



## Use of stakeholder analysis to inform risk communication and extension strategies for improved biosecurity amongst small-scale pig producers

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### ABSTRACT

Extension and communication needs amongst small-scale pig producers, described as pig producers with less than 100 sows, have been previously identified. These producers, who are believed to pose a biosecurity risk to commercial livestock industries, are characterized by a lack of formal networks, mistrust of authorities, poor disease reporting behaviour and motivational diversity, and reliance on other producers, veterinarians and family for pig health and production advice. This paper applies stakeholder identification and analysis tools to determine stakeholders' influence and interest on pig producers' practices. Findings can inform a risk communication process and the development of an extension framework to increase producers' engagement with industry and their compliance with biosecurity standards and legislation in Australia. The process included identification of stakeholders, their issues of concerns regarding small-scale pig producers and biosecurity and their influence and interest in each of these issues. This exercise identified the capacity of different stakeholders to influence the outcomes for each issue and assessed their success or failure to do so. The disconnection identified between the level of interest and influence suggests that government and industry need to work with the small-scale pig producers and with those who have the capacity to influence them. Successful biosecurity risk management will depend on shared responsibility and building trust amongst stakeholders. Flow-on effects may include legitimating the importance of reporting and compliance systems and the co-management of risk. Compliance of small-scale pig producers with biosecurity industry standards and legislation will reduce the risks of entry and spread of exotic diseases in Australia.

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### 1. Introduction

Biosecurity and disease surveillance are vital to maintain and protect the health status of the livestock industries.

Australia has a substantial advantage in the global livestock market due to its freedom from many animal diseases. The potential biosecurity risks posed by the behaviour of small-scale and peri-urban landholders and how to target them in communication campaigns are a common concern. Hollier and Reid (2007) suggested that the potential biosecurity risks posed by these landholders are mainly due to the lack of prior agricultural knowledge and experience and the lack of local networks of people who can provide information and support. Other studies found that the primary farming motivation of peri-urban landholders was lifestyle,

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amenity and environmental factors and not as a source of primary income. To be effective, communication to these landholders needs to appeal to these interests (Aslin et al., 2004).

The Australian sow herd had approximately 263,000 sows in 2008, housed on about 1625 farms. In addition, there are approximately 600 contract growers. Amongst breeding farms, around 76% are considered small-scale, with fewer than 100 sows (APL, 2009). Small-scale pig producers are believed to pose a biosecurity risk to the commercial livestock industry due, for example, to being less informed about potential risks for disease introduction and spread (Schembri et al., 2006) and less engaged with industry and government agencies (Hernández-Jover et al., 2008a,b; Schembri, 2009). A recent risk assessment suggests that small-scale pig producers in Australia pose higher likelihood of exotic disease spread than large-scale pig producers (Hernández-Jover et al., unpublished results). In this assessment, small-scale pig producers were considered more likely to swill feed and the high frequency of movement of animals off the farm to different destinations, such as livestock markets or other farms, was linked to a significant spread of the disease. Concerns regarding the potential biosecurity risks presented by the small-scale pig sector and by the livestock markets were highlighted in the 2001 outbreak of foot and mouth disease in the United Kingdom. It is believed that the origin of this outbreak was a small-scale pig farm where unprocessed pig swill was fed to pigs and that the virus spread to infect sheep on neighbouring farms and through sheep movements to livestock markets. The disease was suspected and reported after routine ante-mortem inspection of pigs at an abattoir (Bourn, 2002).

Better extension and communication networks amongst these producers and industry and government stakeholders could increase producers' active engagement and participation within the pig industry. This could decrease the potential risk of exotic disease introduction and spread as well as the risk of spread of costly endemic diseases. Moreover, effective communication is crucial in providing accurate and unbiased information on livestock health status and essential for all livestock sectors to contribute to national and regional decision-making processes (Marshall et al., 2006).

Stakeholder consultation and engagement are important components of effective risk management (Beierle, 2002; Slovic et al., 2004) and different approaches have been previously used (Bryson, 2004; Glick, 1999), which acknowledge the centrality of stakeholders in decision-making processes and in increasing the effectiveness of risk governance. Previous research in Australia (Gilmour et al., 2011) has used stakeholder mapping and analysis with a mental models approach to inform a risk communication strategy for peri-urban farmers in the Yass region in New South Wales. Findings from this study suggested that a biosecurity communication strategy for the region should be developed and delivered on a landscape scale, be directed to all landholders, and appeal to the drivers that the landholders themselves identified. Trusted and influential agencies and existing local networks should be used to disseminate information. The objective of the current

study is to apply a stakeholder analysis process to identify those stakeholders most influential on small-scale pig producers' practices related to biosecurity. Knowledge of the communication networks and relationships between small-scale pig producers and other stakeholders, both from the perspective of the small-scale producers and the perspective of other stakeholders, would aid better understanding of extension needs and how these needs could be fulfilled. Involvement of these stakeholders on the development of extension programs targeted at this sector of the industry would improve communication effectiveness and producers' engagement, essential for the success of any risk management strategy.

## 2. Methods

This research undertakes a stakeholder analysis and applies a stakeholder mapping framework to investigate the influence and interest of key stakeholders on biosecurity practices amongst small-scale pig producers in Australia. Results from this analysis can inform a risk communication process and an extension strategy.

For this, an initial stakeholder analysis based on data derived from previous studies conducted by the research team (Hernández-Jover et al., 2008a,b, 2009a,b; Schembri, 2009; Schembri et al., 2010) and the team knowledge of small-scale pig producers, was conducted. This was subsequently tested and verified through consultation with key stakeholders of the pig industry.

### 2.1. Data sources

#### 2.1.1. Small-scale pig producers trading at livestock markets in Australia

Small-scale pig producers in Australia and the potential biosecurity risks posed by this sector of the industry were studied by the research team (Hernández-Jover et al., 2008a,b, 2009a,b; Schembri, 2009; Schembri et al., 2010) during 2006–2009. The broad objective of this previous research was to gather data on small-scale pig producers who traded through livestock markets (saleyards) in eastern Australia.

Pig producers trading through six of the ten saleyards in eastern Australia were considered the target population to collect information on small-scale pig producers' practices, behaviours and perceptions (Schembri, 2009). Two saleyards in each of the three eastern states of Australia (New South Wales, Victoria and Queensland) were purposively chosen for high animal throughput, frequency of sales (weekly to fortnightly) and location (1 peri-urban, 1 regional) (Hernández-Jover et al., 2008a,b, 2009a,b; Schembri, 2009; Schembri et al., 2010). Of the total number of pig farms ( $n=2228$ ) in Australia in 2009, 75% were located in these three states (APL, 2009). A combination of quantitative (postal survey and interviews) and qualitative (focus group discussions) methods was used to gather information, increasing producers' trust with the researchers and providing cross-validation of the results obtained (Duffy, 1987; Breitmayer et al., 1993). A census approach with the target population was taken for the selection and recruitment of producers participating in a

postal questionnaire on demographics ( $n = 815$ ), using sale records provided by the saleyards and government agencies. Of these, data were obtained from 505 producers. Producers participating in the face-to-face interviews and focus groups were volunteers recruited from the cohort of producers who participated in previous phases of the study, opportunistically at saleyards and via advertisements placed in saleyards and livestock agent newsletters. A monetary incentive (AU\$50) to all interview and focus group participants was used to improve participation. Most producers participating in the interviews (91.5%; 97/106) and focus group discussions (90%; 36/40) were small-scale pig producers. A proportion of these (13%), were grow to finish farms keeping less than 300 animals in total. These studies gathered information on on-farm management practices and attitudes and behaviours of producers towards diseases, disease reporting, traceability, communication networks and education needs. Data from small-scale producers participating in the interviews and focus group discussions are used in the current study. A copy of the questionnaire used for the face-to-face interviews and the outline used for the focus group discussions are available from the corresponding author upon request.

A need for extension and education programs targeted towards small-scale producers as well as a communication network for these producers was identified in this project (Schembri, 2009). However, this study did not gather information from the stakeholders' perspective, focusing only on producers' practices, opinions and beliefs.

## 2.2. Stakeholder analysis process

Risk decisions operate at the intersection between science and public policy. That is, they operate at the intersection between individual and social behaviour and scientific knowledge. In the risk analysis literature, it is this interface which drives the arguments for stakeholder involvement (Jasanoff, 1993; Wynne, 1996; Ravetz, 1999; O'Brien, 2000). Within this framework, it is argued that a process of engagement with stakeholders is necessary to frame the risk in terms not only of scientific knowledge, but also of locally derived experiential knowledge, human behaviour, values and social constructs such as trust, transparency and influence.

In previous work, the research team (Gilmour and Beilin, 2007) had identified the need for the development of a strategic approach to risk governance which acknowledges the importance of stakeholder engagement. This risk governance model sees risk assessment, risk communication and risk management as part of an integrated iterative process. Given that effective risk management will depend on stakeholder action, it is important that stakeholders are consulted, their experience, knowledge, values and concerns are factored into decision-making and the communication is relevant to and addresses their needs (Fischhoff, 1995; Beierle, 2002; Beierle and Cayford, 2002; Slovic et al., 2004). To this end, various tools for stakeholder identification, analysis and mapping available in the literature (Eden and Ackermann, 1998; Bryson, 2004) were found to be useful.

**Table 1**

Questions used to identify stakeholders and issues of concern to stakeholders (adapted from The World Bank, 1996) (the questions refer to an issue of concern and the stakeholder/s who could be affected by or interested in this issue).

- 
- Who will be affected?
  - Will the impacts be local, national or international?
  - Who has the power to influence the outcome?
  - Who are the potential allies and opponents?
  - What coalitions might build around this issue?
  - Are there people whose voices or interests in the issue may not be heard?
  - Who will be responsible for managing the outcome?
  - Who can facilitate or impede the outcome through their participation, non-participation or opposition?
  - Who can contribute financial or technical resources?
- 

In this instance, in response to the identified needs of the small-scale pig producers, the current research tested the value of applying stakeholder identification and analysis tools to guide improvement to risk communication and development of a more strategic approach to extension programs. This process included: (1) identification of stakeholders; (2) identification of the issues of concern related to biosecurity; and (3) evaluation of the interest and influence of stakeholders.

### 2.2.1. Identification of stakeholders

Stakeholders are generally defined as all those people who are affected by or can affect a particular decision or action (Freeman, 1984; Donaldson and Preston, 1995; Mitchell et al., 1997). In applying this definition to the issue of biosecurity risk and small-scale pig producers, stakeholders were considered those who are involved in the activities of small-scale pig production where that involvement may affect biosecurity risk. This involvement may be that of a regulator, a supplier, or pig producers themselves. Others less immediately connected, could also be included such as neighbours and family members.

A formal process for stakeholder identification allows the identification of the full spectrum of stakeholders in the issue. In the first instance, an initial list of people anticipated to be influenced by, or able to have an impact on the issue of biosecurity risks and small-scale pig producers was generated. Drawing on data from the interviews and focus groups with producers (Hernández-Jover et al., 2008a,b, 2009a,b; Schembri, 2009; Schembri et al., 2010) and on the knowledge of the project team, this initial list was produced. This was done using the following categories: government agencies, industry associations, community groups, consumers, researchers on biosecurity and private service providers. A set of questions for identifying stakeholders and issues of concern to stakeholders (The World Bank, 1996; Table 1) was used to develop the initial list of stakeholders, being more specific for each stakeholder category and also identifying other potential stakeholders (e.g. Federal government became the specific department and agencies relevant to the issue).

Once the initial list of stakeholders was produced, a basic stakeholder identification map was drawn. Representation of potential stakeholders in a map was useful in visualizing the scope of the issue and the networks of

relationships that might develop around it. Moreover, the map provided an inclusive and transparent approach for future stakeholder consultations.

To confirm the completeness and relevance of the stakeholder list and map, a verification process with a group of representative stakeholders (18 organizations) amongst those already identified was conducted. This process validated the comprehensiveness of the list and map and prompted stakeholders themselves to think about whom they talk to, what their connections are and who is relevant to this issue. The initial stakeholder list and map were distributed by email to key stakeholders representing the initially identified stakeholders' categories, with direct involvement with the pig industry and/or promoting biosecurity as part of their organization goals. Two reminders were sent by email and a phone call was used as a last reminder. Follow-up phone calls with those who were willing to participate were conducted to clarify any possible questions. The invitation to participate in the verification process was sent to 26 individual stakeholders, representing 18 organizations or stakeholder groups. Two organizations and four stakeholder groups were represented by two representatives (Department of Primary Industries Victoria, Livestock Health and Pest Authorities, pig veterinarians, abattoirs, pig producers and researchers on biosecurity) and three individuals were consulted from one organization (Australia Pork Limited). Individuals representing pig veterinarians and pig producers were purposively selected due to their previous participation in previous studies. Of the stakeholders initially contacted, 25 individuals, representing 17 organizations or stakeholder groups, participated in the process. No response was obtained from one organization. A list and description of the stakeholder organizations consulted in the verification process and the number of individuals consulted in each organization are shown in Table 2. Those consulted were asked to identify other potential stakeholders and to delete those who should not be considered as stakeholders in the issue of the study.

### 2.2.2. Stakeholder issues maps

The next step was to draw a stakeholder issues map to better understand the topic of study and the stakeholders' position regarding this topic. The previous project (Hernández-Jover et al., 2008a,b, 2009a,b; Schembri, 2009; Schembri et al., 2010) had identified three core issues with significant importance for the potential biosecurity risks posed by small-scale pig producers—on-farm management practices (including biosecurity related practices), producer disease reporting attitudes and post-farm-gate animal identification (or traceability). Compliance with industry and legislative requirements regarding these three issues is essential for reducing the risk of endemic and exotic disease introduction and spread. Results from the interviews and focus groups suggest this compliance amongst small-scale pig producers could be improved. Table 3 presents main findings of these studies (Hernández-Jover et al., 2008b; Schembri, 2009). On-farm biosecurity practices, disease knowledge and reporting behaviour, use of veterinary services and compliance with traceability requirements are some of the aspects

**Table 2**

Stakeholder organizations consulted in a stakeholder analysis process to identify the stakeholders involved with small-scale pig producers in Australia, their issues of concern related to biosecurity and their interest and influence on these issues.

Stakeholder category	Organization name	Number of individual participants
Industry organizations <sup>a</sup>	Animal Health Australia	1
	Australian Pork Limited	3
	Australian Pig Farmers	1
Government agencies	Australian Quarantine Inspection Service	1
	Department of Agriculture, Fisheries and Forestry	1
	Department of Agriculture and Food Western Australia	1
	Department of Employment, Economic Development & Innovation Queensland	1
	Department of Primary Industries Victoria	2
	Industry and Investment New South Wales	1
	Livestock Health and Pest Authorities	2
	New South Wales Food Authority	1
	Primary Industries and Resources South Australia	1
	Research organizations	Australian Biosecurity Cooperative Research Centre for Emerging Infectious Diseases
Abattoir		2
Private organizations	Australian Livestock Markets (saleyards) Association	1
Private individuals	Pig veterinarians	2
	Pig producers	2
Total		25

<sup>a</sup> Animal Health Australia is a government and industry partnership with the aim of strengthening Australia's national animal health system; Australian Pork Limited is a producer-owned organization supporting and promoting the Australian pork industry; Australian Pig Farmers is a free range pig farmers association with the aim of providing information and training to free range pig producers.

with potential for improvement. Focus group discussions identified the main factors affecting disease reporting and the use of animal identification amongst these producers.

On-farm management encompasses a range of producers' practices related to biosecurity. These include general husbandry, health management, feeding practices, biosecurity measures, such as isolation of new animals and footwear and clothing precautions, and identification practices. Most of these practices are underpinned by the main on-farm quality assurance program of the pig industry, which is required (but not policed) for pig farms providing animals to export and some domestic abattoirs in Australia. Producer reporting refers to the mandatory requirement for all notifiable diseases to be reported to the relevant authority. The owners or the persons in charge of animals

**Table 3**

Practices related to biosecurity of small-scale pig producers trading through saleyards in eastern Australia who participated in a face-to-face interview and focus group study in 2007.

	Proportion of producers, n (%)
<b>Interview study</b>	
On-farm biosecurity practices	
Footwear precautions in piggery	49 (50.5)
Overalls provided for visitors/staff	12 (12.4)
Visitors allowed in piggery	68 (70.1)
Pig isolation practices	
Nothing	38 (39.2)
>30 days and >100 m isolation	3 (3.1)
Feeding practices	
Home table scraps	14 (14.4)
Retail waste food (café, shops)	5 (5.2)
Herd health management	
Keeping health records	49 (50.5)
Exotic Animal Disease training	5 (5.2)
Contact a veterinarian in the last 12 months	16 (16.5)
Disease knowledge	
Foot and mouth disease	95 (97.9)
Erysipelas	77 (79.4)
Ringworm	67 (69.1)
Disease reporting	
Would you report foot and mouth disease?	93 (95.9)
Seek veterinary advice if unusual signs of disease	83 (85.6)
Animal identification	
On-farm breeding stock	32 (33.0)
On-farm growing stock	55 (56.7)
Post-farm-gate identification	89 (91.7)
Own a registered swine brand	82 (84.5)
<b>Focus group study</b>	
Disease reporting factors	
- Economic impact of disease	
- Over-reaction from the media and government agencies on disease outbreaks	
- Fear of negative consequences (quarantine, fear of prosecution, social stigma)	
- Potential loss of stock and livelihood	
- Previous negative experiences with authorities	
Animal identification factors	
- Performance and costs of systems available	
- Reluctance to accept alternative identification systems	

Adapted from Hernández-Jover et al. (2008a,b) and Schembri (2009).

on a farm have the legal requirement to report notifiable exotic diseases. Post-farm-gate identification is mandatory for all pigs leaving a property. The current post-farm-gate identification system in Australia is based on a body tattoo in all States and/or an ear tag for weaner pigs in some States and a national vendor declaration (PigPass). The PigPass, introduced in 2006 largely to meet requirements of overseas markets, is a paper-based traceability system for groups of pigs, where the person responsible for the pigs declares that veterinary chemical use and treatments are undertaken in accordance with legislation and/or industry standards (Hernández-Jover et al., 2009a,b). Deficiencies in the current system for post-farm-gate identification of pigs (Hernández-Jover et al., 2008a) and non-compliance with current industry traceability standards (Hernández-Jover et al., 2009a,b) were previously identified.

The stakeholder issues map was drawn by identifying those stakeholders from amongst the initial stakeholder list who could potentially be affected by or able to affect each of these three issues. This was based on information on communication networks of small-scale pig producers (Section 3.2) collated during the interviews and focus group discussions (Schembri, 2009). Subsequently, the stakeholder issues map was distributed amongst the 26 individual stakeholders for verification, obtaining responses from 25 of these. Stakeholders were asked about their agreement or disagreement with the importance of the three issues identified and to confirm their position in the issues map and the strength (weak, moderate or strong) of their relationship with each issue as a measure of how the stakeholders were affected by or able to affect each issue. Responses from different individuals representing the same organization were evaluated to identify differences and if present, a phone consultation was conducted to obtain consensus in the response amongst individuals from the same organization.

### 2.2.3. Evaluation of the interest and influence of stakeholders

Influence and interest maps are widely used in stakeholder analysis and mapping (Bryson, 2004). They can provide a useful visual tool for identifying those stakeholders with high levels of interest in an issue and high capacity to influence the issue. Using terminology proposed by Eden and Ackermann (1998), these stakeholders are called *players* and are clearly vital to successfully address an issue. Those who have high influence but low interest are *leaders* or *context setters*—potential actors, who may be recruited to a particular cause by those with greater interest in the issue. Those with high interest but limited capacity to influence the outcome are *subjects*. However, through alliances, they may be able to exercise much greater influence. Finally, those with low interest and little or no capacity to influence the outcome are the *crowd*. Understanding stakeholders' interest and influence on the issue can assist in the development of risk management and communication strategies identifying those most likely to be in a position to influence the actions of the target group.

Three influence/interest maps, one for each of the three core issues previously identified, were created using a grid system. *Influence* was ranked from 1 to 4, being: 1, no influence; 2, some influence; 3, significant level of influence; and 4, high level of influence. *Interest* was ranked from 1 to 4 being: 1, no interest; 2, some interest; 3, significant level of interest; and 4, high level of interest.

The current study evaluated the *interest* and *influence* of stakeholders from the perspective of the stakeholders themselves, reflecting the importance of each issue to each stakeholder, the priority each specific issue has in terms of the stakeholder's agenda and their perceived influence upon small-scale pig producers. The three grids were distributed amongst the 26 individual stakeholders, who were asked to rank their organization's interest and influence on each specific issue. Responses were obtained from 25 stakeholders. The same approach previously described for the issues map was used for responses of those individuals representing the same organization.

Information on communication networks and traceability of small-scale pig producers gathered during the interviews and focus group discussions (Schembri, 2009) was used to estimate the potential *influence* of the stakeholders on these producers' practices from the producers' perspective. One of the questions of the interviews asked producers to rank the most useful sources of information related to pig production from a pre-selected list, which included government and industry organizations, veterinarians, other producers and livestock agents. In addition, producers were asked about their association with pig industry organizations. During the focus group discussions, information on whom producers communicate with regarding their pigs was collated through a communication target analysis using a 'Participant Target Diagram' (Clark and Timms, 2001). Producers were asked to list regular and potential contacts regarding their pigs and subsequently to place them in a target according to the frequency of contact (always, sometimes, occasionally/hardly and never) and discuss their choices. Moreover, during focus group discussions producers were asked about the reasons of their compliance/non-compliance with legislative (tattoo) and industry (PigPass) traceability requirements. This exercise provided information on producers' attitudes towards different stakeholders (Schembri, 2009). Those stakeholders considered useful sources of information, to whom producers contacted regularly regarding their pigs and those with authority on traceability requirements were considered influential stakeholders. Stakeholders' influence from the producers' perspective was estimated upon on-farm (including disease reporting attitudes) and traceability practices of pig producers and was ranked from 1 to 4 as previously described.

Differences between the stakeholders' perceived influence upon small-scale pig producers and the potential influence of these stakeholders according to producers' communication networks and engagement with the industry were investigated to better understand the extension and communication needs of this sector of the pig industry.

### 3. Results

#### 3.1. Stakeholder identification map

Fig. 1 represents the stakeholder identification map resulting from the initial stakeholder list and map produced by the research team and the verification process involving consultation with a group of representative stakeholders. The main stakeholder groups considered were: government agencies, industry associations, community groups, private organizations, buyers, consumers, media and research institutions. Other producers, family and friends were also identified as important stakeholders. Politicians were added by the research team at both Federal and State levels as biosecurity issues have the potential to become politicized, and consulted stakeholders agreed on their inclusion in the map. The verification process with the stakeholders added a number of potential stakeholders to the initial list created by the research team. These were the buyers, including butchers, supermarkets or restaurants, the Australian Veterinary Association, the Environmental

**Table 4**

Information on communication networks of small-scale pig producers (<100 sows) trading through saleyards in eastern Australia who participated in a face-to-face interview and focus group study in 2007.

Interview study	Most useful source of information on pig health <sup>a</sup> , n (%)
State Department of Primary Industries	33 (41.8)
Australian Pork Limited	15 (22.1)
Livestock Agents	27 (36.0)
Veterinarian	57 (68.7)
Other producers	41 (50.6)
Focus group study	Comments
<i>First point of contact<sup>b</sup></i>	
Other producers	Local knowledge and expertise
Family	Part of the business
Veterinarian	Knowledge and expertise
<i>Last point of contact</i>	
State Department of Primary Industries	Lost confidence and trust due to
	1. Lack of extension services
	2. Regulatory body
	3. Previous negative experiences
Australian Pork Limited	Representing larger pig operations Lack of interest on smaller operations

Adapted from Schembri (2009).

<sup>a</sup> Ranked high to very high usefulness on a 5 point scale.

<sup>b</sup> First point of contact = stakeholders who pig producers always contact regarding the health of their pigs; Last point of contact = stakeholder who pig producers never contact regarding the health of their pigs.

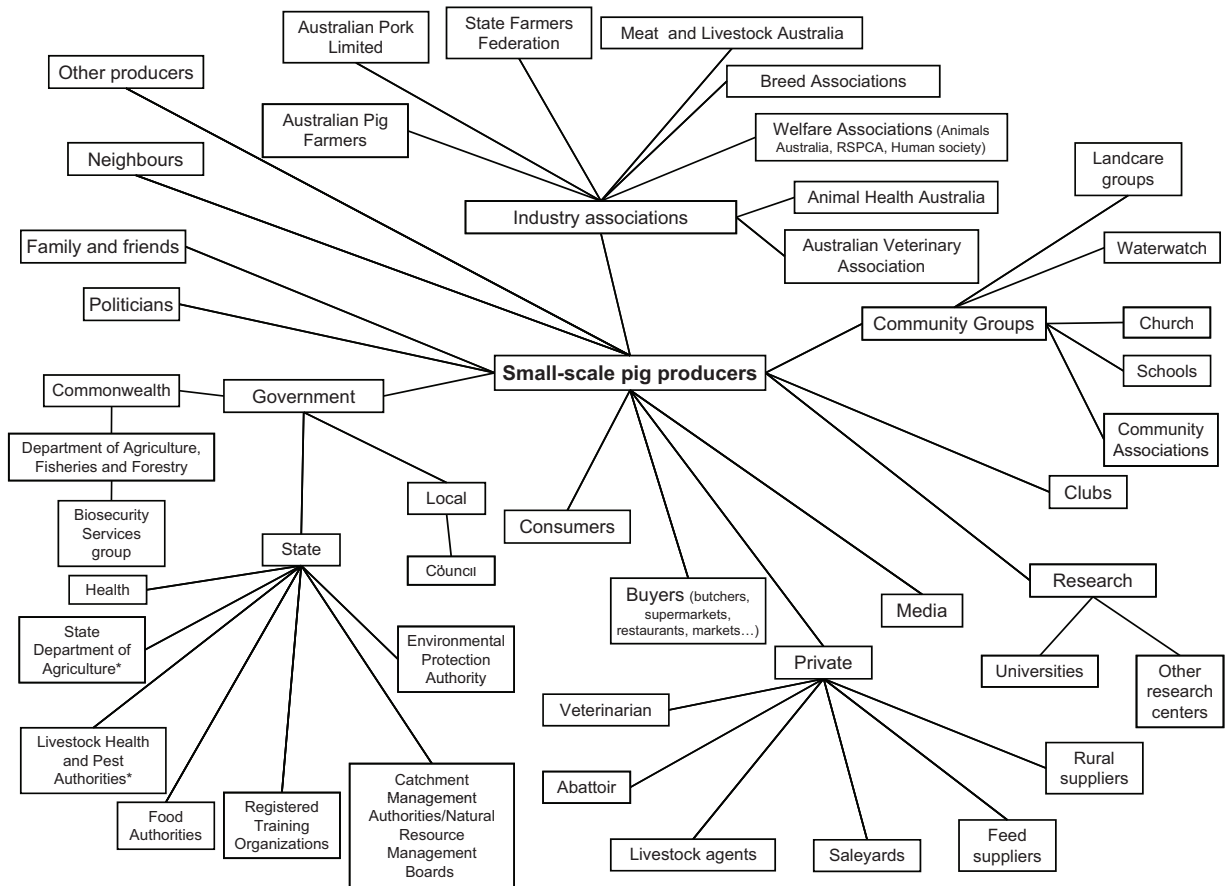
Protection Authority and the Natural Resource Management boards.

#### 3.2. Stakeholder issues maps

The issues map identifying the three biosecurity issues of small-scale pig producers and the stakeholders having an interest in and/or influence on these issues is shown in Fig. 2.

Main findings on communication networks of small-scale pig producers gathered during the interviews and focus group discussions (Schembri, 2009) are presented in Table 4. Results suggest that veterinarians, family and other producers were considered the most useful sources of information on pig production for this sector of the pig industry, with government and APL being considered amongst the least useful sources. Other sources of information considered were livestock agents, rural suppliers and buyers. These stakeholders were all included in the stakeholder issues map.

All stakeholders participating in the verification process agreed that the three core biosecurity issues identified by the research team (on-farm management practices, producer reporting and post-farm-gate identification) were the most important issues related to biosecurity and small-scale pig producers. Another issue mentioned by one of the government stakeholders was profitability and financial situation. The map identifies the main stakeholders who are related to the three issues and represents the strength of this relationship (weak, moderate or strong). The on-farm management is the issue with more stakeholders having an interest or influence on it—including



**Fig. 1.** Stakeholder identification map representing stakeholders having an interest in and/or influence on small-scale pig producers and biosecurity in Australia.

stakeholders concerned with food safety (e.g. Biosecurity Services Group, State Food Authority and consumers) and those interested in maintaining the international integrity of the pig industry and the health status of Australian livestock (e.g. Australian Pork Limited, Animal Health Australia, Meat and Livestock Australia and the government agencies). Similarly, the Australian Pig Farmers, an organization promoting free range pig production with more than 300 pig producers registered, has an important influence on the on-farm management practices of its members. Others are welfare associations, with an important role to protect animal welfare and well-being.

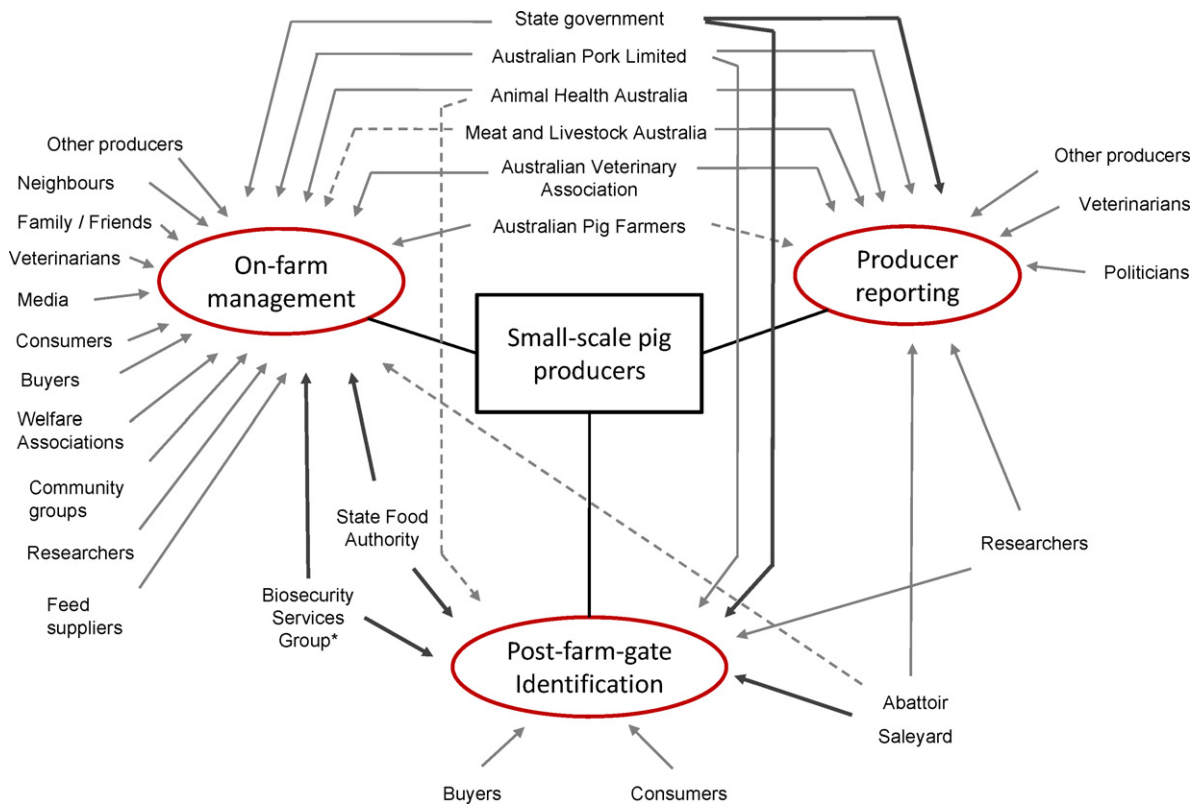
Regarding the mandatory requirements of reporting a notifiable disease to the relevant authorities and of compliance with the traceability requirements for pigs moving off farm, stakeholders with regulatory power (e.g. State government agencies) have the strongest relationship with these two issues. Abattoirs and saleyards also have very strong influence on these two issues as traceability and 'fit for consumption' compliance are a requirement for marketing pigs through these venues. The strength of the relationship of other industry organizations (e.g. Australian Pork Limited, Animal Health Australia and Meat and Livestock Australia) and researchers with the biosecurity issues is weak to moderate. These organizations promote

biosecurity to protect Australian livestock industry from exotic diseases and as a consequence, the Australian export market, however, their influence on small-scale pig producers might be limited.

### 3.3. Influence and interest maps

#### 3.3.1. On-farm management influence/interest map

Fig. 3 shows the self-ranking interest/influence of stakeholders on on-farm management practices of small-scale pig producers. Veterinarians, the Australian Quarantine Inspection Service (AQIS), the State Food Authority and other producers are considered *players* on the on-farm management issue, having high or significant level of interest and influence on this issue. Industry organizations, such as Australian Pork Limited and Animal Health Australia and researchers on biosecurity, although having a *high* interest in the on-farm practices of small-scale producers, their perceived influence was low (*Influence* = 2) and are considered *subjects* on this issue. Self-ranking of government agencies varied according to the different states in Australia. Interest of these agencies ranged from *some* to *significant*; with *no* to *some* influence on this issue. According to these ranks, some agencies are considered *subjects* while those indicating lower interest on the issue would be considered the



**Fig. 2.** Issues map identifying the main biosecurity issues of small-scale pig producers, the stakeholders having an interest in and/or influence on these issues and the strength of the relationship between stakeholders and each issue (—, weak; ———, moderate; —————, strong).

crowd. Saleyards and abattoirs indicated having only some interest on this issue. However, saleyard influence was perceived to be significant, making these stakeholders clear leaders on this issue.

3.3.2. Producer reporting interest/influence map

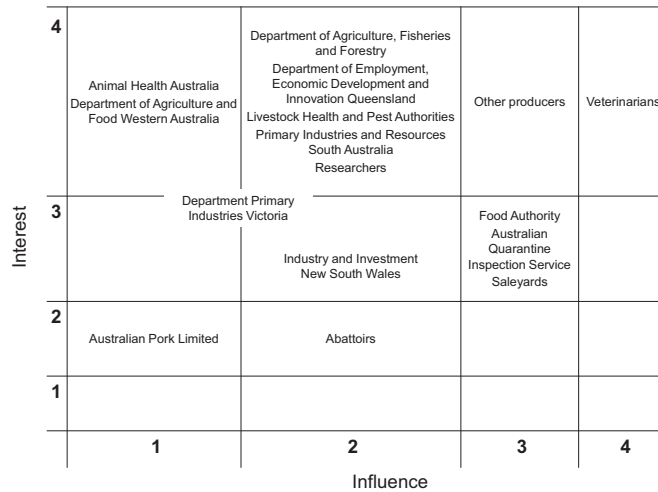
The self-ranking interest/influence of stakeholders on producer reporting behaviour of small-scale pig

producers is shown in Fig. 4. Similar to the on-farm management issue, veterinarians, other producers, saleyards, AQIS and the State Food Authority are considered players on this issue, with high or significant interest and influence. Federal and State government agencies and researchers on biosecurity are considered subjects, having high or significant interest on producer reporting but only some influence on this issue. With a similar rank, Animal

Interest	4		Animal Health Australia Australian Pork Limited Researchers	Veterinarians Australian Quarantine Inspection Service	
	3	Department Primary Industries Victoria	Livestock Health and Pest Authorities		
	2	Department of Agriculture, Fisheries and Forestry	Industry and Investment New South Wales Department of Agriculture and Food Western Australia	Food Authority Other producers	
	1	Primary Industries and Resources South Australia	Abattoirs Department of Employment, Economic Development and Innovation Queensland	Saleyards	
		1	2	3	4
		Influence			

**Fig. 3.** Influence/interest map representing the self-ranking influence and interest of stakeholders on on-farm management practices of small-scale pig producers in Australia. Influence is: 1, no influence; 2, some influence; 3, significant level of influence; and 4, high level of influence. Interest is: 1, no interest; 2, some interest; 3, significant level of interest; and 4, high level of interest.





**Fig. 4.** Influence/interest map representing the self-ranking influence and interest of stakeholders on producer reporting behaviour of small-scale pig producers (<100 sows) in Australia. Influence is: 1, no influence; 2, some influence; 3, significant level of influence; and 4, high level of influence. Interest is: 1, no interest; 2, some interest; 3, significant level of interest; and 4, high level of interest.

Health Australia indicated *high* interest but *no* influence on producer reporting behaviour amongst small-scale pig producers. Australian Pork Limited and the abattoirs were the stakeholders indicating the lowest interest and influence on producer reporting, and as such they are considered the crowd.

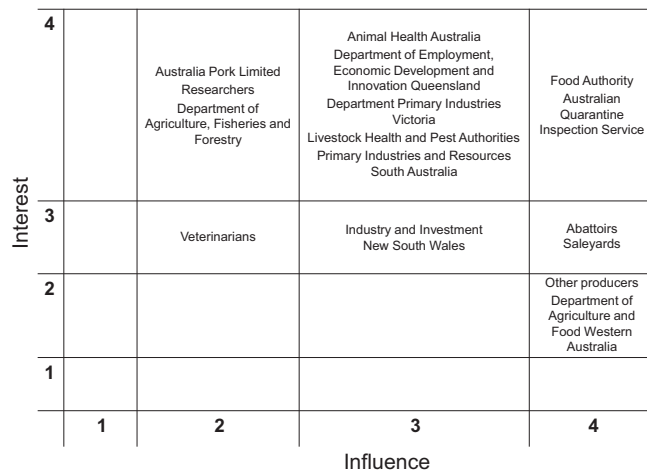
3.3.3. Post-farm-gate identification influence/interest map

Fig. 5 shows the self-ranking interest/influence of stakeholders on the post-farm-gate identification issue. Most stakeholders considered themselves *players* for this issue, with *high* or *significant* influence and interest. Those with the highest interest and influence were AQIS and the State Food Authority. Other producers had some interest and high influence, indicating they could be considered

*leaders* on this issue. Veterinarians, Federal government, Australian Pork Limited and researchers on biosecurity are *subjects* on this issue, with *significant* or *high* interest but only *some* influence.

3.3.4. Stakeholders' influence from the producers' perspective

Stakeholders' influence from the producers' perspective is shown in Fig. 6. According to the interviews and focus group discussions (Table 4), small-scale pig producers considered veterinarians and other producers as the most useful sources of information and to whom they always contact with regarding their pigs, due to their knowledge and expertise on pig production. Family members were also contacted regularly as they were considered part of the business. Accordingly, influence of these stakeholders' on



**Fig. 5.** Influence/interest map representing the self-ranking influence and interest of stakeholders on post-farm-gate pig identification of small-scale pig producers (<100 sows) in Australia. Influence is: 1, no influence; 2, some influence; 3, significant level of influence; and 4, high level of influence. Interest is: 1, no interest; 2, some interest; 3, significant level of interest; and 4, high level of interest.

Influence	4	Veterinarians Other producers Family	State Department of Primary Industries Food Authority Australian Quarantine Inspection Services Abattoirs
	3	Livestock agents Rural suppliers Abattoirs Buyers	Livestock agents Other producers Buyers
	2	State Department of Primary Industries Australian Pork Limited	Veterinarians Australian Pork Limited
	1	Animal Health Australia Department of Agriculture, Fisheries and Forestry	Animal Health Australia Department of Agriculture, Fisheries and Forestry
		On-farm practices	Traceability

**Fig. 6.** Influence of stakeholders perceived by small-scale pig producers (<100 sows) in Australia on their on-farm and traceability practices. Influence is: 1, no influence; 2, some influence; 3, significant level of influence; and 4, high level of influence.

producers' practices was estimated to be *high*. Although, State government agencies and APL were useful sources of information by some producers, focus group results revealed that producers would never contact these organizations regarding their pigs. Reduced extension services provided by the government agencies and their increased regulatory role, and previous negative experiences, such as implementation of quarantine measures, were the main reasons why producers lost confidence with the State government agencies and ranked them as the last point of contact regarding their pigs. Producers perceived APL as being an organization representing only the larger commercial pig enterprises without any interest on smaller operations. The lack of involvement by these producers within the pig industry and the negative attitudes towards authorities identified suggest that these stakeholders only have *some* influence on producers' on-farm practices. Influence of livestock agents, rural suppliers, abattoirs and buyers was estimated to be *significant* as these stakeholders were producers' second point of contact.

Different stakeholders' influence was identified regarding compliance with traceability (post-farm-gate identification) requirements. Producers stated that identifying pigs post-farm-gate with a tattoo was mandatory according to the State government regulations and was also required by abattoirs and saleyards. Moreover, producers were using the national vendor declaration (PigPass) as a requirement of AQIS and the State Food Authority to sell pigs through abattoirs and saleyards. This was also required by some buyers. Therefore, the influence of these stakeholders was estimated *high* or *significant*. Producers considered APL having *some* influence on their traceability practices as the PigPass was developed, implemented and supplied by this organization.

Interestingly, neither Animal Health Australia nor the Federal government was initially mentioned by producers. However, producers ranked these organizations as having *no* influence on their on-farm and traceability practices after being asked by the researchers.

When comparing the influence of stakeholders from the stakeholders and the producers' perspective, agreement was observed in most of the influence ranks for producer's on-farm and traceability practices. Slight differences were reported on the ranking of abattoirs, which self-ranked themselves with lower influence on on-farm

practices than their perceived influence by producers. Similarly, self-ranked influence of State government agencies on traceability practices was also lower than the influence perceived by producers.

#### 4. Discussion

Applying stakeholder analysis and mapping processes to the biosecurity issue amongst small-scale pig producers has provided a better understanding of the various stakeholders and their capacity to be effective as part of a future extension program. To this extent, stakeholder analysis and mapping can add useful insights for the development of a strategic approach to risk governance. This process identified the capacity of various stakeholders to influence the different outcomes and, from the available data, the extent to which they have been successful, or not, in achieving these outcomes. One of the limitations of this study is that influence of stakeholders from the producers' perspective is based on information on communication networks gathered during previous studies. However, interviews and focus group discussions conducted during these studies (Schembri, 2009) provided extensive information on attitudes of small-scale pig producers towards stakeholders and producers' preferences regarding sources of information. This information has been used to estimate the perceived stakeholders' influence by the small-scale pig producers. Similar methodology has been previously used by Gilmour et al. (2011), where surveys, interviews and informal discussions were used to build stakeholders influence/interest maps. Another limitation of the study is that verification of stakeholders' influence was only limited to the initially identified stakeholders with direct involvement with the pig industry and biosecurity. This analysis could have been more comprehensive if other stakeholders were included in the verification process. We also acknowledge that there are other issues that may be of importance to stakeholders, such as animal welfare, environmental degradation or economic considerations. Focusing on compliance with biosecurity standards, disease reporting and post-farm-gate identification allowed us to address topics of major interest to the industry and to the regulatory authorities that are relevant to the activities of small-scale producers within the broader industry.

Most practices related to biosecurity are underpinned by on-farm quality assurance programs. Complying with these programs, which is a requirement of AQIS and some State Food Authorities when providing pigs to an abattoir, is perceived as a complex process by small-scale pig producers, due to the high cost and extra work involved (Hernández-Jover et al., 2009a,b). These stakeholders, and as a consequence the abattoirs, can have high influence on improving compliance of small-scale pig producers with this requirement, as animals should not be accepted for slaughter unless they have been raised under a quality assurance program.

Veterinarians were considered trusted sources of information and players for improving on-farm management practices and disease reporting amongst small-scale pig producers. Arguably, veterinarians have high level of interest as good on-farm management practices are for the benefit of the whole livestock industry and they have the responsibility to report all notifiable diseases. However, although producers stated veterinarians being useful sources of information and the first point of contact regarding their pigs, previous studies (Schembri, 2009) reported only 17% of small-scale producers contacting the veterinarian in the previous 12 months and up to 33% stating never contacting a veterinarian for the health of their pigs. Moreover, producers participating in the focus group discussions were concerned about the lack of veterinarians with pig knowledge and skills in some regions of Australia (Schembri, 2009). Therefore, their influence might be dependent on a pig veterinarian being available in the region. Previous studies reported some level of mistrust of the expertise of private veterinarians amongst sheep and cattle farmers in Western Australia (Palmer et al., 2009). The number of private veterinarians per square kilometre and per livestock standard units in Australia (0.0011 and 2.38, respectively) in 2009 was much lower than that in other countries such the United Kingdom (0.0441 and 5.93, respectively) (OIE, 2008). The low veterinarian to livestock ratio in Australian suggests a shortage of rural veterinarians, which agrees with producers' perceptions.

Saleyards, abattoirs and livestock agents are stakeholders with high influence on on-farm practices and disease reporting, and are perceived by small-scale producers to be useful sources of information and contact (Schembri, 2009). An outbreak of an exotic disease at these venues would mean the closure of the business for a period of time, causing significant income and reputation loss. Although their interest is likely to be commercial to protect their own business, they could be leaders and useful conduits to improve farm management and disease reporting for those stakeholders with high interest but low or no influence, such as government agencies and industry organizations. Small-scale pig producers did not feel represented by APL, the pork industry organization, with only 11% of those producers participating in the interviews study being members of APL (Schembri, 2009).

Trust and legitimacy are clearly important indicators of influence (Lofstedt, 2005; Palmer et al., 2009), hence the capacity of family and other producers to influence outcomes. Family was considered being part of the business and as such, being involved with the decision making

process of the pig farm. Although this influence seems to be related to productivity and financial benefit, family members can also influence on-farm management and disease reporting should there be risks to human health (potential zoonosis), especially if children are part of the family. Recent studies evaluating perceptions of general public and pig producers on the pandemic H1N1 outbreak in Australia (Dhand et al., 2011; Hernández-Jover et al., unpublished results), indicate that people is more concerned about the health of their families than their own. Other producers have high interest in good farm management and disease reporting across all small-scale pig producers, to protect their own herds from unwanted diseases and the reputation of this sector of the industry (Hernández-Jover et al., 2008b, 2009a,b; Schembri, 2009; Schembri et al., 2010). Their high influence on each other is an indication of a trusting relationship. As Palmer et al. (2009) indicates, producers are more likely to trust members of the local community as people living in the local community are known sources known for the producers.

Reporting exotic diseases is enforced by the government agencies. However, as Marshall et al. (2006) and Cameron (1999) identified, diseases are not reported due to poor disease knowledge, lack of awareness of the legal requirement and of potential consequences to the industry, lack of access to communication channels or perceived negative personal consequences resulting from reporting. A previous study amongst sheep and cattle farmers in Western Australia (Palmer et al., 2009) identified trust as the key contributor to perceived risk, and as such, being one of the main factors influencing producers' attitude towards disease reporting and communication networks. Although pig producers acknowledged that reporting is mandatory, there was a general loss of trust and confidence on the government agencies (Table 4), mainly due to the lack of extension services and the fear of potential consequences, such as quarantine measures, social stigma and loss of income. Palmer et al. (2009), stated similar reasons for farmers' dissatisfaction with government agencies, with the lack of accessibility, inappropriate handling of issues and poor communication channels are the main ones. The extent and quality of extension services provided by government agencies have declined in the last decades, due to reduced government funding for this purpose and the use of outdated extension methods (Commonwealth of Australia, 2007; Marsh and Pannell, 1998; Vanclay, 2004). Moreover, if producers are hesitant to trust government sources, important animal health messages may not be delivered (Palmer et al., 2009).

Other organizations included in the stakeholder identification map but not consulted in the verification process were animal welfare organizations, the Landcare and Waterwatch groups and the media. Over-reaction of the media in previous outbreaks was one of the barriers to disease reporting (Table 3). A study on the pandemic H1N1 outbreak in piggeries in Australia (Simon-Grife et al., unpublished results) reported the media involvement as being the most stressful factor during the outbreak.

In contrast with on-farm practices and disease reporting, influence of government agencies on traceability requirements was high due to their regulatory power

on this issue. However, although investing significant resources into extension and education campaigns regarding pig branding, previous research observed a lack of compliance with the branding requirement (Hernández-Jover et al., 2008a) and the use of the PigPass coupled with an on-farm quality assurance program (Hernández-Jover et al., 2009a,b). This suggests that the current processes are not leading to the intended producer action. Focus group discussions identified producers' lack of interest in implementing the new requirements, mainly due to the costs involved and the lack of benefits. Confusion about the PigPass requirements was also identified, especially because they perceived a lack of support and information from industry and government (Hernández-Jover et al., 2009a,b). These producers may not sell animals on a regular basis and so therefore may not be aware of the requirements or, if they are aware, have not had time or motivation to acquire a brand. The State Food Authorities and AQIS also have high influence on this issue. The PigPass system, which was developed as part of the National Livestock Identification Scheme (Pork) Project plan (APL, 2007), is an AQIS driven requirement to protect the pig export market. Abattoirs and saleyards are expected to require both branding and the PigPass coupled with on-farm quality assurance, and they should reject non-compliant consignments, thus having high influence and interest with respect to post-farm-gate identification.

## 5. Implications

This study has highlighted anomalous situations where stakeholders have both high interest in achieving a particular outcome and high compliance-driven influence, but where the desired outcomes have not been achieved. To bring about the change they want to achieve, the government and industry agencies need to work with the small-scale pig producers and with those who have the capacity to influence them. They need to identify those drivers that will encourage the pig producers to see these measures and practices, such as on-farm biosecurity, disease reporting and pig identification as being in their interest so that they become committed to them.

To improve performance in respect of the critical biosecurity issues, the key government agencies will need to adopt different strategies. Firstly there needs to be a focus on awareness-raising, which highlights the benefits that will accrue to small-scale producers. Secondly, they will need to build alliances with those stakeholders (or agents) that are trusted by the small-scale producers, such as veterinarians, saleyards or rural suppliers, and work through them to engage the interest and trust of these producers. Thirdly, they will need to acknowledge that successful biosecurity risk management amongst small-scale pig producers will depend on shared responsibility amongst all the stakeholders involved and this will depend on building trust amongst those stakeholders and on empowering the small-scale pig producers to accept responsibility for biosecurity outcomes.

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