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Place-Based Knowledge Networks: The Case of Water Management in South-West Victoria, Australia

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ABSTRACT: This article aims to investigate the need for effective exchanges between knowledge generators and knowledge users in water management. Firstly, we explore the use of adaptive management for water governance and then outline the communication issues of water-management knowledge at a regional scale. Central to this approach is the need to harness 'local' knowledge that can be used to develop community participation in local water governance. Accordingly, we propose a three-network communication model to illustrate the process and identify the issues of concern for developing place-based strategies. Since research plays a central role in knowledge generation, one of the first ways to proceed is to recognise local research and incorporate it into an inclusive decision-making process. One way to achieve this is through the development of regional networks that are openly available to all, and we explore this by focusing on the place of 'network thinking' at local scale using a newly developed regional network for local knowledge dissemination in south-west Victoria, Australia. We conclude that so far this new network is too heavily reliant upon one web-based tool and outline a broader range of strategies that can be used to achieve its aims.

KEYWORDS: Adaptive management, governance, communication, knowledge, networks, Australia

INTRODUCTION

Sustainable resource management presupposes linkages between economic, social and environmental domains (Elliott, 2004). For Csurgó et al. (2008) "the conservation or renewal of resources, quality of life and the local livelihood-oriented forms of sustainable development are related to the state of resources". Primary among resources for rural areas is water which is now at a critical point in Australia across a range of geographical scales. In western Victoria for example an Aral Sea Syndrome, albeit on a smaller scale, is developing in the vicinity of lake Corangamite. Furthermore, there are already water-related conflicts in western Victoria over environmental flows in the Glenelg and Wimmera rivers, and within the Merri river different users of water are vying for access to water.

Part of the solution to water-related management issues is a change in human perception of water problems. This is in addition to instruments which may be market-based or state-supported (German Advisory Council on Global Change, 1997), although it is likely that the future involves a change in the traditional role of government in this area (Blomquist and Schlager, 2005). Community-level responses to the water crisis involve education, public discussion of the issues, and communication between sectors. This helps in fostering learning, which will result in changes in attitudes and behaviour at various levels of society from the individual to the community to national and international

organisations. However, it must be remembered that people always act in local contexts that are spatially and temporally specific (Brierley et al., 2006). Further, it must be recognised that knowledge transfer implies not only a convergence of information translation but also some confluence on the political values and beliefs of all stakeholders.

If, as the OECD (2006) report argues, place-based "rural policy is strongly knowledge-based and involves multiple actors" then there is a need to harness 'local' knowledge in developing governance in rural locations. Since research plays a central role in knowledge generation one of the first ways to proceed is to recognise and incorporate local research into an inclusive decision-making process. However, access to, or generation of, knowledge can be a major source of power for local and extra-local interests, who may sometimes use a variety of conscious and unconscious strategies to block access to local sources of knowledge (Fonte, 2008). This can occur in a number of ways including the manipulation or selective release of information to suit special interests, the creation of 'expert' language in occupational and managerial settings, the creation of privacy or commercial-in-confidence barriers or the export of expert knowledge to closed networks beyond the local area. One way to overcome this blockage is to develop regional networks that are openly available to all. In the process, knowledge networks would need to move from their safe sectoral boundaries to contested broader place-based networks. This implies that the knowledge generators and knowledge users need to find better ways to communicate in a meaningful way.

The aim of this paper is to investigate the need for effective information exchange between knowledge generators and knowledge users in the area of water management. We discuss regional-scale adaptive management of natural resources and the place of community participation in local water management. The nature of the communication process relating to water management issues at a regional scale is then explored. Next, we outline the place of 'network thinking' at the local scale focusing on a newly developed regional network for local knowledge dissemination between knowledge generators and knowledge users in south-west Victoria, Australia. Finally, we identify some of the problems associated with developing a place-based network resting purely on knowledge exchange.

ADAPTIVE MANAGEMENT AT REGIONAL LEVEL

Over the past few years it has been recognised that regions and catchments are the most suitable scale for managing natural resources, particularly coastal and inland water issues (Alexandra et al., 1998; Rhoades, 2000; Henriksen and Barlebo, 2008). Regional strategies are considered most effective when generated and overseen by the community with appropriate support from other sectors (National Natural Resource Management Task Force, 1999). It is argued that the regional scale offers the best opportunities for planning and action, industry and community development, resolving conflicts and determining priorities, and integrating social, economic and environmental considerations (Aslin and Brown, 2004). Most of the strategic planning for catchment management makes use of the adaptive management approach (Brierley et al., 2006). The basis of this approach is the acceptance that people do not have full control over, or understanding of, their environment and therefore regular revision of management plans is necessary to account for unanticipated changes or development of knowledge (Alexandra et al., 1998).

The argument is that regional strategies are most effective when generated and overseen by the community. This approach requires devolution of decision making and appropriate support. One aspect of this support is the requirement for ready access to relevant data and information. A key requirement for adaptive management is environmental, social and economic information. For effective natural (and, in this case, specifically water) resource management there is an increasing need to combine the experience, knowledge and preferences (or values) of the community with the expertise and knowledge base of managers, businesses and researchers (Robinson, 2000).

Kawashima (1999) argues that the state of the environment should not be judged primarily by researchers or managers but by the community. The lack of effective community participation is a significant barrier to developing regional governance strategies, and the involvement of the community in environmental monitoring is an integral part of current approaches to adaptive catchment management. If this is the case then the community needs to understand environmental problems within a broad framework of knowledge and to achieve this, *their* understanding of local issues should be recognised in the local network.

To meaningfully involve the community in adaptive catchment management requires that the community possesses not only the required knowledge but also skills, attitudes and motivation to work with other sectors to manage water (Allan and Curtis, 2003). This involves decision-making processes that create knowledge partnerships between managers, researchers, businesses and the community. However, partnerships face the governance "problems of securing: (1) convergence among a diversity of actors and organisations; (2) of redistributing power in an organisational or social field that is characterised by a high level of heterogeneity; and (3) of gaining sufficient legitimacy to act in the name of the collectivity" (Contandriopoulos et al., 2004).

Convergence here is defined as the "capacity of individuals, groups or organisations in a collective setting to agree on a certain decision or a certain course of action" and convergence is a 'capacity' to agree, not an agreement itself (Contandriopoulos et al., 2004). There are times when communities may support the delegation of the operational decision making to expert management agencies for particular events or managers may devolve responsibility to local groups (e.g. landcare[1]) (Hatfield-Dodds et al., 2007).

Generally, networks share common languages and understandings around their mutual interests and exchange resources, including knowledge, to achieve their common goals (Borzel, 1998). Central to network thinking is trust but there are significant proportions of the population whose evaluation of water governance is biased due to a lack of trust in the relevant management authority (Jorgensen et al., 2006); in particular, many believe that conflicts arise when water managers act as both resource supervisors and providers of a market product (Po et al., 2005). Building trust between networks requires more than information or knowledge and implies some sense of shared norms.

A second problem, power redistribution, concerns the "changes in the relative capacity of individuals, groups or organisations to interpret decisions and organisational arrangements according to their own values and interests" (Contandriopoulos et al., 2004). A central issue for this paper is the knowledge diffusion within water governance and the place of different forms of knowledge – scientific, managerial and lay (Tovey and Mooney, 2006). Scientific knowledge, because it is construed as coherent theoretical constructions that have a concern to formulate universalistic understandings within a disciplinary framework, is treated as either expert or, outside the scientific community, it is either accepted uncritically or rejected as unintelligible. Managerial knowledge can be interpreted as a second form of 'expert' knowledge that may be shaped both by past experience in management practice and by formal managerial education. Managers are often caught between the adoption of 'expert' opinion and the necessity to translate the results into an instrumental form for political and community consumption. Lay knowledge of natural processes is most often based upon a range of factors including empirical perceptions of practical experience and tacit understanding of "how things work" (Tovey and Mooney, 2006). These will include particular understandings of local ecosystems and relationships between different elements within them or the productive processes such as how to grow particular types of plants under local conditions or how to manage complex water flow systems for agriculture or fishing.

A significant issue for power redistribution is that 'evidence-based' approaches are not purely based on an instrumental view of research. Evidence-based approaches as found in a scientific work is much

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[1] Landcare is a uniquely Australian partnership between the community, government and business to 'do something practical' about protecting and repairing the environment.

more complex and includes conceptual use which encompasses raising awareness, changing perceptions, and increasing understanding of the relevant issues, all of which often come with 'expert' training and background (Law, 2008). In this sense, information becomes knowledge by overview, critical assessment, weighing up conflicting pieces of information and assembling information into coherent groupings (Haigh, 2001). With such strictures, Sueishi (1999) argues that the involvement of researchers in an environmental issue for example has the potential for creating a monopoly in terms of the control of knowledge and/or systems for the collection of information.

A third governance problem is legitimacy that is defined in terms of "a perception that the actions of an entity are desirable, proper or appropriate within some socially constructed system of norms, values, beliefs and definitions" (Contandriopoulos et al., 2004). While there are many issues that can cause conflict in the management of regional water, groups in Australia generally have more similarities than differences (Syme and Hatfield-Dodds, 2007). However, issues of legitimacy can arise when there are divergences in the emphases placed upon values and goals. For example, managers will tend to emphasise output-oriented processes such as efficiency, control and industry outcomes while community expectations may focus on input-oriented processes, such as costs of services, who pays, and issues of vulnerability and distribution (Hatfield-Dodds et al., 2007). As efficiency is often a major goal of policy design, environmental decision making tends to restrict legitimacy to institutional settings where managers tend to rely on expert knowledge (Hallstrom, 2004).

Since legitimacy involves shared norms, values and beliefs, problems arise when 'hostile audiences' stand against one sector or another. This may occur because the management implications of the information being discussed are unpalatable or because the perception of the issue is different amongst the partners in the network. That is, regardless of which sector is involved, it may often be telling other sectors things they simply do not wish to hear. Even attempting to communicate the fact that perceptions differ between sectors may be difficult. This can discourage face-to-face communication and encourages communication through the safer channels of sector networks. Cross-sectoral communication then relies upon serendipitous flows across other sectoral boundaries.

THE COMMUNICATION PROCESS

The previous discussion raises two key issues – decision making and communication. Models and methods, such as multi-objective decision support systems (Robinson, 2000), have been developed to facilitate decision making at the regional scale. However, these decision making management tools assume effective communication between stakeholders (or the business, community, research and management sectors). Models and methods dealing with the communication process and communication strategies at the regional scale do not appear to be well developed. This is a barrier to decision making. While individual organisations involved in natural resource management may have knowledge of exchange strategies and programmes, the key issue is the degree to which integration of communication between sectors occurs on a regional or catchment scale.

Part of the benefit of establishing partnerships for research and monitoring is that gateways which block information flow between sectors can be identified and information flow promoted as part of the process. Partnerships can become counter-productive when they effectively become a network within a network and exclusive rather than inclusive. However, encouraging citizens to be involved in partnerships that require information and knowledge exchange, helps to extend networks and partnerships beyond just the 'expert' realm.

When considering how the information system operates at the regional level there is also a need to consider how communication occurs. According to Cullen (1997), there are two recognised models of science communication. The first is the source-channel-sink model, which involves a transmitter, a channel of communication and a receiver. The receiver is conventionally viewed as passive; that is, it is largely a one-way process. In the current context, this one-way process may be made worse by the

notion of the 'expert' communicating with the 'poorly informed' which connotes information as power and a position of privilege.

The second model is one of two-way communication through dialogue or conversation. This interactive model is based upon the idea that communication occurs so that the recipient acquires knowledge but in listening to the response of the recipient the communicator also learns and gains new insight into the problem. This makes the communicator and receiver partners in the communication process; if more than two partners are involved then this process involves the concept of an information network rather than a series of one-way channels.

For Cullen (1997), two-way communication via a true network is essential if 'deep learning' is to occur as the "potential for misunderstanding and miscommunication always exists, even in the presence of mutual trust and respect" (Mitchell, 2005). Deep learning occurs when the network partners experience the concept under discussion, put it into their own language and apply it to their own problems. Accordingly, deep learning depends upon dialogue within and between networks and the dialogue must allow the community to attempt to apply the knowledge gained and thereby to test their understanding.

What is being communicated?

Communication between sectors within the region can be through the exchange of information and knowledge. Generally, information is exchanged to share a point of view and to inform in order to bring about a change in attitude or behaviour. Information does not of itself change attitude or behaviour. Knowledge is more than information in that it includes discernment. Discernment is possible when sufficient familiarity with a particular subject has been gained to allow critical assessment of further information. Cullen (1997) argues that communication, in the context of environmental management, is not just about passing on knowledge but about imparting a clear message that will change attitude or behaviour in the receiver. It also means ensuring that, along with knowledge, some judgement as to appropriate action is also imparted to the receiver. When considering water management issues at the regional scale we need to ask several questions about whether this occurs, what is received by the various recipients of the information and what knowledge is transferred in a regional network.

A critical aspect of the communication process within a region concerns the nature of the information or knowledge that is communicated between the various sectors. It is often assumed that it is knowledge that is transferred between sectors but it is more often merely an information flow. If different sectors are receiving disparate versions of the knowledge then the potential exists for misinterpretation. This can lead to conflict in management deliberations and varying views on appropriate management actions. Exchange of different parts or versions of knowledge can result from the filtering of information between sectors. Some sectors will possess detailed technical knowledge while others may only receive filtered or simplified knowledge. This means that the various sectors may have different levels of understanding on certain management issues. This is influenced by which sector integrates the research outcomes (and whether integration is conducted at all) and who 'owns' the knowledge.

Figure 1 outlines one approach to the process of knowledge dissemination from researchers to other sectors within the region in different forms and through the media. Knowledge is passed from the research sector to the management sector in a detailed technical form; however, researchers generally simplify research outcomes for transfer to the media and for the community. Researchers generally communicate with the community within their disciplines; this means that the community may receive several lines of filtered knowledge from the research sector. Managers communicate detailed technical knowledge to businesses but generally simplify knowledge for transfer to the media or the community. In all cases, knowledge transfer from managers involves a policy 'filter' which may influence the extent or interpretation of knowledge transferred. The business sector also filters knowledge to the media.

The media further simplifies knowledge before transferring it to the community and may 'popularise' such knowledge by introducing a particular interpretation that suits editorial policy.

Figure 1. Knowledge filtering within the regional envelope.
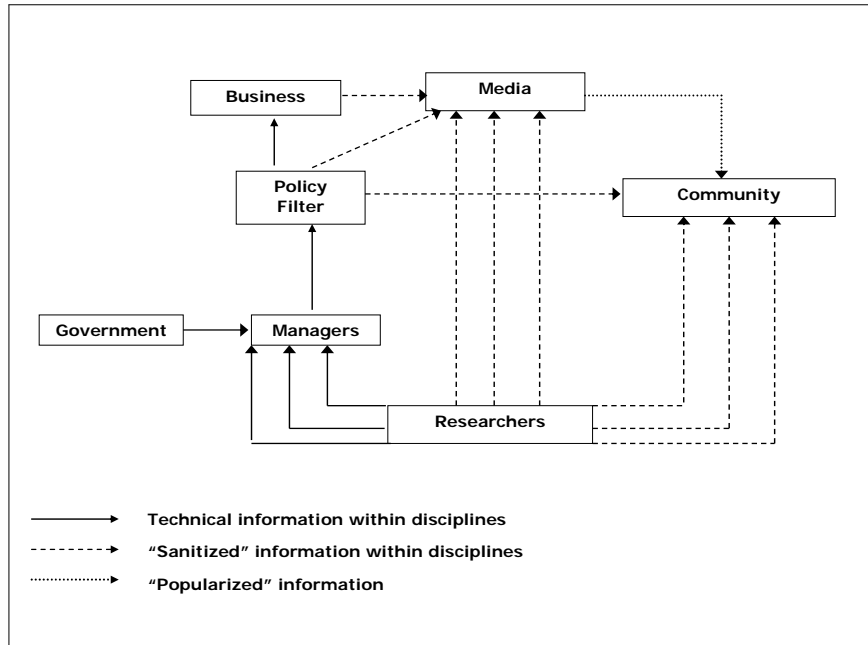
This model suggests that the community receives selectively filtered knowledge from all other sectors. A key issue in this model is which method of communication has most effect on the community sector and therefore exerts most influence on attitudes and behaviour. The importance of integration of knowledge across disciplines and across sectors, and whose responsibility it is to effect such integration, is critical. In the past, such integration at a regional scale has not taken place.

Where does the information come from?

Scientists, managers and bureaucrats, landholders and the wider public communicate well amongst themselves. That is, communication within sectors is good but communication between sectors is often poor and this is particularly the case among scientists/researchers (Cullen, 1997). The model presented in figure 1 depicts information flow within a region but information also flows into a region from outside. Key questions about this information flow are what information penetrates the regional envelope and how does this information pass through the envelope?

The relationship between the regional and wider networks is depicted in figure 2. In effect the model proposes three types of communication networks: regional, sectoral and global. The first network (1 in the model) is the regional network, involving communication between local sectors. Within this network communication is rapid and direct. The second network (2 in the model) is the sectoral network of which each regional sector is a part. This network sits outside of the regional network, which means that researchers communicate with other researchers outside of the region, managers communicate with other managers outside of the region and so on. Generally, communication within the sectoral network takes place via professional publications and technical conferences. Communication within this network is less direct and tends to be slower, relying on publication cycles and annual conference timetables. The third network (3 in the model) is the global information/knowledge network, which may be national or international. In this network, members of one sector may find out about knowledge in another sector by reference to the professional literature

of that network and participation in professional meetings organised within that network. Communication between sectors within the global network is slow, indirect and 'hit and miss', that is, the process of literature-searching means that it is easy for key sources of relevant information to be overlooked.

Figure 2. The three network communication model.
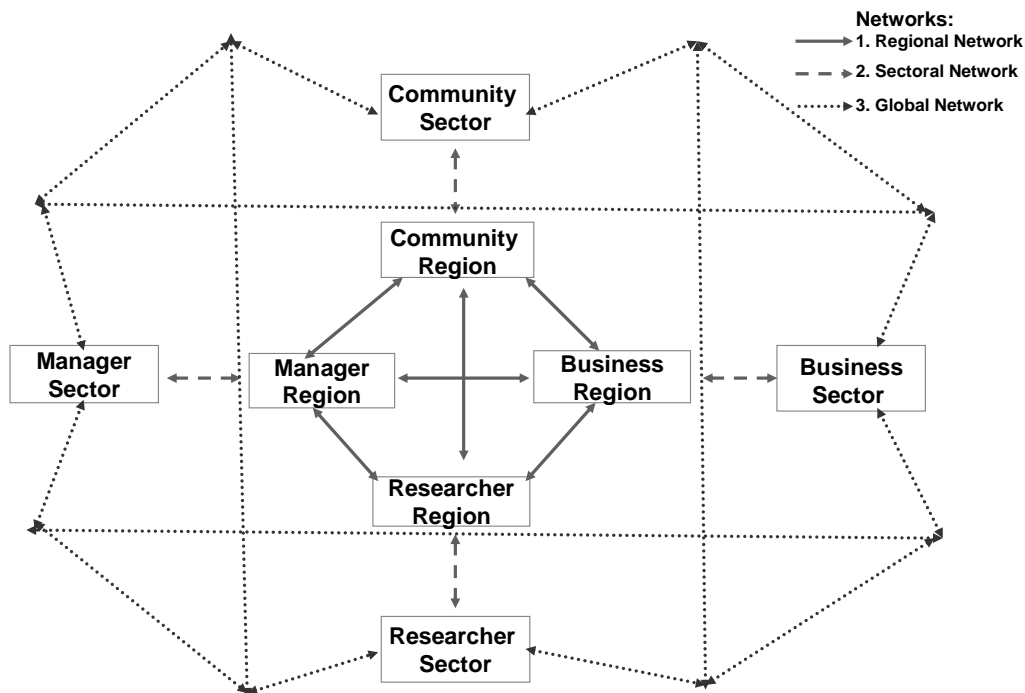
The key issue raised by this model is whether the various sectors within a region are communicating with each other as part of the regional network or via the global network which involves slower and incomplete transmission of knowledge. Regions should be able to short-circuit the knowledge communication process to ensure that it occurs within the regional network and not outside of it. Furthermore, the different sectors can talk directly rather than communicating via the interrogation of each other's literature. If the sectors within a region communicate via sectoral and global networks rather than via regional ones then there will be delays and gaps in the knowledge transfer.

THE WGC NETWORK: A CASE STUDY

The south-west region of Victoria offered a unique opportunity to investigate information exchange at the regional scale. The region encompasses the areas of responsibility of three catchment management authorities (CMA), namely the Wimmera, Glenelg Hopkins and Corangamite CMAs (WGC), covering approximately 61,840 square kilometres of western Victoria (see figure 3).

Within the region there are issues both within and between the different catchments that require communication between the various stakeholders, especially with regard to the overall health of the catchments. There are often interconnections between waterways that can lead to conflict *between* the regions. For example, environmental flows in the Glenelg and Wimmera rivers are often in competition, especially when water is diverted from the Glenelg to the Wimmera. The diversion of water *within* catchments for agricultural, domestic and commercial uses also causes problems within catchments. For example, salinity in lake Corangamite has increased due to diversion of inflowing river water which

has altered the biological communities of the lake and triggered a virtually permanent blue-green algal bloom. Other problems arise for coastal CMAs around the decision to open river mouths into the sea. Rivers blocked by sand bars can cause flooding on agricultural land and problems for recreational fisherman. In opening the rivers, the water managers in the Glenelg Hopkins and Corangamite CMAs must take into account the known bio-science of the rivers, being careful not to degrade oxygen levels which lead to the death of large fish.

There are a number of organisations that share the responsibility for the management of water within the region, for example, water authorities, catchment management authorities and government departments, and there are a number of organisations undertaking research with regard to water issues, for example universities, government departments and industries. Although there are linkages between these organisations it came to be recognised that knowledge generated within one sector was being adopted at a much slower rate than expected by other sectors within the region. It appeared that a communication problem existed and that this was holding back the dissemination of information and knowledge.

Figure 3. The south-west region of Victoria comprising the Wimmera, Glenelg-Hopkins and Corangamite catchment management areas.
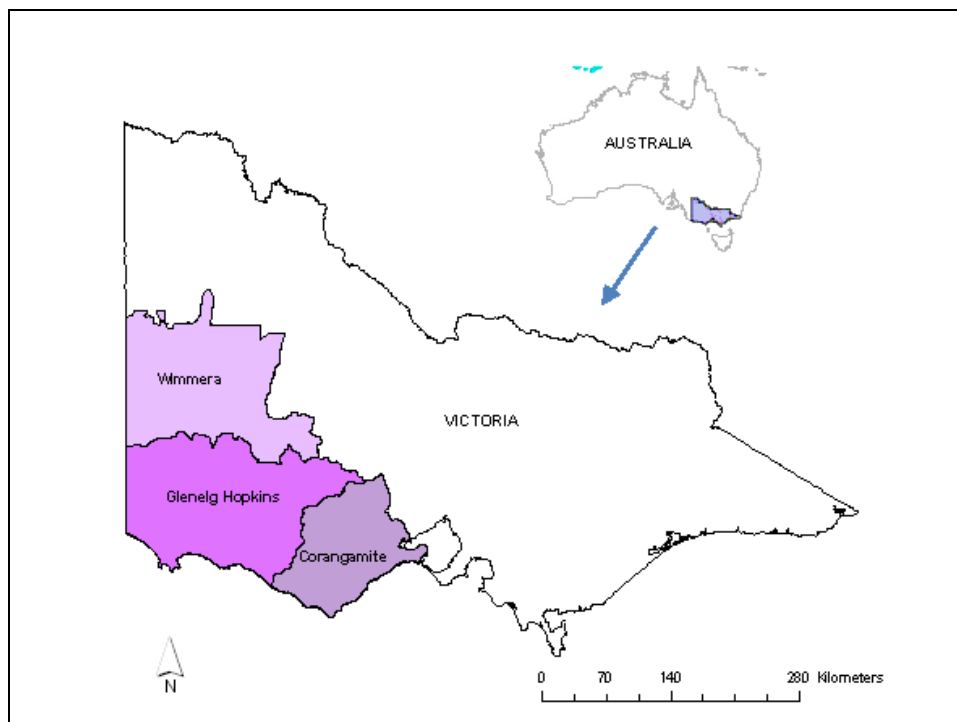
As demonstrated in figure 4, some of the links in the Three Network Communication Model appeared to be missing in the WGC, knowledge generated within the region was slow to be disseminated, and the communication process at the local scale was not working effectively. Methods to encourage communication that would result in improved knowledge dissemination were needed.

Figure 4. The three network communication model as applied to south-west.
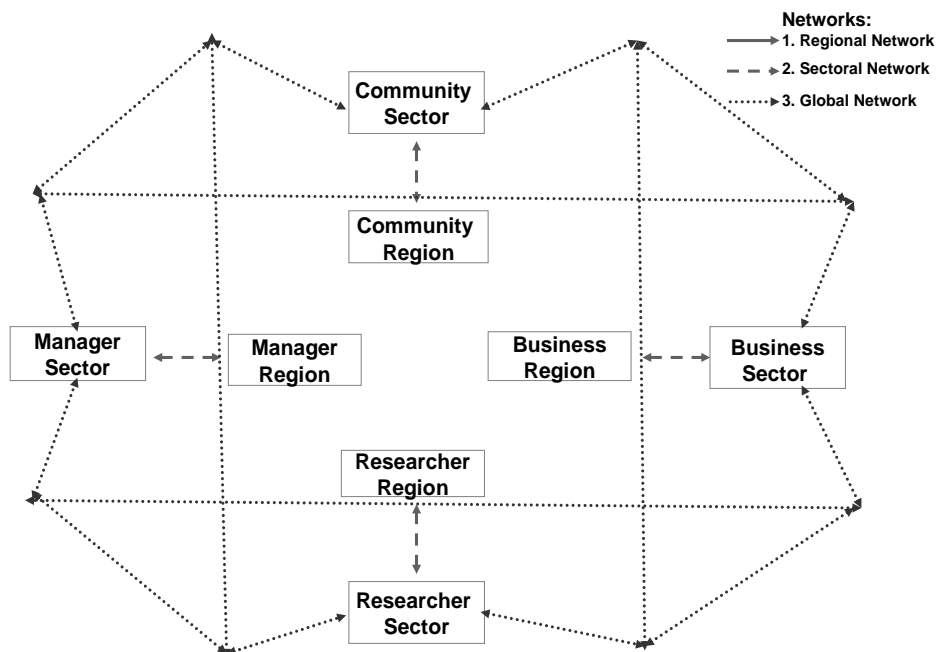
In order to facilitate the development of a regional knowledge network in western Victoria the WGC Sustainability Research Network (WGCSRN) was established in October 2007 by a collection of research stakeholders. It was to be a collaborative, non-exclusive, non-binding, and voluntary virtual network for individuals and organisations interested in sustainability research in the Wimmera, Glenelg Hopkins and Corangamite CMA areas. It has in its charter the central aim of including industry groups, community groups, CMAs, government organisations and universities. As a network, the WGCSRN is not a legally constituted entity and accordingly does not make representations on behalf of its participants nor does it charge people and organisations for membership. The major scope of the WGCSRN is to deal with the dissemination of information relating to research on the broad issue of sustainability and the main research themes include Climate, Socio-economic activity, Water, Biodiversity, Land and Landscapes, and Estuarine, Coastal and Marine spheres.

Individuals or groups are able to participate in the WGCSRN as communicators of information about a range of research-related activities such as research collaboration, local meetings, dissemination of research results, on-line discussion and any matters that are seen as relevant to the regions' sustainability. In this respect, the WGCSRN Website indicates that it can help local groups and individuals in the following ways:

- Support achievement of your organisation's sustainability objectives.

- Facilitate communication in relation to Research and Development (R&D) needs, capabilities and funding/partnership opportunities.

- Build pathways of communication and new networks.

- Improve integration in R&D development, funding and delivery.

- Improve capacity in research and management.

- Leverage more resources for your R&D needs.

- Better R&D knowledge dissemination, storage and handling.

- Reduce transaction costs for R&D.

- Higher profile for the region's sustainability on the state, national and international R&D scene.

- Undertake targeted R&D for organisations with specific knowledge needs.

- Actively contribute to the interpretation of research leading to better management outcomes.

The establishment of the WGCSRN was a deliberate 'experiment' in attempting to strengthen direct communication within the regional envelope and to avoid regional organisations communicating primarily through the global network. After around 12 months there were 123 listed members of the network. However, the interchange on the site has been minimal. Few groups or individuals have posted local research activities and there have been very few hits seeking any information. The interchange facilities are used sparingly with only a few very brief exchanges as table 1 indicates.

Table 1. Use of the WGC network website.

Type of participant	Number	Shoutbox[1]	Comments[2]	Forum[3]
Government	25	1	0	2
Water Agencies	21	5	0	4
Universities	12	2	0	1
NGOs	17	1	0	2
Local Government	3	0	0	0
Business	2	0	0	0
Unspecified	43	2	0	3
Total	123	11	0	12

1. *Shoutbox* is the place where people post information messages.
2. *Comments* is the place where people add comments to postings.
3. *Forum* is the place where people can discuss an issue.

This lack of engagement may indicate a general lack of the ability to engage in wider network thinking or it may result from simple issues such as lack of advertising and marketing the site to the wider community of western Victoria. It may also be that the diversity of water uses across the three catchments (especially in the agriculture sector with major industries such as intensive dairy farming in the south, sheep and blue gum plantation in the centre and cropping in the north) leads the networks to locally specific activities. At the water management level, each of the three Catchment Management Authorities (Wimmera, Glenelg-Hopkins and Corangamite) has different issues to confront (due to landscape and biodiversity differences) while the Water Authorities who deal with the domestic and business distribution of water are faced with a diverse range of generally quite different issues (due to differences in availability and use patterns). At the research level, there are two universities in the region and a range of state government research facilities that are industry-focused. The community is also involved in a range of groups including Landcare, Salt Watch and other environmental action groups. The outcome of the WGC 'experiment' is that drawing together such diverse groups into a water knowledge network becomes quite difficult and involves more than just building a network framework; this highlights a number of problems associated with governance and adaptive management.

THE DEVELOPMENT OF NETWORK THINKING AT THE REGIONAL SCALE

To a large degree, resolving regional-level water-related issues using instruments, such as the WGCSRN tool, are still quite problematic. It is assumed that by making a consultation tool available across a region, local people will take a sense of ownership and participate in a free and open way (Mitchell, 2005). However, the literature on learning networks emphasises that such forms work most effectively when they are embedded in local cultures and social structures (Murdoch, 2000) and in south-west Victoria the evidence indicates that integrated thinking about issues like sustainability is not widespread in the community at the moment (O'Toole and Wallis, 2009). This raises three issues: the capacity of local groups to engage with websites; the use of single tools for network development; and different needs in sectors of the network.

Firstly, the capacity of individuals, groups or organisations to engage in the website will be dependent on the way the different sectoral interests view the process of knowledge diffusion within water governance. The way that knowledge is developed and consumed by local people will be dependent upon the frameworks within which they function whether that is scientific, management or lay (Tovey and Mooney, 2006). This makes an exchange of information among the research, management, business and community sectors a complex operation. At present, the WGCSRN incorporates members from three of the major sectors (research, management and community) with a small input from the business sector but there is little exchange of information. The site is open to all and the web administrators encourage engagement by inviting members to discussion forums but few, if any, members are monitoring the site sufficiently to take up the challenge. For Bruckmeier and Tovey (2008) "knowledge interaction does not happen between abstract types but between forms of knowledge (including scientific) that represent specific kinds of problems, interests, practices and contexts". The site is available to all but it may not be pertinent for the knowledge requirements of the members at this stage.

Secondly, the lack of use by members of the website may indicate that one tool (e.g. web-based) is not enough in itself to build a legitimate framework for effective network thinking and enhance communication between sectors. Other methods need to be investigated and tested to determine if they can better help the establishment of these networks. It may be, and most likely is, that several methods will be needed and together these will provide the tool box that can assist in building the communication channels at the regional level that provide fast-tracking of information that will assist with the development of water management strategies. It is likely that an effective regional communication network will be based on a framework with several components or tools. However, even building a robust communication framework with several components does not guarantee its legitimacy or use.

Thirdly, the mere presence of communication technologies does not necessarily stimulate people to communicate and share knowledge (Alem and McLean, 2005). If there is to be convergence of regional interests for an exchange of resources, including knowledge, to achieve common goals (Borzel, 1998) then there needs to be a genuine effort to harness resources that are directly related to communication strategies. These may be separated into those that communicate within sectoral networks (i.e. within management, community, business, researcher networks) and those with cross-sectoral networks and therefore have the likelihood of contributing to regional network thinking. The types of strategies being used within the region will determine the success or otherwise of the communication process. If the communication strategies employed are exclusive (for example, largely technical reports and professional publications) then the result will be network contraction. Furthermore, if there are no incentives for researchers to use the local network to communicate then they will pursue other communication networks which advance their own personal agendas. The apparent lack of convergence across the sectors may be attributed to the modus operandi of the different sectors where rewards for engagement are defined in terms of sectoral outcomes and where interests may be limited to specific types of practice (Alem and Mclean, 2005).

To achieve effective communication for the enhancement of network thinking within the region and promote the development of improved water management strategies requires the development of a regional communication strategy and the embedding of an informing system that provides more knowledge, not more information. It will require a community participation programme that provides education based on local examples, involvement of the community in environmental monitoring, and improving community understanding of the following:

- Useable social, economic and technical knowledge.

- The causes and effects of water-related problems.

- Unambiguous assessment of the severity of problems.

- The future perspective via predictions and trends.

Most of all, communities of research, management, business and the public need to know that the communication channels are there for their use and this requires that the region needs to adopt at least three interrelated additional approaches in addition to the website: (1) the development and endorsement of a strategy at the regional scale that includes incentives to encourage relevant actors to participate actively in a network; this process will require buy-in of all key stakeholders in the regional communication network; (2) the identification (and employment) of a network broker who would design and implement means to intensify positive incentives of participation in the network, or at least mitigate negative ones; (3) the acquisition of resources to finance network operations (where 'finance' is used in the broad sense of mobilising the necessary time, effort and other resources, such as money for advertising or conferences). Figure 5 illustrates this model of regional communication strategy development and the place of the knowledge broker as a key link in moving the network forward.

Figure 5. Developing the strategic context for network thinking.
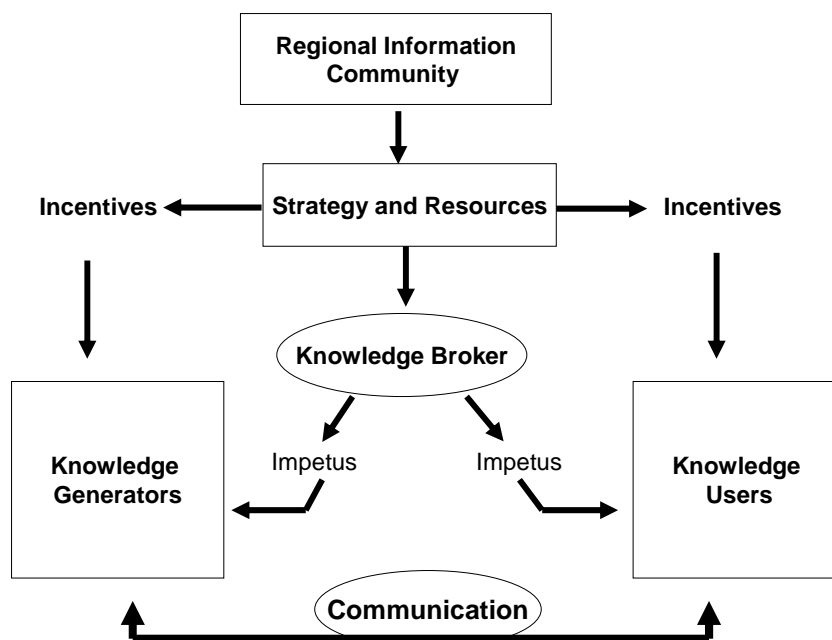
CONCLUSION

The attempt to use a website as a communication channel in south-west Victoria appears not to have achieved its objectives so far. Whether it is because of a lack of significant facets such as capabilities for knowledge exchange, motivation or just interest in issues of water management of all stakeholders has yet to be fully determined. Developing the capacity of the different sectors for engagement across the region seems to imply the need for more than just the use of one web-based tool. All sectors need both the desire and the capability to engage in information and knowledge exchange that can strengthen regional network thinking.

Consequently, there is a need to continue this research by investigating the issues encountered by managers, businesses, researchers and the public that hinder cross-sectoral communication at the regional scale. By identifying the benefits of cross-sectoral communication for local decision making and marketing at regional level there may be some chance of building a broader-based water management process in south-west Victoria.

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