, were characterised as being in a later and more mature phase of development (Take-off and Acceleration – see Deliverable 2.3, section 4.4., p. 26-27). However, this assessment, based on our Technological Innovation Systems (TIS) approach, was not deemed to have a linear relationship to a higher level of participative governance. Several other clusters being in the mature phase of 'Acceleration' according to TIS did not reveal similar activities or ambitions with respect to public engagement. In short, most clusters only show prototypes of public engagement, e.g. some efforts, often scattered, that are still in its infancy. Work packages 3 and 4 in BioSTEP focus on strategies to engage the general public and various stakeholder groups; this will be done by case study workshops that will expand on activities of participative governance. One of the challenges will be to select regional clusters with actors and networks that are willing to open up debates with the publics and/or with Civil Society Organisations. Another important focal point is that this selection also represents knowledge-based innovations representing the 'new' bioeconomy, assuming that these are more sustainable and resource efficient and are generally represented by refined biomaterials with a high(er) degree of added value, e.g. bioplastics, lubricants or applications in the domain of personal care.[2]

The regional case studies (see Annex 1 in Deliverable 2.3 for a full account) show that most constellations of actors and networks in bioeconomy clusters can be characterized in terms of structure and process as the triple helix, i.e. networks involving stakeholders from academia, businesses and public administration. Examples of a quadruple helix, that also involves actors and networks of civil society, are very few or are their infancy (e.g. Norwich Research Park, Biobased Delta, Satakunta, and Västra Götaland). However, this diagnosis is based on desk research only, which has limitations; therefore, through this research method it is not always possible to map and analyse other forms of undocumented engagement activities. Providing more robust data that can inform the analysis and our conclusions on the experiences of the clusters with public engagement, would require other methods such as in-depth analyses of empirical data

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[2] The BioSTEP project recognises eight bioeconomy sectors: (i) biofuels, (ii) bioplastics (including wood-plastic-composites), (iii) industrial, aircraft and automotive parts, (iv) 'green' chemicals (including industrial solvents), (v) lubricants, (vi) personal care and home care, (vii) fibre products (including textiles, pulp and paper, insulating material), (viii) food and feed additives. Well-established bioeconomy-related products (conventional or 'old' bioeconomy) are based on forestry, agriculture, the use of fibre and so forth. See Deliverables 2.1 and 2.2 for further details.

gathered, for example, through interviews or other forms of consultation with key actors. In the next chapter, we will argue that it is also necessary to pay attention to participatory stakeholder dialogue methodologies.

2.3 Guidelines for the case study workshops

National and regional bioeconomy strategies are differently shaped, but the following general guidelines can be formulated for the further development of case study workshops in BioSTEP. The two points outlined below emerge from reflecting on the actors and network activities in the bioeconomy domain that were identified in Deliverable 2.3:

- The BioSTEP workshops should pay attention to different innovations within the bioeconomy, e.g. not only sectors and issues of the 'old' bioeconomy should be covered, but also sectors featured by knowledge-based innovations related to bioeconomy applications with a higher degree of added value. Prominent public debates on specific issues should be recognized, but also other applications of the bioeconomy that have met less public opposition and are relatively unknown.

- Given the observation that the involvement of other publics than those represented in the triple helix (e.g. civil society) in the bioeconomy is absent or has just started in very few cases, the selection of relevant cases should in part also be guided by the existence of actors and networks that are willing to engage in dialogues with these publics and/or with Civil Society Organisations. This pragmatic criterion is particularly relevant for the workshops that focus on regional bioeconomy clusters.

3 What is public engagement?

Our preliminary conclusion, based on the analysis of national bioeconomy strategies and those of regional bioeconomy clusters, is that public engagement in part of the bioeconomy domain is sparse and limited examples can be idenftied from the publically published literature (Deliverable 2.3). However, before we outline some recommendations for subsequent work in BioSTEP based on these findings, it is valuable to briefly explore the complex and sometimes contested meaning of public engagement. This section draws on a WP2 working paper that includes an overview of key literature on public engagement (see Ribeiro and Millar, 2015). Here we present the salient points from this working paper reproduced and summarised so as to support, along with the findings of the overall work done in WP2, the recommendations of this report.

3.1 Public engagement in BioSTEP

The main objective of BioSTEP is to develop guidelines and propose recommendations to stakeholder and public engagement in the bioeconomy, so as to support a more participatory development of bioeconomy-related sectors. For that, the project not only analyses the current state-of-the-art in stakeholder and public engagement in the bioeconomy, but also looks for supporting and promoting it through the development of different engagement activities within BioSTEP. The pathway to fulfill this objective involves reflecting on some key aspects of the topic, which can be extended to the bioeconomy from a multidisciplinary discussion of public engagement in the governance of science and technology.

The framework that supports the analysis of public engagement in BioSTEP is therefore composed by three main dimensions, i.e. actors involved, motivations for engaging and levels of engagement (Ribeiro and Millar, 2015):

Figure 1: Actors, motivations and levels of engagement

Actors	Motivations	Levels of engagement
• The roles of publics are not static and homogeneous, but context-dependent and constantly (re)defined by engagement proponents and participants themselves	• There are different reasons and objectives for engaging with publics; these can range from instrumental to more normative perspectives	• Engagement does not always "look" the same; approaches and activities can be seen as being of a more informative, consultative or participatory nature

3.2 Stakeholders and publics

In alignment with other approaches (e.g. Ross, 2003; Reed et al., 2009), BioSTEP recognises that the groups of actors that are or might be involved in the bioeconomy belong to different interest groups and therefore makes a distinction between stakeholders and members of the public (i.e. citizens which do not formally indentify with stakeholder groups). BioSTEP target groups for the engagement activities are therefore generally defined as either *stakeholders* or *publics*, both representing rather heteregenous groups of actors. On the one hand, stakeholders include, for

example, policy-makers, representatives of government institutions, research and development, businesses, NGOs and CSOs.

On the other hand, publics are members of the civil society who differ from these groups in terms of their level of organisation and visibility. They usually lack the resources to become organised or might not identify themselves with any formally organised group as the ones mentioned for stakeholders (see Mohr et al., 2013). In any case, what is important to bear in mind is that categorisations of stakeholders and publics are highly dynamic and context-dependent. At least in theory any kinds of publics are *a priori* 'qualified' to participate in public engagement experiments and participants themselves may redefine their role during or after engagement activities.

3.3 Motivations: From instrumental to normative approaches

It is possible to identify at least three accounts of motivations for promoting public engagement with science and technology (Marris and Rose, 2010; Pallet, 2012):

1. Instrumental: Public engagement seeks to improve public trust and reduce conflict to smooth the way for emerging technologies. It could also help achieving pre-determined outcomes to serve the interests of more powerful actors.
2. Substantive: Public engagement aims at incorporating lay knowledge to decision-making processes and to improve the suitability of technological developments for their embedding in society.
3. Normative: Public engagement responds to an ethical need or a 'right' of publics to be involved in decision-making processes, since science and technology directly affect our lives and are ultimately funded with public money.

The theory and practice of public engagement have been criticised mainly for drawing on instrumental rationales which are very much connected to a popularly model of engagement rationale know as 'the deficit model'. This model is based on the idea that a lack of trust by the publics or a negative public perception of science and technology is a direct result of misinformed publics, i.e. that people who lack information on (the benefits of) science and technology tend to be opposed to these. According to some scholars, the assumption of a deficit is also a reason that public engagement initiatives could gain popularity and it has been claimed that they were promoted in an attempt to increase public support of emerging science and technologies. This meant that, through public engagement (and somehow against the original objectives of the proponents of engagement), those claiming to hold the expertise for it, would create spaces, define rules, design and implement initiatives aimed at promoting participation of publics, yet they might be creating only a certain type of public involvement and support (Felt and Fochler, 2010). Certainly, there is still a long-way to go in the transition from 'deficit' to 'democracy' in more participatory forms of scientific governance. What is often seen are engagement processes that can be described as hybrid attempts at democratising science, where both forms coexist through different aspects of the engagement exercises (Irwin, 2006). Despite the valid criticism, and recognised by Irwin (2006) himself, public engagement is still a sort of social experiment.

3.4 Levels of engagement

Along with international Conventions and engagement practice within assessment processes (UN Economic Commission for Europe, 1998; Roberts, 2003), we believe there are distinctions between different methods and levels of public engagement. These can range, for example, from improving access of people to information to the actual participation of citizens in decision-making processes.

In summary, engagment practices could take more 'consultative' or 'participatory' forms, being situated therefore in a sort of engagement spectrum:

Figure 2: Public engagement spectrum in the context of impact assessment (based on Roberts, 2003)

Consultative approaches
tend to be more...

- Advisory
- Fixed
- Controlled
- Prescriptive

Participatory approaches
tend to be more...

- Non-directive
- Empowering
- Uncertain
- Flexible

Core values and principles that govern more participatory and democratic approaches to public engagement include, for example:[3]

- Directly involving citizens in decision-making processes;
- Taking into account the publics' input in decision-making, i.e. that this input influences the decision;
- Designing engagement practice in agreement with participating publics;
- Making publics aware of how their input may affect the decision.
- Allowing people to express their interests and concerns in their own language and terms;
- Attending people's leading concerns;
- Engaging with marginalised groups.

'Lower levels' of engagement are therefore usually related to practices of top-down, one-way flow of information transmission or communication between scientists, regulators and the public; 'higher' levels are associated on the other hand to consultation exercises, focus groups and questionnaires; and 'even higher' levels to dialogue initiatives giving the opportunity to publics to have some authority in the decision-making process and characterised by a two-way flow of information exchange (Rowe and Frewer, 2000).

Different forms of engaging with publics (i.e. from more consultative to participatory approaches) should not be regarded as 'better' or 'worse' than one another. They are simply adequate to different situations and depend on the objectives of the organisers and participants of engagement

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[3] See http://www.iap2.org/?page=A4 and
http://www.publicagenda.org/files/public_engagement_primer.pdf (last visited on 21 October 2015).

activities. As noted by Roberts (2003), one cannot completely separate consultation and participation, as the outcomes of activities are typically located somewhere between both engagement approaches. Outside regulation or impact assessment, in the case of broader dialogues around science and technology, not all activities experimenting with public engagement aim at being fully participatory or assuming deliberative-democratic aspects (Tlili and Dawson, 2010). In fact, the complexity of motivations, objectives and characteristics of such activities, which range from citizen's juries to science festivals makes it rather hard to situate practices. One of the reasons for this is because the field of public engagement with science and technology sits at the intersection between informal science education, democratic processes and 'science as entertainment' (Tlili and Dawson, 2010).

3.5 Questions for the work of BioSTEP

Public engagement with science and technology is a complicated topic and raises many questions. Also, the BioSTEP project cannot ignore the complex and multi-dimensional issues of this subject that require careful consideration. On the basis from what has been discussed in this chapter, we propose a series of clarifying questions with respect to public engagement that could strenghten the work of BioSTEP. We identify five key questions (Infobox 3).

Infobox 3: Five key questions for public engagement

1. Who are the publics we are engaging with (i.e. what is our understanding of these publics)? If we categorise them, are we able to explain the relevance of such a categorisation in our work?

2. Based on which criteria (informed by a set of assumptions or context) are we selecting / inviting publics? Are we open to reassess these assumptions?

3. What are our motivations to engage with publics, within the remit of the project?

4. How are we engaging and how would we classify the different activities we are promoting in the participation spectrum?

5. What do we expect in terms of impact from our engagement activities (what are the changes we are hoping for)?

These key questions can be understood as a reflection exercise regarding the perspectives on public engagement and their potential implications for planned engagement activities. By doing this exercise for the different case studies and engagement activities that are part of the work programme of BioSTEP, two aims can be achieved: better articulated views on public engagement (including assumptions and goals), as well as a better acknowledgement of the scope and limitations of the work of BioSTEP.

4 TIS and stakeholder dialogue

> *In a situation of controversy, a dialogue should aim at an 'opening up' first: rather than trying to arrive at unitary prescriptions, it should aim at throwing a light on different problem definitions, neglected issues, uncertainties, marginalised views, different possibilities and future options.*
>
> (Breukers et al., 2014: 234)

Deliverable 2.3 concluded that public engagement in the bioeconomy is emerging, but it is very limited and sporadic. Because of this situation, the impacts on public debate and participative governance of actors and network activities in the bioeconomy domain are very modest or absent. The intentions and several attempts in the bioeconomy domain to move towards participative governance might be seminal building blocks for best practices, but are not indicative of best practices - much more is needed. As a consequence, it is hardly possible to identify 'lessons from best practice networks as factors that foster future-oriented multi-stakeholder dialogues'.[4]

At the end of Deliverable 2.3, we noticed that the Technological Innovation System (TIS) approach (Hekkert et al., 2007; Hekkert et al., 2011) we followed in our assessment of regional bioeconomy clusters, did an effective job in mapping the networks and social processes that seem important in bioeconomy clusters, but that it fares less well in grasping societal controversies and different underlying stakeholder perspectives.[5] Particularly in the case of the bioeconomy, that appears to have a low level of participative governance, the TIS approach merely scratches the surface of these perspectives and misses the ability to go beyond this. Our conclusion that public engagement in the bioeconomy is very limited and sporadic and the question concerning our methodology thus correlate.

In this chapter, following on our reflection of public engagement, we first take a closer look at an attempt to combine TIS research with participatory stakeholder dialogue. After that, we will give an overview of different models of science and society relationships. At the end of this chapter, we point at some tools and the TranSTEP framework that could be helpful for opening up debates with the publics or Civil Society Organisations.

4.1 Combining TIS with participatory stakeholder dialogue

The TIS approach (Hekkert et al., 2007) has been recognized as a relevant and developing theoretical construct within the Innovation Systems (IS) literature for the study of processes of innovation at different levels. According to Bleda and Del Rio (2013: 1041) the functional TIS perspective is 'currently considered more appropriate for policy analysis than the structural view that characterises IS [Innovations Systems] literature,' whereas Breukers et al. (2014: 227) pose

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[4] The aim of this work package as formulated in the work plan. The plan within BioSTEP was to elaborate these factors further in the following work packages that focus on strategies how to engage the general public and various stakeholder groups.

[5] The main reasons for this are its focus on economic stakeholders and concentrating, from a functional starting point, on the progress of the innovation system as such.

that the TIS approach has 'recently shown great progress in mapping and explaining the dynamics of technological innovation processes.'

Both Bleda and Del Rio (2013) and Breukers et al. (2014) can count as scholars that attempt to improve the analytical capacity of the TIS framework. Bleda and Del Rio, discussing the market failure and the systemics failure rationales in technological innovation systems, propose to combine TIS with a further multi-level framework that makes it possible to analyze market 'malfunctions' in more detail. This attempt might add more depth to the key system function of 'market formation' of TIS, but does not tackle the problem that societal controversies and different underlying stakeholder perspectives can easily pass below the radar screen. For bringing into scope the whole dimension of public engagement, particularly the more interactive forms of engagement that exceed information transmission, the attempt of Breukers et al. (2014) to combine the TIS approach with participatory stakeholder dialogue methods, is more interesting.

As presented in Deliverable 2.3 (p. 29), social science studies have demonstrated that one-way communication that focuses on the benefits of new technologies does not always work to gain public support (see e.g. Stenekes et al., 2006; Flynn and Bellaby, 2007; Gupta et al., 2012). To the contrary, this type of approach can even lead to scepsis and distrust. One-way communication or 'pure' information transmission may play a role in informing the public, but has limitations concerning the societal embedding of new technologies. It is often not capable of building confidence in the new technologies and can ignore consumer concerns, which are likely to emerge later. Interaction with a broad group of stakeholders and publics is considered critical to increase mutual understanding and building trust, as well as helping to open up a discussion around critical value conflicts that may be difficult to solve. In short, it is commonly acknowledged that it is important to go beyond 'the deficit model' (see also chapter 3.3 Motivations: From instrumental to normative approaches of this report) to capture what is going on in 'hearts and minds' of people when they are made aware of or confronted with new technologies, and preferably before these are further developed and reach commercial scale. Therefore, interaction with a broad group of stakeholders and publics is critical to increase mutual understanding, or as Breukers et al. (2014: 228) put it: "Successful innovation requires a certain level of commitment, support or at least acceptance by relevant societal stakeholders" (2014: 228).

Within the world of Technology Assessment (TA) and Science and Technology Studies (STS), stakeholder dialogue methods have become common practice to identify and discuss different concerns and interests on a deeper level. Breukers et al. (2014) build on this tradition of knowledge and argue that participatory stakeholder dialogue methods could support the aligment of diverging expectations, needs and interests. Combining TIS with such methods could provide in their view a more comprehensive picture of the innovation system under study. Figure 3 shows how they envision the two approaches as complementary to one another.

Figure 3: TIS approach (historical) and stakeholder dialogue
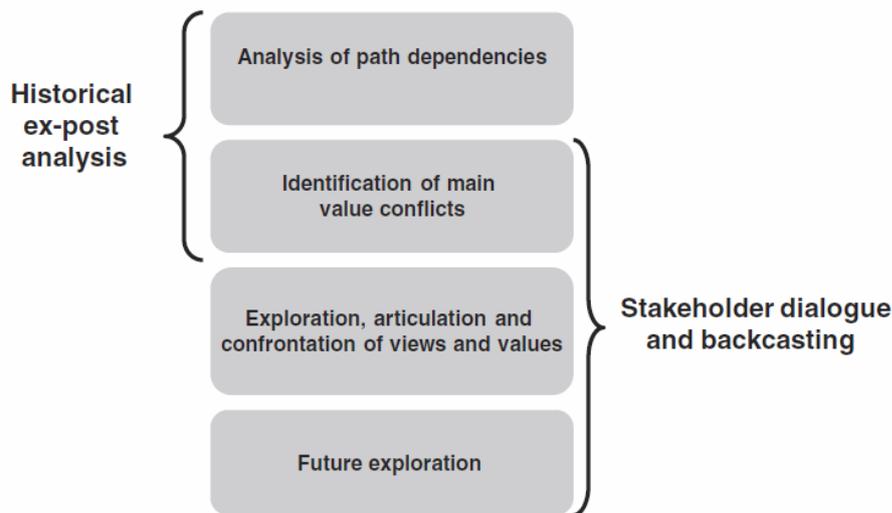
Source: Breukers et al, 2014: 229

Following the argument of Breukers et al. (2014), participatory stakeholder dialogue is necessary for bringing into scope societal controversies and different underlying stakeholder perspectives, but

> "a limitation of the dialogue method is that the quality of the sometimes rather anecdotal information is hard to assess. Longitudinal ex-post TIS research can help to place the dialogue discussions and outcomes in a broader historical and systemic perspective" (2014: 234).

By combining the strengths of the historical and systemic perspective of TIS with stakeholder dialogues that can reveal underlying expectations, needs and interests, it may be possible to transcend the limitations of each method. Breukers et al. (2004) illustrate this by their empirical finding of the Biomass Dialogue in The Netherlands, where they used the seven functions of TIS to structure the ideas that were generated in the process of this dialogue. In their research, they gave special attention to marginal stakeholders of the biomass innovation network and interviewed representatives of knowledge institutes, NGOs, companies and sector organisations, small and medium-sized enterprises, and from national, regional and local governments ('other publics' or citizens, that do not formally represent an interest group, were seemingly left out, but these can also be considered as stakeholders). Though they admit that their work is explorative and leaves room for further improvement, they conclude that using both historical and participatory methods provides more insight in the actual functioning of innovations systems and opportunities for improvement. In short, such a combined approach is doing (more) justice to the dynamics of technological innovations.

4.2 Science and society relationships

The main purpose of BioSTEP is supporting and stimulating participative governance that could connect the developing bioeconomy more strongly to society. We will not attempt theoretical endeavours as outlined above to improve the conceptuel framework of TIS by combining or integrating this functional perspective with other approaches. But taking such attempts into account does help to appreciate our previous mapping of actors and network activities in the

bioeconomy domain and reflections on possible guidelines for the further work of BioSTEP. What we can learn from the more comprehensive methodic approach of Breukers et al. (2014) is that TIS has weaknesses regarding the 'use' of public engagement, but that stakeholder dialogue methods can compensate these flaws (to a certain extent). Using such methods in the further work of BioSTEP does not run counter to our previous work with TIS that took stock of the actors and network activities in the bioeconomy domain in several countries and regions.

However, the conclusion supported by TA and STS research that paying more attention to participatory approaches and using stakeholder dialogue methods in the case of the developing bioeconomy is fundamental for BioSTEP, does not mean that more passive, consultative approaches do not have a role and should be rejected. As we already stated in the previous chapter 3.4), different forms of engaging with publics should not be regarded as 'better' or 'worse' than one another *per se*. The choice of consultative or participatory approaches, or more likely a specific combination of such approaches, will depend on the objectives of the organisers and participants of engagement activities and social and political circumstances. In short, there is not one 'right choice' of methods and different approaches can be adopted. Each technological innovation system has its own context and possibilities and it is important to always see the full scope of relationships that are possible between science and society. As a summary of what has been discussed previously, applying Felt's (2007) approach, three broad models of science and society relationships can be helpful for considering the route(s) of public engagement in the developing bioeconomy and more specifically in BioSTEP (see table 1).

Table 1: Models of science and society relationships (based on Felt, 2007)

Model	Description
Public education	Science and technology are sources of societal progress, but their **development should be protected from societal intervention** (i.e. publics do not intervene in process of knowledge creation). Potential public mistrust on **science derives from public illiteracy**, as well as ignorance and superstitions. **Scientists and experts, whose roles are of instructing and educating publics, must tackle this mistrust**.
Public dialogue and participation	Science and technology are open to **societal debate** (with public authorities, industry and citizens), **although publics do not participate in the creation of scientific knowledge**. The limits between expert and lay knowledge become blurrier. The **existence of open debates legitimises decisions**.
Public co-production of knowledge	Science and technology are **intertwined with society**. Citizens and other interest groups get **actively involved in the process of knowledge production of direct use for them** (scientists, experts and lay publics collaborate and work together in hybrid collectives). Knowledge is still created in formal R&D spaces, such as laboratories, but it **takes into account actions from citizens**.

4.3 Tools available and TranSTEP

Breukers et al. (2014) discuss the example of the Biomass Dialogue in the Netherlands that used a stakeholder dialogue methodology called Constructive Conflict Methodology (Cuppen, 2009): an approach to the design and facilitation of stakeholder dialogue containing four steps: (1) stakeholder identification & selection, (2) articulation of divergent perspectives, (3) confrontation of claims by stakeholders with divergent perspectives, and (4) synthesis. Within this overarching

approach two other (sub)tools were deployed: a specific method to identify the diversity of perspectives on sustainable biomass (*Q methodology*) and a tool for scenario research (*Backcasting*) that involved 'looking backwards from one or more desirable future visions to the present in order to assess the feasibility of the vision(s) and in order to develop ideas about the necessary (policy) interventions to reach the future vision(s)' (Breukers et al., 2014: 230). The seven functions of TIS were used to structure the new ideas that were generated here.

The rendition above illustrates that a combination of tools can be deployed for engaging society. (More tools are available, although it should be noted there are still not many systematic assessments of these new methods.) The choice and combination of available (sub-)tools will allways depend on the wider context and the specific issues at hand. The most important but also often most complex part of public engagement and (broad) stakeholder dialogue is the step or activity that involves the problem definition or situation analysis. This should deliver a transparent and collaborative framing of the problem that is recognised by all participants. This part of the process is perhaps the most important one since it is where the complexities of the issue are integrated into and communicated via a workable problem that has been identified as important to discuss. There may be different interests, needs and expectations, but a good stakeholder dialogue needs robust problem characterisation that is acknowledged by everyone, whatever perspective one may have on the causes and the solution to the specified problem. In reality, it is often a time-consuming process to achieve this – it often also involves building a climate of trust – but when this step is (succesfully) done it can prevent (time-consuming) misunderstandings.

One potentially useful guide in choosing the right tools and methods is TranSTEP: an approach to the assessment of technologies or technological applications that present challenges related to complexity, uncertainty and controversy over facts and values.[6] More than being itself a new TA-tool, TranSTEP is a roadmap for a more integrated assessment of emerging technologies, pointing at other tools (e.g. Soft Systems Methodology (SSM) or Multicriteria Analysis (MCA)) that can be helpful to start a broader dialogue with civil society. Figure 3.2 offers a simple diagram version of the TranSTEP process (the full map of the TranSTEP process can be found in the Annex)

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[6] TranSTEP (https://transtepapproach.wordpress.com/) is the result of the EST-Frame project (Integrated Framework for Emerging Sciences and Technologies: http://estframe.net/) and offers an approach where the range of participants is widened, the assessment process itself is made transparent and the output has been subject to broad review.

Figure 4: Map of the TranSTEP process (simple version)

Source: https://transtepapproach.wordpress.com/
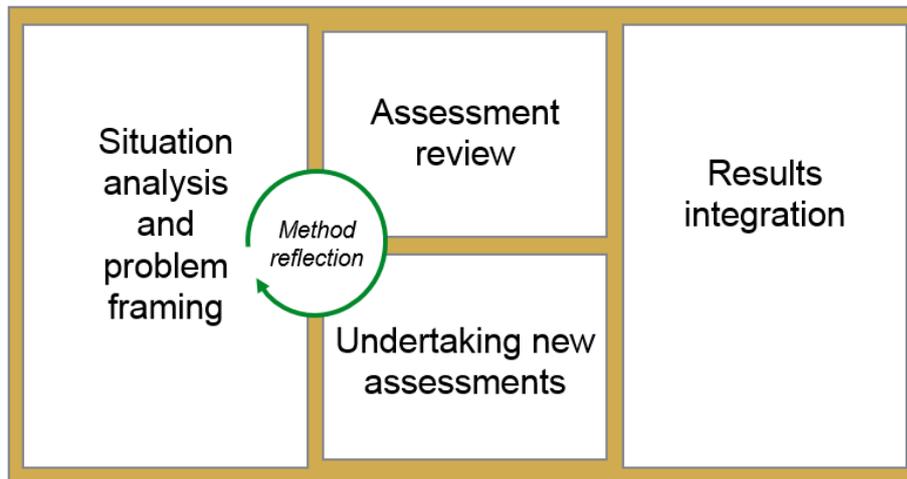
A last approach/method that can be mentioned is the idea of a 'Societal Incubator' (SI) that could be described as a safe discussion arena in which different stakeholders feel free to discuss their views with one another without being afraid that everything what is said in this arena is 'on the street' the next day. The idea of a SI, analogous to a Business Incubator, was originally presented in a workshop on 'nanofood' to break through 'the waiting game' that stakeholders identified here. That is, due to the many uncertainties concerning (further) risks, regulation and consumer/societal responses, the industry involved in the development of relevant products are aware of risks to a company's trade-mark by introducing such novel products in their portfolio. 'The waiting game' refers to a situation that firms are waiting for other companies to introduce a product first and then see how the market would react.[7]

4.4 Main conclusion for the work of BioSTEP

One of the challenges for BioSTEP will be to choose the right methods and tools (e.g. Citizens Hearing, Café Seminar, Scenario Workshop, Stakeholder Panel, Voting Conference)[8] that can help to start public engagement activities in clusters that until now have only seen a very low level of participative governance. Science and society relationships can be characterised by different models that show 'lower' and 'higher' levels of engagement. All these models should be considered when examining options that different actors and addressing different networks to connect the developing bioeconomy more strongly to society. However, taking into account current research, and building on the insights of these strands of knowledge, it should be recognized that public education dominated by one-way communication that focuses on the benefits of new technologies will not be enough for gaining public support and aligning innovation to societal needs. Interaction with a broad group of stakeholders and publics, either by public dialogue and participation or public co-production of knowledge, is critical to increase mutual understanding, also about value conflicts that may be difficult to solve.

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[7] Currently, the idea of a SI is explored by the Rathenau Institute (Dutch technology assessment agency) and LEI for NanoNextNL (the leading research consortium in the Netherlands on nanotechnology). The main challenge, it was concluded, is to break through this 'waiting game' and to open up a wider debate with societal stakeholders, such as NGOs and the public.

[8] See for an extensive list: https://transtepapproach.files.wordpress.com/2014/11/methods-and-domains.pdf.

5 Guidelines for the BioSTEP workshops

In this report we have reflected on the actors and network activities in the bioeconomy domain that were identified in Deliverable 2.3 and on the topic of public engagement. We considered general guidelines for the further development of national and regional case studies in BioSTEP. We propose the following reflective questions on public engagement and guidelines for the further development of national and regional case studies in BioSTEP.

Infobox 4: Reflective questions on public engagement

1. Who are the publics we are engaging with (i.e. what is our understanding of these publics)? If we categorise them, are we able to explain the relevance of such a categorisation in our work?

2. Based on which criteria (informed by a set of assumptions or context) are we selecting / inviting publics? Are we open to reassess these assumptions?

3. What are our motivations to engage with publics, within the remit of the project?

4. How are we engaging and how would we classify the different activities we are promoting in the participation spectrum?

5. What do we expect in terms of impact from our engagement activities (what are the changes we are hoping for)?

Infobox 5: Guidelines for the case studies of BioSTEP

1. The workshops should pay attention to different innovations within the bioeconomy, e.g. not only sectors and issues of the 'old' bioeconomy should be covered, but also sectors featured by knowledge-based innovations related to bioeconomy applications with a high degree of added value. Promient and societal debates on specific issues should be recognized, but also other ap-plications of the bioeconomy that have met less public opposition and are relatively unknown.

2. Given the observation that the involvement of other publics (e.g. civil society) in the bioeconomy has just started, the selection of interesting cases should also be guided by the existence of ac-tors and networks that are willing to open up debates with the publics and/or with Civil Society Organisations. This pragmatic criterion is particularly relevant for the workshops that focus on regional bioeconomy clusters.

3. Beyond the wider priority to facilitate dialogue as a goal in itself, public education dominated by one-way communication that focuses on the benefits of new technologies will not be enough to gain public support. Interaction with a broad group of stakeholders and publics, either by public dialogue and participation or public co-production of knowledge, is critical to increase mutual understanding and explore value conflicts that may be difficult to solve. In the wide range of available tools for participatory stakeholder dialogue the framework of TranSTEP (an integrated technology assessment 'roadmap' for examining options) could offer BioSTEP a helping hand.
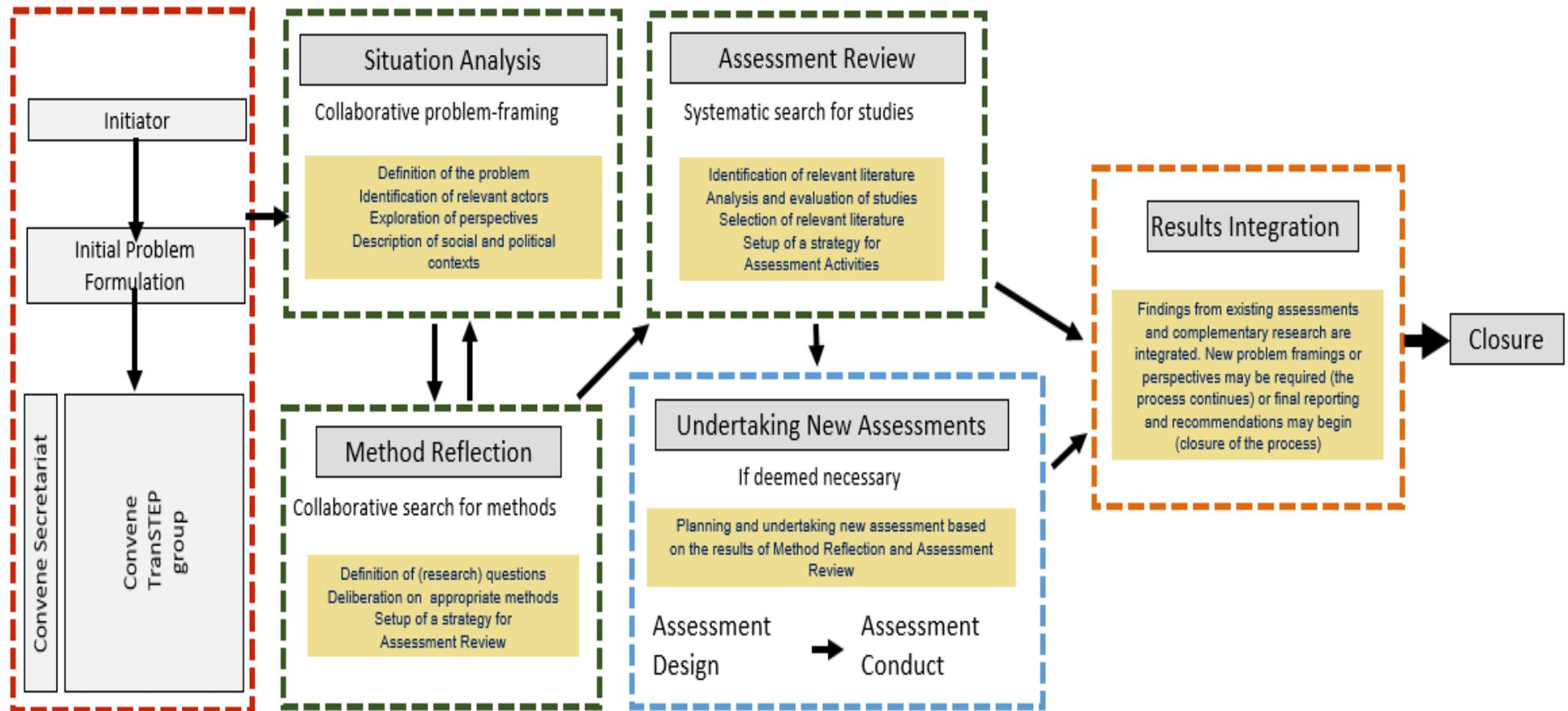
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Annex 1   Map of the TranSTEP process

Source: https://transtepapproach.wordpress.com/about/map-of-transtep-process/