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Knowledge and innovation management in the policy debate on biofuel sustainability in Mozambique: what roles for researchers?

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This paper explores the relationship between knowledge management (KM) and innovation management (IM) in policy processes. By describing and analysing the roles of researchers as knowledge and innovation managers in policy processes we also contribute to the debate on how researchers can enhance their effective contribution to policy processes. Empirical data for the paper were gathered between December 2008 and November 2010. During that period, two of this paper's authors conducted participatory action research whilst supporting the Mozambican inter-ministerial Subgroup Sustainability Criteria in developing a sustainability framework for biofuel production in Mozambique. We conclude that KM and IM are mutually reinforcing and inextricably bound: KM can provide the basis for engaging in IM activities or roles, which may – consequently – create an enabling environment for more effective KM in policy processes. The active embedding of researchers in policy processes an action-oriented research approach and systematic reflection can enable researchers to continuously determine what (combination of) KM and IM strategies or roles can enhance the actionability of research in, and the quality of the policy process. To do so successfully, a process-based research approach and strategic management of the boundary between research and policy are key.

Introduction

In recent years, the interest in researchers' roles in, and their contribution to, policy processes has increased considerably (Jasanoff 1990; Steel *et al.* 2004; Pielke Jr. 2007; Boaz *et al.* 2009; Sterk *et al.* 2009). In the light of the growing complexity of social, economic and environmental challenges, many have argued that it is time for researchers to abandon their traditional roles as producers of authoritative, objective and value-free knowledge (Gibbons *et al.* 1994; In 't Veld 2000; Hoppe 2005) and engage more actively in research that is embedded in interaction with societal stakeholders to collaboratively describe and explain problems, and to explore and design sustainable solutions (Giller *et al.* 2008, p. 6).

There exists a lively debate about how far researchers can or should go in mobilising their research findings in policy processes. The Knowledge Management (KM) approach, where researchers focus on producing and managing credible, legitimate and relevant knowledge through processes of multi-stakeholder learning, has become increasingly popular and is widely promoted in the field of international development. However, some claim that the KM approach is too narrow, and that researchers should go beyond their focus on

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knowledge and knowledge management by also anticipating the more structural formal and informal institutional processes, and relational and power dynamics that determine how knowledge is mobilised and used in practice. This approach is often referred to as Innovation Systems Management or Innovation Management (IM).

This paper seeks to contribute to sharpen the debate on the relationship between KM and IM in policy processes. We present a case study on the contribution of action-researchers to developing a biofuel sustainability framework for Mozambique. The case describes the roles of researchers as knowledge and innovation managers in the policy process and is used to analyse the relationship between different KM and IM roles, how KM and IM shaped the policy process and vice versa. Such insights on knowledge and innovation management in policy processes are important for researchers, but also for policy-makers and development practitioners who want to improve their responsiveness to development challenges (Ferguson *et al.* 2010, p. 1797).

The next section provides a brief overview of the literature on KM and IM to date, followed by an exploration of the roles of researchers as knowledge and innovation managers in policy processes. Subsequently, the research objectives and methodological approach are presented. In the section thereafter, we describe and analyse our roles as knowledge and innovation managers in the policy debate on biofuel sustainability in Mozambique. Finally, we analyse our findings, and follow this up with the main conclusions of the paper.

Knowledge and innovation management

Terms such as 'knowledge', 'knowledge management' or 'innovation management' are in themselves not easy to define (Amalia and Nugroho 2011, p. 72). Definitions of KM and IM abound (Swan *et al.* 1999, p. 264), are prone to multiple interpretations and evoke questions about whether knowledge or innovation can be managed in the first place (e.g. Snowden 2002, p. 101). We acknowledge that any description of KM or IM is contested, and that the boundaries between the approaches are often blurred. On top of that, both approaches – especially KM – are conceptualised in a 'variety of ways' (Alvesson and Kärreman 2001, p. 1004). However, in order to study the roles of researchers as knowledge or innovation managers in policy processes, we cannot escape from at least providing a broad description of KM and IM.

Knowledge management (KM)

A meta-review of literature on knowledge management for development by Ferguson *et al.* (2008) identifies different types of KM, for example, 'engineering and emergent KM approaches' (van den Hooff and Huysman 2009), or 'rationalist and post-rationalist KM approaches' (Ferguson *et al.* 2010). The engineering or rationalist KM approaches perceive knowledge as: '[A] "thing" (object) which is amenable to being "managed" – by a "subject" (a manager)' (Quintas *et al.* 1997, p. 389). The main purpose of this form of KM is to produce objective and value-free knowledge, and transfer that to end-users, such as policy-makers (Hartwich *et al.* 2007; Ferguson *et al.* 2010). In this paper, we refer to KM as the emergent or post-rationalist approaches that have a much stronger emphasis on learning and are rooted in the idea that knowledge is contextual and co-constructed by stakeholders (van den Hooff and Huysman 2009). The knowledge production process itself (develop relevant research questions, decide on research methods, gather data, and analyse and interpret the findings) is organised in close collaboration with the stakeholders.

Doing so can facilitate processes of joint leaning and develop shared understanding about the nature of the issues at stake, as well as about the space within which solutions can be explored and designed. One of the challenges of joint knowledge production and multi-stakeholder learning is that stakeholders often act strategically, rather than collaboratively or communicatively (Leeuwis 2000). KM may therefore not be able to address the more fundamental power or relational dynamics that shape the outcome of multi-stakeholder processes (Pohl *et al.* 2010, p. 271).

Innovation management (IM)

In this paper we approach IM from an innovation systems perspective, implying that: '[I]nnovation is considered the result of a process of networking and interactive learning among a heterogeneous set of actors' (Klerkx *et al.* 2010, p. 390). Within the perspective, knowledge creation, exchange and use form important – but not always central – functions of innovation (World Bank 2006, p. 89; Klerkx *et al.* 2009). IM goes beyond KM by also focusing on: '[E]nabling and constraining factors other than knowledge [. . .] such as informal norms and practices, and formal rules embedded in legislation and policy' (Klerkx 2008, p. 12). In doing so, KM is a sub-function of IM. IM seeks to bring together insights related to the socio-cultural, economic and environmental nature of a problem, but also related to the political and legal dimensions across different levels and scales of analysis that influence the space within which solutions can be explored (Giller *et al.* 2008, p. 7). Such an holistic and systemic approach can provide the basis for promoting more strategic institutional learning, and addressing relationship dynamics between stakeholders and stakeholder networks (Hall *et al.* 2003, p. 223). Consequently, it can also enhance the actionability of knowledge and research in policy processes (cf. Kristjanson *et al.* 2009).

Researchers as knowledge and innovation managers in policy processes

Policy processes are often characterised by fundamental uncertainties and the involvement of many stakeholders, thus making them unsuitable for linear pathways (Funtowicz *et al.* 1999, p. 7). In line with Giller *et al.* (2008), we perceive policy processes as dynamic negotiation processes in which research – but also other resources – are used selectively and strategically by stakeholders to influence the course and outcome of the policy process (Hoppe 2005, p. 203). Such an approach acknowledges that research and researchers can support certain stakeholder perspectives or facilitate negotiations, but is also itself subject to negotiation (cf. Leeuwis 2000; Giller *et al.* 2008). As a policy process evolves, numerous contextual factors determine when, how and in what role researchers can contribute to opening up or closing down negotiation space in policy processes, and for whom (Schut *et al.* 2010b, p. 625).

Below, we discuss some typical roles for researchers as knowledge or innovation managers in policy processes. We want to emphasise that the KM and IM roles do not exclude each other. KM should rather be seen as a sub-function of, or being embedded in IM (see Figure 1).

Researchers as knowledge managers in policy processes

In line with van Buuren *et al.* (2004), we have identified three important KM strategies or roles for researchers in policy processes.[1] A first role is safeguarding the quality of

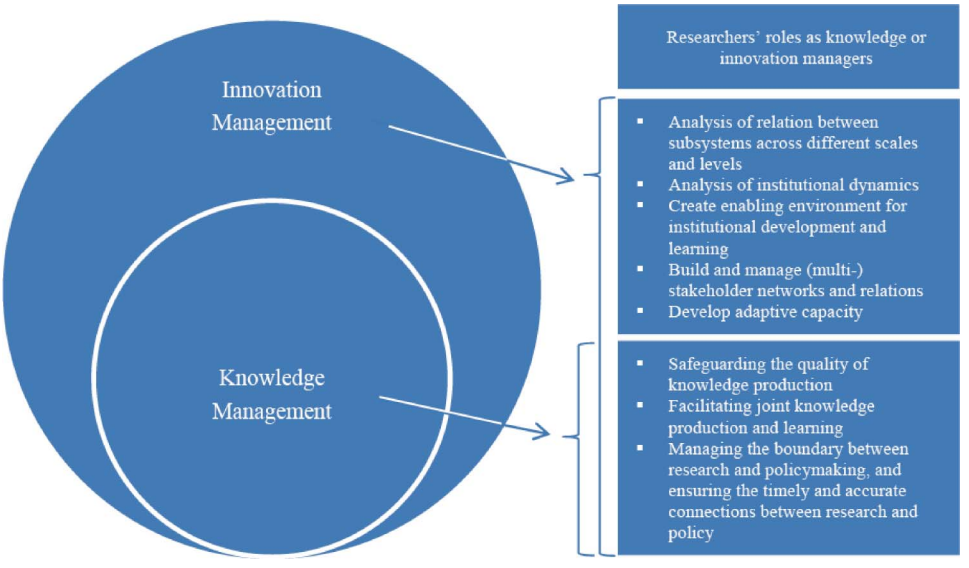

Figure 1. Illustration of the embeddedness of KM in IM, and examples of researchers' roles as knowledge or innovation managers in policy processes.

knowledge production. Knowledge production can imply producing 'new' knowledge by describing and explaining problems (Giller *et al.* 2008), but also the acquisition and capturing of existing knowledge. According to Cash *et al.* (2003, p. 8086), research is likely to be perceived as effective by stakeholders if it is not only independent and credible, but also relevant and legitimate to their claims and interests. A second KM role emphasises the importance of facilitating joint knowledge production and learning when problems are being described and explained, and solutions are being explored and designed (Giller *et al.* 2008). It may lead to a degree of shared understanding (Cash *et al.* 2003) that can form the basis for bringing together different stakeholders and their interests (van Buuren *et al.* 2004, p. 15). Moreover, researchers may contribute to contextualising knowledge and embedding it in the social context of stakeholders (van den Hooff and Huysman 2009, p. 2). The close collaboration with multiple stakeholders also enables the researcher to identify, articulate and respond to (changing) knowledge demands throughout the different phases of the policy process, and this may enhance the relevance of the research. A third KM role relates to managing the boundary between research and policy-making, and ensuring the: '[T]imely and accurate connections between [the] research process and policy negotiations' (van Buuren *et al.* 2004, p. 14). It underlines: '[T]he importance of a good process architecture (Edelenbos *et al.* 2003, p. 9) of the research process itself, but also of the relation between research and [the stakeholders in the] policy processes' (van Buuren *et al.* 2004, p. 23).

Researchers as innovation managers in policy processes

In line with our definition of IM, we also approach researchers' roles as innovation managers from an innovation systems perspective.[2] A first fundamental premise of IM in policy processes is to approach the policy process in itself (but also the research process) as a subsystem or part of a larger complex system, in which the problem it seeks to address

is another subsystem (Funtowicz *et al.* 1999, p. 7; Smits and Kuhlmann 2004, p. 14). Knowledge production should therefore focus on describing and explaining how interactions between socio-cultural, political, legal, economic and biophysical subsystems across different scales and levels (cf. Cash *et al.* 2006) influence the space within which stakeholders can explore and design sustainable policy solutions (Schut *et al.* 2010b, p. 625). A second distinct feature of IM is its focus on the analysis of formal institutions (legislation and policy) and informal institutions (norms and practices), and how they enable or constrain learning, development or change. Thirdly – although closely related to the previous point – the innovation manager seeks to create conducive conditions (Klerkx *et al.* 2010) or an enabling environment (World Bank 2006) to facilitate continuous stakeholder and institutional learning. Although the creation, exchange and mobilisation of knowledge is important to create such conditions or environment, several other functions – such as ensuring the availability of financial resources, market formation, vision development, create an enabling legal or political environment – are just as decisive for innovation (Klerkx *et al.* 2009, p. 411). A fourth role for researchers as innovation managers is to actively build and manage stakeholder networks (Swan *et al.* 1999) and relationship dynamics (Hall *et al.* 2003, p. 223). In order to do so, researchers need profound insight into stakeholders' positions and their mutual relationships. This may include addressing power asymmetries and deep-rooted conflicts (Leeuwis 2004, p. 54). The fifth and last element of IM is developing strategic intelligence (Smits and Kuhlmann 2004, p. 12) or adaptive capacity (Hall and Clark 2010) in stakeholder networks to respond to the uncertainty and the unpredictability of policy processes.

For researchers to fulfil the above-described IM roles, their structural embedding and active involvement in the policy process is essential. Such embedding can enable researchers to enhance their actionability in policy processes, for example by penetrating political agendas, create (stakeholder) coalitions, or engage in political lobbying or issue advocacy (Hekkert *et al.* 2007; Pielke Jr. 2007). However, such actions or roles are also likely to result in discussions about what is politically desirable, and how that affects ideas about the independence and credibility of researchers in society (Hoppe 2005). It implies that researchers need to think carefully about, on the one hand, who their clients are, and on the other hand how to remain credible and relevant to other stakeholders in the policy process (Giller *et al.* 2005).

Research objectives and methodological approach

The key objective of this paper is to explore the relationship between KM and IM in policy processes by describing and analysing the roles of researchers as knowledge and innovation managers. We pay special attention to how the different knowledge and innovation management activities and roles influence the policy process and vice versa. In doing so, the paper contributes to sharpening the debate on the value, differences and synergies of KM and IM in policy processes, but also to the debate on how, in what roles and under what conditions researchers can enhance their effective contribution to policy processes, which forms the second objective of the paper.

Empirical data for the paper were gathered between December 2008 and November 2010. During that period, two of this paper's authors conducted participatory action research whilst supporting a Mozambican inter-ministerial Subgroup Sustainability Criteria (SSC or subgroup) in developing a sustainability framework for biofuel production in Mozambique. The SSC is one of four inter-ministerial subgroups that were developed to operationalise and implement the Mozambican government's National Biofuel Policy and

Strategy (NBPS – Resolution 22/2009). The four subgroups are coordinated by a National Biofuel Taskforce (NBT).

Central to the action research approach (cf. Lewin 1946) are acting, observing, reflecting and revising in a cyclical process (Pleijte *et al.* 2011, p. 224). The iterative character of action research enables the researcher to adapt – on the basis of active reflection – the research strategy during the research process, which may include fulfilling different roles in the policy process. Participatory action research positions the researcher in a more active role that implies closer contact with practice (Ottosson 2003, p. 90). 'The active involvement of the researcher should [. . .] not necessarily be considered as a "threat" to the validity of the research conducted, but [. . .] as a dimension that can produce more insight' (Trondsen and Sandaunet 2009, p. 18). The embeddedness of a researcher in policy processes may lead to better understanding about the dynamics that influence when and in what form research can contribute to exploring, designing and implementing sustainable policy solutions (Schut *et al.* 2010b, p. 624).

Hoppe (2005, p. 202) argues that researchers who seek to optimise the interdependence between research and policy often use: '[M]ultiple research methods in a context of argumentation, public debate and political struggle in order to create, evaluate and communicate policy-relevant knowledge'. The empirical data presented in this paper results from a variety of quantitative and qualitative research methods and data collecting techniques. In addition to this, action research concerns active reflection upon the research process and the role of the researcher. These reflections among the researchers in the form of meetings, notes and personal memos allowed us to document, reconstruct and analyse the roles we played as knowledge and innovation managers in the policy process.

Knowledge and innovation management in the policy debate on biofuel sustainability in Mozambique

Before we describe and analyse our roles as knowledge and innovation managers, it is important to briefly elaborate on the institutional embedding of the research, and our intentions as researchers in the policy process. Our work in Mozambique formed part of the research programme 'Competing Claims – Competing Models'; a partnership between DGIS, CEPAGRI and WUR.[3] We developed our research proposal in collaboration with CEPAGRI, focusing on: 'Getting more grip on different stakeholders' perceptions on sustainability', that could provide: 'The basis for establishing a national set of biofuel sustainability criteria or a certification scheme'. Although it was our intention to study and support the policy process by actively participating in it, we did not have a clear strategy in terms of what concrete KM or IM activities or roles we wanted or were allowed to fulfil, nor did we have a formal mandate to participate in the policy process.

The following sections provide an overview of the main roles and activities we fulfilled as knowledge and innovation managers. Figure 2 provides a timeline of the process, and positions the most important phases and activities.

Process architecture to facilitate joint learning

Upon our arrival in Mozambique in December 2008, terms of reference (ToR) for the SSC were in the process of being developed by CEPAGRI and CONDES,[4] the latter of which was formally assigned to coordinate the SSC. As part of our collaboration with CEPAGRI, we[5] were invited to develop an action plan for the SSC. On the basis of our

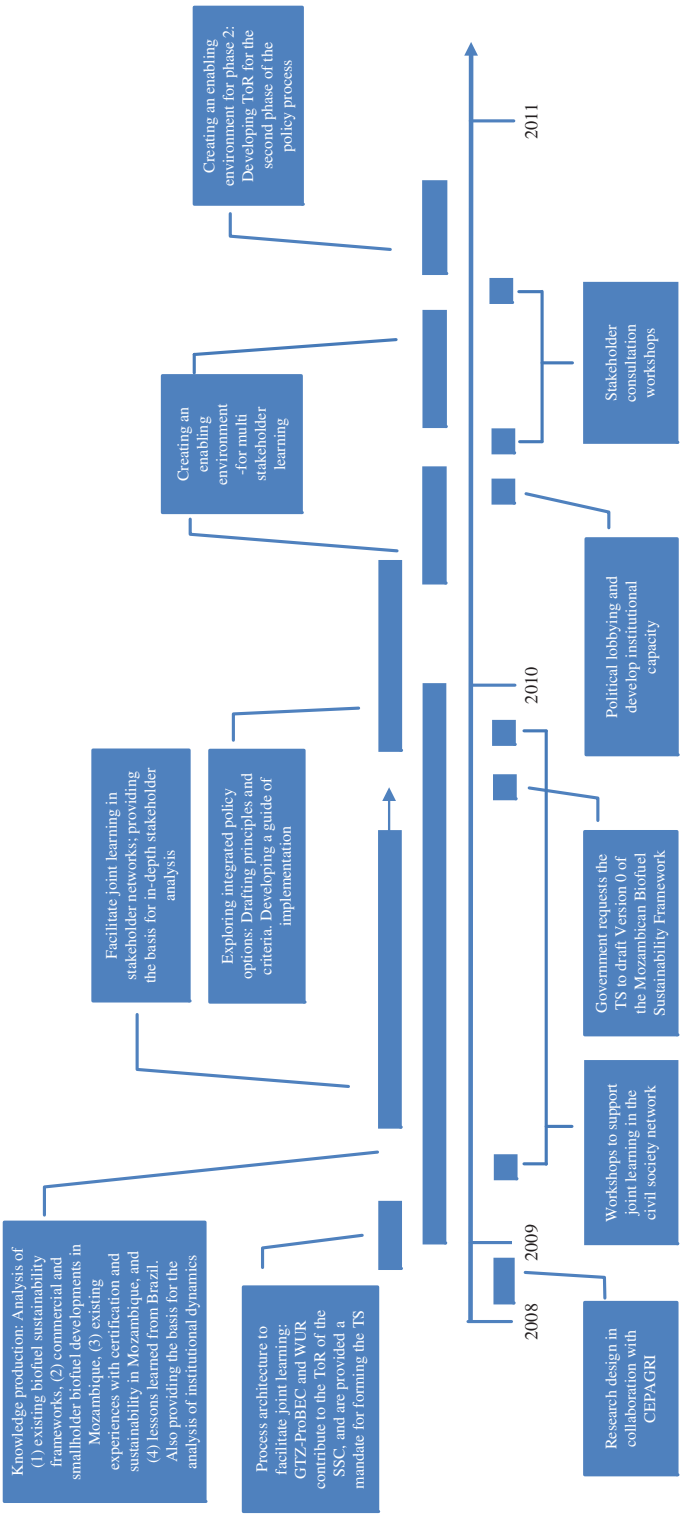

Figure 2. Timeline of the policy process and the most important research phases and activities.

research interest in identifying and bringing together different stakeholder perspectives, we proposed an action plan based on the principles of social learning.[6] We adapted and translated Woodhill's (2004) social learning roadmap to the context of the Mozambican biofuel debate, of which a slimmed down version was included in the final ToR of the subgroup. The ToR moreover stated that the subgroup would be composed of government officials and representatives of private sector and civil society organisations.

On the basis of our contribution to the ToR we were formally provided a mandate to form a technical secretariat (TS). The TS was responsible for doing research to support the SSC in designing a realistic and implementable biofuel sustainability framework that would reflect both the Mozambican reality and the long-term requirements of major biofuel markets. For us, it emphasised the need to approach our research holistically and from an interdisciplinary perspective, taking into account different levels of policy influence and the perspectives of the three main stakeholder groups (government, private sector and civil society organisations). Our contribution to the ToR had moreover enabled us to sharpen and increase the relevance of our research questions.

Knowledge production

In January 2009, we started elaborating our research strategy. As the ToR of the subgroup had not yet been formally approved, and its representative members still had to be selected, we began by summarising and comparing seven leading international biofuel sustainability frameworks.[7] Harmonising the Mozambican framework with these existing international frameworks could facilitate the export of biofuels from Mozambique to other countries (one of the government's objectives), but would also be important in terms of demonstrating political "'[G]oodwill" to international donors and powerful trade partners' (Di Lucia 2010, p. 7401).

With regard to the Mozambican biofuel reality, on discovering that there was no comprehensive overview of biofuel developments in Mozambique, we consequently decided to develop one ourselves. We analysed existing biofuel-related policies and legislation, and our partnership with CEPAGRI provided access to biofuel investment proposals that – under strict conditions – could be analysed. We mobilised the CEPAGRI and GTZ-ProBEC networks to contact and visit commercial and smallholder biofuel projects in different parts of the country. Our analysis demonstrated the environmental, social and economic opportunities and challenges in the emerging biofuel sector. It also revealed potential mismatches between the government's biofuel objectives and those of biofuel investors (Schut *et al.* 2010c). With regard to smallholder biofuel projects in Mozambique, we concluded that lack of knowledge on crop management had resulted in crop failure, and we stressed the need for an enabling environment to support smallholder farmers (Bos *et al.* 2010). Furthermore, we emphasised the potentially negative impacts if smallholders were to comply with biofuel sustainability criteria (Schut *et al.* 2011).

Parallel to this research, we studied other commodities produced in Mozambique under certification or sustainability criteria. Our analysis demonstrated that certification can easily result in trade barriers for, and exclusion of, smallholder producers, and that certified products supply only a very small segment of the Mozambican market, as they are mainly produced for overseas markets. The more structural institutional problem of the enforcement of laws, regulation and standards presents a challenge in Mozambique.

We also explored how other biofuel producing countries position themselves in the international biofuel sustainability debate, in particular Brazil. The most important lesson learned from Brazil was that additional biofuel certification or sustainability frameworks are not necessary when the country's legal framework regulates the social, economic

and environmental sustainability of biofuel production, processing, blending and use. Furthermore, we believed that a framework developed by a Brazilian civil society platform (see: Moret *et al.* 2006, pp. 10-11), in which biofuel sustainability criteria are accompanied by examples of what each criterion seeks to promote and prevent, could serve as a good discussion-support tool that could be useful later in the policy process in Mozambique.

Analysis of institutional dynamics

The first phase of the research (which roughly took from January to October 2009) did not only result in insights into the, factors that are driving the direction of biofuel developments in the country, and opportunities and challenges with regard to the sustainability of the emerging biofuel sector in Mozambique but also provided the basis for more profound insights into institutional dynamics – both formal rules (e.g. legislation and auditing) and informal practices (e.g. enforcement of legislation) – to which a biofuel sustainability framework would be exposed in practice. For example, the analysis of existing biofuel-related policies and legislation demonstrated that data requirements under the existing Project Application and Land Acquisition Process[8] could potentially be adapted to assess the sustainability of biofuel operations in Mozambique.

The analysis of leading international biofuel sustainability frameworks provided valuable insights on how the Mozambican government could strategically position itself in the international biofuel sustainability debate to facilitate the export of biofuels to e.g. EU member states and demonstrate political goodwill, but at the same time develop a sustainability framework that reflects the Mozambican reality. Such understanding would become important during later phases of the policy process, as it shaped the political and legal space within which policy options could be explored and designed.

Facilitating joint learning in stakeholder networks

To better understand our data, we conducted interdisciplinary analysis in collaboration with other researchers and a policy-maker from CEPAGRI. Our attempt to explain our findings from socio-cultural, political, legal, economic and biophysical perspectives provided a holistic image of what was driving biofuel developments in Mozambique. This exercise initiated a joint learning process between researchers and policy-makers that was mutually beneficial; it strengthened the relationship between the researchers and the policy-makers, and improved the quality of the data analysis. The researchers and policy-makers concluded that the SSC should explore policy options that focus on harmonising different stakeholders' objectives. The joint analysis resulted in a research report (Schut *et al.* 2010a) and a joint research paper that was published in a peer-reviewed scientific journal (Schut *et al.* 2010c).

The fact that CEPAGRI acknowledged our research findings was important for our position in the debate. We found that it increased our credibility as researchers (at least within the government network but also within other stakeholder networks), and that this facilitated access to information and people.

Increasingly, we were invited to civil society and private sector platforms to present, defend and get feedback on our research findings. We found that especially the maps, tables, scenarios and figures that we used to visualise our findings (e.g. Figure 3) were perceived as credible and relevant by stakeholders. As there was no other research that provided a comprehensive overview of biofuel developments in Mozambique, our study provided a degree of shared understanding about what was driving the direction of the emerging biofuel sector in the country (Schut *et al.* 2010c).

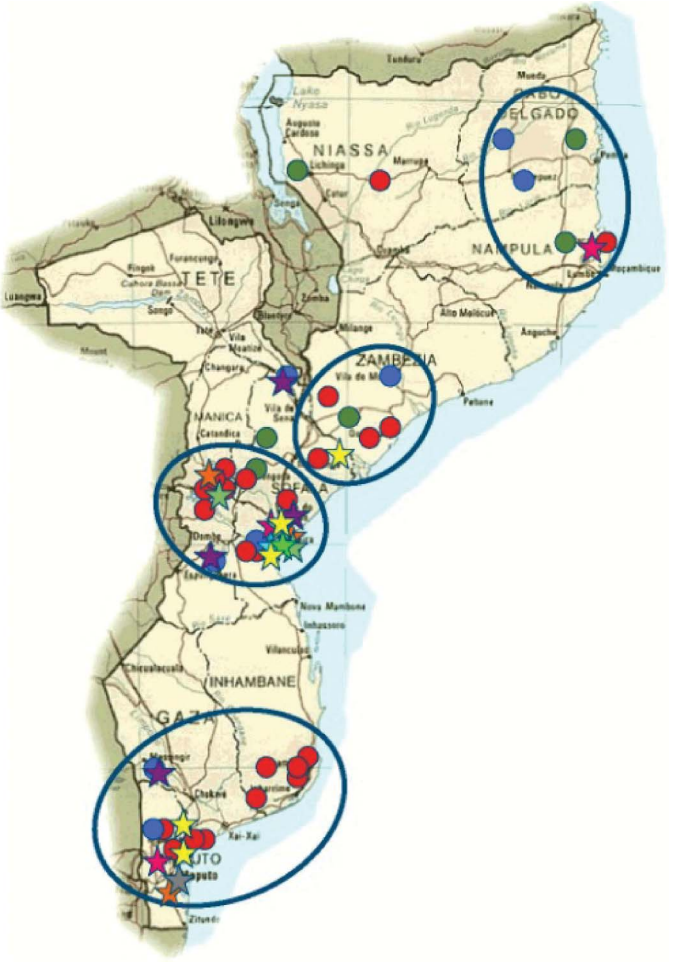

Figure 3. Overview of biofuel developments in Mozambique. (Schut *et al.* 2010c, p. 5162)

Building and managing stakeholder networks and relationships

In March and November 2009, we contributed to organising two workshops to support civil society organisations to better position themselves in the biofuel debate. The objective of the workshops was to developing a joint vision and strengthen the civil society network. We presented our research findings and contributed to facilitating the workshops. On many occasions, we also tried to convince private sector stakeholders to develop such a joint vision, but although some individual project managers and investors were enthusiastic, they did not manage to organise themselves.

Our access to different stakeholder networks allowed for the development of a mutually dependent relationship between the researchers and the three stakeholder groups (government, civil society organisations and private sector). On the one hand, it provided us with better insights into the positions of different stakeholders in the biofuel debate, and their positions vis-à-vis each other. This enabled us to conduct indepth stakeholder analysis, which had been central in our original research proposal. On the other hand, we could

provide access to knowledge and information, connect different stakeholders and stakeholder networks, and update them on the policy process. This relationship should not be romanticised, however. As we formed part of the TS that supported governmental activities, our mandate and credibility were repeatedly questioned (especially by civil society organisations), both directly and behind the scenes. Critical questions were asked about the TS's legitimacy to fulfil such a role, the transparency of the policy process, and the limited space for civil society organisations and the private sector to participate in the SSC. However, we also received support, as we had developed a constructive relationship with the Dutch Embassy in Maputo and one of their programme officers, who formed part of a more 'informal network' that actively facilitated our work from behind the scenes.

Although we actively built, managed and connected different stakeholder networks, we had growing concerns about the limited space for multi-stakeholder debate and negotiation, and the growing distrust of civil society organisations and private sector towards the Mozambican government, which also affected our position as researchers and how we were perceived by stakeholders.

Exploring integrated policy options

By October 2009, the position of the SSC had weakened considerably. Due to changes in leadership within the government, the initial commitment to the SSC had decreased. This had resulted in a subgroup with few permanent members, who were moreover all government representatives.[9] During a meeting intended to reanimate the SSC, the chair of the NBT proposed that the TS should draft the biofuel sustainability framework, before involving civil society and private sector stakeholders. The request completely changed our role as researchers in the policy process. Until then, we had mainly focused on producing knowledge and engaging in joint learning with different stakeholder networks. Despite some critique, this had enabled us to remain rather neutral in the process, by not engaging too much in the political debate.

In our deliberations, we discussed that not taking the assignment would somehow undermine the mandate that was given to us by the Mozambican government. Furthermore, we realised that the request provided a unique possibility to mobilise our research findings and translate them into tangible policy recommendations; this made us decide to accept the assignment. In collaboration with the SSC (at that time consisting of the three government officials), we started developing a draft Version 0 of the Mozambican biofuel sustainability framework. As we were aware of our vulnerable position, we put extra emphasis on ensuring that the developed sustainability principles and criteria were firmly rooted in our research findings. In that way, we could legitimize and defend our choices, thereby enabling us to remain credible to the different stakeholders in the process. Another guiding principle was to ensure that civil society and private sector stakeholders would recognise their key interests in the draft sustainability framework. Our active participation in different stakeholder networks had enabled us to gain indepth understanding about their positions in the debate, their priorities and their positions vis-à-vis each other. Due to their limited participation in the process until then, addressing their interests would be crucial for the credibility and acceptance of the framework. We sought to formulate principles and criteria that could bridge and harmonise different stakeholder interests and objectives. In line with that, and following the example of the Brazilian civil society platform, we developed a discussion-support tool in which each criterion was linked to examples of what the criterion sought to promote or prevent. The underlying idea was that the tool would stimulate multi-stakeholder learning, debate and negotiation later in the policy process.

Once the biofuel sustainability principles and criteria were drafted, the focus shifted towards developing a guide for implementation. On the basis of our research findings from Brazil and experiences with other certification/sustainability schemes in Mozambique, we proposed a government-led, mandatory framework that was to be integrated into the existing Mozambican legislation. This proposal was quite sensitive, as our study had also shown that enforcement of laws and legislation is generally weak in Mozambique. From our (institutional) analysis of biofuel-related legislation, we concluded that – instead of developing separate legislation – data requirements under the existing Project Application and Land Acquisition Process could potentially be adapted to assess the sustainability of biofuel operations in Mozambique. This procedure was generally perceived as effective and powerful, as was demonstrated when the Mozambican government used it to void the contract of a biofuel company that failed to comply with their contractual obligations. Another advantage of the procedure was that it allowed for discrimination between commercial and smallholder producers, as the smallholders do not have to comply with the procedure.

Political lobbying and develop institutional capacity

When the draft sustainability framework was nearly finished in February 2010, CONDES proposed that the TS and SSC should continue directly with the development of sustainability indicators, before consulting civil society and private sector stakeholders. Informally, we heard that a high government official had questioned the level of detail in the draft Version 0 (principles and criteria) and had concluded that a framework without indicators was not worth discussing with other stakeholders.

We faced a dilemma: continue to work on the indicators and – most likely – lose the support of civil society and private sector stakeholders, or, refuse to develop the indicators, which most probably would have resulted in the end of the TS. We discussed the situation with people in our informal network and colleagues, resulting in an internal memo including strategies to constructively criticise the government's proposal and find ways to penetrate the political agenda. Our main argument was that stakeholder participation was formalised in the NBPS and that not consulting stakeholders would endanger the credibility, legitimacy, acceptability – and consequently – the implementability of the biofuel sustainability framework. Moreover, multi-stakeholder consensus was described in the ToR and would create political backstopping on the principles and criteria (phase 1), before continuing with the development of indicators (phase 2). The memo was discussed during a meeting with the chair of the NBT and proved to be convincing, as it was decided that a first of in total three stakeholder consultation workshops should be organised as soon as possible. As the planned research period was coming to an end (the original proposal stated that the research would take till February 2010), we contacted our managers at the university with the request to extend the research period; this was granted.

The event created awareness that more structural institutional problems needed to be addressed. The TS proposed to expand the SSC by including representatives from different government departments that would be affected by the implementation of the biofuel sustainability framework (departments that played a role in the Project Application and Land Acquisition Process). A number of meetings were organised in which the TS and the 'new' SSC discussed the original ToR, the research that had been conducted, and how the drafted criteria and principles as well as the guide for implementation and discussion-support tool had evolved from that. The joint learning process between researchers and policy-makers

that emerged was useful. It resulted in changes in the sustainability framework, which – as a result – lost some of its research-based character. However, the overall quality of the framework improved, and within the SSC ownership of the framework increased substantially.

Creating an enabling environment for multi-stakeholder learning

For the stakeholder consultation workshops, the TS proposed an interactive workshop methodology to optimise multi-stakeholder debate. As there had been a general lack of multi-stakeholder learning and negotiation so far, we proposed to spend as much time as possible in small, heterogeneous stakeholder groups to discuss the principles, criteria and guide for implementation. The discussion-support tool was proposed as a way to stimulate discussion and debate during the workshops.

In March 2010, the TS and SSC presented the workshop methodology to the chair of the NBT. Although we had to defend the proposed workshop methodology to work in small groups, rather than organising a – more common – plenary workshop, the approach was approved. As the majority of SSC members were not familiar with facilitating group work and observing discussions, the TS organised a training session in which we did role-plays and practiced observing and note-taking. We moreover lobbied to organise financial resources for the workshops, amongst other things by mobilising our formal and informal networks. After several rounds of discussions, three organisations provided funds to support the three stakeholder consultation workshops in Maputo, Nampula and Beira.

Facilitating joint learning and multi-stakeholder negotiation

The first stakeholder consultation workshop was organised in Maputo in May 2010. The 70 participants included government officials, private sector and civil society stakeholders, researchers, and representatives from embassies and development organisations. We were somewhat surprised about the relative enthusiasm on the part of the private sector and civil society about the framework.

After the first workshop, the TS facilitated a meeting to analyse and process the feedback and written comments we had received through both regular mail and e-mail. The subgroup also received support from a senior consultant working with the Roundtable for Sustainable Biofuels, who had been hired to support member states of the Southern African Development Community (SADC) in formulating national biofuel policies and strategies. The TS played a crucial role in facilitating the communication between the consultant (who did not speak or read Portuguese) and the SSC, which eventually resulted in draft Version 1 of the Mozambican biofuel sustainability framework.

This draft Version 1 was discussed in workshops in Nampula and Beira in October 2010, attended by 85 participants. A substantial difference from the Maputo workshop was that members of the SSC (and not the TS) presented the framework, thus underlining the increased ownership over the framework within the SSC.

Creating an enabling environment for phase 2

After the workshops, the TS and the SSC members analysed and processed the feedback, which resulted in the final Version 1 of the biofuel sustainability framework. Some criteria were added, removed or modified, but the overall structure of the framework and the guide for implementation were accepted by the stakeholders, making Mozambique the

first African country with a national biofuel sustainability framework. Together with some members of the SSC, we reflected on phase 1, of which the most important lessons learned were presented to representatives of other SADC member states during a SADC Biofuel Taskforce workshop.[10]

Towards the end of phase 1, we actively supported the SSC in developing ToR for phase 2, in which the need for a new TS and the continuation of the multi-stakeholder debate were formalised. Together with the Dutch Embassy and colleagues at Wageningen University, we explored how and in what form a TS for phase 2 could be organised and funded. Proactively, we initiated exploratory research focusing on how existing biofuel sustainability indicators could be used or modified to fit the Mozambican framework, and conducted additional institutional analysis on how the existing Project Application and Land Acquisition Process could be upgraded to effectively assess the sustainability of biofuel projects in Mozambique.

Analysis and discussion: knowledge and innovation management in policy processes

Below, we analyse and discuss our empirical data in accordance with the two main objectives of the paper. Both sections provide examples from our action research to illustrate: (1) the relationship between KM and IM in policy processes, and (2) how, in what roles and under what conditions researchers (be it as knowledge or innovation managers) can enhance their effective contribution to policy processes.

Relationship between KM and IM in policy processes

Upon our arrival in Mozambique, the conditions for multi-stakeholder learning and KM were not optimal. Although the Mozambican government had intended to work together with civil society organisations and private sector in developing a biofuel sustainability framework, these stakeholder groups were not organised, and decreased government commitment had resulted in a weak position of the SSC. Consequently, the subgroup did not get off the ground, let alone provide a platform for multi-stakeholder learning. In terms of KM, it did not provide a situation in which we could jointly develop research questions, and design the research in close collaboration with the stakeholders. Although this example does not really illustrate the relationship between KM and IM, it did create awareness for us as researchers that we had to engage in other activities before we could contribute meaningfully to multi-stakeholder learning, as some of the fundamental preconditions for effective KM were absent.

Based on our contribution the subgroup's ToR, we decided to describe and explain biofuel developments in Mozambique from an interdisciplinary perspective, taking into account different levels of policy influence. Our holistic research approach 'forced' us to collaborate with different groups of stakeholders, which did not only result in data about the sustainability or unsustainability of the emerging biofuel sector, but it also exposed potential mismatches between the stakeholder's objectives, as well as the legal and political space within which policy solutions could be explored. We put a lot of efforts on safeguarding the credibility, but also the relevance and legitimacy of our study to different stakeholder groups. In the case of the government, this was strengthened by the joint analysis of our research findings with a policy-maker from CEPAGRI. However, also within other stakeholder networks our research findings (notably the maps that we used to visualise our findings, e.g. Figure 3) were perceived as credible and relevant, and facilitated

a degree of shared understanding about what was driving the direction of the emerging biofuel sector in the country. In doing so, the process of knowledge production provided the basis for intensifying the interaction and collaboration with the different stakeholder groups. In the case of the civil society, for example, we actively contributed to network and vision development, which strengthened their position in the policy debate. It shows how effective KM (the holistic research approach, safeguarding the credibility, relevance and legitimacy of the research) provided the basis for IM activities (build and support stakeholder networks and coalitions) that contributed to more effective multi-stakeholder learning later in the policy process.

Our embedded position in the different stakeholder networks enabled us to conduct in-depth stakeholder analysis. This resulted in valuable knowledge and insights for drafting a sustainability framework that would be acceptable for different stakeholder groups. We could also signal problems more easily, for example that due to the limited space for multi-stakeholder debate and negotiation, civil society organisations and private sector were losing their trust in the policy process. Our position also provided the basis for effectively identifying and responding to (changing) knowledge demands, connect different stakeholders and stakeholder networks, and update them on the policy process. It illustrates how KM (joint learning with stakeholders) created a situation in which we could better understand stakeholder perceptions, and (more fundamental) institutional and relational dynamics. Consequently, it created awareness that addressing these dynamics as part of an IM strategy would highly affect the degree to which our research findings could provide an effectively basis for multi-stakeholder learning and negotiation in the policy process.

A last example of how KM and IM are closely connected relates to our efforts to support the multi-stakeholder consultation workshops. We constructively criticised the government's proposal to postpone stakeholder consultation till after the development of biofuel sustainability indicators. We expected serious problems with regard to the progress and quality of the policy process, as not consulting stakeholders would reduce the credibility – and eventually the acceptability and implementability – of the biofuel sustainability framework. Moreover, stakeholder participation had been formalised in both the ToR of the subgroup and the NBPS, which created a legal basis for stakeholder participation. In order to penetrate the political agenda we engaged in political lobbying and mobilised our informal network, which eventually led to the decision not to postpone stakeholder consultation. In so doing our efforts contributed to creating an enabling environment for multi-stakeholder learning.

Roles of researchers in policy processes

In line with the previous section, we conclude that the combination of KM and IM roles may enhance the effective contribution of researchers to policy processes. The participatory action research approach provided a degree of flexibility to adapt our research to the changing context, and the uncertainty and unpredictability of the policy process. Based on regular reflection, we fulfilled a variety of KM and IM roles in the policy process, from the analysis of biofuel investment proposals to strategic lobbying to create an enabling environment for multi-stakeholder learning. According to Hoppe (2005, p. 202), such use of '[M]ultiple research methods in a context of argumentation, public debate and political struggle [is needed] in order to create, evaluate and communicate policy-relevant knowledge'.

As embedded researchers, we had better insight into the dynamics of the policy process, which enabled us to strategically fulfil certain knowledge and innovation management roles. Initially, we succeeded in creating and maintaining a degree of independence, but, when the government approached us to draft Version 0 of the sustainability framework, the dynamics in the policy process changed, and we were forced to think more carefully about our position and role in the process. This required the active management of the boundary between research and policy. Where we initially sought to 'blur' the boundary in order to embed ourselves in the policy process and the different stakeholder networks, we eventually also emphasized and used the boundary between research and policy to respond to accusations of defending specific stakeholder interests and to remain credible to the different stakeholders in the policy process (cf. Giller *et al.* 2005). The effective contribution of researchers to policy processes therefore very much depends on how the boundary between research and policy is managed during different phases of the policy process (cf. Jasanoff 1990).

Although our initial research proposal stated that the research was supposed to take until February 2010, the evolution of the policy process made us realise that we needed more time to effectively mobilise the research findings in the policy process (eventually phase 1 of the policy process was finalised in November 2010). We think this pleads for more process-oriented research approaches in which researchers seek to strategically position themselves in policy processes (Pielke Jr. 2007, p. 9), rather than transferring their knowledge when the research project is finished.

Conclusions

KM as part of a research strategy that focuses on producing credible, relevant and legitimate knowledge through processes of multi-stakeholder learning is crucial, especially in policy processes characterised by high uncertainty and the involvement of many stakeholders. The basis for effective KM in policy processes is grounded in a holistic and interdisciplinary research approach (cf. Hoppe 2005) that takes into account all relevant levels of policy influence (cf. Giller *et al.* 2008), and the needs and interests of different stakeholders. Consequently, KM can facilitate access to different stakeholder networks and provide insights into the more structural enabling and constraining institutional and relational dynamics in policy processes. However, to deal with such dynamics, KM alone is often not enough. We believe that addressing such dynamics may require researchers to engage in more strategic IM activities to improve the quality of policy-making. Consequently, this may also enhance the actionability of research in policy processes. In doing so, IM can create the conditions for more effective KM, for example by engaging in political lobbying or building stakeholder networks to create an enabling environment for multi-stakeholder learning.

We do not, and cannot, present a magic formula of what combinations of KM and IM strategies or roles are effective in policy processes. On the basis of our experience, we can conclude that the active embedding of researchers and an action-oriented research approach can enhance in-depth insight into the dynamics of the policy process. Furthermore, it provides a certain degree of flexibility to continuously determine what solution space exists in policy processes, and – based on systematic reflection – decide on the most effective (combination of) KM or IM strategies or roles to enhance the actionability of research in,

and the quality of the policy process. It pleads for process-based rather than project-based research approaches that provide researchers with the time and resources to become more flexible and actionable in policy processes, in which the active and strategic management of boundaries between research and policy is key.

Concluding, KM and IM are mutually reinforcing and inextricably bound. KM can provide the basis for engaging in IM activities or roles, which may consequently contribute to creating an enabling environment for more effective KM in policy processes. Our case demonstrates that notably the combination of KM and IM activities and roles can enhance the effective contribution of researchers to policy processes.

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Notes

1. Van Buuren *et al.* (2004, p. 14) describe four KM strategies. We chose to combine 'boundary work' and making 'timely and accurate connections between research process and policy negotiations'.
2. The innovation systems literature mainly refers to 'innovation brokers' (cf. Klerkx *et al.* 2009).
3. Dutch Ministry of Foreign Affairs (DGIS), the Mozambican Centre for the Promotion of Agricultural Investment (CEPAGRI), which is part of the Mozambican Ministry of Agricultural (MINAG), and Wageningen University and Research Centre (WUR).
4. National Council for Sustainable Development (CONDES), part of the Mozambican Ministry for Coordination of Environmental Affairs (MICOA).
5. 'We' refers to the researcher from Wageningen University and a Technical Advisor from GTZ-ProBEC; the Programme for Basic Energy and Conservation (ProBEC) of the German Technical Cooperation (GTZ) – http://www.probec.org. GTZ-ProBEC provided technical support to the SADC Energy Sector and SADC Biofuel Taskforce.
6. Woodhill (2004, p. 47) defines social learning as: '[B]ringing together different stakeholders (actors) who have an interest in a problem situation and engaging them in processes of dialogue and collective learning that can improve innovation, decision-making and action'.
7. We first compared frameworks by the Roundtable of Sustainable Biofuels (RSB), the EU policy framework for sustainable biomass production the Dutch Cramer Criteria and the UK's Renewable Transport Fuels Obligation (RTFO) (see: Schut *et al.* 2010a, p. 16). As the EU and RSB frameworks were in the process of being developed, we studied the policy proposal by the Counsel of the European Union (17086/08 of December 11, 2008), and Version Zero of the RSB. During a later phase in the research, we also studied biofuel sustainability frameworks developed by the Better Sugarcane Initiative (BSI), the Global Bioenergy Partnership (GBEP) and SADC.
8. This procedure links the processes for awarding land titles and approving investment proposals of large-scale commercial agricultural projects (Schut *et al.* 2010c, p. 5154).
9. The original terms of references stated that civil society organisations and the private sector would be part of the SSC. It is also important to notice that the NBPS stressed the government's intention to actively collaborate with civil society organisations and private sector in the development of biofuel sustainability criteria.

10. Note that the presentation at the SADC Biofuel Taskforce workshop took place in August 2010, shortly before the stakeholder consultation workshops in Nampula and Beira.

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