

Foot and mouth disease ready? How co-creation of and participation in knowledge development and sharing can transform relationships between livestock producers and other animal health stakeholders — an Australian case study

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Abstract

Building a strong and trustworthy communication network to report unusual signs of disease will facilitate Australia's response to a foot and mouth disease (FMD) outbreak. In a four-year study, the FMD Ready Farmer-led surveillance project adopted the Agricultural Innovation Systems (AIS) framework, modelling transformation of how knowledge is co-created, valued, and communicated. The FMD Ready project has highlighted the need for multiple stakeholders' voices to be heard, and the importance of regulatory bodies to listen. Relationships take time and need to be valued as a necessary tool in a participatory, innovative approach to animal health and disease management.

Keywords

Public engagement with science and technology; Risk communication; Science communication: theory and models

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Introduction

Foot and mouth disease (FMD) is a highly contagious animal disease prevalent in the world's poorest nations. Ongoing international effort is required to ensure that the impact of disease is mitigated [World Organisation for Animal health, 2021]. In Australia, which is free of FMD, FMD has capacity to significantly damage livestock product markets, both at home and abroad. It is estimated that a small outbreak of FMD would cost Australia \$5.6–6.2 billion dollars over 10 years [Buetre et al., 2013]. These estimates do not include control and compensation costs and do not come close to measuring the full impact on farming families and their communities.

While strong border protection plays a role in preventing entry of FMD to Australia [East et al., 2016], this does not provide an impervious barrier to disease entry [Matthews, 2011]. Therefore, actions and perceptions of all stakeholders within the animal disease surveillance system become very significant. A surveillance system that supports disease reporting in ways that are respectful and safe can increase the likelihood that the first case of FMD is diagnosed sooner [Knight-Jones and Rushton, 2013], disease spread is controlled and the overall impact of FMD is reduced [East et al., 2016]. Garner et al. [2016] found that the faster the disease is detected, the more likely it is that it can be successfully eradicated. This means that producers themselves are best placed to pick up early signs of the disease [Wright, Jorgensen and Smith, 2016] and this early detection can dramatically lower the risk of FMD spreading to other properties [Knight-Jones and Rushton, 2013].

The Australian animal disease surveillance system is multifaceted and aims at demonstrating the absence or presence of certain diseases and detecting exotic diseases as early as possible. The surveillance system consists of both targeted programs against specific diseases, and general surveillance. While there are various definitions for general surveillance, for the purpose of this project, it is defined as “the process whereby a livestock disease is noticed by someone. This person, directly or indirectly, informs or alerts a veterinarian or another person with animal health knowledge” [Wright, Jorgensen and Smith, 2016, p. 16]. For producers to be able to get help quickly in cases of unusual signs of disease in their animals, they need awareness and knowledge about what signs should be reported, knowledge of who to contact in these circumstances, and confidence that their concerns, priorities and privacy will be acknowledged, understood and respected [Maru, Hernández-Jover et al., 2017]. Ensuring that the surveillance system that supports the reporting of unusual signs of animal disease is strong and trustworthy, is critical to facilitating this rapid response [Palmer, Sully and Fozdar, 2009].

Traditional approaches to improving disease surveillance typically follow a linear research-extension-adoption model [Palmer, Sully and Fozdar, 2009] and focused solely on the behaviour of the producer [Hidano, Gates and Enticott, 2019]. Accompanying this there have been numerous historical examples of when local knowledge and expertise of producers/animal owners has been ignored in animal disease outbreaks in place of expert driven approaches [Jaye et al., 2021; Manyweathers, Taylor and Longnecker, 2020; Wynne, 1998]. Such approaches can result in poor uptake of recommended strategies and increasing hostility and decreased trust between stakeholders [Jensen, 2004; Manyweathers, Field et al., 2017]. These approaches also highlight the persistence of the deficit model of communication in biosecurity and surveillance [Raps, 2016; Seethaler et al., 2019]. The deficit approach assumes the audience, producers in this case, are empty vessels, waiting to be filled by scientific experts [Bucchi and Trench, 2014; Millar and Wynne, 1988] and that science knowledge is unproblematic with a one-way flow of information from experts to audience considered appropriate [Palmer and Schibeci, 2014; Wynne, 1991]. While the deficit approach to science communication can play an important role in the foundational work of science communication [Metcalf, 2019], such deficit based approaches are ineffective in addressing complex issues involving multiple stakeholders with conflicting priorities, such as animal disease management [Higgins, Bryant, Hernández-Jover, Rast et al., 2016]. Transformation of the surveillance system from a deficit-based approach to a more

participatory, two-way communication approach is needed to enhance FMD preparedness [Wright, Jorgensen and Smith, 2018].

Participatory science communication is based on recognition and acknowledgement of the co-creation of knowledge that needs to take place between scientists and various publics [Seethaler et al., 2019] and highlights the need for all stakeholders to be instrumental in the development of scientific policy [Higgins, Bryant, Hernández-Jover, McShane et al., 2016]. This democratization of science allows for a shift in power and paradigm transformation to an arena where joint problem solving [Metcalf, 2019] and critical reflection on the institution of science is encouraged [Bucchi and Trench, 2014; Wynne, 1993]. When considering engagement with science, Bucchi and Trench [2014] highlights the benefits of such an approach, including potential for fresh connection between science, publics, politics and ethics [Longnecker, 2016]. Diversity in view and priority will contribute to the shift in thinking required for understanding the context in which science communication occurs, including social, cultural and political contexts [Broks, 2006; Davis, Stephenson and Flowers, 2011]. A shift is required from focusing on information content alone and transitioning to a dialogue that values meaning and co-creation [Metcalf, 2019]. Using a participatory science communication lens to examine communication about animal disease surveillance highlights the need for more inclusive communication strategies to transform the biosecurity arena and better prepare Australia for an FMD outbreak [Maru, Hernández-Jover et al., 2017].

Historically, a siloed approach by agricultural researchers, and technology and policy developers operated without constructive communication between stakeholders. Input from end-users of policies and research, that is producers and communities, were not included [Hayes, Manyweathers, Langstaff et al., 2020; Higgins, Bryant, Hernández-Jover, McShane et al., 2016]. More recently, the Agricultural Innovation Systems (AIS) approach provides an innovative and inclusive framework that connects diverse stakeholders and creates a problem-solving network to tackle complex issues [Hall, 2007; Klerkx and Nettle, 2013]. Some examples where AIS has been used in the past include agricultural innovation in Australian horticulture biosecurity [Kruger, 2017a; Kruger, 2017b], New Zealand agriculture [Turner et al., 2017], food security and poverty in sub-Saharan Africa [Maru, Sparrow et al., 2018], and climate change adaptations [Barrett et al., 2017]. Using a systems-based approach, AIS promotes the creation of multi-stakeholder networks, where co-creation of knowledge, and sharing of expertise can be harnessed to create innovative solutions to address jointly identified problems within complex systems [Edwards et al., 2013; Hall, 2007]. This means that participatory communication is more than shared words, and can be a productive and powerful tool to create systemic capacity for innovation [Hall, 2007].

In a four-year study, a research project to strengthen Australia's animal disease surveillance and preparedness for an FMD outbreak, used AIS approaches to guide the creation of farmer-led networks. The project flipped the traditional top-down deficit model approach to animal disease surveillance and created a model for transforming how knowledge is co-created, valued, and communicated, by promoting mutual trust, and inclusion of multiple sources of knowledge and experience [Manyweathers, Hernandez-Jover et al., 2020]. This paper reports on the impact of participatory communication on stakeholder relationships within the

sheep and dairy cattle pilot groups and the development of innovative solutions to locally identified issues within the animal health surveillance system.

Methods

As part of the overall project, five pilot groups were created, representing the main livestock industries impacted by FMD (one each for beef and dairy cattle, sheep, goats and pigs), to examine the impact of an AIS approach on the Australian animal disease surveillance system. Specifically, this paper examines the impact of participatory communication on stakeholder relationships within the sheep pilot group in Western Australia (WA), and dairy cattle group in Victoria (Vic). These pilots ran from 2018–2020 and involved 13 members and seven meetings for the sheep pilot and 10 members and nine meetings for the dairy pilot. All research activities were approved by the Human Research Ethics Committee at Charles Sturt University (H18061) and CSIRO (129/16).

Development of the pilot group: the pilot groups began with an information meeting and stakeholder analysis that provided information on relevant stakeholders, current relationships among animal health surveillance stakeholders and the direction and strength of these relationships [Hayes, Manyweathers, Maru et al., 2021]. The research team then invited additional stakeholders to participate in the pilot groups as a result of the stakeholder analysis. ‘Producers’ were those people who raised the animals themselves, while ‘Industry representatives’ included people from organisational bodies, such as Dairy Australia in the dairy group, and shearers in the sheep group, as well as stock agents, abattoir workers, etc. ‘Other’ included those involved in project management and governance.

Pilot group processes and activities: the groups were tasked with considering the problems of and opportunities for improving partnerships and disease surveillance within their industry and region. Each meeting discussed any ideas and issues that were identified by the group, with solutions devised and tested by the groups.

Evaluation of the impact of the participatory communication approach: the evaluation process involved the use of a mixed method approach for data collection, including interviews, the collation of the physical outputs from the pilots, and base/end line surveys. This paper will reflect on the impact of the participatory communication approach within the sheep and dairy cattle pilot groups through consideration of the physical outputs of the project, and interview data. Evaluation of the overall AIS approach used in the project will be reported elsewhere.

Interviews were conducted with pilot participants and those closely related to the groups. A total of 16 dairy cattle and sheep pilot members participated in the MSC interviews. The words of respondents have been included as transcribed verbatim. Any additional information added for clarification is included in bold, square brackets. When information has been removed to preserve confidentiality, it has been replaced with #####. These interviews were based on the Most significant Change (MSC) approach of intervention evaluation data collection [Davies and Dart, 2005; Wilson, 2016]. The MSC approach is participatory, allowing the collection and interpretation of stories about participatory change [Wilson, 2016].

Questions relevant for the participatory communication approach were focused on changes in relationships and communication.

For privacy reasons due to the size of the groups, participants in the interviews were not identified in this study beyond their role. The interviews were undertaken by researchers not involved directly in the pilot group being evaluated and were recorded and professionally transcribed. The transcripts were uploaded into NVivo (QSR International Pty Ltd. Version 12, 2018). Initial coding was undertaken using thematic analysis [Braun and Clarke, 2013], with themes being developed by iterative interaction with the data and research team discussion. Any additions to the comments needed for clarification are included within square brackets.

Results

The results from the evaluation of the impact of participatory communication approaches are presented here in two sections: reflection on the products (the physical outputs) of the pilot groups, and analysis of the interview data. The overall findings can perhaps best be encapsulated by the following quote from a government officer.

“Learning to shut up and listen was a quite a change for me. I mean I work in government; we are used to going in and telling people what to do.”
(Government 1)

Products

The pilot groups were instrumental in developing information materials by group stakeholders for producers using participatory communication among pilot members. The dairy cattle pilot group developed a flyer for distribution to smallholders in the area where they are located (Gippsland area, Victoria), about the risk of animal diseases and how the National Livestock Identification System (NLIS), the national official traceability system in Australia, can be used by smallholders to manage this risk. This was supported and distributed by local government, with potential for mapping impact through interactions with Agriculture Victoria.

This pilot group also sent several motions to the Victorian Minister for Agriculture, one of which supported a change in the uniform of government biosecurity and veterinary officers, away from a police-like uniform, and to one that looked less regulatory. Another motion supported the allocation of resources to building relationships between the jurisdiction and producers.

The sheep pilot group in Western Australia produced numerous newsletter articles for their members and prepared a biosecurity declaration and information for livestock and grain growers to include in their induction pack for workers that may have travelled from other regions, either within Australia or internationally. These materials were also shared with other grower groups.

While these products are a snapshot of what was produced by the sheep and dairy cattle group, they do reflect an important transformation within the surveillance system. Firstly, these products were produced by locally based stakeholders,

including but not restricted to the end-users of the products. In addition, the products were also designed to meet needs identified by the stakeholder groups themselves and had local relevance and content. Furthermore, materials produced also had relevance to the wider industry, as illustrated by the interest in adoption outside the pilot group of the staff induction material.

This approach, made possible by the participatory communication approach within the groups, is in direct contrast to material that is produced by regulatory bodies alone, based on a one-size-fits all approach with little local relevance. It is possible that by creating an arena where multiple voices can be heard, contrasting priorities can be met using a shared perspective approach. While this study considers Australian livestock industries, the findings will also have significant implications for many science communication arenas.

Interviews

A total of 16 dairy cattle and sheep pilot members participated in the MSC interviews. The words of respondents have been included as transcribed verbatim. Any additional information added for clarification is included in bold, square brackets. When information has been removed to preserve confidentiality, it has been replaced with #####. The key themes developed from analysis of the MSC interviews were Transformed Relationships, Innovative Potential, and Wider Benefits.

Transformed relationships

Creating an arena for participatory communication provided the opportunity for new relationships to develop, by bringing people together and allowing transparency for multiple priorities. This approach allowed for dynamic discourse and identified new significant surveillance stakeholders.

“I’ve actually got a presentation tomorrow to small landholders. Which we’re talking about animal health generally. But with a biosecurity slant. So that’s accessing a group of people that we normally don’t have — don’t access at all.” (Producer 1)

“I think that because we had all elements in the industry, so we had the livestock, the farmers, the stock agents, the abattoirs and I’m sure everyone in the room got a new understanding of the challenges for each one of those individually and how they fit into the system, so I’m sure we all have a bit better understanding of each other’s roles within the industry.” (Industry 3)

These comments reflect on the understanding that comes from listening to different perspectives and that this does create opportunities for relationships not previously available. The different perspectives also allow for a fresh look at old challenges, and opportunities to identify new commonalities.

“So getting those people together on a more frequent basis. And look at what common problems. Don’t expect to cure the world. But you can pick up a few little things, that may be worthwhile. So the idea of getting groups from

different areas together is certainly worth continuing and exploring.”
(Producer 4)

“I would think that values have improved because the pilots would’ve opened producers’ eyes to the fact that they are part of a whole. No producer works on their own and the success of a producer led surveillance system in the end relies on close collaboration with neighbours and with other producers in the same region and I think that would be a positive value shift.” (Others 1)

“I think that Cross Pilot workshop in February was a really excellent thing to do where you brought them all together and it was quite clear then that there was a lot of commonality between the groups even though they were from different livestock industry and different areas of the country, a lot of the things that keep them up at night are the same and I think that was a really good relationship building exercise as well as being a really good demonstration to the Government stakeholders there those relationships are important and that the networks are important.” (Other 2)

The impact of producers developing stronger relationships with other members of the surveillance system cannot be overstated. The following comments highlight the challenges that faced existing relationships due to a government agency uniform that had the appearance of police and were accompanied by a motion sent to the Minister for Agriculture supporting a uniform change (see Products).

“At the start of the project, ### would come along with their policeman-like uniform on. . . That perception, that they are like policeman, rather than working cooperatively with the farmers to have a good outcome, it was very, very good to see at the end of the project that they had decided to scrap that policeman-like attitude and rather be on a much more conciliatory level with farmers. That was one of the jumps off the page things for me.” (Producer 3)

“they’re [biosecurity officers] trying to do good cop/bad cop as the same cop and are wearing cop uniforms. I think it is actually a genuine barrier, I think, to connecting as — you know, when they’re trying to do extension, and they have more two-way conversations that physically what they look like is actually a barrier.” (Industry 2)

Another significant issue within the surveillance system is a lack of trust by producers in what happens if they report something unusual. This is tied up with a fear of repercussions for reporting unusual disease signs, from both government agencies and their community. The following comments suggest that the participatory science communication approach used by the pilot groups goes some way to addressing these issues by contributing to stronger trusting relationships.

“I think there’s been definitely an increase in trust between producers and jurisdictions. As I said earlier, there’s been this long-held belief that if a producer reports the fact that they’ve seen something suspicious in their livestock, the next thing that will happen is that the jurisdiction will arrive on the property and . . . a quarantine or want to cull animals, whatever the case may be. And I think that mindset, that fear has been relayed and I think after the pilots have run there would be greater trust in relationship between farmers and the jurisdictions.” (Other 1)

This snapshot suggests that participation in the pilot groups provided many members with opportunities to establish and reprioritize relationships within the animal health and biosecurity arena.

Innovative potential

Innovation requires awareness of issues and problems before solutions can be considered. This theme illustrates the developing awareness that can inform co-creation problem solving. The following comments capture some of the opportunities identified by the pilot groups for attention.

“A pretty enlightening moment when we had discussions with the local NRM [Natural Resource Management] rep. I mean there’s pigs about there, small scale commercial operations that I think anecdotally didn’t have an understanding of swill feeding being illegal.” (Producer 1)

“We would never had done anything in the small landholder’s space if it hadn’t been for the group and I think understanding and I think farmers like especially big farmers have trouble understanding what small farmers do so and understanding the drive behind somebody with a small land holding that’s got a couple of sheep so I think that’s been really good and obviously we identified them as a risk because they could get a disease, an animal disease and not do anything about it which could practically spread through the whole district.” (Industry 1)

These comments highlighted a gap in knowledge and stakeholders that became evident in pilot group discussions. The following comments include identifying a variety of ways that prevention of swill feeding may be managed, with some approaches being implemented by the group. The same producer reported two other areas that the sheep pilot looked at that had not been considered as biosecurity challenges before.

“I’ve had communications with the local shire council — councillors around planning developments for ecotourism on livestock properties. So again, that transitioning of — of tourists, and international travellers traversing and camping on livestock properties.” (Producer 1)

“And some of the places that the cruise ships passengers disembark. And again, pass through farms to get to a couple of the local tourist attractions. And the buses that are carting tourists around are the school buses. But then the school kids go on and go home.” (Producer 1)

The fact that these topics were raised in the sheep pilot highlights the potential for innovative thinking and solution creation that is possible when multiple stakeholder voices are heard. This also relies on setting aside previous agendas and old ways of relating, as the following comments highlight.

“it’s breaking down egos and things. I think that’s very important. It’s, egos is probably a bit harsh, but it’s working out, it’s hard to put into words, but it’s about getting that group to galvanise on a common cause.” (Other 3)

“Learning to shut up and listen was a quite a change for me. I mean I work in government; we are used to going in and telling people what to do. So just stopping and listening and just being an observer in the room for the most part was quite different for me. I mean listening to the people in the room say that the government veterinary support services in ##### were decidedly absent when we as the government were under the impression that pulling the government out of ##### wasn’t anything whereas clearly it was. I mean the change was I guess in people having the freedom to say that kind of thing.” (Government 1)

Wider benefits from participatory approaches

These comments hint at the transformation that is possible within the surveillance system when the traditional siloed approach is replaced with one where stakeholder voices are heard. These benefits extend beyond the goals of the pilot groups and have capacity to improve relationships and collaborations in a wider arena.

“I think this sub-project and the pilots have indicated the immense value that can accrue from cross collaboration of various disciplines. You’ve had people participate in these pilots who are veterinarians in the broad sense, who are specialist epidemiologists, who are sociologists, social science experts and I think what these projects have done is to open these various experts’ eyes to the expertise that exist[s] in the existing other fields to their own, but which are very complementary to what they do and the immense benefit that can arise from getting multiple disciplines to collaborate with each other towards a common goal.” (Other 1)

“Personally, I appreciated getting the insights directly from like the stakeholders being stock agents, farmers, service providers and how they played off and interacted with each other. So, it’s not easy to get that information sort of critiqued so instantaneously at the grassroots level. So, the information I got from that has allowed me in my normal role ##### to, reinforce and power me to push harder on some issues which were also identified by the committee.” (Government 3)

The need for participatory bottom-up social science approaches, integral to running the pilots, were recognized as essential for relational and communication transformation. The next two comments are from pilot support participants and speak of the transformation that comes from hearing about other ways of thinking.

“I really think we have to be taking a different approach to surveillance. We have done the same model over and over again and that was the attempt, what we were trying to do with the Animal Health Surveillance workshop is to try to get a shift in thinking, to go, let’s have a look at, well, what are the issues that we need to be addressing going in the future and what do we need to do and what are our key challenges, and I think this project really addressed that head-on and we need to be thinking about the social research and that aspect of it and bringing that in to underpin our policies.” (Government 2)

“When we did the survey for the National Animal Health Surveillance Business Plan, it [social science research] came up as a key area — community, producers’ awareness, all that sort of stuff, and it’s one of the key challenges going forward so it will be incorporated as a body of work or something in the national and also likewise for us in ##### is . . . in its own right would be a body of work about how we can improve that and not just the usual, let’s go and collect data the traditional way, and ignore that.” (Government 2)

These comments highlight the changes in perspective made possible by engagement with the participatory pilot groups. They illustrate that multifaceted perspectives need to inform how the surveillance system is transformed and strengthened. Moving the surveillance system towards one that relies on evidence-based communication practices, social science and systems/behaviour change approaches will strengthen the networks and relationships needed for a robust reporting system and rapid, informed response to animal disease outbreaks.

Discussion

The current project, using a participatory science communication approach, has highlighted the need for multiple stakeholders' voices to be heard to strengthen relationships with the common goal of enhancing the disease surveillance system in Australia.

Traditional approaches to research into surveillance uptake and engagement with biosecurity have focused on extension through improving quality of one-way top-down communication. The project used a systems based Agricultural Innovations Systems approach to reflect on how Australia's animal health surveillance system may be strengthened by engaging participation from all stakeholders allowing multidirectional interactions and communications. This approach has provided evidence that real transformation in the surveillance system is possible by creating opportunities to disrupt previous top-down communication and relationship patterns and create space and alternative perspective to drive creation of innovative solutions.

The participatory approach highlights that strengthening the performance of Australian animal disease general surveillance does not just depend on improving the quality of extension communication and extension materials but on the process by which these materials are produced and enacted. Strong, functional and trusting relationships between all stakeholders and their complementary roles are also required to underpin multi-directional communication and co-design of effective extension materials. Increasing the opportunities for these strong relationships to develop, at a time when there are no animal disease emergencies, without a lens of competing priorities, allows for increased interaction, negotiation and learning between stakeholders. This moves the traditional focus on improving quality of materials from top-down one way communication to partnerships among farmers and other stakeholders that allow multi-directional communication and co-design of solutions that are fit for the local context. Participatory communication approaches, where stakeholders' voices are heard, and their experiences, knowledge and priorities are valued and understood, can clear the path for a strengthened animal disease surveillance system. These approaches need to facilitate the inclusion of a stratified connectivity between all stakeholders, from local, through to regional and jurisdictional and to national stakeholders.

Participatory communication approaches also facilitate the integration of local and scientific knowledge creating potential for technical, behavioural and institutional changes, including increased capacity for system innovations [Hall et al., 2003; Hawkins et al., 2009]. The pilot groups created an arena for interaction, multidirectional communication and the consideration of different perspectives and priorities. This opportunity to co-create knowledge and consider fit-for purpose solutions moves beyond traditional linear approaches to extension and the deficit model of science communication and onto a participatory approach to science communication with ramifications reaching far beyond animal health management.

The opportunity afforded by the co-creation of knowledge and materials by diverse stakeholders and creation of locally relevant solutions was significant. While it appears to make sense that the development of materials to assist in managing animal disease surveillance being shared with stakeholders should have input from these stakeholders, this rarely happens. Animal and human health, and other

areas involving information distribution around adoption of certain behaviours are littered with failed advertising campaigns and wasted resources because of lack of audience/stakeholder participation in identifying the initial problem, and the development of communication tools [Hayes, Woodgate et al., 2017; Manyweathers, Taylor and Longnecker, 2020; Powell and Leiss, 1997]. This study has shown the great potential of a participatory communication approach in developing communication tools that have greater usefulness for stakeholders and will contribute to the strengthening of the surveillance system.

The benefits of the participatory approach extended beyond the direct pilot group members. This approach brings with it the framework for deep reflection on the institutional and systemic factors that contribute to the complexity of the surveillance system and may inhibit its efficacy. The results of this study illustrate the far-reaching impacts of the participatory approach, highlighted by the involvement of jurisdictional Chief Veterinary Officers and their ongoing commitment to sustain the pilot groups beyond the end date of the project. Without a participatory and systems-based framework, on the ground changes will be transient at best and may not outlast changes in priority, or government or the next natural disaster. However, creating an arena for participatory discourse provided an opportunity for systems change, where participatory conversations become the norm and activities and approaches that strengthen relationships and networks are prioritized. Embedding participatory approaches within industry and government approaches, and a willingness to prioritise resourcing of these activities, and relationship building itself, would result in a larger scale roll out of the benefits of the AIS approach.

This study was limited by the fact that while the participatory approach did include interaction with jurisdictional agencies, time and resources did not allow for deeper penetration into the national jurisdiction, an important aspect of the surveillance system. In the Australian context, sustainable and resourced participatory groups that work to strengthen the animal disease surveillance system will require national support. Representation of the national surveillance priorities in a participatory arena will be important for the further strengthening of the surveillance system.

Another potential limitation of this approach was the question about transferability of trust. This was a reflection on whether trust developed between a jurisdictional pilot member and a producer, for example, would transfer to the same producer trusting other jurisdictional actors. While it is understood that trust develops through emotional involvement and making sense of the issues at stake [Engdahl and Lidskog, 2014], the question of transferability of trust and relationships cannot be answered by this study, and will require further reflection. A participatory approach, however, does increase the likelihood that stakeholder needs and priorities will be acknowledged and understood, which may lead to wider spread of trust and respect among stakeholders.

Another challenge is that the time taken for the full benefits of such a participatory approach to be manifested may also be considerable. This means that immediate, urgent problems may need a modified approach to source solutions, unless the response is building on existing, trusting relationships. However, the capacity for the participatory stakeholder approach to respond in times of crisis is significant, if the networks are already established and nurtured.

This study also highlights some of the issues that may arise when adopting a participatory stakeholder-network approach to solving complex problems. The approach at this piloting phase was very resource intensive. One of the challenges is how to scale the findings to other communities with less use of resources. Given the indication of success in building trust and reporting of diseases, industries and governments will need to invest in working with established farmers groups to incentivize the inclusion of other animal health stakeholders to take on roles to address local animal health and other priority issues and facilitating the scaling out to other communities and industries.

This project has contributed to further emphasizing the role of participatory communication in enhancing Australia's preparedness for animal disease outbreaks. This study has shown that individual stories and collective listening can strengthen the surveillance system, creating a trust-based model that can transform Australia's national animal disease surveillance system. The need for disease preparedness, however, is not only an Australian issue. The AIS framework and findings from this study, including the need to establish and value relationships between regulators and publics, have implications and potential on a global scale.

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