TRANSrisk

TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

TRANSITIONS PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE MITIGATION AND ADAPTATION STRATEGIES

D6.1 Stakeholder mapping

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Work Package 6

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Preface

Both the models concerning the future climate evolution and its impacts, as well as the models assessing the costs and benefits associated with different mitigation pathways face a high degree of uncertainty. There is an urgent need to not only understand the *costs and benefits* associated with *climate change* but also the *risks, uncertainties and co-effects* related to different *mitigation pathways* as well as *public acceptance* (or lack of) of low-carbon (technology) options. The main aims and objectives of TRANSrisk therefore are to create a novel assessment framework for analysing costs and benefits of transition pathways that will integrate well-established approaches to modelling the costs of resilient, low-carbon pathways with a wider interdisciplinary approach including risk assessments. In addition *TRANSrisk* aims to design a decision support tool that should help policy makers to better understand uncertainties and risks and enable them to include risk assessments into more robust policy design.

PROJECT PARTNERS

No	Participant name	Short Name	Country code	Partners' logos
1	Science Technology Policy Research, University of Sussex	SPRU	UK	
2	Basque Centre for Climate Change	BC3	ES	
3	Cambridge Econometrics	CE	UK	
4	Energy Research Centre of the Netherlands	ECN	NL	
5	Swiss Federal Institute of Technology (funded by Swiss Gov't)	ETH Zurich	CH	
6	Institute for Structural Research	IBS	PL	
7	Joint Implementation Network	JIN	NL	
8	National Technical University of Athens	NTUA	GR	
9	Stockholm Environment Institute	SEI	SE, KE, UK	
10	University of Graz	UniGraz	AT	
11	University of Piraeus Research Centre	UPRC	GR	
12	Pontifical Catholic University of Chile	CLAPESUC	CL	

Executive Summary

In this opening Deliverable for Work Package 6, we elaborate on the concepts of innovation systems and the role of stakeholders, which are central to later tasks and case study analysis in Work Package 3. The aim of Work Package 6 is to investigate the relationship between innovation dynamics and alternative transition pathways in selected TRANSrisk case studies. To better understand these phenomena, we set out a systematic approach to explore the position of stakeholders in identified value chains, and their interests and capabilities to influence outcomes in transition pathways. Our approach draws from socio-technical innovation systems literature and builds on initial stakeholder analysis in TRANSrisk, developed in D2.3.

An accompaniment to this report is the Stakeholder Attribute Matrix (SAM), which is a tool we have developed to facilitate systematic stakeholder analysis by TRANSrisk partners. The matrix and approach outlined in this report have been piloted in two case studies, Indonesia and the Netherlands, both of which have undertaken initial stakeholder consultations to support their analysis. The information presented on the case studies is preliminary, based initially on researcher's expert judgment and then revised based on information gathered in stakeholder consultations. It provides a strong foundation for continued analysis of the role of stakeholders and their contribution to transition pathways in case studies under Work Package 3.

The results from the pilots show that a systematic analysis of stakeholders can help case studies ensure all relevant stakeholder roles are represented in their analysis, and also help identify areas for further analysis in order to better understand the innovation system dynamics in transition pathways. In the Indonesia pilot, analysis of a diverse set of 84 stakeholders related to bioenergy development in the provinces of Bali and East Java indicated momentum behind a low-carbon transition, with supportive stakeholders significantly outnumbering unsupportive stakeholders among those found to be most influential. However, further analysis is needed to better understand stakeholders' interests in the transition and the implications these interests may have depending on which parts of the bioenergy value chain they are active. In the Netherlands pilot, 24 stakeholders related to integrated manure management in the Dutch livestock sector were found to be exclusively supportive or neutral to a low-carbon transition. This reflects the sentiment amongst technical stakeholders, which are well-represented in the sample, but further development of the stakeholder network may be necessary to capture the views of communities living in livestock-dense regions where some known public opposition exists.

The Stakeholder Attribute Matrix is part of an analytical toolbox that is beginning to emerge within TRANSrisk. These tools have been designed for application to case study analysis, but have potentially broader use beyond TRANSrisk. We envisage that further application of the SAM to other case studies during the course of their stakeholder analysis will allow us to further refine and improve this and other tools for broader application.

Table of Contents

Figures

Tables

1 EC Summary Requirements

1.1 Changes with respect to the DoA

This Deliverable is prepared in accordance with the DoA.

1.2 Dissemination and uptake

This Deliverable is an internal guidance document for TRANSrisk consortium partners. It is intended to introduce the concepts of Work Package 6 and provide a stakeholder analysis approach and tool for country case studies in Work Package 3. The approach and tool have benefited from discussion and feedback from partners during their development.

1.3 Short Summary of results (<250 words)

In this report, we outline a systematic approach to establish and analyse the roles of stakeholders in TRANSrisk case studies. Building on the stakeholder database developed in D2.3, our approach explores the role of stakeholders in low-carbon transition pathways in relation to their position in identified value chains and their interests and capabilities to influence outcomes. These stakeholder characteristics are understood through socio-technical innovation systems literature, the theoretical foundations of which are presented in this report. An accompaniment to this report is the Stakeholder Attribute Matrix (SAM), which is a tool we have developed to facilitate stakeholder analysis by TRANSrisk partners. The matrix and approach outlined in this report have been piloted in two case studies, Indonesia and the Netherlands, both of which have undertaken initial stakeholder consultations to support their analysis. The results from the pilots show that a systematic analysis of stakeholders can help case studies to transparently demonstrate that all (or the majority of) relevant stakeholder roles are represented in their analysis. They can also help to identify areas for further analysis, in order to better understand the innovation system dynamics in transition pathways.

1.4 Evidence of accomplishment

Submission of this report to the European Commission and publication of the Stakeholder Attribute Matrix template on the TRANSrisk file server for partners use.

2 INTRODUCTION

This report outlines a systematic approach for TRANSrisk case studies to establish and analyse the roles of stakeholders in the innovation systems that drive transition pathways. In line with the technological innovation systems (TIS) approach adopted in TRANSrisk, we define innovation systems following Bergek et al., 2008 as the "overall function of developing, diffusing and utilizing new products (goods and services) and processes". This is a complex set of phenomena, the evaluation of which requires interdisciplinary and interconnected analysis that includes stakeholders as key elements. This forms the core subject of Work Package 6.

2.1 Objective and scope

In this opening Deliverable for Work Package 6, we elaborate on the concepts of innovation systems and the role of stakeholders, which are central to later tasks in this Work Package. The aim of Work Package 6 is to investigate the relation between innovation dynamics and alternative transition pathways in selected TRANSrisk case studies, thereby acknowledging that a central role in innovation is played by stakeholders. To better understand these phenomena, including the interests and capabilities of stakeholders, our analysis approach explores the position of stakeholders in identified value chains and their interests and capabilities to influence outcomes in transition pathways.

The tool we have developed for systematic stakeholder analysis is called the Stakeholder Attribute Matrix (SAM). It elaborates on the stakeholder database developed in D2.3, which contains stakeholders identified by TRANSrisk partners for engagement in the case study analysis. While D2.3 characterises stakeholders in terms of their affiliation and professional background, with SAM the stakeholders are further characterised in terms of, among others, their interests, influence, capabilities and potential role in innovation systems. The envisaged strength of SAM lies in the possibility to combine stakeholder characteristics into a profile of stakeholders' contribution to innovation systems and transition pathways. For example, the contribution of a stakeholder with a strong influence on decision-making but without interest in a low-emissions transition is likely to be weak or even negative, while a powerful stakeholder with such interests can become a stimulator of a low-emission transition. A potential weakness of applying SAM is that stakeholder profiles are initially based on expert judgements by TRANSrisk partners. In order to address this, all judgements will be made explicit in the case study reports and refined based on consultation with stakeholders.

This report presents the matrix template and provides a step-by-step approach for TRANSrisk consortium partners to apply it in case study countries. The report also presents the results of two case study pilots of the matrix, Indonesia and the Netherlands.

The stakeholder analysis is static, based on the present situation, but it is designed to be refined and updated as case studies develop more knowledge about the roles of stakeholders. In this

exercise, we do not account for future stakeholders that are likely to materialise later in transition pathways, even though some of these may be instrumental to the innovation system. A dynamic analysis, accounting for these changes, can be more readily delivered by system mapping approaches being developed in case studies and the latter tasks of Work Package 6. These tasks are T6.2, on analysing transition discourses and power relations, and T6.3, on agent-based modelling. They will draw on information from the stakeholder analysis in T6.1, and our design of this Deliverable has been adapted to suit their required inputs (see Section 2.2.2).

2.2 Relation to WP6 and other WPs

This task draws directly from the stakeholder engagement and mapping work in WP2, as presented in D2.3. It also provides a foundation for the micro-perspective, or actor level analysis, adopted in WP6 under D6.2, D6.3 and D6.4, as well as on going case study and stakeholder work in other Work Packages (especially WP3 which organises case study analysis with several participatory analytical steps with active stakeholder engagement).

2.2.1 Inputs

A list of inputs from other TRANSrisk Deliverables used to develop D6.1 comprises:

- D3.1 TIS matrix (month 3 – SPRU)
- D2.1 Report on stakeholder engagement tools (month 6 - JIN)
- D2.3 Stakeholder mapping (month 10 - JIN)
- D2.4 Stakeholder engagement plan (month 6 – JIN)

2.2.2 Outputs

In Work Package 6, the findings about stakeholder roles in this Deliverable will inform further analysis of the types and forms of relationships between actors (D6.2). This includes data on interests and capabilities to explore linkages and tensions in the socio-institutional context, power dynamics, priorities and needs. This is necessary to understand the interplay and dynamics between different stakeholders through micro-level modelling of behavioural responses to social, political and economic incentives (D6.3), and macro-level modelling of innovation policies (D6.4).

In Work Package 3, the Stakeholder Attribute Matrix template is designed to be used for stakeholder analysis in other case study countries in the lead up to D3.2. The pilots in Indonesia and the Netherlands already provide valuable information for these case studies.

Stakeholder analysis methods in TRANSrisk can also benefit from the matrix, including the Market Mapping Tool developed by NTUA and the forthcoming enhanced stakeholder database (MS7).

2.3 Report organisation

This introduction has outlined the contribution of this task to WP6 and TRANSrisk overall. The report will now turn to the methodology underpinning our analysis and its application, as follows:

- Section 3 explores the theoretical frameworks guiding our analysis of stakeholders in innovation systems and their influence in transition pathways.
- Section 4 introduces the Stakeholder Attribute Matrix and provides a step-by-step approach for its application to stakeholder analysis in TRANSrisk case studies.
- Section 5 outlines pilots of the Stakeholder Attribute Matrix in two TRANSrisk case study countries, Indonesia and the Netherlands.

3 THEORETICAL FRAMEWORK: STAKEHOLDERS IN THE INNOVATION SYSTEM

We adopt here an approach that considers stakeholders to be central elements in innovation systems, defined in Section 2 following Bergek et al. 2008. Stakeholders, or actors as they are commonly called in the literature, fulfil a key function in moving society in a certain direction, as they produce, distribute and consume products and services including new technologies. Among the broadest and most inclusive definitions of stakeholders is "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman 1984 in Mitchell et al., 1997). While this quotation shows that stakeholder theory has a strong background in management and economic studies, social and natural sciences have also made use of the concept (Reed et al., 2009). Given the research focus of TRANSrisk on innovation systems, stakeholders can therefore be understood as actors who would contribute to "developing, diffusing and utilizing new products (goods and services) and processes" as defined earlier following Bergek et al., 2008. Besides actors along a certain innovation system value chain – from input material providers to distributors of the end product – Bergek et al., 2008 suggest that stakeholders also include policy makers, regulatory bodies, universities, research institutes, influential interest organisations and financing providers. We consider stakeholders to be the entity under analysis, rather than the individual contact point, except for researchers who are considered in their individual capacity.

Those stakeholders are bound by certain rules and routines which shape not only technology developments but also society's use of technology and dependence on it. These notions of co-evolution, interdependence and lock-in are some of the conceptual foundations of the socio-technical perspective, which is used in TRANSrisk to understand innovation and transitions. It is the subject of a significant body of literature that sees technology and innovation as inseparable from society, including two major frameworks: technological innovation systems (TIS) (see Bergek et al., 2015, 2008; Markard and Truffer, 2008) and the multi-level perspective (MLP) (see Geels, 2011, 2002; Geels and Schot, 2007).

In relation to stakeholders in innovation systems, the TIS and MLP frameworks adopt a similar understanding (Markard and Truffer, 2008). While they all are important for the functioning of an innovation system, stakeholders do not necessarily share the same goals, which makes competition and cooperation between them a defining element in the innovation system (Bergek et al., 2008). They are "self-interested, act strategically, and try to calculate which actions will best achieve their goals" (Geels and Schot, 2007).

3.1 Stakeholder identification, selection and analysis

This brings us to the question of stakeholder selection. This involves considering how or why a stakeholder is relevant to an innovation system associated with a particular product, service or sector. Reed et al., 2009 observe that stakeholders are often identified and selected on an ad-hoc basis, presuming they are self-evident. Rather than beginning with stakeholder analysis, they argue for a systematic process of stakeholder identification and selection to avoid marginalising important groups, biasing results and jeopardising long-term viability and support for the process.

The Stakeholder Attribute Matrix, outlined in Section 4, is our attempt to develop a systematic way to transparently identify, select and analyse stakeholders and their roles in transition pathways being explored in the TRANSrisk case studies. According to Reed et al., 2009, this necessitates a clear understanding of the issue under investigation and requires the research to "identify who holds a stake in the phenomenon under investigation". Reed et al., 2009 state that it is usually an iterative process, where stakeholders are added as the analysis continues and the researcher engages with stakeholders[1]. As such, the Stakeholder Attribute Matrix is a dynamic tool for identification, selection and analysis which can be revisited as the researcher learns more about the transition pathways in focus.

Which criteria allow us to determine whether a stakeholder has a stake in the transition pathway under investigation? Table 1 identifies the criteria or "categories" included in the Stakeholder Attribute Matrix, which, we argue, allows the user to ensure that all relevant "attributes" associated with those categories are adequately captured by the stakeholder list. It then allows for analysis of the attributes of stakeholders in the list to gain insight into their roles in the innovation system. A set of steps for applying these categories in the analysis of each case study are set out in Section 4, and the theoretical foundation for the analysis is set out in Section 3.2.

[1] For a description of the different stakeholder engagement processes used in TRANSrisk, see "D2.1 – Tools and Procedures for Engaging Stakeholders in TRANSrisk Case Study Analysis"."

Table 1: Categories for stakeholder identification and analysis in the Stakeholder Attribute Matrix.

Category	Description	Attributes	Source
1. Type	The occupation type of the stakeholder.	Government (national); Government (subnational); Research / consultancy; Business / private sector; NGO / CSO; Donor; Network / platform / media; Community leader; Land owner / farmer; Faith-based institution; Other	TRANSrisk D2.3
2. Economic sector	The sector within which the stakeholder operates.	Energy; Industry; Transport; Environment; Agriculture / forest; Financial / trader; Water; Interdisciplinary (more than 2 sectors); Other	TRANSrisk D2.3
3. Market role	The market role of stakeholders in the value chain for the product, process or sector.	This depends on the product, process or sector in focus for the case study. This should include supply (upstream, production, distribution), demand (consumption), finance and regulatory.	Authors' own categories
4. Scale	Scale of operation.	International / transnational; National; Provincial; Community	Authors' own categories
5. Stated interest	Stated interest in a transition pathway end-state.	Strongly supportive; Supportive; Neutral; Unsupportive; Very unsupportive	Authors' own categories
6. Demonstrated implementation	Status of investment in infrastructure or products towards the transition pathway end-state.	Past; Current; Planned; No	Authors' own categories
7. Resources, including:	The ability to mobilise a resource to facilitate or constrain a transition pathway.	Low; Moderate; High; Insignificant	Adapted from various, indicated below.
a. Assets	"Artefactual resources [assets] comprise apparatuses, products, construction and infrastructure, but artefactual resources can also include a song, a dance, a painting, a photography or a movie."		(Avelino and Rotmans, 2009)
b. Human resources	"Human resources refer to 'manpower' or human leverage ['human support'], i.e. personnel, members, voters, clients, supporters, fans, etc."		(Avelino and Rotmans, 2009)
c. Monetary resources	"Monetary resources are funds, cash and financial stock."		(Avelino and Rotmans, 2009)
d. Natural resources	"Natural resources refer to raw materials, physical space, land and organic life."		(Avelino and Rotmans, 2009)
e. Authority	Authority resources refer to "command of legitimacy, credibility or other recognised sources of authority in making demands upon the behaviour of others...developing or passing legislation, or in implementing regulations".		(Smith et al., 2005)
8. MLP level	The stakeholder's role in the multi-level perspective view of the innovation system, which should expand the "market roles" into niche and regime.	Niche (specific product towards transition 1); Niche (specific product towards transition 2); Niche (mix of 1, 2, etc.); Regime (specific product towards transition 1); Regime (specific product towards transition 2); Regime (mix of 1, 2, etc.); Regime (specific product against transition 1); Regime (specific	(Geels, 2011, 2002; Geels and Schot, 2007)

Category	Description	Attributes	Source
		product against transition 2); Peripheral to regimes and niches.	
9. TIS functions	The stakeholder's participation in the TIS, which capture key processes "that directly influence the development, diffusion and use of new technology and, thus, the performance of the innovation system."	Knowledge development; Resource mobilisation; Market formation; Influence on the direction of search; Legitimation; Entrepreneurial experimentation; Development of external economies.	(Bergek et al., 2008)

Source: Various, cited in table.

3.2 Stakeholders' influence on transition pathways

As mentioned above, stakeholders are key actors within an innovation system and as such they are important for achieving a transition towards a low carbon economy. Those transitions can take many pathways, a term understood in TRANSrisk to be based on the Intergovernmental Panel on Climate Change's (IPCC) definition of transformation pathways, which are large scale transformations in human societies to stabilise greenhouse gas emissions (Clarke et al., 2014). The central question posed in Clarke et al., 2014 is "how do we get from here to there?", which comprises three sub-questions: What are the goals we set and the near-term choices that define transformation (or transition) pathways? What are the characteristics of different pathways? And how do actions taken today influence the options available in the future?

It is the stakeholders who play a decisive role in discussing, negotiating and acting on those normative questions as society moves forward on a certain pathway. TRANSrisk case studies aim to shed light on these dynamics, and our analysis of stakeholder interests and capabilities can help to understand how stakeholders influence the innovation process getting from "here" to "there". Put simply, stakeholders can either support the transition pathway or they can obstruct it (Reed et al., 2009), but that does not necessarily tell us why they support or obstruct. Theories such as MLP and TIS offer a much broader toolkit to understand the context in which stakeholders act in an innovation system and in the world around it. These insights then enable us to identify appropriate actions to accommodate stakeholder behaviour, address their concern or build further on their support.

The MLP framework considers change in innovation systems to come about from the interplay between a stable structure ("regime") and destabilising forces ("niche"), together with external pressures from outside the system or 'gradients of force' ("landscape") that make some actions easier than others (Geels and Schot, 2007; Markard and Truffer, 2008). Geels and Schot, 2007 also refer to the niche as "in the making" and the regime as "stable and well-articulated".

Consider the earlier stages of the German energy transition as an example: here, a fossil fuel based power generation *regime* was firmly in place but had come under pressure from renewable energy sources (*niches*), with both levels embedded in a lager *landscape* of global energy markets. Support for a transition can come from stakeholders within the regime as well as the niche. Changes initiated from within the regime can be considered incremental changes to the current prevailing structure. These changes may take the form of new products or services to keep the regime intact and could be driven by niche forces or landscape pressures or may even be initiated autonomously – consider again the German government's dedication to its energy transition (Geels and Schot, 2007; Markard and Truffer, 2008; Smith et al., 2005). Changes initiated from within a niche can be considered radical shifts associated with novel products, or approaches geared towards addressing specific problems in regimes (Geels, 2002). According to Kemp et al., 2001, regime shifts come about through 'alignment' of developments at different levels.

By comparison, the TIS framework is focused on the functions or key processes within an innovation system that are necessary for its performance (Bergek et al., 2008; Markard and Truffer, 2008). In their latter work, the primary authors of TIS have acknowledged the value of explicit consideration of broader contexts in which technology development and diffusion takes place, which is similar to the MLP levels and 'alignment' concept (see (Bergek et al., 2015)).

In relation to stakeholders, it is important to recognise that these frameworks have not been explicitly designed for stakeholder analysis, rather the broader dynamics at play of which stakeholders are an important part. A major limitation regarding MLP levels is the blurry boundary between the niche, regime and landscape, which are abstract concepts, possibly counterproductively so when considering a practical matter of stakeholders' roles (Smith et al., 2010). That said, our experience shows MLP to be useful for an initial, yet systematic, categorisation of a stakeholder's position and role within a transition. TIS, by contrast, lends itself more readily to the dynamics and interactions between those stakeholders. MLP and TIS can therefore be used in a very complementary manner covering different aspects of a transition, namely positions of stakeholders (in an energy system for example) and the dynamics between them. For an initial analysis we felt that MLP offers a more intuitive categorisation than TIS functions, but both categories remain as optional fields in the SAM as they might require further research after an initial categorisation.

So far we have considered the supportive-unsupportive dichotomy in relation to a transition pathway and how major innovation systems frameworks conceptualise the role of stakeholders. But however supportive or unsupportive a stakeholder may be, an analysis of their capacity to actually influence the transition pathway is a necessary complement to understanding their role in an innovation system. Can a stakeholder translate their position into tangible results in either driving change or maintaining the status quo? This discussion of influence upon a transition pathway leads us to the concept of power - a complex and contested subject. We do not attempt to consider the different definitions of power here, rather we would like to focus on stakeholder influence in innovation systems, which (Smith et al., 2005) frame as the ability "to bring about pressure, deploy resources, and collaborate in processes of system innovation."

Avelino and Rotmans, 2009 elaborate on this concept of "resources", defining power as the capacity to mobilise resources to facilitate or constrain a pathway. Their typology includes four types of resources, namely "artefactual resources" (which we have renamed "assets" for ease of interpretation) and "human", "monetary" and "natural" resources. To this, we add a fifth resource, "authority"[2], adapted from Smith et al., 2005. All five resource categories are defined in Table 1 and their application is explained in Section 4.3.2. It is, however, important to note that this is only a first, preliminary step in our power analysis. A more nuanced and sophisticated approach will use a variety of tools, such as social network analysis (SNA) or agent based modelling (ABM), to further develop this analysis of power as part of later tasks in Work Package 6. In this initial phase, assigning attributes of power and influence based on the identified literature and desk research allows for stakeholders to be categorised to develop an understanding of likely roles in transition pathways.

[2] It is important to note that "authority" can also be defined not as a resource but as an attribute describing a human resource. However, when using the definition of authority "[…] making demands upon the behaviour of others […] developing or passing legislation, or in implementing regulations." (Smith et. al. 2005; p.1506), authority can be understood as a resource. Of course, the definition of resources and the associated categories might be adapted and refined as the case studies move further.

4 STAKEHOLDER ATTRIBUTE MATRIX

The Stakeholder Attribute Matrix has been conceived as a tool to systematically identify, select and analyse stakeholders and their roles in the transition pathways being explored in the TRANSrisk case studies. It is designed to be developed by researchers initially, and then verified and refined through stakeholder consultation. In this section, we present the matrix template and set out a series of steps for case study leaders to develop it. In section 5, we present pilot applications of the matrix in Indonesia and the Netherlands to demonstrate its potential analytical outputs.

We recommend the following steps, which will be explained in detail in this section:

1. Stakeholder screening, using the approach developed in D2.3
2. Initial market role assignment and analysis
3. Initial interest and capabilities analysis
4. Gap analysis and stakeholder network expansion
5. Verification and refinement through stakeholder consultation
6. Results extraction and application to case study analysis

These steps refer to the categories and attributes in the matrix, which are outlined in Table 1 and discussed in Section 3.2. The assessments made in the matrix are initially based on desk research and the researcher's own best estimates. These should be adapted during the project as knowledge of specific stakeholders and their attributes grows.

We suggest categorising the entity the stakeholder is affiliated with and not the individual contact themselves. For example, the individual person within the ministry of environment should not be classified, but the ministry as a whole. Exceptions are researchers, who will be assessed in their personal capacity rather than their organisation.

4.1 Stakeholder screening

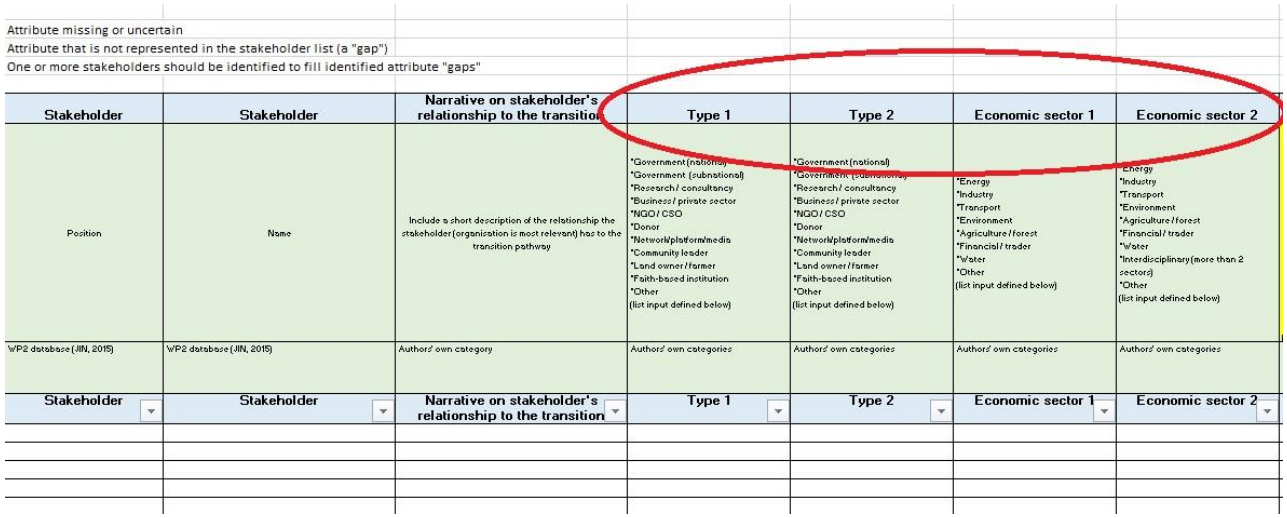
As a first step, the template developed in D2.3 is used in order to identify an initial list of stakeholders for the case study in focus. Depending on how well-developed the stakeholder list is for the case study in focus, additional relevant stakeholders can be added. This may be the case when during the case study analysis stakeholders are identified as actors in the innovation system analysis, which TRANSrisk partners had not identified beforehand. To put it simply: while D2.3 forms an identification of stakeholders that TRANSrisk partners know, in the course of the case study we may learn about stakeholders that we did not know but who are nevertheless important to include in the analysis.

After entering their name, their organisation and their position within this organisation, drawing directly from the D2.3 database, the researcher can choose to provide a short narrative about the stakeholder and their role in the case study in focus. It can prove useful to continually

update this as the stakeholder analysis is developed, so as to ensure attributes are consistently filled out in the matrix. This can help provide other users of the matrix with a deeper understanding of the stakeholders, and provide a justification for the assignment of attributes across the matrix's categories.

The next step is to enter attributes for each stakeholder associated with the stakeholder "Type" and "Economic sector" using a drop down menu. As outlined in Table 1, the stakeholder type and economic sector categories signify the occupation of the stakeholder and the sector within which the stakeholder operates. There are two columns for each category in order to account for stakeholders who are active in more than one category (i.e. interdisciplinary or multi-sector stakeholders).

A screenshot of these first categories in the Stakeholder Attribute Matrix is in Figure 1. Stakeholder details, followed by the narrative, then the type and economic sector, are each represented as columns in the matrix.



Attribute missing or uncertain
Attribute that is not represented in the stakeholder list (a "gap")
One or more stakeholders should be identified to fill identified attribute "gaps"

Stakeholder	Stakeholder	Narrative on stakeholder's relationship to the transition	Type 1	Type 2	Economic sector 1	Economic sector 2
Position	Name	Include a short description of the relationship the stakeholder (organisation is most relevant) has to the transition pathway	*Government (national) *Government (subnational) *Research / consultancy *Business / private sector *NGO / CSO *Donor *Network/platform/media *Community leader *Land owner / farmer *Faith-based institution *Other (list input defined below)	*Government (national) *Government (subnational) *Research / consultancy *Business / private sector *NGO / CSO *Donor *Network/platform/media *Community leader *Land owner / farmer *Faith-based institution *Other (list input defined below)	*Energy *Industry *Transport *Environment *Agriculture / forest *Financial / trader *Water *Other (list input defined below)	*Energy *Industry *Transport *Environment *Agriculture / forest *Financial / trader *Water *Interdisciplinary (more than 2 sectors) *Other (list input defined below)
WP2 database (JIN, 2015)	WP2 database (JIN, 2015)	Authors' own category	Authors' own categories	Authors' own categories	Authors' own categories	Authors' own categories
Stakeholder	Stakeholder	Narrative on stakeholder's relationship to the transition	Type 1	Type 2	Economic sector 1	Economic sector 2

Figure 1 Screenshot of Stakeholder Attribute Matrix categories: type and economic sector.

Source: Stakeholder Attribute Matrix

4.2 Initial market role assignment and analysis

In the next step, stakeholders can be classified according to their position in the value chain (i.e. their market role) and also according to the scale at which they operate. While the scale – from international to the community level as outlined in Table 1 – should be generally applicable to many case studies, the market role might be adapted to each case. This depends on the product, process or sector in focus for the case study, and should include supply (upstream, production, distribution), demand (consumption), finance and regulatory roles. In Indonesia, for example, the value chain has been established for bioenergy developments, ranging from feedstock production to the production, distribution and consumption of energy products

deriving from those feedstocks. Other market roles, such as “finance” and “research & projects”, are also available attributes.

Category	Stakeholder	Market role	Scale
Details / Attribute	Organisation	FOR INPUT: The market role of stakeholders in the value chain for the product, process or sector: For example, bioenergy might include: *Feedstock production (supply) *Feedstock collection (supply) *Bioenergy production (supply) *Bioenergy distribution (supply) *Bioenergy consumption (demand) *Research & projects *National policy & regulatory *Provincial policy & regulatory *Finance (supply) *Other (include each category in the input	*International / transnational *National *Provincial *Community (list input defined below)
Source / explanatory notes	WP2 database (JIN, 2015)	Authors' own categories	Authors' own categories
Category	Stakeholder	Market role	Scale
1	<Insert stakeholder>		
2			
3			
4			
5			
6			

Figure 2 Screenshot of Stakeholder Attribute Matrix categories: market role and scale.

Source: Stakeholder Attribute Matrix

4.3 Initial interest and capabilities analysis

After this initial categorisation, the Stakeholder Attribute Matrix can now be used to look at the interests and capabilities that each stakeholder has, with regard to the transition pathway to be analysed.

4.3.1 Stakeholder interests

The Stakeholder Attribute Matrix assesses stakeholders' interests with two categories: "stated interest" and "demonstrated implementation" (see Table 1). This serves to distinguish between stakeholders who position themselves supportively and those who also have a track record of actually undertaking supportive action (towards a low carbon transition pathway). This becomes particularly important in societies where a complex bureaucracy is seen as a hindering factor to successful policy development and implementation.

As mentioned in Section 3.2, stakeholders can position themselves in a supportive or unsupportive way on a transition pathway. For each stakeholder, the matrix allows a specification of attributes against these two categories, as outlined below.

Stated interest towards the transition pathway end-state or goals can be determined with the following guidance:

- "Very Supportive" or "Supportive": the stakeholder has made a public statement of support (e.g. on their website or at a public event) or is known to be supportive based on private discussions (e.g. during stakeholder consultations). Note: judgment is required on whether to qualify a stakeholder as "very supportive" or "supportive".
- "Unsupportive": the stakeholder has not made a public statement of support even though required to support by legislation.
- "Very unsupportive": the stakeholder has made a public statement in opposition.
- "Neutral": the stakeholder has not made a public statement and is not required to support the transition pathway by legislation, but has no opposition to doing so, should the opportunity arise.

Remember:

- Use the drop down menu in each cell to specify attributes. New attributes can be added to the "input form" at the end of the matrix. This will help ensure consistent data entry and prevent errors in Excel analysis through Pivot Tables and Charts later.
- Include justifications for attributes assigned to stakeholders in the matrix. General justifications about a stakeholder can be added to the notes column and more specific notes in the form of comment bubble for the specific cell. This may include links to websites or key documents. This will help provide a justification for attributes assigned to each stakeholder and allow for verification with colleagues and through stakeholder consultations later on.
- Follow the formatting conventions in the matrix key to make work in progress clear. For example, yellow highlight for cells with a missing attribute or an attribute for review by others, and "to be identified" in red where more information is needed before assigning an attribute. This is very useful when working collaboratively.

The "demonstrated implementation" category can be determined based on whether the stakeholder has made (is making is undertaking feasibility studies for) actual infrastructure investments in any product or sector (Note: this does not include general reports or sector analyses). Options to categorise stakeholders include "past", "current", "planned" and "no". The screenshot in Figure 3 shows these categories in the Stakeholder Attribute Matrix.

Category	Stakeholder	Stated interest	Demonstrated implementation
Details / Attribute	Organisation	*Strongly supportive *Supportive *Neutral *Unsupportive *Very unsupportive ...of transition pathway end state	*Past *Current *Planned *No ...investment in infrastructure or products towards the transition pathway end state.
Source / explanatory notes	WP2 database (JIN, 2015)	Authors' own categories Explanation: Supportive: the stakeholder has made a public statement of support, eg on their website. Judgment for how strong.	Authors' own categories Explanation: The stakeholder has made (is making or plans to make) actual infrastructure investments in any <insert infrastructure, product or
Category	**Stakeholder**	**Stated interest**	**Demonstrated implementation**
1	<Insert stakeholder>		
2			
3			

Figure 3 Screenshot of categories: stated interest and demonstrated implementation.

Source: Stakeholder Attribute Matrix

4.3.2 Stakeholder capabilities

Drawing on Avelino and Rotmans, 2009, the stakeholder's capability categories try to capture the power of a stakeholder to influence a transition pathway. As we have already mentioned in Section 3.2, notions of power are not only important for the TIS and MLP frameworks, but also an integral part of WP6. Again, we would like to draw attention to Table 1 which includes a description of categories in the Stakeholder Attribute Matrix to allow us to understand power and influence, including our power categories such as the ability to mobilise "assets", "human resources", "monetary resources", "natural resources" and "authority". Here we understand that mobilizing resources means both actually disposing of such resources and being able to get a hold of such resources. Consider, for example, an NGO which may be able to gather many people to exercise pressure, or a government ministry that can develop an idea within a government and call upon the human resources of other ministries.

It is noted that while we aim with this attribute to explicitly characterise power or influence, this may also be implicitly part of the attributes explained in the above sections. For example, demonstrated implementation could be an indication of power or influence. However, as it is

risky to characterise stakeholders influence on decision making based on other attributes, it has been decided to treat stakeholder capabilities as a separate attribute.

For these categories, the matrix can be used to assign attributes depending on whether the extent of the stakeholder's ability to mobilise a resource to facilitate or constrain a transition pathway is: "High", "Moderate", "Low" and "Insignificant".

Again, this classification is initially drawn according to the researcher's best estimates and insights gathered from desk research. As discussed in Section 3.2, subsequent tasks in WP6 will employ tools such as SNA and ABM to further analyse and refine this initial assignment of attributes.

Category	Stakeholder	Resources: Assets	Resources: Human resources	Resources: Monetary resources	Resources: Natural resources	Resources: Authority
Details / Attribute	Organisation	The ability to mobilise this resource to facilitate or constrain a transition pathway: *High *Moderate *Low *Insignificant "Mobilising" is understood to be not just the resources available within the organisation, but also the resources within their close networks they can make available. We presuppose a certain hierarchy (e.g. government entities could mobilise more resources than local NGOs).	The ability to mobilise this resource to facilitate or constrain a transition pathway: *High *Moderate *Low *Insignificant "Mobilising" is understood to be not just the resources available within the organisation, but also the resources within their close networks they can make available. We presuppose a certain hierarchy (e.g. government entities could mobilise more resources than local NGOs).	The ability to mobilise this resource to facilitate or constrain a transition pathway: *High *Moderate *Low *Insignificant "Mobilising" is understood to be not just the resources available within the organisation, but also the resources within their close networks they can make available. We presuppose a certain hierarchy (e.g. government entities could mobilise more resources than local NGOs).	The ability to mobilise this resource to facilitate or constrain a transition pathway: *High *Moderate *Low *Insignificant "Mobilising" is understood to be not just the resources available within the organisation, but also the resources within their close networks they can make available. We presuppose a certain hierarchy (e.g. government entities could mobilise more resources than local NGOs).	The ability to mobilise this resource to facilitate or constrain a transition pathway: *High *Moderate *Low *Insignificant "Mobilising" is understood to be not just the resources available within the organisation, but also the resources within their close networks they can make available. We presuppose a certain hierarchy (e.g. government entities could mobilise more resources than local NGOs).
Source / explanatory notes	WP2 database (JIN, 2015)	Adapted from Avelino and Rotmans, 2009 (p551) Explanation: "Assets" are referred to as "Artefactual resources" in Avelino and Rotmans 2009. "Artifactual resources comprise apparatuses,	Adapted from Avelino and Rotmans, 2009 (p551)) Explanation: "Human resources refer to 'manpower' or human leverage ['human support'], i.e. personnel, members, voters, clients,	Adapted from Avelino and Rotmans, 2009 (p551) Explanation: "Monetary resources are funds, cash and financial stock."	Adapted from Avelino and Rotmans, 2009 (p551) Explanation: "Natural resources refer to raw materials, physical space, land and organic life."	Adapted from Smith et al 2005 (p1506) Explanation: Authority resources refer to "command of legitimacy, credibility or other recognised sources of authority in making demands upon the behaviour of others...developing or passing
Category	Stakeholder	Resources: Assets	Resources: Human resourc...	Resources: Monetary resources	Resources: Natural resourc...	Resources: Authority
1	<Insert stakeholder>					
2						
3						
4						
5						

Figure 4 Screenshot of Stakeholder Attribute Matrix categories related to resources.

Source: Stakeholder Attribute Matrix

4.3.3 Stakeholders in innovation systems frameworks

Finally, we have developed several potential categories related to how a stakeholder is conceived within the TIS and MLP frameworks introduced in Section 3.2, which might become useful later on in the case study process. Stakeholders are only one, albeit important element of these innovation systems frameworks. It is therefore appropriate to include "MLP level" and "TIS functions" in the Stakeholder Attribute Matrix as categories for optional use. As the case studies and WP6 develop through the project, these categories could be revisited and refined in the context of elements of the innovation systems analysis.

MLP levels that can be assigned to stakeholders in the matrix relate to their contribution to the innovation system from either a niche or a regime and the specific infrastructure, product or sector they are pursuing in the case study. The attributes for MLP level to be adapted for each case study include:

- Niche (specific product/sector towards transition 1): the stakeholder has a "stated interest" in support of a novel product/sector that is "in the making" and low/medium/high attributes identified in one or more "resources".
- Niche (specific product/sector towards transition 2): as above for another product/sector.
- Niche (mix of 1, 2, etc.): as above for a number of identified products or sectors.
- Regime (specific product/sector towards transition 1, 2, etc.): the stakeholder has a "stated interest" in support of an incremental change to a product/sector that is "stable and well-articulated" and low/medium/high attributes identified in one or more "resources".
- Regime (mix of 1, 2, etc.): as above for a range of products or sectors.
- Regime (specific product/sector against transition 1, 2, etc.): the stakeholder has a "stated interest" unsupportive of a novel product/sector that is "in the making" in a niche and low/medium/high attributes identified in one or more "resources".
- Peripheral to regimes and niches: any stakeholder that does not have a low/medium/high attribute identified in any "resources", even if they have a stated interest in relation to a specific product/sector.

These niche/regime attributes will vary considerably between case studies, depending on the system boundaries are defined for the products or sectors in focus. As an example from our pilot in the Indonesian case study on bioenergy development, we included a set of five niche attributes to represent different efforts towards a transition in different products, namely "1st generation bioethanol", "2nd generation bioethanol", "2nd generation biogas", "biomass pellets" and a mix of these. We included the same products for the regime attributes towards a transition, as some established stakeholders are also active in these same products, in addition to one attribute for "no bioenergy" to represent those established stakeholders against a transition. The niche and regime attributes may be quite different from one another if niche and regime stakeholders are pursuing different products or sectors.

The TIS functions lend themselves less readily to stakeholder attribution than MLP levels, as discussed in Section 3.2 and would be more applicable for in depth analysis in the case studies. It may be that, during the course of the project, this category becomes more relevant, particularly as the TIS has been identified as part of TRANSrisk's theoretical framework. The attributes for TIS functions (see Table 1) remain in the Stakeholder Attribute Matrix as categories for optional use by researchers.

4.4 Gap analysis and stakeholder network expansion

After successfully completing the assignment of attributes to each stakeholder, the next step is a careful review of each row in order to identify any gaps in a given stakeholder list. For example, the "Stated interest" category from Section 4.3 may not include any stakeholders with the attribute "Unsupportive". It may be that the transition pathway is uniformly supported

across stakeholders. For example, in some cases the vast majority of products and services supplied by the sector would directly gain under a low carbon transition pathway, and most stakeholders would therefore be supportive of the transition pathway (e.g. the renewable energy sector). The opposite may hold true if the sector explored would be adversely affected under a low carbon transition pathway, for example the oil sands and coal sectors, in which case we would expect the overwhelming majority of stakeholders to be 'Unsupportive'.

However, a lack of 'Unsupportive' stakeholders may also indicate that stakeholders with views in opposition to the transition pathway are not adequately represented in the list. In other words, it may indicate a "gap" in the stakeholder list. Using the "filter" options in Excel should allow the researcher to quickly identify which attributes are missing from any given category.

By including these gaps in the matrix (at the bottom of the list under Gap 1, 2 and so on), the user can determine whether new stakeholders should be added to the stakeholder list in order to better understand the transition pathway. This may provide something to explore during stakeholder consultations, which are discussed in Section 4.5.

Country:				
Key:		Attribute missing or uncertain		
	Text	Attribute that is not represented in the stakeholder list (a "gap")		
	To be identified	One or more stakeholders should be identified to fill identified attribute "gaps"		
Category	**Stakeholder**	**Stakeholder**	**Stakeholder**	**Type 1**
Details / Attribute	Organisation	Position	Name	*Government (national) *Government (subnational) *Research / consultancy *Business / private sector *NGO / CSO *Donor *Network/platform/media *Community leader *Land owner / farmer *Faith-based institution *Other (list input defined below)
Source / explanatory notes	WP2 database (JIN, 2015)	WP2 database (JIN, 2015)	WP2 database (JIN, 2015)	Authors' own categories
Category	**Stakeholder**	**Stakeholder**	**Stakeholder**	**Type 1**
Gap 1				Business / private sector
Gap 2				Community leader
Gap 3				
Gap 4				

Figure 5 Screenshot of the Stakeholder Attribute Matrix gap analysis approach.

Source: Stakeholder Attribute Matrix

4.5 Verification and refinement through stakeholder consultation

As case studies proceed, the matrix could and should be updated, tested and validated through stakeholder consultation processes and the use of targeted stakeholder questions. A variety of

tools have been documented by TRANSrisk to facilitate these stakeholder engagement processes (D2.1). The Stakeholder Attribute Matrix itself could also be adapted and refined over time to better suit individual case study countries and help facilitated analysis.

4.6 Results extraction and application to case study analysis

Although there is no "right" number of stakeholders, the following analysis of the results will be much more fruitful and relevant, for a high number of stakeholders included in the matrix. However, it should be kept in mind, that several stakeholders from the same institution might be treated as one since a natural hierarchy can be assumed (i.e. capacity of mobilising different assets should be considered to be the same within an organisation). Moreover, it may sometimes be necessary to adapt certain categories to specific case studies.

Other case study and stakeholder tools used in TRANSrisk may also benefit from the matrix results and analysis. These include the TRANSrisk System Mapping Tool, which is designed to analyse the market chain in case study transition pathways and explore relationships between stakeholders, the business environment and policies: the market role, stated interest and resources categories of the Stakeholder Attribute Matrix could be used to quantify and qualify the directions and strengths of these relationships. For example, a provincial agriculture ministry stakeholder with "high" or "moderate" attributes in the resource categories, "authority" and "human resources", could be expected to have a strong influence on policies governing bioenergy feedstock production and distribution that are specified in the system map. Similarly, an investor with "high" "monetary resources" and a "stated interest" that is "very supportive" of a transition could be expected to have a strongly positive influence on investment in the business environment articulated in the system map. The System Mapping Tool, furthermore, includes the option for users to label connections with narrative text, which is a good place to include justifications from the Stakeholder Attribute Matrix like the examples above.

When it comes to extracting data from the Stakeholder Attribute Matrix, several Excel functions might be used. On a very basic level, and as mentioned in Section 4.4, a simple filter could reveal gaps in the stakeholder matrix and can identify missing stakeholders for specific attribute categories.

A much more powerful way to understand and analyse stakeholders is to make use of pivot tables and pivot charts in Excel. This allows for the stakeholder categories and attributes to be isolated and compared in different ways using tables and charts, depending on what is useful for the case study. For example, the level of activity of stakeholders (international, subnational or community based) could be matched with their ability to mobilise resources in order to see on which level the most influential stakeholders are situated. A similar analysis could also be done on resources by market role, in order to identify barriers to (or enablers for) change in a value

chain. Another cross-category analysis would be to order the stakeholders' stated interest on the transition pathway (supportive or unsupportive) with their sector of activity. In that case, it may be interesting to see whether stakeholders in the energy sector are more or less supportive than stakeholders in the financial sector for example. Pivot tables also facilitate reporting back to stakeholders as they can easily see the larger picture and patterns, which being able to 'recognise' one's own profile from the table.

A detailed presentation of these kinds of stakeholder analysis is included for each pilot case study in Section 5.

5 CASE STUDY PILOTS

The Stakeholder Attribute Matrix and approach outlined in Section 4 have been piloted in two TRANSrisk case studies: Indonesia and the Netherlands. These pilots were used to test, debug and refine the matrix and develop the steps for its application in other case studies. These pilots were chosen as they were relatively well advanced, having undertaken early stakeholder consultations to support their analysis, and as they were led by partners responsible for Work Packages 6 (SEI) and 2 (JIN), which are the major Work Packages contributing to the analysis.

The pilots aimed to show that a systematic analysis of stakeholders can help case studies ensure that all/the majority of relevant stakeholder roles are represented in their analysis. They also aimed to identify areas for further analysis, to better understand the innovation system dynamics in transition pathways.

5.1 Indonesia

5.1.1 Introduction to the Indonesia case study

Indonesia was chosen as a case study country for two reasons. Firstly, SEI has a strong track record of working in the region as well as a wealth of professional and personal contacts. Secondly, Indonesia is interesting for TRANSrisk on many levels. Like many lower income countries, economic development has gone hand in hand with a significant emission increase which makes Indonesia the 6th largest emitter of greenhouse gases in the world. Moreover, Indonesia's demography and geography – almost 250 million people live on a territory comprising more than 18,000 islands – are administered by a complex bureaucratic system, which draws a significant amount of its income from the development of fossil fuels. In 2014, it was the world's largest coal and the world's 4th largest LNG exporter. The IEA estimates that as much as 30% of government revenues come from the fossil fuel sector (IEA, 2015a), which is largely controlled by state-owned enterprises. It is therefore safe to assume that there is a strong fossil fuel regime in place.

This regime might impact niche and other innovation systems such as bioenergy developments which are said to hold a large potential in Indonesia. The nation's biomass potential, for example, is said to amount to 50 GW in the most optimistic estimates, which is roughly the equivalent of the country's total installed electricity generation capacity in 2014. Only a fraction of this potential is currently exploited, and several innovation systems, such as bioenergy production from various agricultural waste products like rice husks, rice straws of animal manure, might be explored.

It is against this background that the Indonesian government has adopted several policies with the objective to boost Indonesia's bioenergy developments.

5.1.2 Transition pathways in Indonesia

By 2030, the Indonesian government wants to reduce the country's emissions unilaterally by 29% compared to a business as usual scenario, an effort that could increase to 41% with international help (Republic of Indonesia, 2015). Part of this reduction should be achieved by increasing the share of renewable energy in the energy mix to 23% by 2025 according to the National Energy Policy (NEP) of 2014 (IEA, 2015b). Moreover, similar legislation for the transport sector aims to increase the share of bioethanol and biodiesel in the transport sector to 20% and 30% respectively, by the same year (Ministry of Energy and Mineral Resources [MEMR] Regulation 12/2015 in (USDA, 2015)). The following table gives an overview of the country's renewable and bioenergy targets.

Table 2 Overview of Indonesia's renewable and bioenergy targets.

Energy source	Share by 2025	Notes
Renewable Energy	23% of energy consumption	Target based on NEP 2014
Biodiesel	30% blending target	This target sets a minimum consumption of 30% biodiesel for all sectors (transportation; industry & electricity), meaning that 30% of total diesel consumption should be biodiesel
Bioethanol	20% blending target	This target sets a minimum consumption of 20% bioethanol for transportation and industry sectors, meaning that 20% of all petrol consumption should be bioethanol

Sources: NEP 2014 in (IEA, 2015b); MEMR Regulation 12/2015 in (USDA, 2015)

The structural dichotomy between fossil fuel based regime and bioenergy niche technologies also prevails when it comes to Indonesian policy making. While some policies aim to reduce emissions and increase the share of renewable energies, the government simultaneously pursues an expansive strategy concerning fossil fuel developments to meet rapidly growing energy demand. For example, more than 55% of new power plants planned under the government's third fast track programme (or 19.6 GW by 2019) are expected to be coal-fired according to the Asian Development Bank (ADB, 2015). These additions will contribute to an increase of coal fired power to 30% of the Indonesian energy mix by 2025 as stipulated in the NEP 2014. Moreover, the

government sees the abundance of fossil fuels such as gas and coal as important assets to the country's economy, and domestic market obligations (DMO) have been introduced to direct fossil fuels from export to domestic markets (IEA, 2015a). It is not within the scope of this report to analyse those policy inconsistencies which will be dealt with more extensively in the case study concerning Indonesia. Nevertheless, they too guided our analysis of relevant stakeholders and their potential role on a pathway towards the government's bioenergy targets.

5.1.3 Indonesia case study stakeholders

The stakeholder list for Indonesia was compiled using the extensive network of SEI researchers in different SEI offices, in addition to the SEI personnel on the ground in Indonesia. In line with the scope of the case study, SEI focused on stakeholders in Bali and East Java. Researchers identified potentially valuable stakeholders based on country specific information on Indonesian climate change and energy policies and the country's energy sector structures. After an initial list was compiled, researchers began to classify stakeholders using the Stakeholder Attribute Matrix and the steps detailed above. A first gap analysis then revealed some important missing actors in the stakeholder list, which were filled by desk research and discussions with researchers' professional networks. The case study's first participatory workshop on bioenergy potential in Bali provided the opportunity to expand the stakeholder list, and also to refine the Stakeholder Attribute Matrix based on the findings of the workshop.

These exercises led to the inclusion of 84 stakeholders relevant for bioenergy development in Bali and East Java. The distribution of sectors was fairly even with 29 stakeholders from national and sub-national governmental entities, 20 from the NGO/CSO sector and 16 from the business and private sector. Researchers and consultancies were represented 13 times in our sample. The chart in Figure 6 provides an overview.

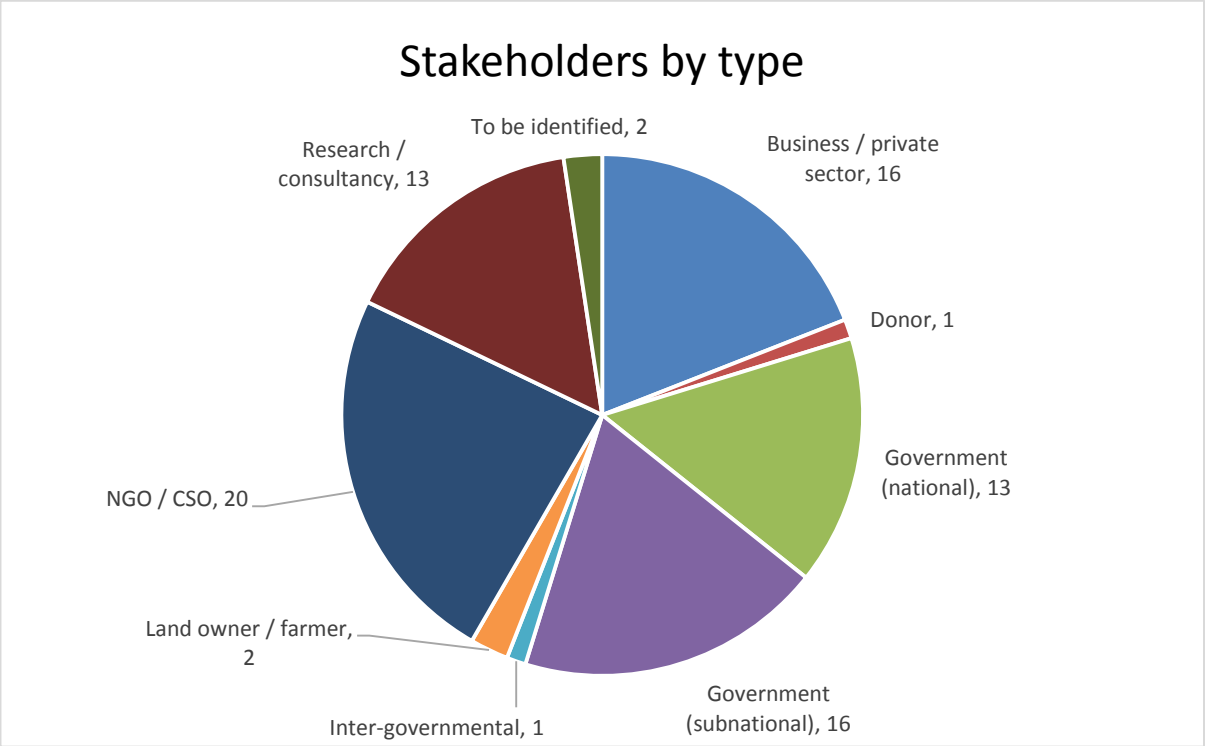


Figure 6 Indonesia case study stakeholders by type.

Source: Stakeholder Attribute Matrix, Indonesia

Those stakeholders were mainly active in the energy sector, where 31 of our stakeholders hailed from, followed by the agricultural and forest sector, which is the main sector of economic activity for 22 of the Indonesian stakeholders. Ten stakeholders were active in the environmental sector whereas 7 representatives came from the industrial sector.

After this initial classification, a deeper analysis of our stakeholder matrix yielded some interesting results. Again, it is important to note that these results are not definitive conclusions but rather guidance for further, in-depth research.

5.1.4 Analysis of Indonesia case study stakeholders

Overall, most of the stakeholders of the Indonesian case study seemed to be supportive of the government's bioenergy targets as detailed in Table 2. The chart in Figure 7 shows that 65 stakeholders are supportive or strongly supportive (77%) compared to 4 stakeholders who are unsupportive or very unsupportive (5%).

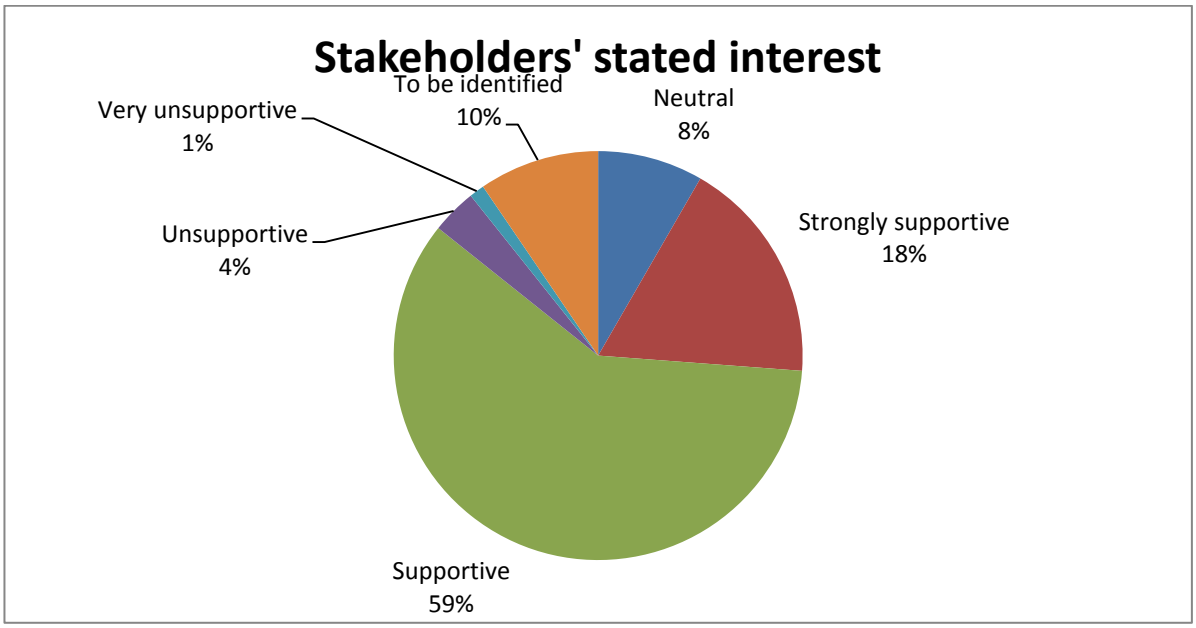


Figure 7 Indonesia case study stakeholders' stated interest in bioenergy development.

Source: Stakeholder Attribute Matrix, Indonesia

Although this result is largely based on desk research, SEI and its partners undertook several consultations with stakeholders on the ground and have been using in-country experience of researchers based in Bali, in order to determine said sample of 84 stakeholders and fill in the SAM. For further research, also and with regard to Deliverable 6.2, it might however be beneficial to include more stakeholders who would be less supportive of bioenergy developments in Bali and East Java. These stakeholders could offer insights about any potentially obstructive role they might play, which could help understand bioenergy development potential and policy responses

If one breaks down these stakeholders according to their sector of activity, one can see that all four stakeholders qualified as "unsupportive" or "very unsupportive" can be found in the energy sector of Indonesia, based on initial research. The chart in Figure 8 provides an overview.

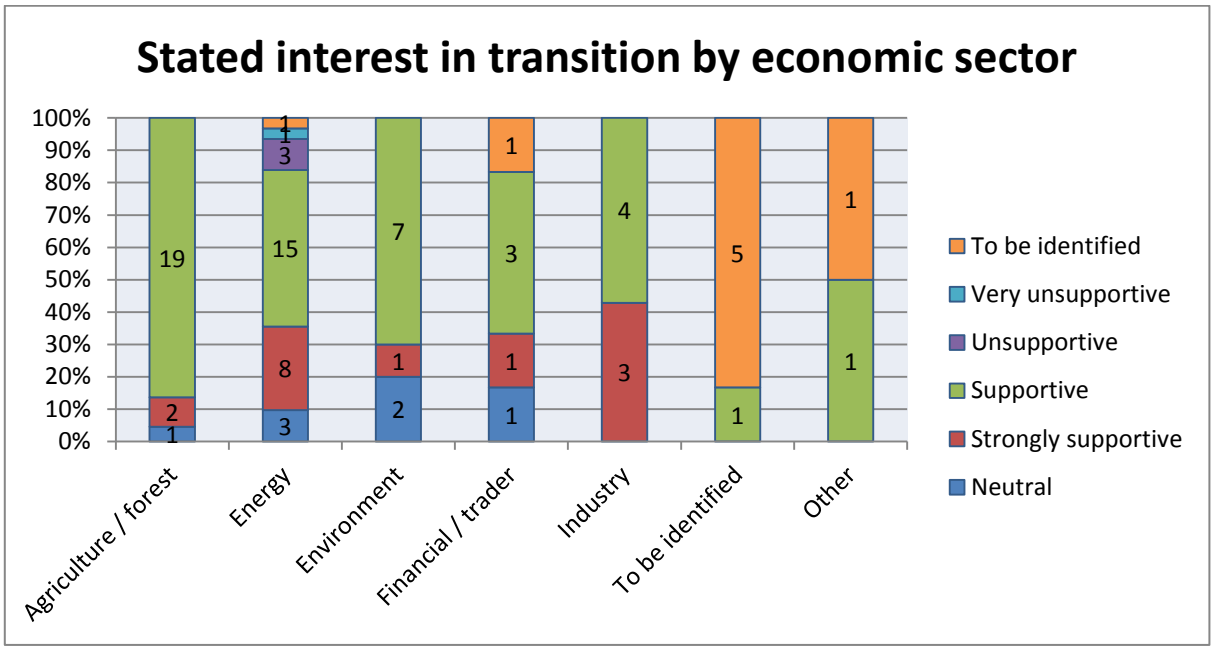


Figure 8 Overview of Indonesia case study stakeholders classified according to their economic sector and their stated interest in bioenergy development.

Source: Stakeholder Attribute Matrix, Indonesia

This might be explained by the fact that the Indonesian energy sector is largely state-owned, and due to the competing policy objectives of the Indonesian government in meeting strong energy demand growth and plans to increase both fossil fuel and renewable energy. Nevertheless, the case study will conduct further research in order to discern the extent of stakeholders' support of and opposition to bioenergy transition pathways and the reasons for this.

When it comes to those "unsupportive" and "very unsupportive" stakeholders, it is interesting to note that two of those four stakeholders have either a "high" or a "moderate" capacity of mobilising all five types of resources. The other two unsupportive stakeholders have high or moderate attributes in all but natural resources. Further analysis of such influential stakeholders would be important as they are more capable of facilitating or obstructing a transition pathway than stakeholders with low capacity to do so. The chart in Figure 9 allows us to examine the stated interests of these influential stakeholders, of which there are 16 matching our criteria. This shows that many more influential stakeholders are supportive than unsupportive, which may indicate momentum towards the transition even though aforementioned caveats concerning the balance of the sample between supportive and unsupportive stakeholders still hold.

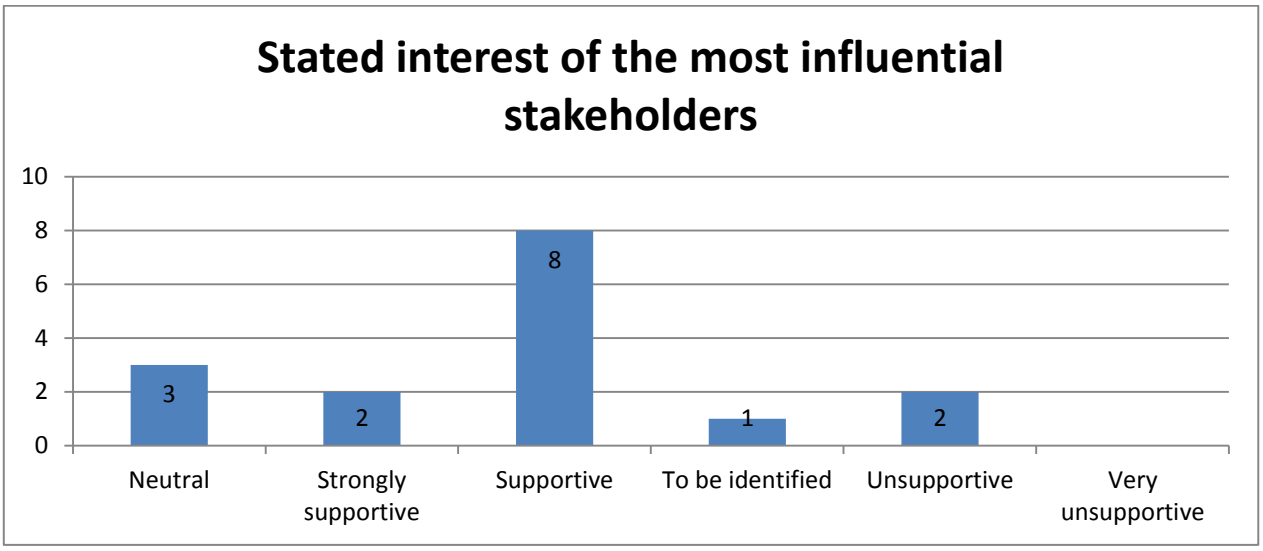


Figure 9 -Stated interest of influential Indonesia case study stakeholders (i.e. those with high and moderate attributes for all five resources).

Source: Stakeholder Attribute Matrix, Indonesia

However, unsupportive stakeholders might be found at crucial points in the value chain of producing and distributing bioenergy, which makes them powerful actors to make or break innovation. This would create what in political institutional theory is called a veto player, whose agreement is necessary to change the status quo (or the regime) (see Tsebelis, 2002) and whose disagreement might, in turn, hinder a change in the regime character.

We can use the matrix to analyse specifically unsupportive stakeholders along the value chain. The chart in Figure 10 shows the stated interest of these influential stakeholders along the bioenergy value chain adopted for the case study. Here, our analysis shows that, for example, the most unsupportive stakeholders can be found at the end of the value chain in "bioenergy consumption". This is an important finding that may be taken up for deeper analysis as the case study progresses given the fact that energy purchasing is largely controlled by state owned enterprises in Indonesia.

Figure 10 Market role and stated interest of influential Indonesia case study stakeholders (i.e. those with high and moderate attributes for all five resources).

Source: Stakeholder Attribute Matrix, Indonesia

Again, one has to be careful when interpreting this data. For example, not only would it be important to further explore why stakeholders are unsupportive at the end of the value chain (or, indeed, whether they really are) but also to further scrutinise the most supportive parts of the value chain, including those stakeholders responsible for provincial policy and regulation. The matrix could also be used to provide an overview of all stakeholders (at all levels of influence) in the value chain. Our analysis of this data shows that the most support for bioenergy in Bali and East Java comes from the research & projects and the feedstock production part of the value chain. This comprised 38 supportive or very supportive, 2 neutral and 1 unsupportive of 84 total stakeholders. However, one has to keep in mind that these stakeholder market roles were the most highly represented in our sample of 84 total stakeholders. Here, a more balanced sample might yield some more insights.

Keeping these limitations and the preliminary nature of the findings in mind, one can see that the Stakeholder Attribute Matrix is nevertheless a valuable tool to classify stakeholders. It allows for a systematic categorisation of stakeholders involved in a certain transition pathway and helps to identify gaps. Moreover, the initial attribution of qualities and their analysis potentially yields interesting insights which could then be used to guide further research.

5.2 The Netherlands

5.2.1 Introduction

The Netherlands has been selected for performing two case studies in TRANSrisk. The case study detailed here focuses on the transition pathway to a more sustainable management of animal manure from the livestock industry. After the United States, the Netherlands is the 2nd largest exporter of agricultural products and services in the world.[3] The livestock sector is very large relative to the country size, and animal densities are amongst the highest in the European Union. As a result, the Netherlands relies on large imports of animal feed products, and also exports large quantities of animal manure, as the domestically available arable land cannot technically sustain such a large livestock sector. Hence, the majority of animal proteins produced in the Netherlands (e.g. milk, meat, etc.) are exported. The livestock and agricultural sector has reached its social and environmental limits in the Netherlands, and therefore has to engage in a transition to produce more sustainably.

With the EU's key agricultural markets being increasingly liberalised (e.g. abolishment of quota systems) and production patterns becoming more market driven, an intensification and/or industrialisation of the agricultural sector (and the livestock sector in particular) can be observed. As a result of this intensification, the environmental and social effects of agricultural activities have become more concentrated (e.g. effects on air, soil and water quality, safety and animal health). This has led to an intensification of the debate regarding the role and position of the agricultural sector in the Netherlands, where there are different positions and sentiments in society. Within this ongoing debate, the livestock sector and the environmental effects on air, soil and water stemming from animal manure have a prominent position.

The current policy regime regarding the agricultural sector dates back for many decades, but has of late become increasingly complex and fragmented. With regards to manure management, the incentives/regulations are not always properly aligned, and the market is not always triggered to produce, handle, process and use manure more sustainably.

It is against this background that the Dutch government has adopted several policies with the objective of triggering the agricultural sector to produce more sustainably.

[3] "Export value agricultural products hits new record", 8th June 2016, Statistics Netherlands (CBS), https://www.cbs.nl/en-gb/news/2016/23/export-value-agricultural-products-hits-new-record (Accessed: 14 July 2016)

5.2.2 Transition pathways in the Netherlands

By 2030, the Dutch government has national and/or sectorial targets/ambitions regarding the emissions of ammonia (NH_3), greenhouse gas emissions (CO_2, CH_4, N_2O), as well as the excretion of nitrogen and phosphates in animal manure and its usage on agricultural soils. The agricultural sector is a large contributor to most of these pollutants, in particular phosphates, ammonia and methane.

Table 3 shows a number of national (EU-level) environmental targets that have a link to manure management as well as the livestock/agricultural sector. With regards to GHG emissions, it seems that the Netherlands is likely to meet its short-term (2020) climate target. However, with regards to all other energy, environment and climate targets (i.e. renewable energy, phosphate excretion and ammonia emissions) there is a considerable challenge ahead. For the agricultural sector, the ammonia emissions and the current level of phosphate excretion (in animal manure) are considered particularly problematic. As a result, it is expected that the EU's air quality legislation, as well as the national measures stemming from the EU nitrates directive, will be the key (political) drivers for stimulating more sustainable management of animal manure.

Table 3 National (EU-level) environmental targets that have a link to manure management.

Target	Current (year indicated)	2020	2030	Units	Source
Renewable energy	5,80% (2015)	14%	27%*	Gross final energy	EU Climate & Energy Framework
Non-ETS	98,1 (2014)	111,6	-40%#	Mt CO2-eq.	Effort Sharing Decision
Non CO2-in agriculture	19 (2014)	16		Mt CO2-eq.	Agro Covenant
Air - ammonia (national)	134 (2014)	128	120	Kt	Clean Air Policy Package
Phosphates (national)	176,3 (2015)	172,9		Mln. kg	Nitrates Directive
Phosphates (dairy sector)	86,1 (2014)	84,9		Mln. kg	Dairy sector Covenant

**At the EU level. National targets are not foreseen.*

 # EU level target for GHG is -40%, but an effort sharing decision with national targets for the Non-ETS sectors at the member state level is foreseen.

Sources: www.emissieregistratie.nl and CBS for current energy and environment data & EU Directives and sector covenants for quantitative targets 2020/2030

The Dutch government wants to limit the various environmental impacts of the agricultural sector, and the livestock sector in particular. While the objective is quite clear, it has however, been the same for the past three decades. While several successes can be claimed on reducing specific pollutants, other emissions have increased or are again increasing. The livestock sector currently is at a pivotal point where the economic interests and benefits seem to no longer outweigh the local social and environmental costs.

While there are different transition pathways to reduce the environmental impact of the livestock sector, more sustainable management of animal manure (via Integrated Manure Management) is considered to be the preferred option in this case study. Other transition pathways include reducing animal numbers and/or changing livestock feed to reduce, for instance, phosphate excretion and/or methane emissions. On top of that, there are a multitude of 'low-emission' animal housing and/or manure storage solutions available on the market. Each of these options has its advantages and disadvantages. For example, reducing the number of animals in the Netherlands would be favourable for reducing local NH_3 emissions, national CH_4 emissions and the excess excretion of phosphates. However, if this reduction of animals in the Netherlands would result in an increase of animal numbers in Eastern Europe, for example, it is possible that (most of) the environmental impacts would simply be 'exported' to another country/region. A potential drawback of changing livestock feed is that it could significantly change the global trade-flows in animal feed commodities, as well as the cropping strategies (and therefore have land-use related impacts). This could affect nutrient balances and fertilisation practices. Promoting human diets with considerably lower levels of animal protein could also be a viable transition pathway, but with continuing global population growth, it would require much lower levels of animal protein consumption than today.

In this case study Integrated Manure Management (IMM) is chosen as the 'most favourable' transition pathway in the sector for the period up to 2030/2040. The main reason for this is that IMM can be implemented at the national level, mostly by domestic stakeholders, which makes it more manageable in comparison to other pathways that require a stronger international collaboration and coordination. Within the IMM transition pathway, it is assumed that the global production of animal proteins (as opposed to plant-based proteins) is at least at a level equivalent to today's production levels. This implies, that given the growing global population, the per capita consumption of animal proteins already has to drop significantly. Also it is not anticipated that animal proteins will be completely phased-out within the next two to four decades, meaning that the management of livestock and animal manure has to be made more sustainable. IMM can therefore be considered an 'end-of-pipe' or 'retro-fit' strategy with the objective to minimise the impacts of manure management (given the continuing presence of a livestock sector).

5.2.3 The Dutch stakeholders for Integrated Manure Management

The stakeholder list for the Dutch IMM case study was compiled by using the extensive network of JIN researchers in the Netherlands. This network has been build up in previous research activities in bioenergy, and agriculture. For the purpose of this case study the network has been expanded to include more stakeholders, not only focussing on bioenergy activities in agriculture, but also more general activities in the agricultural sector, including manure management, livestock management, fertiliser production and use, soil management, etc.

After the initial list was compiled, a preliminary analysis was performed to see if there were any 'gaps' in the coverage of stakeholders. The gap analysis showed that local stakeholders (e.g. from provinces / municipalities) were initially underrepresented. In order to include a better sample in which local stakeholders are also fairly represented, JIN attended a national expert workshop on manure management, which proved valuable in extending the case study's stakeholder network.

The next step in the process is to engage in a round of interviews with key stakeholders to discuss the transition pathway in more detail in order to extract different viewpoints on its viability from a technical, social, economic and environmental perspective. These interviews will be held as part of the case study preparations (in Work Package 3).

Table 4 Netherlands case study stakeholders on IMM by type.

Types of stakeholders	Number of stakeholders
Research & Consultancy	9
Business & private sector	5
Network / platform / media	5
Government - national	4
Government - subnational	3
NGO / CSO	0
Community leader	0
Land owner - farmer	0

Source: Stakeholder Attribute Matrix, the Netherlands

The current stakeholder attribute matrix includes 26 individuals representing various public and private entities, all having a 'stake' and/or influence on the agricultural sector (and hence in the further development and implementation of IMM activities). Some of the stakeholder

categories are not directly present in the current attribute matrix, but are often represented by an intermediary (e.g. branch organisation or networking organisation). A number of these stakeholders have a scientific/research background in livestock, agricultural, soil sciences and/or other related environmental sciences. The key reason for this is because the agricultural/livestock sector is highly knowledge-intensive. This sector has such a wide diversity and complexity of environmental impacts, making it challenging to fully appreciate even for experts. For decision makers, as well as investors or policy makers, it is most pragmatic to also have the latest scientific information and insights 'at the table'.

5.2.4 Analysis of stakeholders

Overall, most of the stakeholders in the Dutch case study are classified as being supportive or neutral towards IMM as a key technological option towards reducing the environmental impacts of manure management. Having chosen IMM as the preferred transition pathway for the purposes of this case study, a number of other alternative transition pathways are excluded. This is one of the reasons why a large number of stakeholders (mainly from research and the public sector) are assumed to have a more neutral attitude towards IMM activities. In many cases, for them IMM is just one of the transition options/pathways they could deploy.

The fact that a larger number of local communities or local stakeholders are not represented directly in the attribute matrix could indicate a bias with regards to public perception towards IMM initiatives. For example, it is already known that, in some livestock-dense regions in the Netherlands, there is already considerable public opposition against large-scale manure treatment/processing facilities. However, several of the listed stakeholders are already involved in IMM projects, or have a role in involving local communities in IMM, livestock or agriculture related transitions. Those experiences are often documented and, if needed, such stakeholders can be reached via several of the stakeholders already listed in the attribute matrix.

Table 5 Netherlands case study stakeholders' stated interest in IMM development

Stated interest	Number of stakeholders
Strongly supportive	5
Supportive	8
Neutral	13
Unsupportive	0
Very unsupportive	0
To be identified	0

Source: Stakeholder Attribute Matrix, the Netherlands

If these stakeholders are broken down according to their sector of activity, they can see that mainly stakeholders from the agricultural sector are represented and that there are only a few energy-related stakeholders. The reason for this apparent underrepresentation of bioenergy-related stakeholders is that the knowledge and information available about bioenergy production in the agricultural sector is widely available. There is a large body of existing literature on the social, environmental and economic aspects and effects of, for example, biogas production based on agricultural residues. Within IMM, anaerobic digestion is considered an 'add-on' to existing agricultural practices, and has to be mainstreamed alongside ongoing pollution prevention controls as well as with more conventional manure treatment technologies.

Table 6 Overview of Dutch case study stakeholders classified according to their economic sector and their stated interest in the development of Integrated Manure Management.

Sector	Very supportive	Supportive	Neutral	Unsupportive	Very unsupportive	To be determined
Energy	1		1			
Industry	3	1	1			
Transport						
Environment		2	1			
Agriculture & Forestry	1	5	8			
Financial / trader			1			
Water			1			

Source: Stakeholder Attribute Matrix, the Netherlands

A key feature of IMM activities as a retro-fit or end-of-pipe measure is that it has to be embedded in an existing sector and an existing market and policy regime. However, from a technical perspective implementing such a 'new'[4] integrated concept mainly for pig and cattle systems is not the most challenging. The key challenge for stakeholders will be to organise

[4] The novel aspect of IMM is that existing and mostly proven technologies for biogas production and manure/digestate treatment are now integrated into a single concept, so as to overall achieve better environmental performances.

themselves and coordinate/facilitate information and knowledge exchange. On top of that there is a key requirement to develop a viable proposition (or business case) for each individual actor involved.

During a national workshop on manure valorisation[5], IMM stakeholders discussed what coordinating/initiating role there would/should be for the government with regards to, for example, triggering IMM activities, as well as which 'stakeholders' are in the driver's seat when it comes to initiating and implementing this transition pathway in agriculture. Although all stakeholders agreed that there is a high urgency and need for a fundamental transition, there was no real conclusive answer as to which stakeholders would be leading in the transition. One stakeholder stated that "there is no single actor in the driver's seat", and that "all stakeholders – in principle - have a 'hand on the wheel'". With no single actor in the field that can solely establish the needed transition, a multi-actor strategy that is beneficial for most key stakeholders is needed to ensure a proper and efficient transition. The consensus between all stakeholders present during the national workshop on manure valorisation was that each actor has a certain stake, and therefore a certain responsibility and task, in order to engage in a full transition of the agricultural sector, especially with regards to manure management.

Overall the Indonesian and Dutch case studies highlight the pragmatic value of characterising stakeholders as a part of analysing and developing low carbon transitions pathways in two distinct national contexts. The Stakeholder Attribute Matrix (SAM) provides a systematic method of categorising and characterising stakeholders in TRANSrisk across a wide range of case studies in Europe, Latin America, Asia and Africa. This exercise is not only an important first step in identifying stakeholders' role in supporting or opposing a particular pathway but also helps to inform researchers in TRANSrisk to identify potential gaps in the stakeholder identification and engagement process. SAM, when applied reflectively, should lead to research results that better reflect the nuanced national/sub-national context and sentiments.

[5] National workshop, 'Valorisation of animal manure', 23 June, 2016 (The Hague).

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