

# Towards dynamic research configurations: A framework for reflection on the contribution of research to policy and innovation processes

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This paper seeks to contribute to a better understanding of the complex dynamics that shape the contribution of research to policy and innovation processes that address ‘competing claims’ on natural resources and their management. Research in the context of competing claims requires strategies that: (1) can cope with high uncertainty and unpredictability; (2) are concerned with understanding the multiple dimensions of the issue at stake; (3) can facilitate change across different scales and levels; (4) include collaboration with different actors and stakeholders; and (5) may imply new roles for research and researchers. This paper reviews and builds upon research approaches to address these challenges. These research approaches are combined in a framework for dynamic research configurations that aims to stimulate reflection among researchers and to promote more embedded, context-sensitive and flexible research strategies.

*Keywords: natural resource management; environmental science; research policy; science–policy interface; interdisciplinarity; multistakeholder; Mode 2; agricultural innovation; complex problems.*

## 1. Introduction

Access to, and management of natural resources lie at the heart of many local, national and international conflicts and disputes (Giller et al. 2008). One of the reasons is that natural resources have characteristics—limited quantity, increasing scarcity, extractability, culturally defined meaning and unevenly distributed (Cloke and Park 1985)—that give rise to people having competing claims on those natural resources. The concept of ‘competing claims’ was introduced and reconceptualised for the field of environmental and agricultural sciences by Giller et al. (2008) amongst others. They describe competing claims in the light of: (1) uncertain and unpredictable natural resource management contexts; (2) complex

multidimensional problems; (3) interactions between levels within and across, for example, spatial and administrative scales; and (4) multi-actor processes. Consequently, they argue that: (5) research is likely to become contested in such contexts and that new roles for research and researchers may be required to contribute to solving competing claims problems. In this paper we analyse the dynamics of, and interactions between, these five challenges and how they shape the credibility, legitimacy and relevance of research in policy and innovation processes addressing complex natural resources management problems.

Interest in the contribution of research to policy and innovation processes dealing with competing claims on natural resources has increased considerably (Cortner 2000; Hall et al. 2003; Sumberg 2005; Dilling 2007; Boaz

et al. 2009). This has resulted in studies that highlight the (apparent) gap between research and societal stakeholders (e.g. policy-making communities), but also in practical and theoretical approaches to how this gap can be bridged (cf. Cutts et al. 2011; Edelenbos et al. 2011; Hegger et al. 2012). An example is the growing attention for the role of intermediaries and innovation brokers who can connect the worlds of research and, for example, policy (McNie 2007; Pielke Jr. 2007; Klerkx et al. 2009; Michaels 2009). A review by Hessels and van Lente (2008) discusses the disconnect between research and policy/innovation processes from the perspective of different types of ‘traditional’ versus ‘new’ knowledge production systems. They compare these with the distinction between Mode 1 (traditional) and Mode 2 (new) research made by Gibbons (1994) and Nowotny et al. (2003) which they regard as the ‘most famous’ example of different knowledge production systems (Hessels and van Lente 2008: 740). Table 1 provides examples of traditional and new knowledge production related to the five key characteristics of competing claims contexts.

Although thinking about different types of knowledge production can be useful, we feel that the contribution of ‘traditional’ versus ‘new’ modes or systems of knowledge production is too often classified as ‘either/or’, where one system is favoured or promoted over the other (e.g. Cortner 2000). Following Michaels (2009), who looked at the relationship between knowledge brokering and different types of complexity levels of environmental policy issues, we deem such ‘either/or’ approach too static to address the complexity and unpredictability in policy and innovation processes. Research can benefit from perceiving, for example, Mode 1 and Mode 2 as two ends of a spectrum between which many blends of modes, theories, concepts, methods and roles for research(ers) can co-emerge and coexist (Hessels and van Lente 2008). Although this need for (more) flexible research approaches to support policy and innovation processes has been frequently advocated in the scientific literature (Kristjanson et al. 2009; Dilling and Carmen

Lemos 2011), it requires unremitting attention as substantial institutional changes in incentive and funding structures to actually promote research flexibility appear to fall behind (Holmes and Clark 2008; Holmes and Savgård 2009). The contribution of this paper must be positioned in this debate, as it provides a framework for reflection on the relation between dynamic research configurations and the contribution of research to policy and innovation processes.

The objective of this paper is threefold. The first objective is to elaborate on the challenges for research in competing claims contexts, and to review, build upon, and explore synergies between different approaches for research to address these challenges (Section 2). The second objective is to combine the different approaches in a framework for dynamic research configurations that can stimulate reflection among researchers working in competing claims contexts (Section 3). The third objective is to discuss how the framework for dynamic research configurations can be used in practice and to identify challenges related to its use, resulting in suggestions for further research (Section 4).

## 2. Research approaches to address competing claims challenges

This section is structured along the analysis of the five key characteristics of competing claims contexts:

- (1) uncertainty and unpredictability,
- (2) multidimensional problems,
- (3) interactions between scales and levels,
- (4) multi-actor processes,
- (5) contested research(ers).

Below, we discuss how these characteristics relate and what type of challenges they pose to the contribution of research to policy and innovation processes in competing claims contexts.

**Table 1.** Features of traditional and new knowledge production in relation to the key characteristics of competing claims contexts

	Traditional knowledge production	New knowledge production
Uncertainty and unpredictability	Reduction of uncertainty and unpredictability are key objectives of research	Uncertainty and unpredictability are inherent part of the research process
Multidimensional problems	Problem dimensions are studied separately and along disciplinary lines	Problem dimensions are studied in a holistic and integrated way and from interdisciplinary perspective
Interactions between scales and levels	Boundaries of scales and levels are clearly demarcated. Limited attention for interactions between levels within and across different scales	Boundaries of scales and levels are negotiated and renegotiated over time. Attention for interactions between levels within and across different scales
Multi-actor processes	Research is conducted in isolation of societal actors and stakeholders	Research is conducted in collaboration with different groups of actors and stakeholders
Contested research(ers)	Research produces authoritative, objective and value-free knowledge	Research contributes to, and is subject of, ongoing negotiations between actors or stakeholders

Different types of approaches are explored to address these challenges for research. These approaches are neither exhaustive nor mutually exclusive. On the contrary, they overlap, and we seek to explore synergies between the different approaches in enhancing the contribution of research to policy and innovation processes.

### **2.1 Uncertainty and unpredictability: Embedded and process-oriented research strategies**

Competing claims problems are often characterised by high uncertainty and unpredictability. This relates both to the nature of the problem and how it develops over time, as well as to the impact and the potential side effects of strategies to deal with the problem. In policy or innovation processes addressing uncertain competing claims problems, phases are often not linear or sequential, but iterative with stages that can be more problem-oriented or more solution-oriented (Sabatier and Jenkins-Smith 1999; Graffy 2008). Problem-oriented phases include agenda setting, describing and explaining problems, whereas solution-oriented phases include exploring, designing, implementing and monitoring strategies to solve the problem. (Giller et al. 2008).

Often, phases in research processes and policy or innovation processes do not align (Schut et al. 2010). One of the reasons is that research generally needs time to generate credible findings, whereas decision-makers often require quick results to demonstrate financial, administrative and political accountability (Haas 2004; Hoppe 2005). Furthermore, the perceived credibility, legitimacy and relevance of research is influenced by the phase of the process. Research findings that are mobilised during the solution-implementation phase may be framed as a threat to the agreed upon solution, whereas similar finding findings could have provided the basis for developing alternative solutions if mobilised during the problem-oriented phase in the process. A study on the role of research in developing flood prevention policy in the Netherlands for example showed how lack of scientific data resulted in ‘administrative’ river discharge norms, and how during a later policy phase, ‘research-based’ river discharge norms that questioned the necessity of some of the flood prevention policy measures were ridiculed by the Dutch government (Schut et al. 2010).

This example illustrates that timing is a crucial factor that influences the contribution of research to policy and innovation processes. To better understand the dynamics of policy and innovation processes in competing claims contexts, researchers should try to strategically embed themselves in policy and innovation processes and apply context-sensitive research strategies. This can provide a degree of flexibility to anticipate the changing problem context, and to constantly determine when, how, and in what form, research can efficiently contribute to exploring solutions.

### **2.2 Multidimensional problems: Interdisciplinary research approaches**

Competing claims problems often have biophysical, social-cultural, economic, institutional and political dimensions (Schut 2012). Consequently, exploring solutions to competing claims problems requires integrated approaches in which the dynamics between the different problem dimensions are analysed holistically and from different disciplines (Spielman et al. 2009). Interdisciplinarity can be interpreted as the practices that consciously transcend the disciplinary or dimensional modes of knowledge production (Weingart 2000). In interdisciplinary research, researchers combine insights from different disciplines, or researchers from different disciplines work together. Traditionally, these disciplines are often categorised according to the biophysical nature of the problem (e.g. biology), the social and cultural practices in which the problem is embedded and within which solutions can be explored (e.g. anthropology), and the economic impact of the problem and the economic viability of different solutions (e.g. economy). More recently, increasing attention has been paid to the formal and informal institutional ‘rules of the game’ and political power dynamics, and how they constrain or enable solution space in policy and innovation processes (Edelenbos et al. 2011; Hounkonnou et al. 2012). Such institutional and political analyses provide information on the feasibility and acceptability of policy scenarios for different actor groups and the broader institutional context in which solutions can be explored and implemented.

Interdisciplinary research approaches are generally found to lead to more credible, legitimate and relevant research outcomes for different groups of actors and stakeholders (Cash et al. 2003; Hegger et al. 2012; Schut 2012). Furthermore, it is often the combination of knowledge related to ‘content’ and ‘process’ that can enhance the contribution of research to policy and innovation processes. For example, insight into multi-actor interactions or formal decision-making procedures (process) may facilitate better understanding of when and how research on the nature of the issue at stake (content) can contribute effectively (Schut et al. 2010). Interdisciplinary research approaches do not imply that there is no space for traditional disciplinary research. Nor do they imply that one researcher must be able to address all the dimensions of competing claims problems alone. Rather, researchers should work together and develop structures that enable them to work across disciplines. This is further elaborated in Section 2.5.

### **2.3 Interactions between scales and levels: Analysis of scale dynamics**

The biophysical, social-cultural, economic, institutional and political dimensions of competing claims problems discussed in Section 2.2 often have different meaning

across different scales and levels. Scales can be defined as the frame of reference to structure, measure or study a phenomenon, for example the spatial scale (Gibson et al. 2000; Vervoort et al. 2012). In line with Cash et al. (2006) and Termeer et al. (2010), we define levels as the positions on a scale, for example the global, zonal, habitat, landscape or patch levels that constitute the spatial scale. Scale dynamics refer to the interactions between levels within and across different scales (Cash et al. 2006). Accordingly, scale dynamics analysis refers to the process of describing and explaining such interactions.

A broad variety of scales and levels has been identified (Gibson et al. 2000; Cash et al. 2006). In this paper, we elaborate on the interactions between levels within and across the spatial and administrative scales (see Fig. 1), as these have particular relevance for policy and innovation processes addressing competing claims on natural resources. Depending on the nature of the issue at stake, other scales and their respective levels can be included in scale dynamics analysis.

Climate change is a classic example that illustrates the interactions between different levels on the spatial scale, as phenomena at the global level are rooted in processes at landscape and patch level and vice versa. The administrative scale contains different decision or policy-making levels, ranging from supranational levels (e.g. the UN) to more local levels (e.g. village or household) where strategies for dealing with complex problems (such as climate change) can be developed. Developments at one administrative level can both enable and constrain developments at other administrative levels, although local decision-making is often constrained by decisions or

policies developed at higher levels. According to Giller et al. (2008), feasible solutions for competing claims problems may emerge from balancing interests and bridging perceptions across different scales and levels, for which the analysis of scale dynamics is crucial. The *ex-ante* analysis of scale dynamics can provide the basis for developing, for example, policy scenarios that inform policy-makers on how changes or actions at one level may provide opportunities or create challenges at other levels (Cash and Moser 2000).

Cash et al. (2006) identified three types of scale dynamics challenges: (1) ignorance about interactions between levels within and across different scales, (2) different forms of mismatches between scales and levels, and (3) plurality, referring to the representation and participation of actors and their scale- or level-related interests in policy and innovation processes. The *ex-ante* analysis of scale dynamics can effectively contribute to transforming these scale dynamics challenges into opportunities (Schut et al. 2013a). First, *ex-ante* analysis can contribute to increasing awareness about the interactions between scales and levels, and their implications for policy and innovation processes; for example by showing how policies developed at the supranational level influence developments at the national level. Secondly, it can support identifying matches and prevent mismatches between scales and levels. Mismatches occur when different levels within or across different scales do not correspond, for example when seeking to address a transfrontier problem (such as river basin management) at the local administrative level (e.g. village or household level) (Cumming et al. 2006; Veldkamp et al. 2011). Thirdly, the analysis of scale dynamics facilitates the identification of different actors and their stakes and interests. This can provide the basis for collaborative multi-actor learning.



**Figure 1.** Spatial and administrative scales and different levels on these scales (based on Cash et al. 2006).

## 2.4 Multi-actor processes: Analysis of boundary arrangements at research–stakeholder interfaces

In any policy and innovation process, the relationships and interactions between actors, their organisations and networks are complex (Morriss et al. 2006). Following the definition by McNie (2007 19), stakeholders are those actors or groups:

[W]ith a vested interest in the outcome of a [...] decision and can include just about anyone, e.g., citizens, farmers, resource managers, business, politicians, and the like.<sup>1</sup>

Stakeholder participation in policy and innovation processes has become an established way of addressing complex environmental problems and is perceived as a critical success factor for sustainable development. The involvement of different groups of stakeholders provides important insights about the different dimensions of the problem and what types of policy solutions are technically feasible, social-culturally acceptable and economically

viable. However, as stakeholders often tend to act strategically rather than collaboratively, multistakeholder processes in competing claims contexts can easily become ‘arenas of struggle’ (Leeuwis, 2000: 946).

In multistakeholder processes where researchers are actively involved, two types of interrelated interfaces can be distinguished; stakeholder–stakeholder interfaces and research–stakeholder interfaces. At these interfaces, researchers, decision-makers and other stakeholders continuously negotiate their roles and the division of tasks and responsibilities: a process that is referred to as establishing boundary arrangements (Hoppe 2005). The contribution of research to facilitating boundary arrangements at stakeholder–stakeholder interfaces in natural resources management has been discussed extensively (e.g. Steyaert et al. 2007). However, existing theories of boundary arrangements that describe the relation between research and stakeholders rarely go beyond the research–policy interface as the unit of analysis (cf. Waterton 2005; Klerkx and Leeuwis 2008). Furthermore, the theory is applied statically to empirical material in the sense that one boundary arrangement is used to characterise the relationship between research and stakeholders throughout a policy or innovation process (Sterk et al. 2009). To better understand the contribution of research to multistakeholder policy and innovation processes, there is a need to analyse boundary arrangements at multiple research–stakeholder interfaces (e.g. research–government, research–private sector, research–civil society) and how such boundary arrangements evolve and change over time. Table 2 provides examples of boundary arrangements that can emerge between research and stakeholders. Boundary arrangements at the research–stakeholder interface do not equal

researchers’ roles, as researchers may fulfil different roles and undertake different activities within each of the specific boundary arrangements (see Section 2.5).

A number of recent studies highlight that different boundary arrangements at multiple research–stakeholder interfaces can co-emerge and coexist (Neef and Neubert 2011; Hegger et al. 2012; Schut et al. 2013b). Boundary arrangements at different research–stakeholder interfaces influence each other, and are influenced by interactions at different stakeholder–stakeholder interfaces. For example, research efforts to build the capacity of both government and civil society stakeholders in a policy process are likely to be influenced by an emerging conflict between these two stakeholder groups. Another feature of boundary arrangements at research–stakeholder interfaces is that they are path-dependent, meaning that their feasibility or credibility at a particular point in time is influenced by earlier boundary arrangements between research and stakeholders. For example, claiming an independent position as a researcher may not be credible in a multistakeholder process in which the government has determined the research agenda and how the research was conducted. The analysis of boundary arrangements at multiple research–stakeholder interfaces provides a more realistic image of how multistakeholder dynamics affect the contribution of research to policy and innovation processes in competing claims contexts.

## 2.5 Contested research(ers): New roles for research and researchers in policy and innovation processes

Working in an embedded and process-oriented way on different dimensions of competing claims problems,

**Table 2.** Boundary arrangements at the research–stakeholder interface (Descriptions are inspired by Burton 2006; Michaels 2009; Edelenbos et al. 2011. An adapted version of this table has been published in Schut et al. 2013b.)

Boundary arrangement	Description
Independent research	Research is independent of stakeholder or political interests. Research is not concerned with how research findings are mobilised and used by stakeholders in policy and innovation processes
Research steers stakeholders	Research actively seeks to persuade stakeholders to select a specific solution for problem or a certain way of organising policy or innovation process
Informative relationship	Dissemination of information on e.g. policy content and process. Research and stakeholders inform one another in a supply-oriented fashion
Advisory relationship	Research and stakeholders operate in their own separate domains, but research provides advice to stakeholders, and stakeholders can advise research about relevance of research questions
Exchange relationship	Research acknowledges that stakeholders have specific needs and questions, and proactively seeks to reconcile demand and supply. Research and stakeholders interact on research demands and exchange information
Co-learning relationship	Co-production of research. Researchers and stakeholders engage in a joint learning relationship to produce stakeholder-relevant research. Research and stakeholders seek to complement each other
Capacity building relationship	Research builds capacity and seeks to strengthen position and capacity/skills of stakeholders in policy and innovation process. Stakeholders can also empower research by providing research with a platform to mobilise research findings
Selective use of research	Research is used opportunistically, selectively and strategically by stakeholders to defend their interests and pursue their goals. Research has little influence on how findings are interpreted, mobilised and used by stakeholders
Stakeholders steer research	Stakeholders influence and determine research agenda setting, how research is conducted and/or used. Degree to which researchers can participate in, or contribute to, policy and innovation process is controlled by stakeholders

across multiple levels and with a variety of actor and stakeholder groups has implications for the role of research and researchers in policy and innovation processes. As Section 2.4 showed, research can engage in multiple relationships (boundary arrangements) with different stakeholder groups. Research that aligns with stakeholders' objectives and perceptions is likely to be framed as credible, legitimate and relevant, whereas research that does not align with stakeholders' objectives is likely to be framed as less credible, legitimate and relevant (Cash et al. 2003). As actors and stakeholders in competing claims contexts often have conflicting objectives and needs, there is a high probability that research becomes contested. Hence, a key challenge becomes to explore what (combination of) roles can enhance the credibility, legitimacy and relevance of research for different groups of actors and stakeholders.

Researchers can fulfil a variety of roles to support the policy and innovation process (Pohl et al. 2010). To categorise different researchers' roles we distinguish between knowledge management and innovation management roles (see Table 3) (cf. Schut et al. 2011). Knowledge management roles include the more traditional knowledge production roles related to the production of new knowledge and insights, and the analysis of existing knowledge and insights. Knowledge brokering strategies require a willingness between researchers and stakeholders to collaborate or interact. Knowledge brokering<sup>2</sup> refers to different types of activities that can enhance the accessibility and meaning of research for actor groups (Turnhout et al. 2013). Knowledge brokerage strategies and activities can vary from the transfer and dissemination of research findings among different actor groups, to facilitating joint knowledge production and learning with or among involved

actors and stakeholders. Based on their action-research to support the policy debate on biofuel sustainability in Mozambique, Schut et al. (2011) concluded that the joint interpretation of research data with different stakeholder groups enhanced the credibility, legitimacy and relevance of the research findings for the different groups, strengthened the relationship between the researchers and the stakeholders, and improved the overall quality of the data analysis.

The accessibility and usability of research in policy and innovation processes is highly influenced by the way in which research is packaged. There are different ways of packaging research that are more or less useful for different stakeholder groups. Traditional types of packaging of research include reports, scientific research papers, tables, charts or models. More innovative packaging can be in the form of games or interactive scenario planning tools. Strategic packaging of research can enhance the credibility, legitimacy and relevance of research in policy and innovation processes. It can bring together and create shared understanding between researchers and different groups of actors. If research outcomes or products have this ability they are often referred to as 'boundary objects' (cf. Star and Griesemer 1989; Carlile 2002; Turnhout 2009).

Knowledge management is important, but several other roles and activities—such as ensuring the availability of financial resources or creating an enabling institutional or political environment for problem solving—can be just as decisive for the course and outcome of policy and innovation processes. Innovation management acknowledges that the contribution of research to policy and innovation processes is to a large extent determined by institutional and political factors (Klerkx et al. 2012).

**Table 3.** Examples of knowledge management roles for researchers (based on: Edelenbos et al. 2003; van Buuren et al. 2004; Michaels 2009) and innovation management roles for researchers (based on: Swan et al. 1999; Hall et al. 2003; Hall and Clark 2010; Klerkx et al. 2010; van Mierlo et al. 2010; Leeuwis and Aarts 2011)

Knowledge management roles	Innovation management roles
Knowledge production: generate and mobilise new and existing knowledge and insights	Manage boundary arrangements at multiple research–stakeholder interfaces
Knowledge brokerage:	Develop adaptive capacity in policy and innovation processes
<ul style="list-style-type: none"> <li>● Inform: transfer and disseminate content</li> <li>● Consult: mobilise and provide expertise</li> <li>● Matchmake: connect experts and actor/stakeholder groups</li> <li>● Engage: involve stakeholders in, e.g. policy debates</li> <li>● Collaborate: facilitate collaboration at multiple stakeholder–stakeholder interfaces</li> <li>● Capacity building: develop process architecture and joint knowledge production and learning</li> </ul>	<ul style="list-style-type: none"> <li>Develop enabling environment to facilitate continuous stakeholder learning, e.g. fundraising, lobbying or criticising political agendas</li> <li>Address institutional constraints and structural power asymmetries</li> <li>Enhance reflexive monitoring and evaluation, and strategic adjustment of policy and innovation process</li> </ul>
Knowledge packaging:	
<ul style="list-style-type: none"> <li>● Enhance accessibility of research for different stakeholder groups</li> <li>● Develop boundary objects</li> </ul>	

Consequently, knowledge and innovation management roles are not mutually exclusive, but rather mutually reinforcing, and sometimes even inextricably bound together. Building upon the above example of action-research in Mozambique, knowledge management—the joint interpretation of research data with different groups of stakeholders—can build a degree of trust between the researcher and stakeholders. This can lead to a more embedded position of the researcher in the policy process (see Section 2.1) which can provide the basis for engaging in innovation management roles such as lobbying, penetrating political agendas, fundraising and addressing structural power asymmetries in policy processes. Consequently, such innovation management roles and activities can facilitate more effective knowledge management (e.g. mobilising funds for multi-actor interaction and learning); showing how the combination of knowledge and innovation management roles can enhance the contribution of research to policy and innovation processes.

Depending on the types of boundary arrangements at multiple research–stakeholder interfaces, certain knowledge management or innovation management roles may be more or less appropriate for the researcher to fulfil. Researchers do not necessarily have to fulfil or master the multiplicity of knowledge and innovation management roles. The majority of knowledge management and innovation management roles can also be fulfilled by specialised intermediaries, or knowledge/innovation brokers (Klerkx et al. 2009; Michaels 2009). The objective here is to create awareness on the importance of fulfilling specific knowledge management and innovation management roles and the strength of combining different roles in policy and innovation processes.

### 3. A framework for dynamic research configurations

To support researchers in their reflection, we combine our findings and recommendations in a framework for ‘dynamic research configurations’ (see Fig. 2). The framework aims to increase awareness about the complexity of research in policy and innovation processes in competing claims contexts, and to support individual researchers, groups of researchers or research projects in reflection on their contribution to, and role in, policy and innovation processes in competing claims contexts. It is not a heuristic framework in the way that it tells the user: what to do next and how to do it. Nevertheless, the framework can support researchers in better understanding the complex dynamics that influence interactions between research processes and policy or innovation processes, and reflecting on this. Potentially, the framework can be used to design or revise research strategies to enhance the contribution of research to policy and innovation processes.

The framework comprises of several layers (phases, dimensions, scales and levels, stakeholders, boundary arrangements and roles for research(ers)) that relate to the key challenges of competing claims contexts identified in this paper, and the theoretical, conceptual and methodological approaches that can support researchers in addressing these challenges. Some of the layers contain of sublayers such as the spatial and administrative scales, and knowledge management and innovation management. Each layer consists of different categories or levels, for example the different spatial or administrative levels, different stakeholder groups, or different types of boundary arrangements. Furthermore, the categories or levels contain ‘tick boxes’ that can be turned either ‘on’ or ‘off’ as they are not always applicable.<sup>3</sup>

The slide rule running vertically down through the different layers indicates the focus of the policy, innovation or research process at a particular moment in time. Each horizontal layer is movable to the right or to the left in relation to the position of the slide rule. The upper part of the framework includes the policy or innovation process considerations, e.g. what does the policy/innovation process look like in terms of the phase, the dimensions it addresses, the level(s) at which the problem is framed and is being addressed, and the actors and stakeholders involved. The lower part of the framework includes the research process considerations that include the type of research activities and roles. In Fig. 2, boundary arrangements form the dividing line of policy/innovation process and research process considerations: they visualise the relationship and division of tasks and responsibilities between research and stakeholders in policy and innovation processes. However, this line is not static (as indicated by the arrows) as decisions on which dimensions to address in research, and decisions on the inclusion and exclusion of scales and levels as part of scale dynamics analysis are just as much part of research process considerations as they are of policy/innovation process considerations. Also the other way around, the type of research(ers) roles, and the boundary arrangements between research and stakeholders (e.g. capacity building of farmers) are likely to affect the focus of the policy or innovation process in terms of how problems are defined and what type of solutions are being explored.

The first layer relates to the uncertainty and unpredictability in competing claims contexts. Policy and innovation processes in competing claims contexts consist of various iterative problem- and solution-oriented phases. Embedded research approaches can enhance insight into how these phases evolve over time and improve the alignment of phases in research processes, and in policy and innovation processes. The second layer refers to the bio-physical, social-cultural, economic, institutional and political dimensions of competing claims problems. Exploring, designing and implementing strategies to address competing claims problems, requires integral



**Figure 2.** Framework for dynamic research configurations consisting of various (sub-)layers and levels/categories that visualise dynamic nature of research in a context of interconnected policy/innovation and research process considerations.

analysis of the different problem dimensions, for which an interdisciplinary research approach is essential. The third layer analyses the scale dynamics that can contribute to creating awareness of interactions between scales and levels, identify matches and mismatches, and provide the basis for multi-actor collaboration across different levels. The fourth layer addresses multi-actor processes and boundary arrangements at the multiple research-stakeholder interfaces. Policy and innovation processes in competing claims contexts are characterised by the involvement of multiple actor and stakeholder groups, whose interests and mutual relations (stakeholder–stakeholder interfaces) evolve and change over time. Research is likely to engage in multiple boundary arrangements with different groups of stakeholders. The last layer concerns the variety of roles for research and researchers in policy and innovation processes in competing claims contexts.

The combination of knowledge and innovation management roles can enhance the contribution of research to policy and innovation processes. Table 4 includes key questions related to the above-described layers that can support researchers in their reflection.

The researchers who use the framework should keep in mind that within each of the layers, different categories or levels can be selected. For example, the research(ers) can simultaneously collaborate with different groups of actors or stakeholders such as farmers, politicians and development workers. The vertical slide rule indicates a focus, not that all other categories and levels are excluded or irrelevant. Moreover, changes in one of the layers are likely to imply changes at other layers. For example, if the focus changes from addressing food security at national level to the village level, different questions regarding the biophysical, social-cultural, economic, institutional and

**Table 4.** Key questions related to using framework for dynamic research configurations

Layers	Key questions
1. Uncertainty and unpredictability	<ul style="list-style-type: none"> <li>• In what phase is the policy or innovation process?</li> <li>• What has happened in previous phases?</li> <li>• Who was involved in agenda setting?</li> <li>• To what phase in the process does research seek to contribute?</li> <li>• How can research process and policy/innovation process be aligned to prevent mismatches and optimise timing of research findings?</li> </ul>
2. Multidimensional	<ul style="list-style-type: none"> <li>• What are the biophysical, social-cultural, economic, institutional and political dimensions of the problem?</li> <li>• What existing research is available on the different dimensions of the problem?</li> <li>• How do different dimensions relate?</li> <li>• How can insights from different disciplines be combined?</li> <li>• What dimensions can be addressed by researcher/research team?</li> <li>• What type of expertise is missing in the research team and how can this expertise be mobilised?</li> <li>• What conditions for interdisciplinary research have to be put in place?</li> </ul>
3. Scale dynamics	<ul style="list-style-type: none"> <li>• At what spatial level(s) does the problem occur?</li> <li>• At what administrative level(s) is the problem being addressed?</li> <li>• What are potential consequences of scale and level selection in terms of inclusion and exclusion of stakeholders in the process?</li> <li>• How do interactions across different scales and levels influence each other?</li> <li>• What scale and level matches and mismatches can be identified and how can these be dealt with?</li> <li>• What type of research has relevance to decision-makers at different levels?</li> </ul>
4. Multi-actor processes	<ul style="list-style-type: none"> <li>• Which actors have a stake in the policy/innovation process?</li> <li>• What are objectives and needs of different stakeholder groups?</li> <li>• How is research mobilised and used by different stakeholder groups?</li> <li>• Are stakeholders willing to collaborate in addressing the problem?</li> <li>• What are ideas of stakeholders about division of tasks and responsibilities?</li> <li>• What boundary arrangements at multiple research–stakeholder interfaces can coexist?</li> <li>• How do dynamics at stakeholder–stakeholder interfaces influence the boundary arrangements at different research–stakeholder interfaces?</li> <li>• How have boundary arrangements at multiple research–stakeholder interfaces evolved over time?</li> <li>• What type of path-dependency has emerged in relation to credibility of different boundary arrangements?</li> </ul>
5. (New) roles for research(ers)	<ul style="list-style-type: none"> <li>• What roles is/are the researcher(s) willing to play?</li> <li>• What roles is/are the researcher(s) expected to play by actors and stakeholders?</li> <li>• How do such expectations vary across different groups of actors and stakeholders?</li> <li>• What combinations of knowledge management and innovation management roles can enhance contribution of research to policy/innovation process?</li> <li>• Is there sufficient trust or mandate for researcher to fulfil innovation management roles</li> <li>• What type of packaging can enhance accessibility and meaning of the research for different actors?</li> </ul>

political dimensions of the problem will be posed, different stakeholders need to be involved, and different types of roles may need to be fulfilled by the researcher(s). In sum, the changing policy or innovation context is likely to require a different research configuration.

As is often the case when a dynamic framework is presented on paper, a number challenges need to be discussed. First, the framework suggests that different configurations can be randomly and unlimitedly selected. In line with our earlier findings on boundary arrangements, research configurations are stored in the ‘memory’ of involved actors and stakeholders and consequently show patterns of path dependency. This implies that the credibility, legitimacy and relevance of research configurations as perceived by actors and stakeholders at a particular point in time are influenced by earlier research configurations. Secondly, at what time intervals can or should the framework be used? In particular, the boundary arrangements between research and stakeholders are never fixed but are constantly negotiated and renegotiated in interactions as the policy or innovation process evolves. Therefore, there is no rule or norm on how often the framework can or should be used. As stated, the main objective is to support reflection on the key characteristics of competing claims contexts, how they relate, and how they influence the credibility, legitimacy and relevance of research in policy and innovation processes in competing claims contexts.

#### 4. Conclusions and recommendations for further research

One of the objectives of this paper was to better understand the characteristics of competing claims contexts and how they influence the contribution of research to policy and innovation processes addressing in competing claims problems. Essential are awareness about: (1) uncertainty and unpredictability in competing claims contexts; (2) a better understanding of the different dimensions of competing claims problems; (3) interactions between different scales and levels; (4) multi-actor processes; and (5) the (new) roles for research and researchers. Rather than promoting Mode 1, Mode 2 or proposing a ‘Mode 3’ type of research, we conclude that more dynamic approaches to enhance the contribution of research to policy and innovation processes in competing claims contexts are needed. Within such approaches there is space for ‘traditional’ and ‘new’ forms of research, and the various blends and combinations between them. Embedded, context-sensitive and flexible research strategies can support researchers to strategically and continuously reflect on when, how, and in what form or role the contribution to, and credibility, legitimacy and relevance of research in, policy and innovation processes can be enhanced. The framework for dynamic research configurations can

support researchers in their reflection. However, the framework also poses challenges, which are related to how the framework can be used in practice. First, there is a challenge with regard to making choices, and who determines the research configuration. Making choices implies a degree of power. This can be power in relation to what research questions are formulated, which approach is found most appropriate, and which actors and stakeholders are perceived to be legitimate participants in the policy and innovation arena. This makes the inclusion or exclusion of certain dimensions (e.g. the economic dimension), or scales and levels (e.g. study food security at village level or at national level) complex and political (cf. Lebel 2006). Hence, strategies or tools that can facilitate making such choices in multi-actor policy and innovation processes are needed.

Secondly, there are challenges related to the changing boundary arrangements at different stakeholder–stakeholder and research–stakeholder interfaces. As policy and innovation processes unfold, it is likely that different boundary arrangements at these interfaces will evolve. In this paper we have mainly reflected on (changing) boundary arrangements at multiple research–stakeholder interfaces. We believe that the combined analysis of interactions at multiple stakeholder–stakeholder interfaces and at multiple research–stakeholder interfaces through time can provide additional insights into factors that influence the contribution of research to multi-actor policy and innovation processes.

Thirdly, research and researchers face an institutional challenge. In competing claims contexts, embedded and context-sensitive research strategies seem most effective. Such research approaches require flexibility in terms of adapting research questions, scales and levels of analysis, working together with different groups of actors and stakeholders and fulfilling different types of roles. Funding requirements and incentive structures often stimulate research to be ‘predefined projects’ rather than dynamic ‘processes of inquiry’.

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## Notes

1. Although we acknowledge that researchers can also have a stake in policy or innovation processes, we do not treat them as stakeholders in this paper.
2. The knowledge brokerage roles as described in Table 3 are based on work by Michaels (2009). Michaels describes knowledge brokerage as a role that is fulfilled by independent intermediaries while we think they can equally be described as part of researchers' roles in policy processes.
3. For reasons of illustration, the categories and levels in Fig. 2 have been randomly selected as 'on' or 'off'.

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