Usefulness of Stakeholder Network Analysis: A case study of the aquatic plant industry in Victoria

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Introduction

This paper will highlight the usefulness of social network analysis (SNA) through a discussion of an evaluation conducted by Roberts Evaluation in 2008 for the Victorian Department of Primary Industries (DPI) programs *Improving Provincial Victoria's Biosecurity* and *Weeds and Pests Initiative.* SNA is a method that is used in the social sciences to understand the links that exist between stakeholders within a network or system. In this study, a modified version of SNA was used in conjunction with other methods including stakeholder profiling and supply chain analysis to build a profile of the aquatic plant industry within Victoria. This information was used for guiding communication and engagement strategies to reduce the spread of aquatic pests through the aquatic plant industry. We argue that the usefulness of SNA is that it provides evaluators with a means to collect evidence primarily concerning the spread and extent (quantity) of networks. Combined with a more traditional stakeholder analysis approach that inquires into the quality of interactions between stakeholders, we argue that SNA is a useful method for evidence based decision making for community engagement programs.

Network Analysis in Evaluation

Social network analysis has been applied in a wide range of disciplines including organisational development (Durland, 2005), health (Lewis, 2005), education (Penuel et al, 2005) sociology (Scott, 1988), natural resource management (Prell et al, 2007), criminology (Sarnecki, 2005), and cultural studies (Crossley, 2008) to name a few. According to social network theory, the structure of relationships between stakeholders determines their access to resources and information, and hence, their relative power and influence within a network. By focusing on the *connections* between stakeholders, network analysis can reveal the pathways for disseminating information and identify flows of exchange within and between actors within a system. This assists in identifying potential *risks*, *opportunities* and *barriers* to effective community engagement.

In the past ten years, there has been increasing interest in the application of network analysis methods within evaluation. In 2005 for instance, the American Evaluation Association Journal *New Directions in Evaluation* released a whole issue devoted to this theme. This issue documented a range of studies that have used network analysis methods to evaluate

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interventions and programs spanning disability (Fredericks, 2005), research and development (Birk, 2005), organisational restructuring (Durland, 2005), health care delivery (Introcaso, 2005), and education.

Natural Resource Management and Biosecurity Networks

Recently in Australia there have been a handful of evaluations which have used SNA or a similar approach in the evaluation of natural resource management (NRM) programs and policies. These studies have used network analysis methods to determine the influence of social networks on a range of NRM projects including:

- Indigenous land management in the Gulf Country, Northern Territory (Woodward, 2008);
- Coastal ecosystem management in Gippsland, Victoria (Dawson, 2007);
- The identification of opportunities for a New South Wales Catchment Management Authority to partner with other organisations (Molino Stewart, 2008); and
- Community engagement in weed and pest management in Victoria (Roberts Evaluation, 2008, 2009).

Meanwhile, other Australian studies have used systems approaches to study fire responsiveness in community networks (Elsworth et al, 2009), and investigated stakeholder analysis in risk assessment (Gilmour & Beilin, 2006). The common thread in these studies is an emphasis on understanding the system of relationships as a whole between NRM stakeholders and the recognition of the role that social capital[2] plays in shaping natural resource outcomes (Cocklin & Dibden, 2005). The management of natural resources is increasingly recognised as a problem that features a high degree of interdependency between stakeholders with disparate and often conflicting interests and value systems. In his recent climate change review, Ross Garnaut (2008) cited the management of Australia's natural resources as a classic example of a 'wicked problem'. Wicked problems are characterised by constant change and defined a myriad of different causes, which cannot be distilled and reduced to one single factor. The policy solutions to wicked problems therefore lie in the hands of multiple stakeholders, who inevitably have differing interests and values (APSC, 2007).

We argue that pest management, and in particular Biosecurity, is a classic wicked problem. Pest management is often characterised by a high degree of interdependency between public and private stakeholders across various federal, state, regional, and local jurisdictions, often with different interests and objectives. Pests do not recognise boundaries (i.e. are tenure blind), and therefore what is a private problem can quickly become a public problem and vice versa.

[2] Social capital is commonly associated with "relationships...social networks...[and] other attributes such as trust, reciprocity and shared norms and values, which maintain the ties between individuals and enable common action" (Cocklin and Dibden, 2005, 5).

Recognising these challenges, federal and state agencies responsible for managing pests have in recent years begun to focus on the social nature of pest management (Fitzgerald, 2008) in addition to traditional technical control methods. Thus, resources are increasingly being devoted to understanding what influence social networks and other factors have on pest management outcomes.

Aquatic Plant Trade Case Study

Research conducted by the DPI has identified the aquatic plant industry as posing a particular risk to Australia's Biosecurity (TWOPL, 2005). Several aquatic plant species with weed potential are presently traded for domestic use in home aquariums and water gardens, and current Weeds of National Significance (WoNS) such as *Cabomba*, and *Salivinia* are still traded as ornamental aquarium plants in some states (Petroeschevsky, 2004). If these seemingly benign domestic plants are disposed of inappropriately (i.e. flushed down a toilet) or cultivated illegally (i.e. in waterways), they can become pests. Aquatic weeds can reap massive environmental damage by clogging up and suffocating waterways, lakes, and estuaries, and present serious environmental, economic and social costs to taxpayers (Petroeschevsky, 2004). Presently the trade of aquatic plants in Australia is largely unregulated, with penalties for traders in plant species identified as noxious weeds being different in each state. To make matters more complicated, the trade of aquatic plants occurs across state boundaries, with allowances for certain nationally prohibited weeds in some locations due to climactic variability.

In early 2008 under the auspice of *Improving Provincial Victoria's Biosecurity* and *Weeds and Pest Initiative*, the DPI commissioned an evaluation of the aquatic plant industry in Victoria. The objective of the study undertaken by Roberts Evaluation was to determine the pathways for the spread and supply of aquatic plants within Australia. More specifically, this study sought to identify specific points within the supply chain – including producers, suppliers and consumers – which presented a particular risk in terms of their likelihood to trade, or have an interest in plants that have the potential for weediness. In addition this study also sought to identify barriers and opportunities for disseminating information within the network by identifying potential information channels and conduits.

Methodology

This study was conducted over two phases in 2008 and utilised a mix of methods including social network analysis, stakeholder profiling, and a market supply chain analysis. The first phase set the parameters for the network that was investigated in some detail in phase two. The primary source of data used in this study was interviews with key industry representatives and informants. Other forms of data included a document review, observations, and textual analysis of online plant discussion groups. The first phase was exploratory and sought to determine the

scope of the industry and provide direction for further research from in-depth interviews with 12 key government and industry representative stakeholders, while in second phase a further 43 interviews were conducted with aquatic plant traders.

Each respondent in phase two was asked questions that pertained to their network position and relationships with other stakeholders in the industry, as well as questions that focused on the attributes of the stakeholder themselves. In order to determine the relative position of stakeholders in the network and supply chain for aquatic plants, respondents were asked the following questions:

- Where do you obtain information about aquatic plants?
- Where do you source your aquatic plants from?
- Who do you distribute aquatic plants to?

These questions yielded relationship data which was entered into a socio-matrix for all the stakeholders within the network. Using the socio-matrix, the relationships between stakeholders were analysed to identify the hubs for the dissemination of aquatic plant information, and also for the supply of aquatic plants within Victoria. This was done by simply counting the number of connections that each stakeholder had with one another.

Relationship data was then used to construct a model of the supply and distribution of aquatic plant information and material goods across Australia (though with a focus on Victoria), which was developed manually using spreadsheet software (see appendix). Stakeholder profiles were also developed to provide further insight into their role; position within the network; degree of aquatic plant and weed awareness; the relevance of their activities to the DPI programs *Weeds and Pests Initiative* and *Improving Provincial Victoria's Biosecurity*; and finally their level of perceived responsibility with regard to weed management.

In addition to stakeholder profiles and network analysis, a qualitative analysis of the supply chain was undertaken using Porter's Five Forces model (1998) that took into account: degree of rivalry, threat of substitutes, buyer power, supplier power, and barriers to entry. This market analysis complemented the stakeholder and network analysis by providing insight into the influence of competition on the supply and trade of aquatic plants particularly in terms of the formal and informal markets for aquatic plants that would be impacted by policy responses.

Findings

A map of aquatic plant stakeholders was developed encompassing government and industry stakeholders (see appendix).

Government agency and authority stakeholders were centred on the following clusters in the network:

- Research and development (R & D) (i.e. CSIRO);
- Coordination and implementation (i.e. the National Aquatic Weed Management Group, DPI); and
- Statutory authorities responsible for the management of waterways and estuaries.

Based on the number of connections within the network, the hub for the disseminating aquatic plant information was identified as the National Aquatic Weeds Management Group (NAWMG). NAWMG plays a key role in coordinating the national approach to aquatic weed management by liaising with research and development organisations, state government agencies and industry organisations.

Industry stakeholders were centred on the following clusters:

- The **garden and nursery** industry comprised of:
    - Specialist water garden growers;
    - Generalist garden and nursery suppliers; and
    - Landscaping and revegetation.
- The **aquarium and pet shop** industry comprised of:
    - Aquarium retailers; and
    - Aquarium hobbyists.

Within the aquatic plant industry it was found that although the retail supply of aquatic plants is dispersed within the garden/nursery, water garden and aquarium industries across Victoria, the origins of aquatic plants is quite centralised with a few key players being responsible for the majority of plants on the market. This market centralisation was most pronounced in the aquarium plant industry with an estimated 60 – 80% of aquarium outlets sourcing their plants from one supplier based in Queensland[3]. A similar trend was observed in the water garden market, with two major growers supplying the majority of Victorian retail nurseries, hardware stores and garden centres. This centralisation is in part due to the fact that the commercial cultivation of aquatic plants is a highly specialised practice which has large set up cost and a set of horticulture skills *distinct* from other forms of plant cultivation (i.e. barriers to entry).

[3] This business cannot be identified due to confidentiality.

Within the aquarium sector there was a significant degree of overlap observed between aquarium retailers, hobbyists and informal traders; for instance, it is not uncommon for an aquarium retailer to have come from a hobbyist background. Meanwhile, 'swap meets' and casual plant and fish trade within aquarium clubs and societies contribute to a culture of informal trade. In addition approximately 40% of aquarium retailers contacted for this study[4] reported contact with unlicensed operators. Due to this high level of informal trade within the aquarium sector, the aquarium industry was identified as presenting a particularly high risk in terms of the likelihood to trade in/or have an interest in aquatic plants with a potential for weediness.

Summary

In this study an indicative profile of high risk plant trade was developed using mixed methods including social network analysis, stakeholder profiling and supply chain analysis. The evidence collected using these methods highlighted informal hobbyists and backyard traders within the aquarium industry as representing the highest risk in terms of likelihood to trade in aquatic plant species with weed potential. The major challenge encountered in this study, and no doubt one found in other evaluations of social networks and community engagement programs, is how to evaluate 'informal' networks that by their nature remain hidden from view? As evaluators we typically rely on 'official' contacts, whom, to generalise, tend to operate with more accountability and less risk than smaller 'informal' hobbyists and 'backyard' plant traders. These informal traders who were unreachable precisely because of their informal status were identified as presenting the highest *risk* (and by proxy *priority*) for subsequent engagement.

While this study was not able to identify these traders specifically, SNA played a key role in illuminating the centralisation of aquatic plant trade to a few key operators within the water garden and aquarium sectors by eliciting evidence concerning the quantity of connections within the network. Combined with a more traditional stakeholder analysis approach that focused on the *quality* of the relationship attributes between stakeholders within the network (i.e. *how* traders interact), this study generated an understanding of the culture of interactions between aquarium traders, and specifically, reliable evidence of informal trade within this sector. As this study moves towards implementation of a community engagement and industry partnership program by the DPI, this knowledge of the industry has assisted the industry partnership team with an evidence base for a more informed and targeted engagement strategy.

[4] Of 22 aquarium stakeholders contacted, nine (41%) reported contact with an unlicensed informal trader who tried to sell them aquatic plants or fish.

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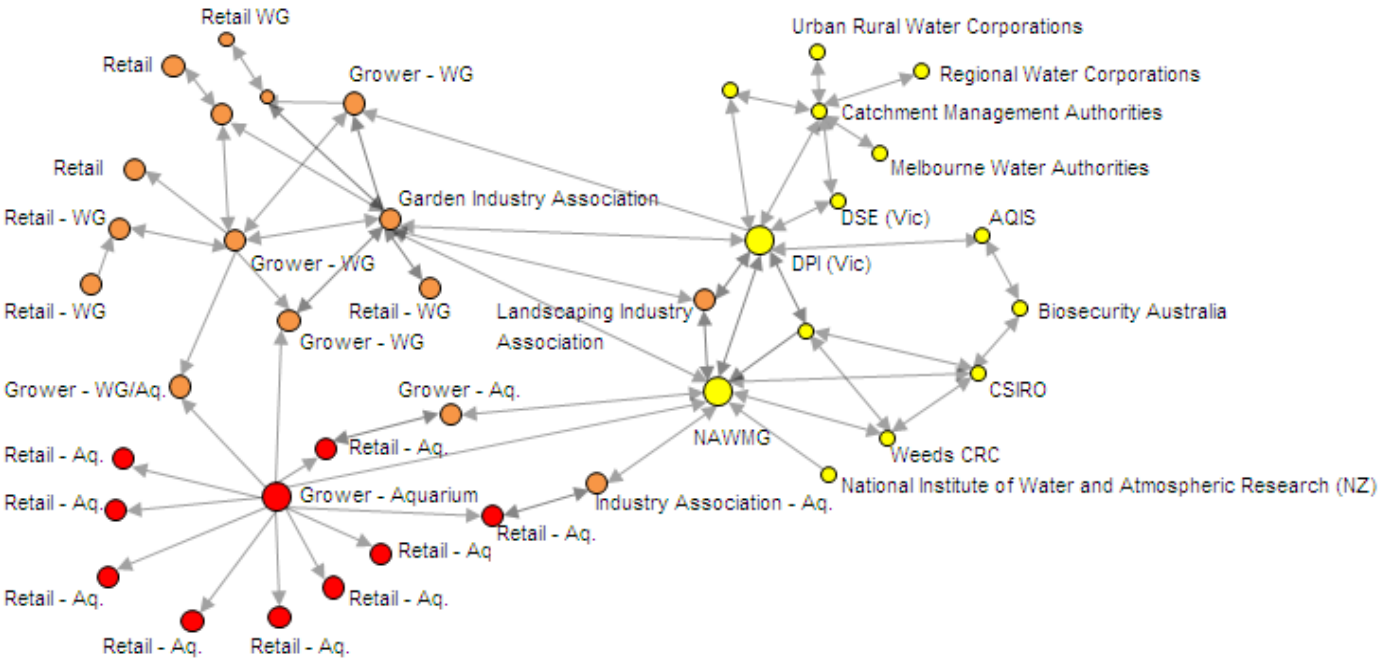
Appendix

Aquatic Plant Industry (Victoria): Stakeholder Network Map*



*Note this map has simplified to illustrate the major clusters.

**Industry stakeholders have not been identified to ensure confidentiality.