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Making sense together: The role of scientists in the coproduction of knowledge for policy making

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Abstract

New forms of knowledge production that actively engage in different types of knowledge in participatory settings have emerged in the last two decades as 'the right thing to do'. However, the role scientists play in facilitating these processes remains unclear. This article contributes to calls for more deliberate and critical engagement between scholarship and practice of the co-production of knowledge by constructing and testing a conceptual framework based on the literature outlining specific task for scientists in co-production processes. This framework is used to analyze the co-production of knowledge for local food security policy in South Africa, based on documentary analysis and in-depth interviews with scientists, policy makers and stakeholders. It shows that the tasks set out in the conceptual framework provide a useful lens for unpacking, and so better understanding, the role played by scientists in knowledge co-production. Applying the framework also helps to uncover insights into proximate outcomes of co-production, such as increased capacity and power redistribution, as well as critical contextual factors, such as the type of policy problem and the prevailing governance framing. The article concludes that more nuanced and critical understanding of the role of scientists in the co-production process will help over-come the apparent paradox that, although co-production is a 'buzz word', researchers often they still adhere to objective and linear knowledge production.

Key words: coproduction; knowledge brokering; knowledge exchange; science–policy–practice interface; evidence-based policy making; food security

1. Introduction

It is now broadly accepted that complex 'wicked' policy problems, such as food insecurity, cannot be solved by technical expertise alone. It is argued that these types of policy problems require the successful integration of scientific knowledge with local knowledge of the particular social, ecological, and historical circumstances (Coen and Roberts 2012; Gollagher and Hartz-Karp 2013). This realization has led to calls for new ways of doing science that actively engage in different types of knowledge in participatory settings (Funtowicz and Ravetz 1993; Nowotny et al. 2001; Turnhout et al. 2013; Spruijt et al. 2014).

Shifting toward more integrated and participatory forms of research, however, is not without its challenges or critiques. It requires scientists to acquire new skills, ways of learning, and working together across organizational, social, and economic lines and new ways of drawing upon insights from many disciplines and ways of knowing (Ramaley 2016). It also requires more empirical understanding of how to nurture the kind of knowledge production that leads to sustainable outcomes (Lemos et al. 2018: 722). Not all coproduction of knowledge leads to inclusion and desirable use of that knowledge and not all knowledge needs to be coproduced (Lemos et al. 2018). Despite these new ways of doing science increasingly being seen as 'the right thing to do' (Maasen et al. 2006: 394), recent literature has pointed to a dearth of empirical evidence about what they entail in practice, at what costs and with what outcomes (Maasen et al. 2006; Oliver et al. 2019). In particular, much of the research on the role of scientists in politics and policy making is theoretical and empirical verification of these models is often lacking (Michaels 2009; Turnhout et al. 2013; Spruijt et al. 2014; Lemos et al. 2018). Indeed, many studies describe a hypothetical normative situation of what 'should be achieved rather than the current situation that can be investigated empirically' (Spruijt et al. 2014: 23). Thus, what the new roles of science mean in practice, and the role scientists should play in facilitating this, remain uncertain (Maasen et al. 2006; Turnhout et al. 2013; Yang 2017).

This article contributes to the previous literature on coproduction of knowledge by responding to these calls for more deliberate and critical engagement between scholarship and the practice. We use the definition of the coproduction of knowledge offered by Armitage et al. (2011: 996) as 'the collaborative process [between science and nonscience actors] of bringing together a plurality of knowledge sources and types together to address a defined problem and build an integrated or systems-orientated understanding of that problem'. By constructing a conceptual framework from the literature on science–policy interaction and then empirically testing this in a real-world example, the article seeks to shed light on the role of scientists when facilitating coproduction processes. It is hoped that the framework can both be used as a conceptual lens to better understand knowledge coproduction processes in practice as well as a heuristic model for scientists designing similar coproduction processes in future.

In the next section of the article, we set out some of the literature on different models of science–policy interaction before digging more deeply, in Section 3, into this literature to construct a conceptual framework setting out the specific tasks of scientists when facilitating new modes of knowledge production. These tasks are organized into three phases: problem exploration, problem puzzling, and problem-solving. This framework is then used in the next (empirical) section of the article as a lens to explore the real-world experiences of scientists in the coproduction of knowledge for local food security governance in South Africa. In Section 5, we reflect on the 'fit' of the framework to the practical case and highlight some of the key points that differentiating the tasks of scientists in this way reveals. We also suggest ways that the framework could contribute to future research on the coproduction of knowledge.

2. The multiple roles of science in policy making

In the traditional 'two worlds' model of the interaction between science and society, 'facts' generated independently in the scientific realm are supplied across a science–policy gap to policy makers who search for the 'best' or 'right' evidence to underpin their decision-making (du Toit 2012; Vogel et al. 2007). This instrumental use of knowledge assumes that it is possible to understand how policy can impact upon and alter social outcomes (Pawson and Tilley 1997) and that experts, including scientists, can and should play a central role in the process of 'getting evidence', analyzing it and communicating its implications to policy makers (du Toit 2012). Stimulated by the mantra of 'what works is what matters' that followed the election of the Labour government in the UK in 1997, 'Evidence Based Policy Making' (EBPM) became the embodiment of this linear rational model of the science–policy interface (Bohme 2002). Indeed, it is still very much in vogue by governments around the world, despite its many detractors (Clarence 2002).

Postpositivist authors have long argued that knowledge is seldom used to directly inform policy decisions in the neutral and objective way assumed by EBPM (e.g. Bulmer 1987; Weiss 1995). As Juntti et al. (2009: 208) argue:

> [t]he way evidence is produced, selected and interpreted in policy-making and implementation is heavily influenced by decisions about social values and moral and ethical choices.... Moreover, the evidence-policy relationship is further complicated by the interplay of complex institutional processes and actors representing different forms of expertise and interests. Such interactions characteristically operate in obscure and complicated power relationships.

Schön (1979) uses a generative metaphor of a 'policy swamp' to describe this messier model of knowledge in policy making in which a world of change, full of complexity, uncertainty, and ignorance. Only the 'hard high ground' envisaged by the positivist conceptualization of EBPM is territory capable of being 'mapped' and 'occupied' through the instrumental production and use of evidence (Parsons 2002).

In contrast, determining a way ahead in Schön's 'policy swamp' points to the need to develop a more communicative approach to the production and use of policy-relevant knowledge (Parsons 2002). Here knowledge performs a broader 'enlightenment' function in the policy process slowly stimulating social learning of decision makers over time (Weiss 1995). As a result, significant scientific and practical interest has grown in boundary organizations that can form a communication link and provide information brokerage services between the science and policy worlds (e.g. Cash 2001). However, this still assumes that science and policy making inhabit separate worlds that need to be 'bridged'. Other authors have gone further to call for new forms of knowledge production that actively engage in different types of knowledge in participatory settings so that the boundary between science and nonscience becomes blurred (Turnhout et al. 2013).

Various conceptions of this hybrid form of knowledge production have been articulated in the literature: Gibbons, Nowotny, and colleagues (Gibbons et al. 1994; Nowotny et al. 2001) introduced Mode 2 Science to illustrate how new forms of knowledge production are moving away from purely disciplinary perspectives with traditional quality control, such as peer review (Mode 1 Science) toward more democratic forms developed through applied work involving scientists across multiple disciplines and also actors outside science (Mode 2). Literature on transdisciplinary research also describes a process of mutual learning between science and society and understands knowledge production as a process that includes a variety of actors and with an open perception of the relevance of different forms of information produced by the scientific and lay community (Mobjörk 2010; Lang et al. 2012). The literature on postnormal science calls for the management of uncertainty through employing a plurality of perspectives within and outside science and the internal and external extension of the peer community to include representatives from social, political, and economic domains that openly discuss various dimensions of risks and their implications for all stakeholders (Funtowicz and Ravetz 1993; Petersen et al. 2011). More recently, literature on the coproduction of knowledge through collaboration between scholars and stakeholders has come into popular focus generating its 'own brand of support and tension' (Lemos et al. 2018: 722) (see below).

All of these literatures are based on the understanding that integrating different types of knowledge (e.g. socioeconomic, political, and scientific) through the coproduction of knowledge with stakeholders leads to knowledge that is not just scientifically rigorous but also socially robust and policy relevant (Nowotny et al. 2001; Diver 2017). In contrast to EBPM, Sanderson (2009) describes this as 'intelligent policy making': 'What matters is arriving at decisions which are reasonable and appropriate in situations that are both morally and factually ambiguous' (Sanderson 2002: 71).

The recognition of the potential benefits of these new forms of knowledge production has led to emergence of coproduction being seen as the 'gold standard' of engaged science (Lemos et al. 2018: 722). However, a growing number of authors caution against the uncritical adoption of coproduction as a panacea pointing to the many costs and risks associated with this approach (Maasen et al. 2006; Lemos et al. 2018; Oliver et al. 2019; Wynborn et al. 2019). Costs range from the large amount of time and resources required to initiate and manage these processes to the potentially professional costs dealing with tensions that can arise working across disciplines (Oliver et al. 2019). Questions have also been raised about whether all coproduction necessarily leads to better outcomes (Lemos et al. 2018; Wynborn et al. 2019). While not dismissing the merits of coproduction, critics have called for its widespread advocacy to be tempered by more empirical research on which strategies are the most promising and how these strategies actually operate in practice (Maasen et al. 2006; Oliver et al. 2019; Wynborn et al. 2019).

The next section of this article attempts to respond to these calls for more deliberate engagement between critical scholarship and the practice of coproduction by interrogating the literature to tease out the main tasks for scientists embarking on the coproduction of knowledge for policy making.

3. The role of scientists in the coproduction of knowledge: a conceptual framework

While the distinction between the different roles of scientists is not always clearly made, across the existing literature on the science–policy interface a number of collaborative tasks and activities undertaken by scientists when tackling complex wicked policy problems are mentioned. In this section of the article, we collate these insights and organize them in a loose framework that groups the tasks in three phases: 'problem exploration', 'problem puzzling', and 'problem-solving'. These phases are ideal types corresponding to apparently sequential phases of the coproduction process. However, in practice these phases, and their composite tasks, are overlapping and iterative. The framework of potential tasks of scientists in the coproduction of knowledge is set out in Table 1 and further elaborated in the text below.

3.1 Problem exploration

In the problem exploration phase, scientists work hard to help all stakeholders reconsider what they perceive the policy problem to be. This may involve departing from previous assumptions and widening the accepted understanding of the boundaries of the problem as well as actors involved.

One of the first tasks that scientists need to consider, therefore, is to identify if the policy problem has been previously processed by policy makers using path-dependent, structured problem definitions

Table 1. Potential tasks of scientists in the coproduction of knowledge.[a]

Problem exploration
- Deconstruct policy problems to open up cognitive frames to new actors and ideas
- Locate and invite a wide range of actors for face-to-face dialogue
- Facilitate 'thick communication'
- Identify and clarify diverging views and values
- Overlay existing concepts from literature on problem narratives and frames

Problem puzzling
- Translate and interpret complex scientific information to a diverse audience
- Gather ideas (including from the periphery)
- Link scientific analysis to public debate by deliberative two-way communication
- Help ground factual information in local socioeconomic, ecological, and political contexts

Problem-solving
- Decompose a problem into solvable parts
- Find realistic problem-solution couplings
- Balance standard operating procedures and intellectual chaos
- Recognize the implications of current levels of capacity while also building capacity

[a]Authors' own compilation.

that exclude alternative frames. If so, then scientists can act to deconstruct the 'structured' problem, opening up the existing problem framing to new actors and ideas (Fischer 2002; Hoppe 2017).

Another important task in this phase is to identify, locate, and invite actors drawn from a broad range of viewpoints (Blowers et al. 2007). This may be difficult if the policy problem in question is emergent and the relevant stakeholders not yet coalesced in an advocacy coalition or have previously been excluded due to a narrow framing of the policy problem.

Once identified, scientists need to facilitate 'thick communication' with these stakeholders. According to Hoppe (2017), for newly emerging issues, empirical data at best provide a first-cut approach but should not be assumed to form a full analysis. Rather, 'listening to and registering narratives of stakeholders about their problem perceptions and experiences is the only feasible way to get a feel for the problem' (Hoppe 2017: 13). To facilitate this level of communication, scientists can design a good interactive approach based on deliberation—unconstrained dialogue—making sure that everyone wants to be involved and build trust (Turnhout et al. 2013). Equality is essential for deliberative processes (Abdullah and Rahman 2015). Therefore, scientists must be careful not to revert to 'teacher–student' roles, which may insert power imbalances (Hoppe 2010) and preempt the viability of the next steps.

The purpose of nurturing this dialogue between stakeholders and scientists is 'to articulate competing perspectives so that stakeholders can learn from each other' (Spruijt et al. 2014: 21). Provided the process abides by agreed rules, scientists can facilitate constructive conflict to clarify diverging views and values so that even when stakeholders do not agree, they can develop an understanding of each other's perspectives (Hoppe 2010; Cuppen 2012). Scientists can also hold different perspectives when advising on complex issues and so dialogue can also be used to explicate the different points of view within the expert community (Spruijt et al. 2014: 21).

Finally, to connect and illuminate the perspectives of the policy problem uncovered by this dialogue between stakeholders, it can be useful to overlay existing concepts from the literature and theory on the emerging problem narratives and frames. Schön's (1983) detailed empirical study on practices of reflective designers shows that problem exploration and categorization is essentially a trial-and-error process of problem framing. 'More often than not, problem exploration and categorization mean imposing well-known disciplinary or professional concepts, standards, models and theories as an "overlay" on the problem frames discovered in social and political debate' (Hoppe 2017: 15).

3.2 Problem puzzling

Once the policy problem has been collectively explored, and potentially defined, the puzzling of the probing possible policy alternatives begins. In this phase, scientifically generated knowledge can be embodied in people, processes, and places (i.e. contextualized in the context of the intended use of that knowledge). One of the essential tasks here is, therefore, to help decipher and interpret complex issues to a wider public audience, thus facilitating public involvement in decision-making (Fischer 2002).

Scientists do not, however, have the monopoly on knowledge and must also gather ideas from stakeholders, including from the periphery. By facilitating face-to-face deliberation between a wide range of stakeholders, scientists can encourage the free expression of ideas, views, and beliefs (Blowers et al. 2007). This can provide an opportunity where learning is primarily located in 'discovered systems at the periphery', not in the nexus of scientific knowledge and official policies at the center. In these circumstances, the scientists' role is not to ascertain the best course of action based on the 'evidence' and then to educate society but rather to help 'detect significant shifts at the periphery, to pay explicit attention to the emergence of ideas in good currency, and to derive themes of policy by induction' (Schön 1973: 166).

There is in any case often uncertainty in the 'evidence': Funtowicz and Ravetz (1990: 20), in their well-known paper introducing postnormal science, argue that there are now many issues where 'the facts are uncertain, values in dispute, stakes high and decisions urgent'. Linking scientific analysis to public deliberation in an iterative process can help decision-making deal effectively with this uncertainty. Through facilitating thick stakeholder communication and deliberation, the hope is that scientists can 'provide a way of enhancing mutual understanding of facts, including their uncertainty, and values, as well as value differences' (Dietz 2013). In this way, many studies have argued for linking scientific analysis with public deliberation in an 'analytic deliberative process' in which scientific analysis informs and is informed by public deliberation about the issues (Dietz 2013: 14083).

Linking public deliberation with scientific expertise can also contribute to factual understanding by helping to ground abstract knowledge in the local context. This can include 'traditional ecological knowledge, expertise about values, and political expertise' (Dietz 2013). This knowledge is grounded in the community rather than in scientific discourse and amounts to expertise in what might work and what might not, given the stance of other political actors and the capacities of local organizations and institutions (Dietz 2013).

3.3 Problem-solving

Once the policy problem has been explored, knowledge about the problem gathered, contextualized, and synthesized, the next step is to determine what elements of the problem (in the form of policy gaps) can be bridged or solved. An essential element of this process, therefore, is to decompose a problem into solvable parts. Problem decomposition is either 'a protracted framing tug-of-war, or a bumpy learning process between different views on how to decompose an issue in politically acceptable, and more or less solvable, sub-problems', while bearing in mind that the sum of partial problems acknowledges the problem as a whole (Hoppe 2017: 16). Finding suitable 'problem-solution couplings' is another important task as problem definitions and solutions cannot be framed independently of each other. A problem definition ought to be seen as a realistic opportunity to improve a past and current problematic situation. This means that scientists may need to think not in terms of idealistic policy goals, but in terms of 'realistic problem-solution couplings' (Hoppe 2017: 18).

A further task in this phase is to balance standard operating procedures and intellectual chaos. Most day-to-day policy making and implementation relies on standard operating procedures around a small set of allegedly feasible solutions (Hoppe 2017). But they can also result from political games which can strongly bypass and short-circuit the usual processes. When truly novel problems emerge, political prejudice and organizational inertia are likely to kick in, reinforcing the propensity to be overwhelmed and carried away by the apparent intellectual chaos, complexity or 'wickedness' of these problematic situations (Hoppe 2017). The role of scientists is to provide balance between business as usual behavior and the chaos of the unknown.

Finally, scientists should attempt to recognize the implications of current levels of capacity while also building capacity: Exogenous 'best practice' solutions that fail to include the existing levels of capacity as part of the planning process have a history of failure. In contrast, an approach that begins by explicitly recognizing existing practice and capacity within the system is far more likely to lead to adaptive and sustainable responses to policy problems (Andrews et al. 2017). Beyond this, the interaction between scientists and other stakeholders can build both groups capacity to have open debates about the difficult issues concerning uncertainty, complexity, knowledge gaps (Dietz 2013; Rudd 2015). Similarly, scientists engaging with problems within the messiness of local contexts require their learning to move beyond the theoretical into the practical, including the understanding of the political landscape which can impact the policy process. Deliberative processes can also lead to an evolution of values in the face of emerging and highly complex issues by encouraging people to see the other viewpoints (Dietz 2013). They can also help all participants to build relationships and networks with which to collaborate and coordinate in the future.

The next section of this article uses this conceptual framework of the tasks in the coproduction of knowledge set out above as a lens to analyze the role of scientists in a real-world example of knowledge coproduction for food security governance in the Western Cape Province in South Africa.

4. Case study and methods

4.1 Research context

South Africa is considered food secure at the national level and consistently exceeds the dietary needs of its population, some 58 million people in 2018 (FAO 2017). Despite this, household food insecurity in South Africa is high when compared to countries of similar economic development. In 2015, 25 per cent of the population lived below the national food poverty line (Statistics South Africa 2017a). In 2016, South Africa's Demographic and Health Survey reported that 27 per cent of children under the age of fifty-nine months had stunted growth (Statistics South Africa 2017b). At the same time, the same survey shows that 68 per cent of adult women and 31 per cent of men are considered to be either overweight or obese, which has translated into high prevalence of diet-related noncommunicable disease. Despite the Western Cape Province's prosperity, when compared to other South African provinces, and its well-established food system, in 2015 around 1.75 million individuals in the Western Cape had inadequate and severely inadequate access to food (Statistics South Africa 2017c). That is about 30 per cent of the population and slightly higher than the national average of 26.4 per cent. Notably, the largest city in the Western Cape—Cape Town—has the highest rate of households with food insecurity across all of the metros in the country, with 31 per cent of households reporting food access problems (Statistics South Africa 2017c). While the percentage of women in the Western Cape who are obese is significantly greater than the national average (37.9 per cent) (Shisana et al. 2014).

Improving household food security in the Western Cape is a policy problem worthy of Schön's 'policy swamp' metaphor. It is characterized by the lack of consensus on the norms and values at stake as well as a high level of uncertainty about the relevant knowledge available and needed to solve the problem. Rittel and Webber (1973) describe these types of problems as being 'wicked' and food security and nutrition issues in general, and in South Africa in particular, are fully part of the 'complex and wicked' category (May 2017). The challenge with unstructured problems is that they often consist of a cluster of interrelated problems. When you attempt to fix one problem you often find that there is another problem, which needs to be addressed as well. It becomes very difficult to disentangle this web of interrelated problems. As Wolfert (2016: 12) explains:

> Although decision makers and experts [in South Africa] see food security as a problem that needs to be addressed, there is little targeted action taken on this issue, beyond large social welfare programmes [and piece meal urban agriculture projects]. This lack of action may be seen as not only paralysis over the availability and reliability of knowledge but also a deep disagreement over the value of a society that allows food security to exist. The core causes of food insecurity may be our free-market food systems as well as the income inequalities that are created by our current economic and political approach to wealth redistribution.

Furthermore, food security in the Western Cape (and South Africa more widely) can be characterized as an 'emergent decision regime' (Lindquist 2001): Where the policy base has not (yet) emerged and so the policy area contains a relatively small number of actors at the outset and is wide open to the development of a broad vision.

Recognizing some of this complexity and messiness of the food security policy problem, the Western Cape Government launched a policy review process in 2013, which eventually led to the release for public comment in September 2016 of the draft Western Cape Household Food and Nutrition Security Strategic Framework (known as the 'Nourish to Flourish' strategy) (Western Cape Government 2016). This document was the result of an intensive process of stakeholder deliberation led by social scientists from several Western Cape universities. The process was commissioned by a small team of provincial government officials in the Policy and Strategy Unit in the Department of the Premier mandated to assist in policy issues cutting across government. The research approach was put forward by the scientists in late 2014 and four stakeholder workshops took place between May and July 2015. The first workshop included seventeen participants (the scientists, Department of the Premier officials, and other officials from Provincial departments) and developed the main themes for discussion in the following three stakeholder workshops. These were malnutrition, sustainable resource management, nutrition and education, increasing production, building partnership, value chain development, food-sensitive planning, monitoring and evaluation. The stakeholder workshops each included between thirty and forty-five local stakeholders ranging from rural farmers to informal traders and private business. They were supported by a consultant. The final report, on which the strategy was based, was drafted by the scientists (and to some extent the policy making team) iteratively from the time of the first workshop until the last draft delivered by the scientists in December 2015.

4.2 Materials and analysis

Two sources of evidence were used for this research. First, documentary analysis drawing on over a hundred unpublished workshop reports and minutes, participant lists, commissioned input papers, presentations, internal memos, and review comments made by both the scientists and Department of the Premier policy officials. Second, semistructured interviews with the lead scientists and policy officials involved in the workshop and drafting process. Altogether nine interviews were carried out to explore different perceptions of the role of scientists and other actors in the process. Selection of the interviewees was preceded by the document analysis that aimed at gaining a broad understanding of the main milestones and character of the process as well as the key scientists, policy officials, and stakeholders involved. The interviews were semistructured (Bryman and Teevan 2005) and lasted for 45–75 minutes. Approximately twenty open interview questions were arranged in three broad themes: the design and implementation of the stakeholder workshops, drafting the policy document, and evaluation and learning from the process as a whole. All interviews were recorded and transcribed. Both the transcripts of the interviews and the relevant documents were coded by hand using an .xls format in which the three phases and composite tasks outlined in the conceptual framework were used for the codes. Where there was overlap in the data between more than one task it was assigned a primary and secondary code. Left-over texts were revisited throughout the process. Actual findings are results from interactive analysis, reflection, and the writing process.

5. Results

5.1 Problem exploration

From the first workshop, the scientists worked to open the debate beyond the traditional focus on rural areas and agricultural production. First, by going beyond the 'usual suspects' of the departments of agriculture and health when inviting participants (IN 24 August 2017; IN 5 July 2019; SADC Research Centre and CoE FS 2015a, unpublished data). Second, scientists presented information on the urban nature of the food security challenge in the province: it was pointed out that 90 per cent of the population was urban and data was presented showing that households in the Western Cape mostly get their food from supermarkets rather than directly from agriculture (SADC Research Centre and CoE FS 2015a,b, unpublished data). 'So even at this early point there was a sense that this document was not going to be about agriculture, about producing more food' (IN 1 November 2017). In this first workshop, the debate shifted from food 'availability' (e.g. food production by the farms) to other dimensions of food security such as 'access' (e.g. consumers' income, retail planning, and the role of the informal sector) and 'utilization' (e.g. consumers' behavior and adequate nutrition) as well as governance issues (e.g. departmental coordination) (IN 5 July 2019; SADC Research Centre and CoE FS, 2015b, unpublished data). In this way the scientists opened up the different narratives of causality of the food security problem, which in turn opened up the range of potential solutions included in the conversations (IN 11 July 2019).

The scientists worked with the policy team to identify a broad range of stakeholders to take part in a series of workshops (SADC Research Centre and CoE FS 2015a,c, unpublished data; IN 5 July 2019; IN 11 July 2019). A snowball technique was used to identify potential stakeholders and an attempt was made to ensure that most groups or clusters of stakeholders were contacted (IN 15 May 2017; IN 25 August 2017; IN 24 August 2017; IN 22 August 2017). Consequently, the workshops brought in a lot of voices, including many alternative and radical voices that were critical of government (IN 11 July 2019; IN 1 July 2019): 'we had everyone from the Rooibos[1] farmer that had heard about the workshop and drove in from his farm to the child nutrition expert. So, it was a grab bag exercise' (IN 15 May 2017). Even the stakeholders known to be confrontational to government were not only invited to the workshop but given space to speak without deflecting their criticism (IN 11 July 2019).

Critical to the ethos of the stakeholder workshops was the apparent openness by the core scientist and policy team to the policy problem and its possible solutions (IN 11 July 2019; 5 July 2019). Rather than government officials speaking about their preferred policy approach, the methodology for the stakeholder workshops aimed to promote opportunities for stakeholders to put forward their perspectives of the food security problem (and solutions): in pairs, participants identified priorities (set out as objective statements) that they thought should be included in a provincial strategy on food security. Each person presented their priority area for three minutes to their subgroup; clarification was then sought on these priorities guided by a facilitator who helped the participants dig deeper to define the intervention logic, context, and potential partners. Subgroups then pitched their ideas to whole group at the end of the day when participants could vote on which ideas they thought were the most important and strategic ones to pursue in the Western Cape policy (SADC Research Centre and CoE FS, 2015d, e, unpublished data).

The scientists introduced discussion on the cross-sectoral nature of food security and the lack of communication between the various sectors as a barrier to better food governance (SADC Research Centre and CoE FS 2015a, c, unpublished data). This helped to provide context underlying the diverging views and values presented by the stakeholders as well as the different framings of urban versus rural food security. Household survey information presented by one scientist also helped to show that scale issues can help in understanding divergent perspectives. For example, food supply may be achieved at a national level through agricultural production and imports, but at the same time food security may become patchier when looking at a household level. Urban agriculture was a particularly contentious issue debated in the workshops. While this apparent policy solution was strongly advocated by some groups in the workshops, there were also some dissenting views with regard to the contribution of urban agriculture to food security in practice (IN 22 August 2017; IN 1 November 2017). The participatory methodology used in the workshops allowed for voting to shape which values or views gained traction in the workshops (IN 1 November 2017).

The researchers were able to show that the themes that emerged from the discussions matched the internationally agreed four-component definition of food security (i.e. availability, access, utilization, and stability) (SADC Research Centre and CoE FS 2015f, unpublished data; IN 15 May 2017).[2] This was reassuring to the policy officials as:

> it was confirmation that we were actually thinking about the whole system ... that we had thought of all the angles. It was important at every step to have academic partners in this as we had chosen such an unusual approach to gathering the evidence so we needed a vigorous pair of hands somewhere in the process and that was the ultimate assurance was that ultimately they would make sure that this was academically rigorous when we were making assertions one way or another. (IN 15 May 2017)

5.2 Problem puzzling

Short presentations at the beginning of the workshops were the main channel through which the scientists translated complex scientific information to the workshop participants. This includes three specially commissioned input papers in which food security specialists in the Western Cape attempted to distill the key policy-relevant points from their research (IN 1 November 2017; IN 1 July 2019; IN 11 July 2019). 'So for me the workshop was a quite important bridge between the research findings and thinking of these as something which has relevance for policy' (IN 1 November 2017). Empirical presentations were also made by the scientists to set out 'how we understand food security in the Western Cape' (IN 15 May 2017; IN 1 July 2019).

The participatory methodology for the workshops was explicitly designed to draw out ideas from all the participants (SADC Research Centre and CoE FS, 2015g–j, unpublished data). For example, 'if it [the theme] was about land then was it about planning by laws or was it about land ownership? So you listed all of these different things and were tasked to present to the wider group at the end of the day a possible project or initiative that would actually speak to that issue, which would represent a different way of tackling the problem. So it was a very wild and wooly process with all kinds of emergent stuff happening...' (IN 15 May 2017). 'People really got to stand up and engage with alternative point of views, without being shut down.... It was a really unstructured discussion which was good because lots of different ideas came out' (IN 11 July 2019). 'What happened over the course of the workshops is that we gathered a Smörgåsbord of potential ideas and what we were really doing was finding out what people were really doing in the sector because that was really happening was that people were really presenting their own idea and then there was a kind of selection of the fittest and only one idea was presented at the end of the day' (IN 15 May 2017). The role of the science and policy team was to collect as many ideas as possible in 'a living breathing document ... which went beyond the problem to get solutions' (SADC Research Centre and CoE FS, 2015k, unpublished data).

Scientific analysis and information presented by the scientists at the workshops through presentations and also general discussion was intended (by the scientists) to be linked with the perspectives and experiences of stakeholders:

> Researchers and academics bring a particular view, largely in a discipline or spatially . . . powerful views. When you engage those who are directly affected, those with a stake in the game, . . . differences emerge. But in a dialogue what happens is that ideas begin to emerge . . . it's not just about tick boxes that you have engaged with retailers, but putting retailers in a place where they are really forced to think as individuals, as people, and not just as people that are linked to certain interest groups. And this is where new ideas begin to emerge and then that begins to give opportunities to a strategy to see where the leverage points are, see what the issues are, understand more deeply what the concerns are. (IN 4 September 2017)

In a similar vein, the three commissioned input papers were intended to be more 'evocative' (i.e. to provoke thought) than a 'straight reading' and did not map onto the eventual discussion themes that emerged for the workshops (IN 15 May 2017). These papers were designed to give the participants 'a taste of all the complicated issues and having heard these combine that with their own work and see where that came out' (IN 15 May 2017).

The workshops were therefore intended to generate new ideas and insight into the real problems and possible solutions and a sense of what is happening on the ground (i.e. the local socioeconomic, ecological, and political context) (SADC Research Centre and CoE FS, 2015h, unpublished data). 'The hope was that by enlisting people that were embedded in the various parts of the system that we were talking about whether it was about nutrition or about production, that they would be able to talk better that they would be more knowledgeable about the topics that we were going to include into the policy' (1 November 2017). 'Repeatedly during this exercise the provincial people and the consultants[3] were emphasizing that what we should be building on what people were already doing' (IN 1 November 2017). There was also a hope that these activities would help us 'understand why some of these incredibly well resourced programs are having so little effect... It's about understanding what that interface is and that's where the multi-actor, multi-stakeholder process can be very powerful' (IN 4 September 2017). The introduction of political expertise mainly took place after the workshops during the drafting of the strategy document, for example, introducing the language of 'pillars' to structure the document to mirror the National Food and Nutrition Security Strategy (IN 1 November 2017). Specific details of government regulations and institutions (e.g. of planning by-laws) were also added into the drafts when this went beyond the knowledge of the scientist team and the workshop participants.

5.3 Problem-solving

In the first workshop, the scientists worked with the participants to divide the problem into smaller more focused themes (IN 1 July 2019; IN 4 September 15; SADC Research Centre and COE FS, 2015c, unpublished data). These set the topics and subtopics of the workshops to follow but did not necessary find their way into the six 'pillars' in the final strategy document. For instance, 'value chains' was one of the themes of the workshop, but evolved through the workshops into 'inclusive food economies' in the final policy document (Western Cape Government 2016). Throughout the workshop process 'the researchers kept an eye on the bigger picture to make sure that no angles were left out and bringing the group back to the bigger picture after focusing on "their" issue and potential solution' (IN 15 May 17). The workshops generated a huge amount of data: (IN 15 May 15; IN 5 July 19) 'and having gone through the whole process and bringing this all together we [the policy and scientific team] could sit together both in a systems perspective but also to think how to translate that into a programmatic approach: So how do you break it down into clear enough pieces that give you pieces of work that have clear enough focus' (IN 15 May 17).

The participatory methodology chosen meant that 'problems and solutions were actually thought of together in the workshops—as coupled entities. There was also an element of "back mapping" as this process helped identify who would be likely to implement the initiatives' (IN 25 August 17). Policy goals and problem-solution couplings were kept realistic in two ways: first, the scientific team were reminded participants that the ideas and solutions proposed must be within the mandate of provincial government (rather than municipal or national government); second, the close collaboration with the policy team meant that both the wording and the content of the policy document were aligned to political priorities (IN 5 July 19; SADC Research Centre and CoE FS, 2015c, unpublished data).

The scientist provided a balance between standard operating procedures and intellectual chaos in part by choosing not to draft a document setting out all the necessary or possible actions to achieve food security in a general sense, but rather rooting the analysis in the Western Cape and at a fairly high level:

> We were not setting out exactly what need to be done. Rather, we were setting out a lot of what was already being done – moving from a policy to a strategy... At the beginning we thought that we were writing a policy document and somewhere along the line we realized that we were writing a strategy document and somewhere over here we realized we weren't writing the strategy document, we were writing the proposal for the strategy document. (IN 1 November 17)

In addition, the close association with the policy team ensured that the scientists steered away from theory and literature in the policy document and focused instead on the practical stakeholder lead content from the workshops (IN 5 July 19; SADC Research Centre and COE FS, 2015l, unpublished data). For example, a comment on an early draft by the policy officials requested that the upfront material be drastically cut and kept to a minimum (SADC Research Centre and COE FS, 2015l, unpublished data). The policy team also helped shape the structure of the document as it was drafted so that it was more palatable for a political audience (IN 15 May 2017; IN 5 July 2019) and then again later for a public audience (IN 5 July 2019).

The deliberative approach adopted by the scientists helped build capacity of the stakeholders: it meant that they had to learn the tacit rules of engagement that go with coproduction processes, for example, something as simple as not interrupting people and listening until they are finished. 'These standard practices had to be learnt by this group' (IN 1 November 2017).

> I thought that they [the stakeholder workshops] were very useful and that they built up a lot of buzz about the western cape's policy a lot of people started talking about the Western Cape's Policy and I think that this has been helpful when they moved into the implementation phase. There is a familiarity within the

stakeholder group and they became quite familiar with this way of doing things of putting up your ideas and voting on it and accepting the vote. So there was a process here that was also important. (IN 1 November 2017)

6. Discussion

6.1 Differentiating the tasks of scientists

Applying the conceptual framework outlined above to the case study *ex post* (i.e. after the coproduction process had taken place) allows the role played by scientists in the knowledge coproduction process in practice to be unpacked and so better understood in relation to the existing literature. By differentiating between the ideal-type tasks of scientists, the framework helps to bring a level of clarity when viewing the activities of the scientists in the messy mélange of planning, discussions, workshops, reporting, and other activities that commonly surround coproduction processes in practice.

Once the individual component tasks of the scientists have been differentiated, it is then possible to identify those tasks that were more important in this case. For example, in the problem exploration phase, the scientists played a critical role in deconstructing the policy problem and opening it up beyond its traditional framing within the Department of Agriculture. Without this, the coproduction process would have looked rather different from a narrower range of stakeholders and a commensuratly smaller range of 'appropriate' solutions. In the problem puzzling phase, the scientists translated and interpreted current research through short presentations and background papers. However, the main emphasis was placed on using this information to provoke ideas and input from the participants. As an emergent decision regime (Lindquist 2001), both policy makers and scientists recognized from an early stage they held only parts of the information necessary to address food and nutrition security in the province. Furthermore, the cross-cutting nature of the problem pointed to the fact that many initiatives were likely to be already underway that addressed food security but were not labeled as such (i.e. a wide range of actors held valuable information). The scientists, therefore, designed a collaborative process in which knowledge traveled from the stakeholders to the scientists, who were then tasked with organizing this information. This is in stark contrast to the traditional model of science–policy interface where information flows from scientific 'expert' to stakeholder who then puts this knowledge into practice. It is also in contrast to reports of low stakeholder involvement in the formulation of national food and nutrition policy in South Africa (Pereira and Drimie 2016).

Capacity building was another critical role played by the scientists in this case, in which many stakeholders were previously unknown to each other and often unaware of the concept of food security. During the workshops, scientists aimed not only to impart an awareness of food security but also a sense of the 'rules of engagement' for group activities and dialogue. These practices were essential to the smooth running of the group activities (and the collection of information and ideas) but were also carried into subsequent dialogue and workshop processes as the strategy went onto the implementation phase.[4] Our results, therefore, support the assertion by Wynborn et al. (2019) that increased capacity is also a proximate outcome of coproduction. This is perhaps especially the case in emergent decision regimes where 'policy communities' (Rhodes and Marsh 1992) have not yet emerged. As a result of the participatory deliberation processes set up by the scientists in this case, information not only traveled from stakeholders to scientists but also from stakeholder to stakeholder. This created learning opportunities for the stakeholders to listen to (and begin to take on board) perspectives different from their own as well as strengthen interpersonal bonds and relationships. Recognition of the importance of capacity building and social learning in the governance of local food security eventually led to a core group of the scientists, policy makers, and stakeholders present at the workshops establishing a Community of Practice[5] on food governance in the Western Cape.

Unpacking the various tasks of the scientists in this case also helps uncover implicit power dynamics in coproduction processes in practice. According to Wynborn et al. (2019), the redistribution of power is another outcome of coproduction processes. Oswald (2016: 22) argues that '[t]here is rarely a neat fit between interests and perspectives involved and the coconstruction process will often involve the politics of knowledge that will be messy and contested'. According to Juntti et al. (2009), calls for the new role of scientists are often inattentive to these power relations that can emerge in practice. Relinquishing the superior position of scientific knowledge is a critical aspect of the (new) role of scientists in the coproduction of knowledge (Oswald 2016). By differentiating tasks that place emphasis on communicating scientific knowledge as well as those tasks that aim to draw out the knowledge of nonscientific 'experts', the conceptual framework helps to highlight possible power inequalities in the coproduction process. In this case, the emphasis placed on collecting ideas from a wide group of stakeholders shifted the balance of power from traditionally hierarchical relationships between scientists and stakeholders (and policy makers and stakeholders) by empowering traditionally marginalized groups of stakeholders. While the implementation of best practices is insufficient to resolve all contested issues and political tensions within coproduction processes, it can ensure that scientists are aware of them and consciously attempt to counter entrenched interests in an iterative process of reflection and mitigation (Wynborn et al. 2019).

6.2. Reflections on contextual factors

As mentioned above, the type of policy problem represented by food security in the Western Cape (i.e. cross-cutting and complex) points to the utility of a coproduction approach. The emergent nature of the policy problem also emphasizes certain tasks for scientists, such as opening-up the policy debate, collecting ideas, and capacity building. However, other contextual factors also helped create the necessary policy space for the coproduction of knowledge in this case. For example, the coproduction of knowledge is especially relevant for policy formulation in complex, dynamic, and divided societies, like South Africa 'where some of the most important policy debates and decisions involve decisions not only about means but also about ends' (du Toit 2012: 3). Here the question of 'what works well' may not have a clear, decisive, unequivocal, or useful answer (du Toit 2012). Rather, as Perri 6 (2002: 8) points out, better policy making is more likely to come from 'a system which gives recognition to each kind of evidence and judgment and not just those in control of the slide rule'. Moving beyond 'rational' EBPM for certain complex policy problems also helps democratize knowledge, which holds particular relevance in (South) Africa in light of calls for the decolonization of universities (Jansen 2017) as well as developing 'home grown' policy solutions (Adelle et al. 2018). However, this apparent need for coproduction does not shed light on the question of why a coproduction approach was adopted in this case but not for the formulation of national policy.

It is worth reflecting that the way knowledge is used in policy making (and therefore also the role of scientists in the creation and use of this knowledge) is related to the type of governance pursued. EBPM is a meta-policy (a policy about policy) defining how policy should be made, who should make it, whose authority counts as evidence (du Toit 2012). The coproduction of knowledge, on the contrary, actively attempts to include a plurality of perspectives from different actors and to reach decisions by mutual understanding between these. Recognizing this complexity of dynamic social systems, however, 'means giving up control' (Baumgartner 1986: 1), shifting thinking about governance processes away from the primacy of top-down government toward more decentered or poly-centric governance mechanisms in which interdependent forces within and beyond the state effectively coordinate or self-steer (Sanderson 2002; Pereira and Ruysenaar 2012). In this governance framing, experimentation (the deliberate process of innovation) and evaluation are seen as key practices to better understand and govern social complexity (Sanderson 2006; Dunn et al. 2017). These practices take place in an iterative process of 'reflexive social learning' whereby stakeholders, policy makers, and scientists collectively attempt to 'make sense' of the data through interactive, deliberative forms of self-steering, and adaptive governance (Sanderson 2006). The mode of knowledge creation (and policy formulation with which it is so closely entwined) presented in this case, therefore, required a certain type of policy space to allow experimentation, reflection, and hands-off steering. This space is arguably far more accessible in the Western Cape Provincial Government than in the National Government, which has experimented with a number of new ways of governance in the last decade.[6]

6.3 The framework as a heuristic tool and future research

Beyond just applying the conceptual framework to better understand coproduction processes in an *ex post* case, the framework is also intended to be applicable *ex ante* to help inform scientists designing coproduction processes. The framework is flexible and nonprescriptive so that it can be applied across a range of different types of coproduction processes. However, the utility of the framework to analyze other cases still needs to be tested (both *ex post* and *ex ante*). Furthermore, responding to the recent critiques of coproduction literature, the framework could be applied to multiple coproduction examples in various contexts while also monitoring the outcomes and costs of the coproduction. In this way, it may be possible to expand the framework of tasks into a more comprehensive theoretical framework of coproduction. This research would respond to calls for a greater appreciation of when coproduction is most likely to be 'the right approach' in practice and for a more nuanced understanding of which strategies are most appropriate in which contexts (e.g. Lemos et al. 2018; Oliver et al. 2019; Wynborn et al. 2019). This type of more systemic research is surely a necessary next step to underpin the growing enthusiasm for coproduction approaches.

7. Concluding remarks

This article aims to contribute to the previous literature on the coproduction of knowledge by responding to calls for more deliberate and critical engagement between scholarship and practice. By constructing a conceptual framework and then empirically testing this for 'fit' in a real-world example, the article helps to clarify the role of scientists in the coproduction process. The analysis of the role played by scientists in the drafting of the Western Cape 'Nourish to Flourish' strategy showed that the tasks and phases set out in the conceptual framework could be applied in practice to provide a useful lens for unpacking, and so better understanding, the role played by scientists in knowledge coproduction with stakeholders. The conceptual framework, therefore, starts to answer the concerns expressed in the literature that what the new roles of science mean in practice is unclear and hardly empirically tested (Maasen et al. 2006; Michaels 2009; Turnhout et al. 2013; Spruijt et al. 2014; Yang 2017). In future, the framework could be expanded to more systematically link coproduction strategies with their context, outcomes, and costs. It is only through more nuanced and critical understanding of coproduction that it will go beyond being a 'buzz word' and 'the right thing to do' to a viable alternative to more traditional models of the role of scientists in policy making. While researchers appreciate a variety of roles in the science–policy interface from pure scientist to participatory knowledge production, it has been found that they often still adhere to objective and linear knowledge production. (Pohl et al. 2010; Saarela 2019). The ambiguity in the literature on the role of scientists in the coproduction (i.e. what coproduction entails in practice) is partly responsible for this apparent paradox.

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Notes

1. Rooibos (*Aspalathus linearis*) or 'red bush' is indigenous to the Western Cape Province of South Africa. The San people, South Africa's first-nation people, used it as a medicinal herb but today it is mostly used to make tea.
2. Food security was defined by the World Food Summit in 1996 and then ratified by the Committee on World Food Security (CFS) as follows: 'Food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life' (CFS 2012).
3. A consultancy firm had been brought into the 'scientific team' as a partner by the scientists primarily to manage the logistics of the workshop and writing process rather than their subject knowledge of food security in the Western Cape.
4. The next phase of the Nourish to Flourish Strategy led to a series of stakeholder workshops in 2017 discussing possible implementation actions.
5. The concept of Communities of Practice came to prominence in the 1990s depicting groups of people coming together around shared problems/endeavors to interact on a regular basis to build networks, exchange existing knowledge, coproduce new knowledge, and develop collective actions (Wenger 2000).
6. The Western Cape Government has experimented in the last decade with a number of different governance approaches, for example, a behavioral insight approach (OECD 2018) and a Whole of Society Approach (WCEDP 2019).

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List of interviews

IN 15 May 2017 – Interview with a policy official, Western Cape, South Africa.

IN 22 August 2017 – Interview with an academic, Western Cape, South Africa.

IN 24 August 2017 – Interview with an academic, Western Cape, South Africa.

IN 25 August 2017 – Interview with a consultant, Western Cape, South Africa.

IN 4 September 2017 – Interview with an academic, Western Cape, South Africa.

IN 1 November 2017 – Interview with an academic, Western Cape, South Africa.

IN 1 July 2019 – Interview with a policy official, Western Cape, South Africa.

IN 5 July 2019 – Interview with a policy official, Western Cape, South Africa.

IN 1 November 2017 – Interview with an academic, Gauteng, South Africa (conducted via Skype).

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