

Knowledge Seeking Strategies of Natural Resource Professionals

Synthesis of a Workshop held in Bungendore,
NSW from 5-7th June 2000

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The Cooperative Research Centre for Freshwater Ecology improves the health of Australia's rivers, lakes and wetlands through research, education and knowledge exchange. It was established in 1993 under the Australian Government's Cooperative Research Centre Program

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Cooperative Research Centre for Freshwater Ecology

The Cooperative Research Centre for Freshwater Ecology is a national research centre specialising in river and wetland ecology. The CRC for Freshwater Ecology provides the ecological knowledge needed to help manage our rivers in a sustainable way. The CRC was established in 1993 under the Australian Government's Cooperative Research Centre Program. In the CRC, university, government and industry partners work together to understand river systems.

The Cooperative Research Centre for Freshwater Ecology is a collaborative venture between:

- ACTEW Corporation
- CSIRO Land and Water
- Department of Land and Water Conservation, NSW
- Department of Natural Resources, Queensland
- Department of Natural Resources and Environment, Victoria
- Environment ACT
- Environment Protection Authority, NSW
- Environment Protection Authority, Victoria
- Goulburn-Murray Rural Water Authority
- Griffith University
- La Trobe University
- Lower Murray Water
- Melbourne Water
- Monash University
- Murray-Darling Basin Commission
- Sunraysia Rural Water Authority
- Sydney Catchment Authority
- University of Canberra

National Rivers Consortium

The National Rivers Consortium is a consortium of policy makers, river managers and scientists. Its vision is to achieve continuous improvement in the health of Australia's rivers. The role of the Consortium is coordination and leadership in river restoration and protection, through sharing and enhancing the skills and knowledge of its members.

Partners making a significant financial contribution to the National Rivers Consortium and represented on the Board of Management are:

Land and Water Australia
Murray-Darling Basin Commission
Water and Rivers Commission, Western Australia
CSIRO Land and Water

1. Introduction

The degradation of natural resources in Australia has been causing widespread community and political concern. Australia has a well regarded and sophisticated research base in natural resources and yet there is an ongoing challenge to get this knowledge used by the resource managers who could benefit from it (Vanclay & Lawrence, 1995).

The Cooperative Research Centre for Freshwater Ecology and the Rivers Consortium jointly conducted this workshop at Bungendore, NSW from 5-7th June 2000. The aim of the workshop was to provide an opportunity for experienced professionals to reflect on the various models and processes that we use to both disseminate and seek knowledge. The overall goal was to help the participating organisations review their communication strategies. We sought to make these communication activities both effective and efficient, so as to ensure better adoption of new approaches and insights so we can manage our natural resources in a more sustainable way. The workshop focussed on communicating between professionals from the research groups and natural resource professionals in government agencies, community or industry groups or consultants. The workshop did not address issues of communicating science to the general public or other audiences such as community groups.

The workshop was based around a few presentations, several case studies and extensive discussion. What follows is not a series of reports of the different presentations and discussions, but rather an attempt to synthesis the knowledge gained from the workshop. It is supported by a bibliography of materials.

2. Changing Paradigms in Natural Resource Management

Natural resource management is undergoing massive changes and we are operating within a period of some instability as a new paradigm of natural resource management is being established. There are a number of facets to these changes which must be understood.

2.1 Regionalisation

There has been a regionalisation to either single focus organisations such as water authorities or to broad ranging community organisations such as Catchment Management Authorities, that are responsible for managing particular catchments or regions in an integrated way. These organisations focus on a more limited geographic area than the earlier state wide agencies and may not have the resources to employ the range of expertise in-house that might be needed.

2.2 Managerialism

There is replacement of a professional culture with a managerial culture that has a view that knowledge can be accessed by outsourcing. This might be so if the seeker knows enough to ask the right question, but can be a serious impediment when this is not the case. In some ways this strategy tends to transfer the problem to the consulting companies who service these areas and who may or may not be a source of innovation depending on their own knowledge seeking strategies.

2.3 Wider Participation

We are moving from a “technocratic” model of natural resource management based on optimising a single production function, that commonly marginalised other values and ignored externalities. We are now embracing a participatory model where a much wider range of community values, including production, aesthetic recreation, biodiversity and other ecosystem services have to be met, and off-site externalities of either water extraction or pollution have to be managed.

2.4 Changing Patterns of Knowledge Delivery

These reorganisations of central agencies have generally led to a reduction in the staff and resources available to provide traditional “extension” services to rural groups (Grayson, et al 2000). The replacement has been to provide “facilitators” to work with community groups. These people are not necessarily expected to be repositories of much of the technical information but to have the skills to collect and integrate the knowledge. They also tend to focus on environmental aspects rather than production elements.

These changes are happening in a period when landholders have a limited capacity to change. Low agricultural prices mean funding is difficult for landholders, and an ageing cohort of rural landholders have less capacity to make changes (Barr and Cary, 2000).

2.5 Changing Approaches by Research Funding Bodies

Research funding bodies have been concerned for some time about the poor level of uptake of the research they fund. They have responded in two main ways. To ensure immediate relevance of the research they have moved to a model where the obvious users of knowledge dominate the setting of the research agenda. Users may also be involved in negotiating the form of the actual research, and may be involved directly in conducting the research. These changes require changing the way scientists identify research problems and how they develop their research projects, as well as transfer the findings (Johnson, 2000). There is a risk that short-term economic elements get the research attention rather than longer term social or ecological aspects. In some cases the scientists are largely excluded from the setting of the research agenda, which is as flawed as the previous model where the public was excluded (Keen and Stocklmayer, 1999). There is no doubt that uptake of new knowledge requires the recipient appreciating that there is a need for the new knowledge. The recipients may also be able to identify opportunities for experimentation or observation. However, they may not know a lot about the system of concern, may focus on short-term elements, and focus on symptoms rather than causes. There is now a view that setting research priorities requires an effective dialogue between knowledge producers and knowledge users, rather than a simple contracting model. The failure of the purchaser-provider model becomes obvious when the purchaser does not know enough to know what they are buying, and the seller is only concerned to sell their services to make money.

Research funding bodies have also been requiring research groups to take the responsibility for technology transfer on an individual project basis (Grayson, 2000). Such technology transfer plans are required to be incorporated with the funding proposal. The research groups commonly have limited skills and resources to carry out this task, and it is not part of the normal reward structures of science. This model implies a one way model of communication and that the research project is the appropriate unit of knowledge to disseminate. It assumes that the scientists have the

ability and motivation to conceptualise the new knowledge in a way that will engage the appropriate recipients, and to engage in dialogue to facilitate the transfer.

3. The Goals of Communicating NRM Information

The overall goal of communicating natural resource information is to change the behaviour of the recipients of the knowledge. We do not accept that communication is a one way process where an authoritative sender of information fills up what was previously an “empty vessel”. This is a two way process with the sender passing a message to those who can use it, and the recipients possibly providing feedback on the usefulness of the knowledge and how it might be applied in their context. The process might be driven or controlled by either the providers of knowledge or those seeking it.

All recipients have some prior knowledge and preconceptions, which might facilitate or block acceptance of the new knowledge. It is now well understood that “communicating science is not just about packaging information in easy to understand language, it is also about understanding the social, professional and institutional context in which the communication occurs” (Keen and Stocklmayer, 1999).

Knowledge seeking refers to the processes and behaviour we use to actively acquire information from selected information sources and carriers.

Behavioural change might come about by simply providing a new bit of information that the recipient needed. Commonly it is more complex than this. We generally have a conceptual model of any system we are considering. New information that engages that mental model may well provide challenges for the existing model, leading to the questioning of earlier assumptions and the development of a richer, more comprehensive model. Behavioural change is more likely to follow this changed world view of the system being managed.

The concept of information being “in-formation” adds to this idea that it is the processing of new information that provides the learning opportunity needed to change the way professionals think about a problem (Dixon, 2000).

We do know a lot about adult learning. An individual must be motivated and receptive to new information if learning is to take place. The learner needs time to engage and process new material. The information supplied needs to engage the existing conceptual model and lead to a richer conceptual model or the information is discarded. Dialogue with the knowledge provider and other professionals helps build information into richer conceptual models. We know that some people are motivated to learn by the joy of knowledge for its own sake, but for busy professionals it is the immediate usefulness of information that is important in attracting attention. In times of crisis, individuals are often more open to different ideas and approaches, as they realise their earlier model is failing. We also know that people have different learning strategies and that we may need to provide different learning opportunities to cater for those who prefer theoretical development or a problem solving approach.

The sort of dialogue that is desirable to facilitate learning is based on respect and trust. This requires identifying common ground and acknowledging what each party brings to the dialogue and exchange. The communication challenge is to facilitate learning and this requires providing information in a relevant context.

It was accepted there were particular challenges in delivering our messages so as to influence natural resource management:

- the links between actions and outcomes are often hard to establish;
- we work with highly variable natural systems - driven by climate;
- we work with complex ecosystems that often have long lag times between actions and outcomes;
- resource managers are often not familiar with ecological science;
- values and interests are important drivers of natural resource management and knowledge will be interpreted in the context of these frameworks;
- the geographic extent of many natural resource issues can be intimidating.

4. Elements of Knowledge Exchange

Johnson (1996) identified three fields in which individuals operate with regard to information:

- physical environment – office, proximity to libraries, information technology;
- inter-personal environment – the professional networks that develop over time; and
- information environment – the exposure to various sources, reading patterns, electronic scanning such as Current Contents or specialised media.

Johnson (1996) also developed the idea of a three way information seeking matrix, which considered sources, channels and messages. How individuals select the various combinations will determine the efficiency and effectiveness of their knowledge seeking.

There is a long tradition of collating and storing information and making it available to those who seek it. Individuals will have preferred sources based on their experiences and their chosen knowledge seeking strategies.

Library Model.

The traditional model where material is published in scientific or professional journals, or in texts. Resource managers need to trawl these various sources and develop their own synthesis of the knowledge as it is applicable to their issue of concern.

Electronic Repositories.

These may be little more than electronic libraries where technical material is held and can be accessed quickly and cheaply. There is better searching capacity than traditional libraries, and the material may be available on-line. It might go further than this and have the capacity to provide direct electronic dialogue with a knowledge provider.

Technology Transfer Model.

This model is based on producing simplified messages from a research project and sending them to appropriate resource managers. It may be undertaken by the research staff rather than specialist communicators. It tends to be one way, focussing on transmitting information, and the resource manager has to synthesise the information into a relevant context. The current approach is to try to start transfer activities early in a project rather than having it as a major activity at the end, when commonly a project has used all its funds.

Extension Model.

Where specialised extension staff undertake the technology transfer, and are synthesising and integrating information to make it suitable for the recipients. May be undertaken at locations suitable to recipients such as field days or conferences. The extension model was developed to provide knowledge on improving farm production but has now been redirected towards delivering environmental information to landholders.

Knowledge Broking Model.

Where a subject specialist with strong communication skills works with resource managers and research scientists to bring appropriate knowledge from the knowledge base to focus on the issues of concern. Tends towards a two way model, as the manager works to specify the knowledge needed, and the broker identifies what is available. May lead to synthesis documents that integrate what is known in a particular field and incorporate new research findings into the existing knowledge base. Often transactions are initiated by the seeker.

Joint Problem Solving Model.

Where the researchers, knowledge brokers and seekers of information work together to identify what is known and not known in an area, and clarify what needs to be known to address the managers' concerns. Not only does this provide a synthesis of new information, but enables all participants to develop and share their conceptual models, which become richer and more comprehensive through this process.

Advocacy Models.

It is common for interest groups to have good access to relevant knowledge and they package and use this in their advocacy work. They operate in both public and private arenas, but are often seen as respected sources of technical information, and often have the political power to get the attention of resource managers.

Public Communication Models.

Where communication is done through mass media channels to a wide public audience. This can be helpful in raising items on to the political agenda as well as creating organisational “brand recognition”. It can be counterproductive when used to explore areas of disagreement. It might be helpful in reaching natural resource professionals who become aware of new work and may then seek it out.

Relationship Models.

The Communication Strategy of the Murray-Darling Basin Commission emphasises the importance of building ongoing relationships as the core to a strategy. This emphasises the need to build trust and provide easy access between suppliers and seekers of knowledge. The strategy identifies a number of groups that they need to develop such relationships with and articulates the desired relationship, and how it might be developed. The building and nurturing of these networks and relationships is a key aspect of this strategy. This emphasises the point that most professionals have networks of individuals that they relate to and trust, and commonly use as suppliers of information.

Communication Management Models.

Many of the rural research funding bodies now have communication managers who act as information gatekeepers and disseminators. They commonly have media or marketing training and have a role in maintaining the organisations profile with stakeholders (Keen and Stockmayer, 1999). They package material for various audiences and select appropriate channels to reach the audiences they are concerned with.

Table1. Models of Technical Communication

Strategy	Essential elements	Presumptions
Library Model.	Print material is deposited and available to user.	Assumes users know what they want to know, have searching skills and that the required knowledge is in the repository. Language and lack of background knowledge may inhibit.
Electronic Repositories	As for library but greater capacity and easier searching and access. Remote access.	As above. Assumes good IT infrastructure. Requires new searching skills and habits.
Technology Transfer Model	Scientists distribute summary information from project to users.	Users interested and have capacity to understand. Assumes message received is the same as the message sent. Language may get in the way.
Extension Model	Technical professionals prepare summary and integrated information for users.	Select correct material. Simplification might distort message. May act as filters to inhibit the flow of information. Assumes users are receptive and using the selected communication channel.
Knowledge Broking Model	Technical professionals work with users to help bring appropriate knowledge to problem.	Brokers have good access to research base and have strong listening and problem solving skills.
Joint Problem Solving Model	Research staff and technical professionals work with users to jointly define and address problem.	Requires time and trust to develop good problem definition and requires a search for solutions rather than selling of research projects.
Advocacy Model	Interest groups package selected information and present privately and publicly.	Important process of setting management and research agendas. Advocates need to have good access to information.
Public Communication Model	Selected information spread widely using mass media.	Objective is to set agendas and to develop a more literate constituency around issue. Little idea as to who will receive knowledge, their prior knowledge or likely reaction.
Relationship Model	Identify key networks of groups and individuals and develop relationship and trust by the provision of material and active dialogue.	Assumes strong networks without structural holes. Requires strong credibility and being seen as not just selling some favoured solution.
Communication Management Model	This is similar to the extension model except the gatekeepers tend to be professional communicators with little technical base.	Assumes good judgement of issues and that sender can make adequate assumptions about prior knowledge to engage the user.

5. Knowledge Seeking Strategies of Natural Resource Professionals

5.1 Triggers to Knowledge Seeking

It is a normal part of our lives to seek knowledge in various ways. There are a number of basic motivations:

- problem based - personal curiosity or wish to solve some problem. May be a general problem or a crisis situation. Arises from dissatisfaction with existing knowledge of topic;
- ego-based - personal pride in knowing an answer or having an informed opinion; not wanting to look stupid; and
- emotion based - fear/anger of some situation motivates seeking further knowledge, desire for social interaction.

Most professionals do not have the time to seek information unless they have a specific and focussed need for the knowledge. It is common to seek knowledge during a time of major organisational crisis. In these situations it is common to seek one to one advice from some authority figure, or to assemble a team of experts to provide guidance through the crisis, and to share the blame if the solution is inadequate.

5.2 Knowledge Seeking Strategies

Professionals use a variety of strategies in their seeking of information, but Johnson (1996) has identified some common characteristics:

- people seek until they find the first acceptable answer, regardless of its quality relative to other possible solutions;
- people tend to give up searching for knowledge relatively quickly;
- professionals are receptive to new knowledge when they have a concern – relevance;
- tend to seek knowledge from someone who is easily accessible and trusted – salience;
- if the sources are consistent an idea is accepted - regardless of the authority of source – gullibility, naivety or laziness?
- tend not to seek knowledge from high status person who might laugh at the question – safety;
- prefer face to face communication if possible – builds trust and puts an obligation on provider;

- seek information that can be understood rather than references or reprints – synthesis; and
- commonly there is little tradition of library use and the seeker often uses poor seeking techniques.

Knowledge seeking is an active energy using process. However it is dominated by the law of diminishing returns - the more you know about a topic the less likely a pay-off from seeking further knowledge.

Resource managers at the workshop described the knowledge exchange problem from their perspective. They may have less developed strategies for actively seeking information than people on the research side:

- they are very busy with many messages coming to them;
- all messages are peddling something, and the assumption is that the providers main concern is self-interest – selling something;
- many of the messages are conflicting;
- what are the risks of embracing or ignoring a message - do I understand enough to assess the risks?
- do I trust the sender?
- do I have the opportunity for dialogue to test my understanding?

5.3 Barriers to Knowledge Exchange

There are clearly some significant barriers that inhibit natural resource professionals seeking and gaining information:

- many feel they are besieged with information, and totally overloaded;
- lack of time to seek relevant information;
- don't want to appear ignorant - fear of being put down;
- may have poor access to knowledge infrastructure such as libraries or the web;
- may have poor searching skills;
- may feel they have enough knowledge to do the particular job at hand;

- may have poor grasp of existing knowledge base and be unable to frame an answerable question; and
- lack of time and energy to synthesise knowledge for themselves.

David Johnson introduced some interesting ideas and led a discussion as to why people may not actively seek knowledge:

- ignorance is reassuring and helps people stay in a comfortable inertia;
- limited capacity to deal with complex situations;
- not being compelled to act;
- avoiding conflict;
- seeking further knowledge may be seen as a lack of trust or confidence;
- seeking involves admitting ignorance or uncertainty;
- knowledge seeking takes time and energy;
- knowledge seeking involves a set of professional skills which may not be well developed in any individual; and
- the organisational or disciplinary culture within which someone was educated or works may introduce inappropriate knowledge boundaries.

5.4 Structural Holes in Communication Networks

Professionals rely on professional networks to help them find information.

Communication research that tracks who people talk with show there can be significant structural holes in an individual's communications networks (Johnson, 1996).

An example is where water engineers talk to other engineers about managing an algal bloom, but do not talk directly to algologists. They may not know such people exist, and may not commonly have them in their personal information network. This makes for a structural hole in the network where knowledge is isolated from where it could be useful.

The richness and variety of a professional's networks are important to their accessing knowledge as it is needed. There may be real pay-offs in building links to new

groups/bodies of knowledge. Structural holes in natural resource communication networks appear to be quite common.

5.5 The Protection of Intellectual Property

The protection of intellectual property is designed to be a barrier to others using the information without appropriate fees or other safeguards. Some organisations take the view that important Intellectual Property should be protected and not put into the public domain. This tends to subvert the normal quality assurance processes and cultures of science, where open disclosure and peer review is still the norm. Other organisations take the view that the real asset is the knowledge and skills of staff, and take a more relaxed attitude towards protecting IP. The protection of IP can be a divisive process that must be managed strategically and with care.

If trust is to be maintained in any collaborative venture it is important that respect for the intellectual contribution of all participants is shown and the origin of ideas is attributed to the generators of knowledge where this is possible. Dialogue and interactions can add value to knowledge only when it is shared and respected.

Regardless of the IP strategy being followed, it is important to ensure that knowledge generators are able to let go and see their knowledge taken up and used by others, perhaps in unexpected ways. The letting go of ownership, by both individuals and organisations, is essential if adoption is to be widespread.

6. Implications for Knowledge Users

Organisations that need to have access to up to date scientific knowledge need to have active strategies in place to ensure the knowledge they need is accessible.

6.1 Synthesised Knowledge Rather than Research Reports

Resource managers at the workshop indicated that plain english summaries of the findings of particular research projects were not all that useful to them. They did not see the individual research project as the appropriate unit of knowledge to transfer to them. What they seek is up to date concise overviews of the current understanding of a particular area. This might be in the form of regular updates or of specific briefings

on issues of concern. The material might be informed and expanded by the findings of current research projects, but the new knowledge must be embedded with the old knowledge in an easily assimilated form. The material needs to be presented in the users context, with an understanding of the knowledge base the reader brings to the topic. The level of complexity of the material needs to be carefully managed to ensure a match with the understanding of the reader.

6.2 Developing a Knowledge Strategy

Organisations are encouraged to develop a formal knowledge strategy as part of their Business Plan. A strategy is a long-term systematic way of achieving some goal.

There are seven elements to any knowledge strategy:

- What do we need to know, and when do we need to know it?
- How will we get the information, and by whom?
- How do we store the information so it is available when we need it?
- How do we update and check the information itself?
- How do we interpret the new knowledge in the light of existing knowledge and procedures? What does it mean? What does it mean to our cause-effect models?
- How can we apply the new knowledge by translating it into action?
- How do we review and update the knowledge strategy itself?

In assessing what an organisation needs to know, it is helpful to identify needs in four areas:

- day to day operations;
- longer term planning;
- new technologies and approaches; and
- emerging issues.

6.3 Influencing the Research Agenda

Users of knowledge would normally seek to influence the research agenda of knowledge providers by articulating their needs and possibly providing funding support. If they have a formal knowledge strategy their knowledge gaps will be known.

6.4 Learning Organisations and the Culture of Questioning

It is fashionable to talk about learning organisations, but it is less clear how such organisations should be structured to encourage communication, thinking and risk taking. It has been suggested that an organisation can be either efficient or innovative, but it is rare to find both characteristics in any organisation. This has to do with the isolation of knowledge within sub units and with organisational attitudes to risk taking.

Learning organisations need to be able to acquire and create new knowledge, to retain and transfer knowledge and to modify its own agendas and processes in the light of new knowledge. Innovation requires a culture that says there is always a better way if only we can find it.

Learning organisations use three main approaches:

- seeking new knowledge from outside the organisation;
- reflecting on their own organisational experience, making connections across the operational areas within the organisation; and
- experimentation in their own day to day operations. This is a well developed strategy in many organisations, and is termed adaptive management. However, it only works if there is effective monitoring of outcomes and periodic evaluation of the efficacy of the management interventions. These requirements are often lacking.

An effective organisation would be expected to use each of these approaches.

7. Implications for Knowledge Providers

7.1 Clear Goals

Knowledge providers need to be clear about their communication objectives, and how they resource and encourage communication activities. Most science agencies now have communication strategies. These strategies can be designed to facilitate the uptake of research, to market emerging ideas to funders and to provide “brand” recognition of the organisation. Keen & Stocklmayer (1999) have pointed out the ambiguity in the signals these organisations often send to staff and that while they claim to encourage communication activities, may not provide appropriate training or rewards in promotion considerations.

7.2 Understanding the User

It is important to understand the intended recipients of the knowledge and have some idea of their existing knowledge base, as well as their current beliefs and values. It is necessary to consider how you will get their attention, and how they might respond to the message - fear, denial, indifference or enthusiasm.

The material needs to be packaged in the users context, and made easy for them to build on to their existing knowledge base. We must make it easy for people to get and use information. The material needs to be strategically focussed to meet their needs, rather than bombarding them with all the material coming out of the research activities. Depending on the complexity of the issue the user may need either specialised or integrated knowledge.

7.3 The Provider's Credibility

The credibility of knowledge is a function of the credibility of the source of that information. The credibility of a research organisation provides what might be a powerful and valuable “brand image”. The credibility of an individual researcher can be fundamental in whether the material they provide is taken up. The standing of research organisations and individuals is a function of their track record in terms of originality, capacity, ability, the relevance of their projects, their independence and perceived grasp of the field. In natural resource management, formal intellectual

property seems less important than experience, communication ability and standing. The “brand name” is very important, and easily damaged.

7.4 The Concept of Knowledge Assets

The idea that the main asset of organisations resides in the knowledge it has access to is an intriguing one as we enter the knowledge age. The knowledge asset of an organisation is rarely reported in annual reports in the way physical assets are reported, but may be more important. The knowledge asset is made up of three main elements:

- formal Intellectual Property which is protected in some way;
- informal “know how” which an organisation accumulates through experience (“common knowledge”, after Dixon, 1999);
- expertise that resides in key staff.

The workshop explored a number of models of knowledge management from industry.

One such model is from BP, referred to as their “**Peer Assist**” scheme (Dixon, 1999), and is designed to make accessible the tacit knowledge that is learned during the completion of a project.

The underlying assumption is that getting appropriate knowledge used is about learning not just transfer, and that learning takes place before, during and after the completion of a project. Peer Assist is activated only when there is a very specific project or task that must be completed, and a team has been assembled to undertake the task. It is activated only when those seeking knowledge request assistance. When the team has got to a certain place in their work, they are able to call for “Peer Assist”. This means they can call on a small number of people anywhere in the company that might assist with the task. It is a mark of status in the company to be called on for such a team, and the costs involved are met from the peers base unit, not the group calling for assistance.

The core idea is to bring people who have knowledge from past experiences together with the team who need the knowledge. The peer assist takes place over a short time period with the team meeting on site and discussing on the new task. The process has “experts” giving advice and helping to frame critical questions, but the responsibility still rests with the project team. Experience has shown that insights are more important in this process than specific bits of technical information.

Another approach used by some consulting companies is the concept of **knowledge assets**. Assets are developed by an objective third party interviewing participants in a project in real time and documenting the total process of decision making - not just recording what works. This gives a richer knowledge base than just documenting “best practice”, which is only one way of tackling the problem and which might not be the best way in some other context.

Over time the organisation builds its knowledge assets, which are continually refined as new experience is gained. The aim is to ensure the best knowledge is available for any task and to ensure time is not spent “re-inventing the wheel”. There is an obvious cost in documenting the assets and ensuring they are organised in an accessible manner. This can be a particularly profitable investment in situations where there is a rapid turnover of staff.

8. The Place of the Web

Most participants were excited by the possibilities of the Web, and several are planning to introduce interactive capacities where people can ask questions.

Current capabilities and usage of the Web:

- web provides immediate access to a vast virtual library of information;
- widespread and increasing usage;
- it is common to collect bookmarks to important sites;
- common to use it for contact details, politicians speeches and Government announcements and reports;

- incredible power of the technology - noticeboard, bookshelf, updates, marketing tool to interactive chat rooms.
- The knowledge can be tailored to the needs of users.

There were however, a number of barriers to web usage identified:

- it takes time and energy, and some searching skills, to find relevant material;
- many professionals have poor Web searching skills and could benefit from training;
- the material may be arranged in an impenetrable way, both within and between sites;
- rapid changes in technology makes investment decisions difficult;
- volume of the material and garbage are major impediments. Overall the web has massive amounts of information so high level searching skills are needed. Secondly, even valued sites may have outdated or irrelevant information;
- material tends to be organised by those putting in knowledge rather than those seeking the knowledge. If the seeker does not know the question, or even the key words that they could use they may not find relevant material. There may be benefits from turning this around and arranging information from the perspective of the knowledge seeker.

The web offers many opportunities for further development. It is presently being used to deliver formal education programs to remote students, and has the advantage of being self-paced. The CRC for Catchment Hydrology is using it to market research products that can be ordered over the web. Some sites are now becoming more interactive with chat room capabilities. This may require a capacity to moderate both questions and replies, and must be done with a quick turn around time.

In developing web-based material it is important to:

- be very clear as to the objectives of the web investment;
- market the site and create a reason to visit in order to engage participation;
- build credibility and trust in the site;
- put in place appropriate quality assurance mechanisms;

- be aware of the skills of users and the technical access they may have from remote areas;
- be able to manage the site to keep material up to date; and
- bear in mind the needs of users rather than providers in designing the web layout.

9. Evaluation of Knowledge Exchange Activities

Knowledge exchange can be costly and time consuming. While research providers and funders are keen for the knowledge they generate to be used, they seek to ensure the exchange process is both efficient and effective.

There is however a limited tradition of formal evaluation in much of this field, and little agreement on tools and approaches.

For a research provider, the level of adoption of a new idea is the key indicator of the value of the research investment. The time base over which such adoption might be expected is always difficult to determine. Behaviour often changes due to multiple causes, so attributing causality to any piece of knowledge can be a challenge.

One opportunity is to encourage professionals and researchers in Communications Schools to work in the area of natural resource management. Johnson's own work which he discussed showed the need for an improved research base and that findings are often counter intuitive. As we trial and develop various knowledge exchange strategies it is essential we measure outcomes and the best way to do this is to treat it as a research exercise.

Some Tools of Knowledge Exchange

- Face to face provision of new knowledge direct between the researcher and the knowledge user. This is often a preferred model, but is costly and only works when the user has a clear question to be addressed.
- Face to face problem-solving workshops that focus researchers, knowledge professionals and the users on the particular needs of the users. This model is helpful when the question to be addressed is unclear and the joint problem solving approach can help formulate the appropriate question as well as identify what knowledge is available.
- Synthesis documents that draw together current knowledge in a particular area and present it in a succinct and attractive manner. These can be presented in a variety of formats – print, web or mass media.
- Specialised knowledge brokers who have a strong technical base as well as high order communication skills whose role is to act as an interface between the providers and users of knowledge. They bring research problems back to the research community as well as provide appropriate knowledge to users.
- Help facilitate the building of appropriate relationships and networks between the users and producers of knowledge.
- Technical reports, and plain english summaries of technical reports providing information about particular research projects. A common approach but is often not effective.
- A variety of technical transfer approaches, either at the end or through the life of the project. These might include field days, demonstrations, videos, structured training sessions, seminars and brochures.

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OTHER PUBLICATIONS OF

The Cooperative Research Centre for Freshwater Ecology

The Cooperative Research Centre for Freshwater Ecology publishes a range of books, guidelines, newsletters, technical reports and brochures. These publications can be ordered from the Cooperative Research Centre for Freshwater Ecology at its Albury centre, by phoning 02 6058 2310, or by email to: enquiries@mdfrc.canberra.edu.au.

Many reports are also available on our web site at <http://freshwater.canberra.edu.au>

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Identification Guides

The CRC for Freshwater Ecology sells 31 different Identification Guides to the Invertebrates of Australian Inland waters, including:

Hawking, J. & Smith, F. 1997. *Colour Guide to Invertebrates of Australian Inland Waters*. ID Guide no. 8. (\$24.00)

Hawking, J. 2000. *Keys to keys: A guide to keys and zoological information to identify Invertebrates from Australian Inland Waters*. 2nd edn.. ID Guide no. 2. (\$22.00 + \$2.20 postage)

