CREW
centre of expertise for waters

Evaluating knowledge exchange: a review

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Centre of Expertise for Waters (CREW)

CREW is a hub which ensures that water research and expertise is available and accessible to the Scottish Government and its agencies. This is designed to ensure that existing and new research and expertise can feed into the development of water related policy in Scotland in a timely and effective manner.

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1 INTRODUCTION

This review brings together literature relevant to evaluating projects and programmes that aim to enhance knowledge exchange (KE) between researchers, policy makers and other stakeholders (i.e. anyone with a 'stake' in a process or problem). The review will provide background to the development of evaluation procedures to understand the effectiveness of KE projects implemented by the Centre of Expertise for Waters (CREW). CREW is a partnership between the James Hutton Institute and all Scottish Higher Education Institutes that aims to ensure water research and expertise is available and accessible to the Scottish Government and its agencies in a timely and effective manner. CREW links water research to water policy via an enquiry service for small areas of work requiring a quick response; by carrying out capacity building research projects; via dissemination of research; and by assessing future research needs. CREW is therefore essentially a programme of different individual projects that seek to enhance the way knowledge on water and its management is exchanged, shared and used.

This review aims to provide recommendations for what needs to be considered in the design of evaluations. It is not meant to provide a step-by-step guide. The context for which this review has been conducted is environmental management and its relationship to and between the knowledge held by researchers, practitioners and policy makers. However, given the limited research on evaluating KE in environmental fields, the review draws on research from a wide range of other fields including business, management, health and education.

The review includes the following sections:

1) Introduction;
2) A brief background to KE and evaluation of KE;
3) An overview of key stages involved in conducting evaluations;
4) A review of 53 studies that conducted or discussed evaluation of KE. This has four subsections:
    a. General overview;
    b. The theories and frameworks of knowledge or KE used by different studies to frame implementation of KE and/or its evaluation;
    c. The indicators and measures used by the different studies;
    d. The challenges to evaluating KE identified in the studies;
5) Key tools and approaches for assisting the development of evaluation methodologies;
6) Lessons learned from evaluating the RELU programme of stakeholder engagement;
7) Conclusions and recommendations, including a suggested design for a programme of projects such as CREW.

The methodology for this review included two approaches. One approach was a selection of research papers that specifically conducted or discussed evaluations of KE. The results of this approach are presented in Section 4. The other approach focuses on key material, some of which would not have been picked up by the more systematised approach (e.g. because it may have come from a broader literature such as from the field of evaluation rather than KE). The results of this approach are discussed in sections 2, 3, 5 and 6.

2 BACKGROUND TO KE AND EVALUATION

2.1 Knowledge Exchange

Scientists are being required to embrace a new relationship with society (Planet Under Pressure 2012). This includes increasing emphasis on the need for improved multi-way interaction between researchers, decision-makers and beneficiaries of science to set research goals and questions, and to enhance the contribution of research to achieving sustainability (Francis and Goodman 2011; Funtowicz and Ravetz 1993; Planet Under Pressure 2012; RCUK 2009). This call has come partly because of the recognition of the need for more effective and rapid responses to increasing environmental and social challenges. Increasing knowledge about sustainability (e.g. through scientific endeavours) is both important and useful, but unless it is coupled with meaningful engagement with the public and other decision-makers (e.g. those that influence and formulate policies), more research alone is unlikely to bring significant or rapid change. Recognition of this problem has led to increasing emphasis on designing and implementing knowledge exchange processes and interventions between researchers and other stakeholders. This is highlighted by the UK's agenda to enhance research impact and other global agendas that aim to encourage more sustainable global outcomes (e.g. Planet Under Pressure 2012; RCUK 2009).

Knowledge Exchange (KE) is emerging as an important cross-disciplinary approach to sharing knowledge to facilitate linkages between science and practice (Fazey and et al. 2012; Sustainable Learning et al. 2011). There is no single definition of KE, but the term is often used as an umbrella for concepts such as co-production, transfer, storage, exchange, transformation, translation of knowledge and social learning (Fazey and et al. 2012). Despite the lack of a catch-all definition, experts have identified some key characteristics of KE (Fazey and et al. 2012). These are:

1) KE is generally a process of individual or social learning within or between groups of individuals;
2) The process of KE can be unidirectional, but to be more effective, KE needs to be seen to be a multidirectional process that involves the co-production of knowledge;
3) Viewing knowledge as something that can be passed around in inert form through traditional processes of 'transfer' is outmoded and does not reflect what is known about how knowledge is constructed and shared;
4) Viewing knowledge as fixed or inert, no matter who exchanges it, how it is exchanged, or in whichever context is problematic. Such a view does not reflect relatively common and accepted understandings of researchers on knowledge about how it is constructed and shared;
5) KE is significantly influenced by a range of contextual factors including political and social considerations, power relationships, the status of individuals, and what the process aims to achieve;
6) Outcomes of KE can be wide ranging, from the generation of information that can be shared, individual learning, enhanced cohesion and trust, empowerment, participation, ownership and responsibility for decision-making, to flattening of hierarchies between individuals and groups;
7) Outcomes depend on a range of individual factors, such as how people internalize knowledge, the skills of facilitators of KE, and past experience, expertise and background;

8) Outcomes depend greatly on how KE is defined, how goals are identified, and the process implemented.

In summary, KE is increasingly recognised as an important part of linking science with practice but that it is a complex and context dependent process (Bierly *et al.* 2000; Nonaka *et al.* 2000). Improving understanding of how to do KE better is important if the goals of KE related agendas are to be realised. Evaluation of KE projects and programmes is therefore not only important for external validation (e.g. for establishing if funds have been spent appropriately) but also as part of a wider strategy of enhancing the effectiveness of KE processes.

2.2 Evaluation and KE

Despite many claims of the value of KE activities, there has been very little research on how to evaluate KE and examples of carefully implemented evaluations are limited (Fazey and et al. 2012; Phillipson et al. 2012; Plummer and Armitage 2007). Lack of material on evaluating KE is partly because conducting such evaluations can be difficult. It can be difficult to determine what aspects of KE should be evaluated and because it is often difficult to establish linear relationships between implementing KE and longer term outcomes or impact given the strong influence of political, social, cultural and institutional factors on longer term outcomes (Phillipson *et al.* 2012).

Despite the challenges, there are many advantages of evaluating KE beyond simply providing external validation for whether a project has been successful. First, evaluation helps to refine the practice of KE either during implementation or in the design of new initiatives or projects. Second, conducting an evaluation requires evaluators, project managers and stakeholders to clarify the objectives of a KE process. This assists the evaluation and helps project or programme managers to be clearer about their objectives thereby influencing the likelihood that the goals will be met. Third, evaluation requires participants to consider their underlying assumptions as to why they believe that the design of the KE process is likely to deliver the outcomes and whether alternative approaches would be more effective. Finally, evaluation provides opportunities for stakeholders of a project to work together to share perspectives, increase ownership of and responsibility for delivering KE and the intended outcomes. Participation of stakeholders in setting up and conducting evaluations enhances motivation and empowerment to deliver desired KE outcomes and to reflect on and share what they have learnt (Fetterman and Wandersman 2005; Zukoski and Luluquisen 2002). Such participatory evaluations are referred to as ‘empowerment evaluations’ and require close collaboration of stakeholders prior to implementation of a KE process (Fetterman and Wandersman 2005). Thus, if implemented appropriately, evaluation can enhance the exchange of knowledge and learning of those involved and become a crucial part of the design of the KE process itself (Armitage et al. 2011). Overall, evaluation is therefore an important part of improving understanding about KE and enhancing the effectiveness of KE projects and programmes, such as CREW.

3 GUIDELINES FOR CONDUCTING AND DESIGNING EVALUATIONS

3.1 EC guidelines and key stages in conducting an evaluation

This section aims to briefly outline the key stages involved in designing and implementing evaluations. The section is based on the guidelines on evaluation for the European Union’s external assistance projects and programmes (European Communities 2006a, b, c, d). These guidelines have

been chosen because they are particularly relevant to evaluating KE for three reasons. First, the guidelines provide a comprehensive overview of methods, tools and approaches for evaluation more generally, including the key stages involved in developing an evaluation methodology and its implementation. Second, the guidelines cover individual projects, programmes (a collection of projects aiming to achieve a higher order goal) and strategies (complex interventions, such as a strategy aimed at the economic development of a whole country). This means the guidelines are especially suited to different levels of project implementation, such as the CREW's programme of projects. Third, the guidelines are framed in relation to 'interventions'. That is, they are aimed at understanding how the implementation of a project influences some form of change in something (e.g. a community development programme) as opposed to the evaluation of something that is 'constructed' (e.g. building of an engineering project, or evaluation of the extent to which a research programme meets its objectives to 'understand a phenomena or problem). The EC guidelines are therefore particularly suited to evaluations of KE, which usually involve creating some form of change, such as in levels of engagement of stakeholders, the relationship between stakeholders and policy makers, or changes in understanding of different stakeholders about an issue through a process of mutual or social learning. Overall, the EU guidelines are therefore better suited to evaluations of KE than many others, such as the Magenta Book which is primarily about evaluating policy and which, while having useful information, focuses much more on the methods of data collection and evidence and less on the overall structure and design of an evaluation process (HM Treasury 2011).

The EC guides define evaluation as: "the systematic and objective assessment of an on-going or completed project, programme or policy, its design, implementation and results" or as "judgment of interventions according to their results, impacts and needs they aim to satisfy" (European Communities 2006a). The main purposes outlined in these guides is for evaluation to: Contribute to the design of interventions; assist in efficient allocation of resources; improve the quality of the intervention; and report on achievements of the intervention (i.e. accountability)(European Communities 2006a).

Evaluations can be conducted before adopting or implementing an intervention (ex ante evaluation, sometimes called appraisal), during implementation (mid-term evaluation) or after completion of the intervention (ex post evaluation). Key stages for designing and conducting an evaluation are briefly explained below (for further details see: European Communities 2006a, b, c, d):

1) **Analysing the intervention strategy:** To conduct an evaluation, it is necessary to understand the intervention strategy. That is, why an intervention has been implemented and why a set of projects or programme of activities was expected to deliver the desired outcomes. For example, a KE intervention might aim to change understanding through interaction and/or might aim to change some form of behaviour. There are two key parts to analysing an intervention strategy: a) examining the *intervention rationale*; and b) analysing the *intervention logic*. The intervention rationale is the justification for the intervention and why it was considered necessary. Understanding the rationale is important for evaluations because making the reasons for the intervention explicit enables the evaluation to be targeted more specifically towards the objectives of the intervention. The intervention logic is the assumptions as to why an intervention was/is believed to deliver the expected outcomes. Examining the intervention logic in evaluation provides the basis for identifying evaluation questions.

An example is stakeholder engagement between researchers and farmers interested in reducing nitrogen run-off into rivers. The intervention may aim to enhance awareness and/or influence farming practices (i.e. the intervention rationale). The methods used would depend on the aim. For example, more simple discussions and training days might be used to enhance awareness while more intensive processes of engagement and problem solving would be needed to encourage changes in farming practice, with farmers and researchers learning together about the problems and solutions. The intervention logic is thus the reason why a particular approach is expected to work and the underlying assumptions made in this process. In the simpler awareness raising intervention an underlying assumption might be that farmers would actually be interested in attending a training workshop and that more standard modes of delivery of information would result in a change in understanding (as opposed, for example, to more experientially based forms of KE).

2) **Identifying questions for the evaluation:** This includes identifying a number of key points/questions so that the data collection and in-depth analysis can be appropriately targeted. In the EC guidelines, it is recommended that evaluators use a maximum of ten questions. The questions need to provide useful information and be linked to specific evaluation criteria (see below). Some of the questions will be derived directly from the intervention logic while others could come from other cross cutting themes that are considered important, such as the extent to which targets of reaching a wide range of different stakeholders are met in a programme of activities. In the example of raising awareness about nitrogen run-off through a training day event, a range of questions can emerge from the intervention logic. For example, these might be the extent of engagement/participation by farmers, what kinds of farmers participated, and whether their understanding changed as a result of a training day. More challenging questions, such as whether actual farming practices or behaviours changed as a result of the intervention could also be asked, depending on the original aim of the KE intervention.

3) **Establishing criteria for the questions and the evaluation:** Questions need to be carefully considered in relation to the criteria most suitable for the evaluation, and ideally should cover a range of different kinds of questions. In the example with farmers the questions about the extent of engagement/participation by farmers in the training day and whether their understanding changed as a result of a training day relate mostly to effectiveness. Other questions such as whether participants felt that the intervention was relevant and useful could also be asked.

   Criteria can include:

   a. *Relevance:* The extent to which objectives are consistent with beneficiaries requirements and needs;
   b. *Effectiveness:* The extent to which the intervention's objectives were or are expected to be achieved;
   c. *Efficiency:* The extent to which outputs are achieved with the lowest possible resources/inputs;
   d. *Sustainability:* Whether benefits will continue after the project is complete;
   e. *Impact:* The positive and negative, primary and secondary long-term effects of an intervention;
   f. *Coherence/Complementarity*: The extent to which there is overlap with outcomes of other interventions, whether there is convergence of the outcomes with other

strategies/programmes, whether there are contradictions between the different levels of objectives in a project/programme.

4) **Establishing judgment criteria:** These criteria enable a judgment to be made about the merits or success of the intervention being evaluated. This includes establishing *indicators* which specify which data are to be collected and identifying the *target level* or threshold (i.e. how much of a change or result is needed for the intervention to be considered to be successful). This is an important stage because it is the key link between making the objectives of the intervention explicit and enabling a judgment about the merits or success of an intervention to be determined.

5) **Methodological design:** This process involves explicitly establishing the logic of the relationship between a question that is asked, the data used to assess merits and success (indicator) and the level or threshold that will determine whether an intervention has been successful (target level). A table of these relationships is usually established for each of the key questions asked about the success of an intervention when designing an evaluation.

6) **Data collection and Analysis:** This approach depends on the methodology and data that will be collected. Standard research techniques (qualitative or quantitative) such as interviews, surveys, financial data etc. can be used for data collection and analysis and are not repeated here (see European Communities 2006d for details). As with any research, the evaluation needs to ensure that data collection and analysis are conducted in a reliable and rigorous manner.

7) **Judgment:** The conclusions for each question are collated in a way that enables a judgment about the merits/success of an intervention. Care needs to be taken to ensure that ethical principles are adhered to during this process (e.g. legitimacy, impartiality, and protection of individuals).

3.2 Implications of the evaluation guidelines for KE

The stages outlined above are primarily designed to ensure that rigour and objectivity is possible when making a judgment about the merits and success of an intervention. To promote objectivity, each of the stages provides a robust methodology that ensures judgments are carefully made directly against the specified outcomes of a project or programme. **Thus when designing the evaluation methodology, all steps in the process need to be carefully considered**.

For evaluations of KE, it is particularly important to understand and be clear about the intervention rationale and the intervention logic as this is the basis for developing key criteria or indicators on which the project/programme will be judged. Many KE projects are extremely vague about what they are trying to achieve and why they think that their activities will get them to their end goals. **To develop effective evaluation methodologies, managers of projects and programmes will therefore also need to have explicit objectives of their interventions, how they will achieve them, and be able to justify why they believe that their intervention will deliver the desired outcome**.

Given that there are many ways of conceptualising KE (e.g. as co-production of knowledge, knowledge mobilisation, transfer etc.) it will also be important to understand the conceptual frameworks that people are using to help them explain why they believe that a particular intervention will work (see below). In effect, this means that it is possible to evaluate different levels

in the KE process including the merits and success of a project, programme or even the particular theory or framework of KE that guides and provides the justification for the way in which a project or programme is approached and implemented. The key message here is that **managers of programmes and projects need to be clear about what they mean by KE and how this affects the way in which they are trying to deliver it**.

4 REVIEW OF LITERATURE THAT CONDUCTS OR DISCUSSES EVALUATIONS OF KE

This section examines literature that has evaluated KE projects/programmes/interventions. The section seeks to learn from past research. The review includes examining 53 research papers from a diverse range of fields. These were a random selection from 222 papers which were identified from extensive searches from Scopus (see Appendix 1 for full details of the methodology used to select research papers). This section therefore reports on the most important and pertinent findings. This includes four subsections: i) an overview of studies; ii) the underlying theories, frameworks and concepts used to approach either KE or the evaluations, iii) the kinds of data used to evaluate KE, and iv) some of the challenges for doing evaluations. A full list of the papers reviewed for this section is provided in Appendix 2.

4.1 Overview of studies

A key finding of this review is that carefully designed evaluations of KE in the literature are limited. Research that includes evaluations of KE also span an extremely wide range of contexts and sectors including Business (14), Education (6), Environmental (12), and Healthcare (21)(Table 1). Of these studies, there was a fairly even mix of qualitative (21) and quantitative methods used (18), with the number of mixed-method approach slightly less (14). For further details of the specific methods applied in the evaluation of KE, see Table 2.

Field	Quantitative approach	Qualitative approach	Mixed-method approach	TOTAL
Business	6	4	4	14
Education	3	0	3	6
Environmental	2	7	3	12
Healthcare	7	10	4	21
TOTAL	18	21	14	53

Table 1: Number of studies from different research domains and the type of methods used to evaluate KE from a random selection of 53 research papers from a total of 222 that were identified in the literature search.

4.2 Theories and concepts used to frame KE and evaluation

There are many ways that knowledge and KE are conceptualised (Bierly et al. 2000; Fazey and et al. 2012; Nonaka et al. 2000). This influences how KE is approached and evaluated. The review of the 53 research papers therefore examined the theories, concepts and frameworks used to frame KE and/or evaluation of KE (Table 2). Full details of these are provided in Appendix 3.

The review of the theories and frameworks highlighted a number of general issues. These included the need for evaluations to:

1) Involve stakeholders as participants in the evaluation process (see later sections of this report);
2) Be designed specifically for the context in which an evaluation is to be applied and that catch-all types of evaluations are unlikely to work well;
3) Be included throughout the KE process rather than simply at the end;
4) Use a diversity of disciplinary perspectives and methods as KE covers such a wide range of topics.

The key message is that project and programme managers need to consider the kinds of approaches to understanding and conceptualising knowledge and KE being used and the implications of this for implementing KE and its evaluation.

4.3 Indicators and measures for KE evaluation

The theories and concepts discussed above provide the basis for understanding the original intervention logic of a project or programme and help evaluators consider their own approaches to evaluating KE in initial stages of the evaluation design (i.e. stages 1 and 2 in Section 2). In the next phases of the evaluation design clear questions are identified followed by establishing clear measures and indicators to know whether the targets or aims have been achieved (European Communities 2006a). The review of the 53 papers identified a wide breadth of indicators used to evaluate KE. These were grouped within five themes of knowledge exchange outcomes: 1) knowledge and learning of those involved, 2) social and collaborative outcomes; 3) economic and business related outcomes; 4) ecological outcomes; and 5) other impacts of research (Table 3). The indicators were highly context specific, so this report provides a general breakdown of more general indicators with examples of how these were measured in more detail (Table 3). Although indicators have been presented under a specific knowledge exchange outcome, the indicators are not mutually exclusive.

The most frequently examined indicators within the database were knowledge, behaviour and motivation and attitude, which were prominently associated with evaluation of knowledge and learning KE outcomes. These three indicators were used within all identified four research fields (healthcare, environmental, business, education). The measurement of knowledge and behaviour indicators were strongly associated with either a qualitative or mixed methods research approach, while evaluation of ecological and business-related KE outcomes were associated most strongly with either a quantitative or mixed-methods approach. In relation to KE outcomes, indicators included both direct measures of how knowledge exchange impacts an individual (e.g. behaviour, knowledge, communication, participation) and indirect measures of how knowledge exchange impacts a process or activity (e.g. business performance, resource consumption, scientific advance). Again, the use of direct or indirect indicators related specifically to the outcome of KE that was being evaluated. Studies that employed a more participatory approach to evaluation were more commonly associated with direct evaluation indicators.

Table 2: Summary of theories informing the evaluation of KE from the literature. Full details of these are provided in Appendix 3.

Theory	Associated Methods	Relation to KE evaluation	Implications for KE	References
Performance evaluation framework	• Interviews • Open ended questionnaire • Participatory • Range of disciplines	11 criteria that can be used to help define and evaluate outputs and outcomes of KE	Enables a collaborative evaluation of a KE process. The evaluation criteria can be used to assess the success of a project throughout or as a final appraisal. Evaluation of KE using these criteria should a) consider both outputs and outcomes, b) be participatory and generally qualitative in approach.	Hill et al. (2010) Mandarano (2009)
Complex systems approach	• Interviews • Open ended questionnaire • Participatory • Multi-scale • Reflection	Provides guidance as to how to evaluate complex systems generally dealt with in KE.	Evaluation should (a) link objective to consequence or outcome; (b) consider the assumptions and hypotheses that underpin core policy or program objectives; (c) be grounded in the natural resource, policy/institutional, economic, socio-cultural and technological contexts; (d) establish practical, valid and equitable evaluation criteria monitor and assess change throughout time; (e) involve methodological pluralism and (f) integrate different disciplinary perspectives	Bellamy *et al.* (2001) Berkes *et al.* 2003). Plummer & Armitage (2007)
Rowe and Frewer (2000) informed approach	• Participatory • Open and closed questionnaire • Interviews	9 criteria that can be used to help define and evaluate KE processes	Evaluation should: (a) establish how acceptable the process is to the participant and link this to how well designed the process has been; (b) be able to establish a replicable outcome; (c); be acceptable to participant; (d) involve methodological pluralism; and (f) be largely based on social science approaches.	Rowe & Frewer (2000) Kuper et al. (2009)
The self-efficacy concept	• Interviews • Focus Groups • Participant observation • Open ended questionnaires	Looks at how participants may be able to operationalize their learning as a result of the KE process	Evaluation should: (a) link experiences, contextual information, and interpretations of participants; (b) identify how likely participants will be to implement the project; (c); focus on learning as an outcome of KE (d) involve methodological pluralism and (f) be largely based on social science approaches.	Kuper et al. (2009) Bandura (1997)
Social learning	• Participatory • Focus group • Interview	Social learning may result from KE.	In monitoring and evaluation of KE for social learning a project should: a) link context to outcome via the participatory approach taken; b) focus on an evaluation of learning; c) evaluate whether	Kuper et al. (2007) Maurel et al. (2007)

	• Questionnaire • Participant led activities		learning has moved beyond the individual to influence wider groups/society; and d) use mainly methods from social sciences for evaluation.	Reed et al. (2010)
'Change theory'	• Participatory • Interviews • Questionnaires • Focus groups	Helps KE processes that are aiming to create a substantial change in organisational practices.	Evaluation using change theory should: (a) develop indicators for evaluation with participants for each stage of the process; (b) be flexible as to whether evaluation methods are mixed, qualitative or quantitative; (c) be carried out through a process, generally linked to each of the stages; and (f) focused on creating change as a result of the KE process.	Lewin (1946) Kuper et al. (2007)
Action Research	• Participation • Focus groups • Interviews • Questionnaires	Recognises that people's actions are based on implicit assumptions, theories and hypotheses, and with every observed result, knowledge and KE can be improved.	Action research informs a KE evaluation approach. Here evaluation is used as an intervention. Enabling participants and research team to reflect on the success of the project to state and then to plan the next phase of the project taking into account this feedback.	Raman et al (2011)
Community of Practice	• Participation • Focus groups • Interviews • Questionnaires	KE aims to build group capacity or to evaluate whether a CoP has been built as a result of KE	Evaluation of KE a) is specifically informed by a detailed understanding of context/culture of the group; and b) aims to build capacity of the group and facilitate learning. If evaluating whether a CoP has been formed as a result of a KE process evaluation may include social network analysis at the start, midway and at the end of a project.	Chan et al. (2009) Chantarasombet & Srisa-ard (2009), Yang & Wei (2010), Yu et al. (2009),
Realistic Evaluation	• Interviews • Open ended questionnaire • Participatory • Range of disciplines	This theory is centered on outcomes produced from interventions as well as 'how they are produced, and what is significant about the varying conditions in the which the interventions take place'	Monitoring and evaluation should: (a) link theory, hypothesis, data collection and Programme context; (b) be flexible in the methods used for evaluation; (c); have a long term focus on achieving a sustained change as a result of KE (d) utilize methods and views from a variety of disciplinary perspectives; and (f) continually evolve by using the results of the evaluation to inform future theory.	Raycroft-Malone et al. (2011) Shih (2009) Tilley and Pawson (1997) Huang & Tilley (2000).

Table 3: Indicators of KE success from the literature, grouped into 6 categories.

Outcome of KE General indicators used to evaluate KE	**Example of specific indicator used to evaluate KE**	**Example of method used for evaluation**	**Field**	**Example from literature** (see full list of references in Appendix 1)
Knowledge & Learning				
Knowledge (Level, up-take, use, creation, sharing)	Has research been shared? Improvement in patient/clinical outcome? Intention of knowledge sharing? Change in frequency of use of a web-based learning tool? Change in how knowledge is viewed and valued? Change in awareness of knowledge?	Survey, mathematical model, exams, participant observation, interview, focus group, workshop	Business Education Environmental Healthcare	Shaw & Woodward 1988, Chang 2003, McWilliam et al. 2003, Hicks et al. 2006, Plummer & Armitage 2007, Conklin & Stolee 2008, Kirshbaum 2008, Chantarasombat & Srisa-Ard 2009, Cricelli & Grimaldi 2010, Chapman et al. 2007, Liu et al. 2010, Olson et al. 2010, Yang & Wei 2010, Azita & Maryam 2011, Chao et al. 2011, Kuper et al. 2011, Lan & Lin 2011, Ward et al. 2011, Wathen et al. 2011
Behaviour	Change in clinical practice? Development of farming practices? Impact on organisational support for learning? Impact on management skills and co-operation?	Survey, interview Mathematical model	Business Education Environmental Healthcare	Chang 2003, McWilliam et al. 2003, Firestone & McElroy 2005, Amsallem et al. 2007, Skinner 2007, Conklin & Stolee 2008, Kirshbaum 2008, Murray et al. 2008, Kuper et al. 2009, Sullivan et al. 2009, Yu et al. 2009, Blanton et al. 2010, Harsch et al. 2010, Yang & Wei 2010, Lan & Lin 2011
Attitude & motivation	Change in farmer attitude towards management? Attitudes changes towards change in technology? Change in motivation for learning? Reaction to knowledge exchange/learning intervention?	Survey, interview	Business Education Environmental Healthcare	Chang 2003, McWilliam et al. 2003, Baker et al. 2008, Conklin & Stolee 2008, Kirshbaum 2008, Kuper et al. 2009, Sullivan et al. 2009, Lan & Lin 2011
Social & Collaborative				
Communication	Change in ability to communicate knowledge? Evidence of use of communication tools, such as emails and manuals? Evidence of clear, relevant, timely & respectful communication?	Survey, interviews, focus groups	Environmental Healthcare	Firestone & McElroy 2005, Plummer & Armitage 2007, Kothari et al. 2011, Kuah et al. 2011, Raman et al. 2011
Satisfaction & experience	Satisfaction of project participation and project experience? Level of satisfaction with knowledge management? Experiences of using the knowledge exchange intervention?	Survey, focus group, questionnaire	Environmental Healthcare	Chantarasombat & Srisa-Ard 2009, Harsch et al. 2010, Ting et al. 2011, Raman et al. 2011

Working relationships, partnerships & self-organisation	Evidence of new and improved working relationships and formations of trust? Evidence of increased collaboration between organisations (e.g. frequency of emails and telephone calls)? Generation of community knowledge managers? Level of commitment to collaboration?	Participant observation, focus groups, interviews, literature review	Business Environmental Healthcare	Kramer & Wells 2005, Baker et al. 2008, Chantarasombat & Srisa-Ard 2009, Hill et al. 2010, Gutierrez et al. 2011, Kothari et al. 2011
Social welfare	Change in poverty level? Change in unemployment level? Change in level of wellbeing? Extent of community empowerment?	Literature review	Environmental	Copes & Charles 2004, Plummer & Armitage 2007, Gutierrez et al. 2011
Participation	Level of project participation? Equality of project participation (e.g. between gender & different social groups)? Opportunities for participation?	Survey, focus groups	Environmental	Chantarasombat & Srisa-Ard 2009, Ting et al. 2011
Economic & Business				
Business performance	Sales growth? Change in profitability? Change in product value? Improvement in final product quality?	Questionnaire, interview, workshop, Survey, literature review	Business Environmental	Copes & Charles 2004, Robinson et al. 2004, Huang & Shih 2009, Huang et al. 2010, Azita & Maryam 2011, Gutierrez et al. 2011, Hussain et al. 2011, Ting et al. 2011
Innovation	Generation of new ideas, strategies and actions? Increased exploitation of knowledge-based resourced? Level of innovative performance?	Participant observation, analysis of patents	Business Education Environmental	Hicks et al. 2006, Chapman et al. 2007, Kotabe et al. 2007, Hill et al. 2010
Productivity & product development	Impact on fisheries catches and effort? Impact on new product development efficiency?	Survey	Business Environmental	Almeida et al. 2009, Chan et al. 2009, Hussain et al. 2011
Ecological				
Resource consumption	Change in annual household firewood consumption? Evidence of sustainable catches? Extent of resource wastage? Impact on resource dependency?	Survey, literature review, interviews	Environmental	Copes & Charles 2004, Huang & Shih 2009, Gutierrez et al. 2011
Ecosystem, population and/or habitat status	Impacts on specific ecosystem types/habitats or species? Extent of population replenishment?	Literature review, participant observation	Environmental	Plummer & Armitage 2007, Hill et al. 2010, Gutierrez et al. 2011
Conservation	Impact on biodiversity conservation? Impact on	Literature review,	Environmental	Copes & Charles 2004, Almeida et al. 2009, Gutierrez et al.

	protected area management?	interviews		2011
Research				
Impact on policy & programs	Extent of research dissemination (such as written and other forms of presentation)?	Interviews, focus groups, survey, participant observation	Healthcare	Dobbins et al. 2009, Cummings et al. 2011, Kothari et al. 2011, Rycroft-Malone et al. 2011
Scientific advance	Success of research implementation? Citation records? Frequency of medical errors?	Interviews, focus groups	Healthcare	Stokols et al. 2008

4.4 Key challenges to evaluating KE

A number of key knowledge evaluation challenges and recommendations were identified from the 53 research papers (Table 4). In general, however, the majority of empirical studies provided no critical discussion of the evaluative framework or approach used. There were four key challenges identified. These were the need:

1) To support evaluations with further studies to validate the KE framework used (this was the most commonly identified challenge);
2) For more quantified evaluations of KE;
3) To include in evaluation design a dynamic evaluation framework that covers the whole process of development of the KE project;
4) To ensure current evaluation techniques are more thoroughly grounded in theory.

Overall, while discussions of the challenges was limited, when they were identified they tended to support conclusions coming out of this review, such as the need for more robust theoretical bases to the evaluation, the need for evaluations to be designed specifically for the context in which they are conducted, and for clarity in the aims and intervention logic in a project (Section 4.2).

4.5 Implications of the review of the 53 papers for evaluating KE

The key findings and implications from the review of the 53 papers were as follows:

- Project and programme managers need to consider the kinds of approaches to understanding and conceptualising knowledge and KE being used and the implications of this for implementing KE and evaluation.
- Evaluation of knowledge exchange can be assisted by an understanding of some of the key frameworks and theories utilised in the literature (Table 2).
- These frameworks and theories conceptualise KE evaluation as complex and highlight the need for a mixed method, multi- or inter-disciplinary and participatory approach.
- The evaluations tended not to be just at the end of projects with studies highlighting the need for viewing evaluation more as an intervention with cycles of evaluation, reflection and redesign built into the process as a way of achieving significant institutional or behavioural change.
- Indicators to assist evaluations of KE (Table 3) tended to be context specific but generally included some form of evaluation of changes to knowledge, behaviour and motivation and attitude as a result of KE. This means that indicators will need to be identified specifically for individual projects and programmes.
- Measurement of knowledge and behaviour indicators tended to use a qualitative or mixed methods research approach, while evaluation of ecological and business-related indicators tended toward quantitative or mixed-methodology. A range of approaches to evaluation are therefore likely to be needed.
- A number of challenges and recommendations associated with KE evaluation were identified (Table 4) with the most frequent being a need for validation of the evaluation framework itself.

Challenge	Example	Specific recommendation	Papers with example
Further studies required to validate the KE evaluation framework	Many factors may influence the outcome of knowledge exchange, such as learning style and motivation for learning. For example, teachers' perceptions of technology may affect their uptake/sharing of knowledge using a computer-based knowledge-exchange tool	In order to validate a KE evaluation framework, evaluation should use a control group, peer appraisals of the evaluation, or should be applied within a number of contexts (e.g. different schools /hospitals/communities)	Skinner 2007, Conklin & Stolee 2008, Stokols et al. 2008, Blanton et al. 2010, Lee et al. 2010, Yu et al. 2010, Lan & Yin 2011
Obtaining a more quantified evaluation of knowledge exchange productivity	More quantified forms of data is required so that, for example an organisation is able to evaluate the cost required and time spent per unit knowledge level. In this way the productivity of knowledge management can be quantified	In order to quantify productivity of knowledge management/knowledge exchange, relevant, robust and quantifiable data must be collected which includes specific measures of cost and time taken to evaluate	Yang & Wei 2010, Gutierrez et al. 2011
Designing a dynamic evaluation framework of social learning that covers the whole process of development of the KE project	Evaluation of participatory social learning projects (such as the design and implementation of irrigation projects by small-scale farmers) should cover the whole process of development of the KE project including current discourses, institutions and practices	Evaluative frameworks should cover multiple aspects of the learning/knowledge exchange process	Kuper et al. 2009
Ensuring current evaluation techniques have a better grounding in theory	For example, collaborative approaches to knowledge exchange are also consistent with views of knowledge production and with conceptions within organizational studies of tacit knowledge flows	Evaluation frameworks may benefit from an extensive review of other themes and developments within the literature on knowledge exchange and network development	Conklin & Stolee 2008

Table 4: Key challenges identified in 53 research papers relating to evaluation of KE.

5 APPROACHES FOR ASSISTING EVALUATION DESIGN

The previous sections highlight the need for clarity regarding indicators used in evaluation; the need for embedding evaluation throughout the KE process and for involving stakeholders in designing and conducting evaluations. This section therefore discusses a range of approaches to addressing some of these issues. The section discusses: (a) approaches for identifying objectives, goals and measures of success (indicators) and (b) principles and practice of embedding participation of stakeholders into the process (participatory and empowerment evaluation).

5.1 Approaches for identifying objectives, goals and measures of success (indicators)

The key to effective evaluation is knowing what the intended objectives or goals of a project or programme are meant to be. Without this it is impossible to know what to evaluate. Given the wide diversity of possible objectives and indicators, they can only effectively be identified through close collaboration and participation of evaluators, project managers and other stakeholders. This includes examination of what a project aims to achieve, how it will be achieved and the underlying assumptions of why it is believed that certain actions will result in success (Schmidt 2009).

There are a number of approaches and frameworks that guide the process of aligning activities with goals. Such approaches greatly assist stakeholders and evaluators to address the first four stages outlined in the EC guidelines (see section 3 and European Communities 2006a). Two of the most commonly used approaches are developing logframes and theories of change (TOCs). While both of these approaches are planning and management tools rather than evaluation tools *per se*, they both aim to identify goals, assumptions and measures of success (indicators). The two approaches are explained below.

5.1.1 Logframes

This section is a summary of the information provided in Schmidt (2009), although these are also discussed and used in the Magenta Book as part of the UK governments guidelines for evaluating policy (HM Treasury 2011). The name 'logframe' is derived from the way the framework aims to assist thinking through analysing linkages and assumptions between actions and goals. There are four fundamental stages in building the logframe (Table 5). These are:

1) Identifying what is intended to be accomplished and why;
2) Working out how success is measured and verified;
3) Specifying the external conditions that must exist for the results to be achieved;
4) Clarifying how it is expected that outcomes at different levels will be achieved as a result of the specific actions.

Stage 1: The first stage (1st column in the logframe, Table 5) involves identifying what is intended to be accomplished and why. This is important because it enables alignment of projects with what is intended in a longer-term strategy. Addressing the first question is best done by working collaboratively with key stakeholders as there are likely to be multiple perspectives of what a project

is for. The stage involves identifying different levels of objectives (outcomes, purpose and goals) and activities (inputs) where:

1) **Inputs** are the activities and resources necessary to produce the outcomes (e.g. actions and management)
2) **Outcomes** are the specific results that a project team must deliver by managing the inputs;
3) **Purpose** is the impact anticipated of a project and the change expected from producing the outcomes (e.g. the overall objective of a project);
4) **Goals** are the higher level, big picture strategic or programme objective to which the project contributes (e.g. the overarching goals of a programme such as enhancing the way water policy is developed, managed, used and refined).

Stage 2: The second stage (2nd and 3rd column in the logframe, Table 5) is working out how the success of the objectives at the different levels is measured and verified. Identifying the elements that can be measured helps to clarify the objectives at each level. Working out what needs to be done to verify the outcomes helps establish a management and feedback system to keep track of how the project is progressing. The measures need to be 'valid' (i.e. should accurately measure the objective), verifiable (i.e. can be supported by clear evidence), targeted (e.g. in terms of the quality of an objective, quantity of the objective delivered and whether it is delivered on time), and independent (where each level of objectives/actions has separate measures). Note that the 'purpose' measures are considered to be the most critical because they help clarify the extent to which primary objective of a project is delivered.

Stage 3: The third stage is identifying the other conditions that must exist for the results to be achieved at each level (last column in the logframe, Table 5). These are the things that must happen for the project to succeed such as a certain budget being delivered by an external agency at a particular point in time; the continuation of a particular political climate; certain expertise of project team members being available etc. Identifying the assumptions made about the external condition requirements helps to make explicit how they will influence the delivery of a project if they change or are not met.

Stage 4: The fourth stage in the development of the logframe is clarifying how the expected outcomes, purpose and goals will be achieved through the inputs. That is, what are the specific actions and management of these actions that are needed to deliver the objectives? This section is meant to provide a high level summary, not a comprehensive action plan i.e. identify the key points for detailed planning that might listed in a more detailed plan such as a Gantt chart.

By addressing each of the four questions for each of the levels of objectives and activities in turn, the logframe ensures that careful consideration is given to how the overall goals will be met. Logframes require time to work through the different stages, and are most effective when they are worked through collaboratively with key players. Note, however, that the logframe is not primarily about identifying the nitty-gritty project activities. Instead it is meant to clarify the objectives, measures and how one level of objective/activity will give rise to the others (Schmidt 2009). The logframe

analysis is therefore particularly useful for establishing objectives and measures that would be necessary in any evaluation of interventions such as KE processes.

5.1.2 Theory of Change

A different approach to identifying objectives and logical linkages between different stages in an intervention is called a 'Theory of Change' (TOC). An accessible account of this approach is provided in Andersen (2005). Overall, the approach was developed to assist community development projects and interventions where complex multi-activities are needed to achieve desired objectives. The process involves creating a 'theory' or 'pathway' of the different steps and interventions needed to get to the end goal (Figure 1).

Objectives	Success Measures	Verification	Assumptions
Goal Big picture objective to which the project purpose contributes	**Goal measures** Measures of goal achievement (Quality, quantity, time) Tend to be broad macro-measures that include long-term impact of one project or multiple projects aimed at the same goal.	Data sources to monitor and verify goal	**To reach Goal:** External conditions needed to reach goal and beyond
Purpose Change expected from producing the outcomes Motivation for the project	**Purpose measures** Success conditions expected at end of project (Quality, quantity, time) Describe the conditions that are expected when the project is deemed to be a success	Data sources to monitor and verify purpose	**To reach Purpose:** External conditions needed to achieve purpose
Outcomes Specific results expected from the project team What good managers can make happen	**Outcome measures** Description of completed Outcomes (Quality, quantity, time). Descirbe specific tangible results that the project team can make happen and commits to doing so.	Data sources to monitor and verify outcomes	**To reach Outcomes:** External conditions needed to produce outcomes
Inputs Activities and responsibilities needed to produce outcomes	**Input measures** Resource budget and schedule	Data sources to monitor and verify inputs	**To obtain and manage inputs:** External conditions necessary to obtain and manage inputs

Table 5. Key aspects of a logframe (Schmidt 2009).

The key stages (from Andersen 2005) for developing a TOC are:

1) **Identifying long-term outcomes:** This process identifies both the long-term final objectives and the key steps (preconditions) needed to get there. The overall objective needs to clear to avoid imprecise thinking about what needs to be done to reach them; to ensure that consensus is achieved about what is important and how resources are used to deliver the final objective; and to develop a measurement strategy to tell when and if the objective has been achieved. It is important to avoid vague objectives in this stage.
2) **Identifying preconditions through backcasting:** This identifies and sorts the outcomes (results, accomplishments, stages, states, changes etc.) that are needed to achieve the final goal. These are separate objectives and not the actions needed to achieve them. The approach orders the preconditions by working backwards from the end goal to the current situation. This is an approach is called 'backcasting' which helps to unravel and manage the uncertainties involved. It is important in this stage to focus on the stages needed to get to an end goal rather than on what must be done. Focusing on actions rather than outcomes at this point results in confusion, lack of coherence, and dramatically reduces the effectiveness of the approach.
3) **Identifying indicators for each of the preconditions:** This stage involves determining the evidence that will be used to show that the precondition or outcomes have been achieved. This involves carefully identifying indicators, the target population (i.e. who or what is expected to change), the baseline that will be used to measure successful change; the threshold needed to be crossed in order to be able to claim success; and how long it will take (timeline) for the threshold to be reached. This process of identifying and operationalizing indicators is often the most difficult task in the theory of change process.
4) **Defining interventions:** The interventions are the programme activities, policies, and/or other actions that would result in the outcome. This stage is meant to facilitate strategic thinking rather than be a detailed discussion of how to deliver actions.
5) **Articulating assumptions about why it is believed that the intervention will result in expected outcomes:** This includes making explicit the assumptions behind: a) why each precondition is necessary to achieve the overall objective; b) the theoretical basis as to why certain program activities will result in certain outcomes and c) the contextual conditions that need to be met to enable the outcomes to emerge from the pathway of change.

Overall, creating a TOC keeps focus on the big picture and provides space for participants to work through what they are trying to achieve. In the account by Andersen (2005) it is assumed that key stakeholders will be part of a professionally facilitated process, that an optimum size of a group to work through the issues is about 10 people and that it will be take 2-3 days to complete depending on the complexity of the task being considered.

5.1.3 Applying logframes and TOCs to evaluation of KE projects or programmes.

Logframes and TOCs are both most effective when:

a. Sufficient time is spent on consideration of the objectives, activities, assumptions and indictors;

b. When the process is guided by professional facilitators to help manage the complexity of delivering these outcomes;
c. They involve multiple stakeholders to develop shared understanding and ownership of the process.

There are some differences between logframes and TOCs that influence the choice of the method. Logframes are designed to help deliver a research objective or a fixed outcome through some form of problem solving and/or 'building' towards an end goal, such as research to understand a complex problem or to work towards an objective like an engineering project. TOCs on the other hand are more about creating change in complex settings, such as in community development to enhance human wellbeing. Consequently, logframes generally illustrate programme components, outcomes, inputs and activities. They are particularly useful for assisting a manager to determine when outcomes are not synchronized with inputs and activities. TOCs on the other hand are particularly effective at linking outcomes and activities but also have considerable emphasis on explaining how and why the desired change is expected to come about. This is particularly useful in projects that involve changes to/with people, where changes in behavior of a project are complex and where there are high degrees of subjectivity with regards to the problem focus, solutions and different perspectives or ideologies as to how change will be achieved. Thus while logframes are useful, in many cases TOCs are likely to be more appropriate for development of KE projects, programmes and evaluations.

While logframes and TOCs are not specifically aimed at assisting the design and implementation of evaluations, they are extremely useful for managers, participants and evaluators to identify objectives, activities, assumptions, and indicators and relate closely to the key initial steps in the evaluation design process (outlined in section 3). **Thus ideally, project and programme managers and those implementing or conducting evaluations need to work together using an approach such as logframes or TOCs to enhance: (a) the likelihood of success of an intervention; (b) ensure the evaluation is relevant to the project; and (c) improve the design of the evaluation methodology.**

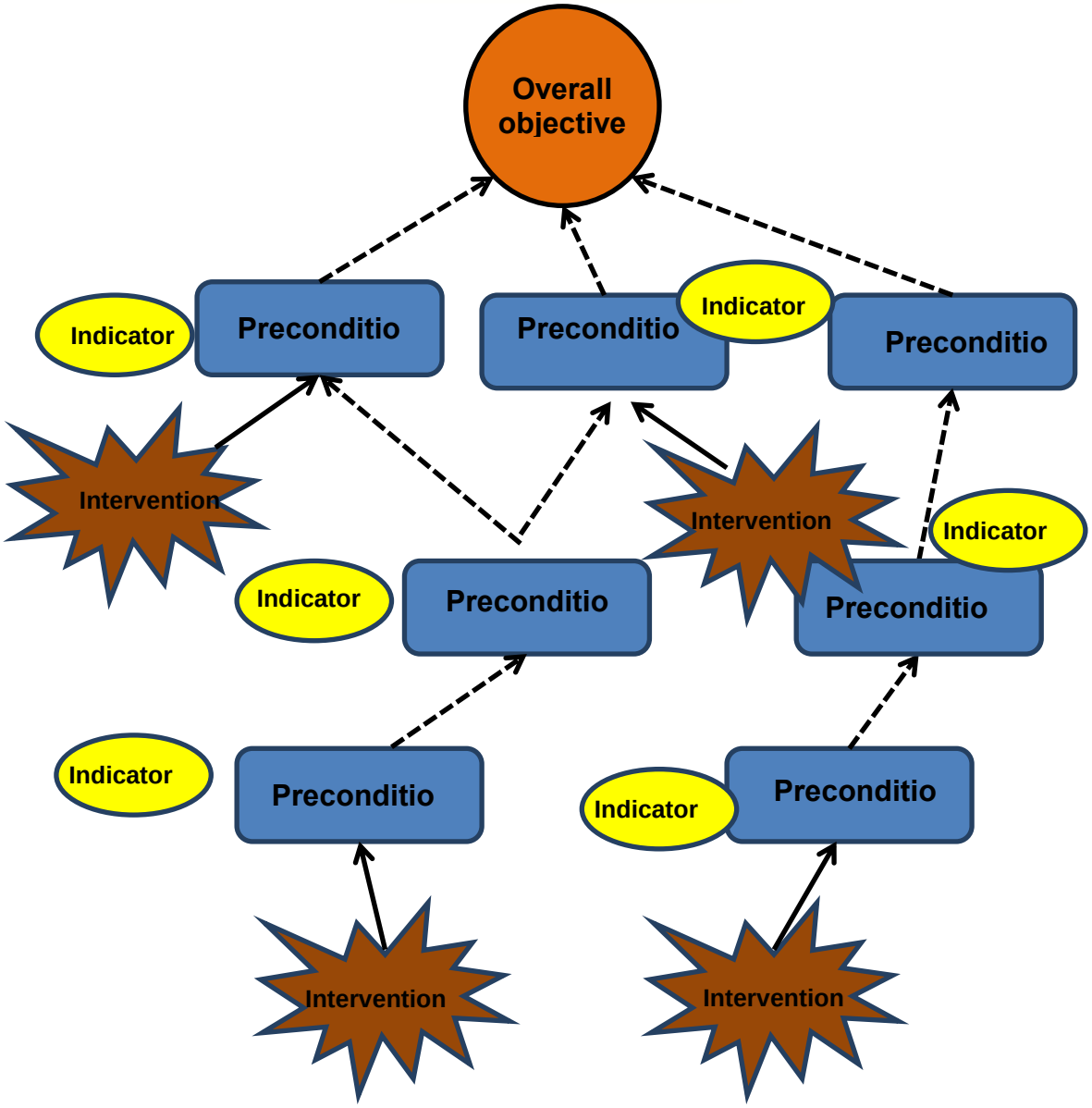

Figure 1: Pathway of change where preconditions (i.e. the stages needed to be achieved in an intervention to reach a final objective), measurable indicators of each preconditions and interventions are identified to map out how the main objective will be achieved (modified from Andersen 2005).

5.2 Participatory and Empowerment Evaluation

The previous section emphasised the importance of the need for managers and evaluators to work together at the outset of project or programme using some approaches such as logframes or TOCs. This essentially is the goal of participatory evaluation which is an approach where stakeholders play an active role in identifying relevant questions, planning the evaluation design, selecting appropriate measures and data collection methods, gathering and analysing data and reaching consensus about the findings (Zukoski and Luluquisen 2002). This is in contrast to 'conventional' evaluation approaches that do not involve stakeholders and where external evaluators are tasked with conducting the evaluation. Participatory evaluation has some benefits over conventional (or non-

participatory) evaluation. This includes potential for the process to: improve relevance of the evaluation questions; provide opportunities for all involved to reflect on project progress; empower participants to take ownership and responsibility for the evaluation (including the results); build capacity for participants to deliver future projects and programmes; and enhance learning about the intervention itself (Zukoski and Luluquisen 2002). Participatory approaches often, however, require more time and other resources than conventional approaches. Differences between participatory and non-participatory approaches to evaluation are highlighted in Table 6.

Question	Participatory evaluation	Conventional evaluation
Who drives the evaluation?	Community residents, project staff and other stakeholders	Funders and program managers
Who determines indicators of program progress?	Members of community groups, project staff and other stakeholders; evaluator	Professional evaluators and outside experts
Who is responsible for data collection, analysis and preparing final reports?	Shared responsibility of evaluator and participating stakeholders	Professional evaluators and outside experts
What is the role of the local evaluator?	Coach, facilitator, negotiator, "critical friend"	Expert, leader
When is this type of evaluation most useful?	• When there are questions about program implementation difficulties • When there are questions about program effects on beneficiaries • When information is wanted on a stakeholder's knowledge of a program or views of progress	• When there is a need for independent judgment • When specialized information is needed that • When only experts can provide • When program indicators are standardized • When rather than particular to a program
What are the costs?	• Time, energy and commitment from local residents • Project staff and other stakeholders • Coordination of many players • Training, skills development and support for key players • Potential for conflict	• Consultant and expert fees • Loss of critical information that only stakeholders can provide
What are the benefits?	• Local knowledge • Verification of information from key players (validity) • Builds knowledge, skills and relationships among • Community residents and other stakeholders	• Independent judgment • Standardized indicators allow comparison with other research findings

Table 6: Differences between participatory and conventional approaches (from Zukoski and Luluquisen 2002).

The extent to which stakeholders are involved in evaluation can vary depending on why participatory approaches are required. For example, participation of project and programme managers and implementers in designing evaluations would be useful to help facilitate learning about how to improve the implementation of a KE project. However, wider participation of stakeholders and beneficiaries (e.g. wider community members, policy makers etc) may also be desired as part of a process in empowering participants to take ownership of and responsibility for delivery of projects; flatten hierarchies of control or influence of dominant groups; reduce conflicts over the findings of the evaluation process; and to build capacity for future projects and evaluations and wider capacity (e.g. social capital) for addressing future problems. Approaches that have a strong emphasis on wide scale participation are called 'empowerment evaluation(s)' (Fetterman and Wandersman 2005).

Involving stakeholders in empowerment evaluation is usually thought to increase the potential success of a programme/project. Empowerment evaluation also provides opportunities for embedding evaluation in the process of KE as a way to enhance continued adaptive management, and learning and refinement of implementation to help achieve the desired outcomes (Armitage et al. 2008; Phillipson et al. 2012). The core principles of empowerment evaluation are summarised in Table 7. The key message from this section is that **participatory approaches to evaluation have many benefits but the extent of participation depends greatly on what the primary aim of an evaluation and why participation of stakeholders is needed or desired**.

Principles	Explanation
Improvement	Empowerment evaluators want programmes to succeed and use approaches to help facilitate success. This is in contrast to traditional evaluation, which values neutrality and objectivity and which examines programmes in their 'natural state' to determine its impact without the influence of the evaluator. Empowerment evaluation sees evaluation as an inherent part of the adaptive process of learning from action to improve outcomes.
Community ownership	Evaluation is considered most likely to lead to programme improvement when the community is empowered to exercise its legitimate authority to make decisions about the evaluation process. Consequently stakeholders have ownership and responsibility for delivering the evaluation while the role of the evaluator is to be a critical friend, coach or facilitator to ensure rigor and systematic approach to the evaluation.
Inclusion	This involves inviting as many stakeholders as possible to take part and making a concerted effort to encourage their participation. The principle aims to include rather than exclude groups. While this may appear to be inefficient at the beginning, lack of early inclusion makes gaining consensus on goals and findings very difficult later on.
Democratic participation	While inclusion means bringing people together to enhance diversity, democractic participation is about how people interact. Democratic participation ensures equality and fairness, such as giving everyone a vote in making a decision.
Social justice	This principle aims to ensure that evaluators assist people in social programmes aimed at ameliorating a specific social concern or injustice. It keeps evaluators on track by reminding them that evaluation is a tool that provides rigour for

	understanding, but ensuring that this rigour is targeted towards helping understand or deliver programmes focused on social justice.
Community knowledge	Empowerment evaluation recognizes and respects the value of local community knowledge. This ensures that a wealth of in-depth information is fully used in evaluation, while also encouraging bottom-up sharing and development.
Evidence-based strategies	These provide strategies that have external credibility and allow local communities to build on knowledge as it emerges. Evidence-based strategies, however, do need to be adapted to local contexts and not blindly adopted.
Capacity building	This aims to ensure that community members learn and develop their skills ion evaluation logic, chain of reasoning, evaluation design, data collection, and making judgments and interpretations etc. At a wider level groups work together to enhance their understanding of the issue being evaluated while also developing capacity to work together and to design and implement their own projects and programmes.
Organizational learning	Empowerment evaluation aims to create a community of learners where information is fed back about how a programme, project or organization is working. This enhances the adaptive capacity of an organization so that it can be more responsive to changes and challenges.
Accountability	The evaluation is for both internal and external accountability. Internal accountability is driven by internal peer pressures and institutionalised mechanisms developed by members of the existing authority structure. In practice, the principle reminds people that they are both individually accountable and accountable as a group of learners. Given that a wide range of stakeholders are involved in empowerment evaluation, funders are also obliged to be accountable and commit to being a partner in the project recognizing that the funding structures and resources pose limits on the flexibility of a project and its evaluation.

Table 7: Ten principles of empowerment evaluation (Fetterman and Wandersman 2005).

6 LESSONS LEARNED FROM EVALUATING THE RELU PROGRAMME;

An example of an evaluation of some of the aspects of KE is provided by Phillipson et al. (2012). The paper was not one of the 53 papers reviewed in earlier sections as it was published at a later date than those selected for review. However, the paper reports on a 2009 survey of 21 research projects within the UK Research Councils' Rural Economy and Land Use (RELU) Programme regarding the involvement and perceived impact of over a thousand stakeholders in the research. The research therefore provides a rare example of evaluating KE in environmental fields at a programme level. While the survey predominantly aimed to understand who was engaging with whom, it also provided cursory information about the impact of that engagement. A copy of the original survey and questions used in the evaluation is included as Appendix 4. In this survey, RELU project leaders were asked to describe:

1) **Stakeholders involved in engagement** where stakeholders were classified as to whether they were from public sectors (government departments, local government, state agencies etc.), private sectors (small and large businesses, trade associations, etc.), third sectors (voluntary bodies, charities, non-governmental organisations, etc.) or were individual members of the public.

2) **The nature of a stakeholder's engagement with a project**. This included whether the engagement of a stakeholder was as a: 1. Research subject (where the stakeholder took part as survey respondent, interviewee etc.); 2. Event participant; 3. Steering/advisory group member; 4. Project partner; 5. Consultee (e.g. where the stakeholder sent research findings for feedback); 6. Research customer (where the stakeholder was described as an end-user or receiver of research findings); 7. Visitor to a project or work shadowing host.

3) **The nature of stakeholders' involvement in a research project** including how stakeholders: 1. Contributed to objective setting/problem framing; 2. Provided access to research facilities, materials or study sites; 3. Contributed to discussions on project design; 4. Contributed to knowledge production as equal partners; 5. Provided information or views as research subjects; 6. Assisted in data collection for a project; 7. Received copies of research findings/outputs; 8. Gave feedback on findings; 9. Helped to disseminate findings. Data on the impact of engagement was collected by asking project leaders to indicate for each stakeholder the 'perceived impact' on 'research relevance' and 'scientific quality', on a five point scale (from very positive to very negative).

4) **The impact of a RELU research project** (as perceived by the project leader) on the stakeholder's 'policies or practices' and 'knowledge or understanding' using a four point scale (very high, high, slight, so far none). This enabled the researchers to measure both the impact of stakeholders on the research as well as impact of research on stakeholders.

Phillipson et al. (2012) highlights two important issues that have not yet been raised in this review. First, it is often claimed necessary to understand longer term impacts of engagement some years after the engagement has taken place but that such analysis is fraught with difficulties. The work by Phillipson et al. (2012) shows the importance of establishing 'audit trails' where early effects of engagement are established before the 'links of causality are lost or (have) become opaque'. By establishing these audit trails, it becomes easier to focus attention to where longer term impacts might be achieved and thus set up evaluations through longitudinal studies that specifically look for these impacts.

Second, Phillipson et al. (2012) also caution against evaluation methods that might become onerous and too detailed which then reduce ability to capture unforeseen and diverse outcomes or worse, serve as straight-jackets to innovation and flexibility as a KE project progresses. RELU programme managers therefore suggest that it is important to resist pressure to have tight and detailed methodologies and instead opt for broad, simple and flexible ways of collecting data that enable a wide breadth of projects to be evaluated (J. Phillipson, personal communication, 2012). Some of these projects were then evaluated in more depth in additional research through further research on KE using qualitative interview methodologies (Sustainable Learning *et al.* 2011).

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Key conclusions

1) Approaches to evaluation highlight the importance of clearly identifying the original goals and objectives of a study and appropriate indicators to know whether a project or programme has achieved it.
2) The goals and indicators then need to be carefully aligned with data collection and methods used to make objective judgements about the merits of a project or programme.
3) There are very limited examples from the research literature that relate directly to evaluating KE.
4) KE is highly context specific. There will not be 'catch-all' and generic methods for evaluating KE.
5) There are a wide range of theories or models of knowledge and/or KE that influence approaches to the evaluation of knowledge exchange. In the literature, these tend to focus more on what is learnt, or how perspectives change, than on the longer term impacts or behaviour change as a result of a KE process.
6) The way knowledge and KE is conceptualised has a strong impact on approaches to implementing and evaluating KE interventions. It is therefore important to be clear and explicit about the concepts that underlie implementation and evaluation.
7) Evaluation of KE is complex because of the multiple possible objectives of a KE process, the multiple stakeholders involved and the challenge of finding measurable indicators. Approaches to evaluation of KE therefore need to simultaneously capture the breadth of possible outcomes whilst also providing some depth about the effectiveness of the approaches taken.
8) A range of methodologies can be used to collect data as part of an evaluation, including both qualitative and quantitative methods. A mixed, mutli- or interdisciplinmary approach is likely to be needed to cover the range of aspects involved in KE.
9) Targeted and tailored approaches will be needed to design appropriate evaluation methodologies and external evaluators will not be able to identify key objectives and indicators in the absence of close collaboration with project implementers.
10) There are two important approaches (logfames and TOCs) that can assist project and programme managers to clarify objectives, how they will achieve them, and how they will know when they have achieved them. Of these approaches, TOCs are likely to be the most promising.
11) Collaborative workshops with programme evaluators and KE project managers/stakeholders will greatly enhance delivery of projects and enables evaluation to do more than just provide external accountability to project deliverables.
12) Participatory approaches to evaluation provide significant opportunities for enhancing implementation and evaluation of KE interventions. Participatory evaluation is particularly pertinent to KE because KE itself often aims to include some form of participation. Applying principles from participatory or empowerment evaluation can therefore assist projects to increase the effectiveness of their outcomes through more participatory mechanisms while simultaneously encouraging adaptability and flexibility as new understanding about KE emerges.
13) Evaluation processes need to simultaneously capture the diversity of possible outcomes of KE while also not reducing flexibility of a programme to adapt as new information emerges.

7.2 Recommendations

Given the points raised above, evaluators of a programme of KE that consists of multiple and separate KE projects should seek to include the following:

1) Work collaboratively with programme and project managers from the outset to carefully identify goals, objectives, measures of success and make explicit the assumptions as to why they believe that interventions are likely to deliver the desired outcomes;
2) Embed evaluation in the process of implementation. That is, ensure that evaluation is used to encourage learning throughout projects and programmes and enhance the continued adaptive management of KE interventions.
3) Apply, as much as possible, the 10 key principles from empowerment evaluation (Table 12). Importantly, in this process evaluators need to perceive themselves and be perceived by others as facilitators of the evaluation process rather than being external authorities of success. By doing so, adaptive learning about delivery of KE will be enhanced.
4) Effective evaluation that enhances understanding about and delivery of KE will require considerable effort and time from evaluators and programme and project managers and (ideally) stakeholders during initial, mid-term and end phases to ensure there is shared understanding of project goals and activities and enable re-orientation of activities as new information emerges.
5) The collaborative development of projects and evaluations will probably require independent professional facilitators to help implement the process. Broad, simple and flexible ways of collecting data that enable a wide breadth of projects to be evaluated are therefore likely to be preferable to tight and detailed methodologies.

7.3 A suggested model for delivery of a KE programme of individual KE projects

Figure 2 provides an overview of a suggested approach to designing evaluation of a programme of individual KE projects, such as that to be delivered by CREW. The design takes into account the issues highlighted in the review, including the need to both apply rigour in the evaluation while also enabling flexibility as understanding about KE and activities increases through implementation of projects. It also provides the basis for participatory evaluation and for evaluators to work with managers and stakeholders to identify goals and measures of projects. Finally, the process itself can be seen as a KE project where project managers and other participants are learning from each other about what works and what doesn't. This enables the process of evaluation to play a key role in encouraging adaptive learning and management of the programme as a whole. The process has seven key stages over a one year cycle of multiple one year projects. It assumes the presence of an experienced lead facilitator. The stages are:

Stage 1: Evaluators design a one day workshop with independent facilitators that will be held with all programme and project managers/implementors.

Stage 2: Programme and project managers participate in the one day workshop. The aim is to identify key goals and measures etc. of individual projects. This would be a large workshop but where groups are defined by the projects they are working on. The workshop provides the basis for the final evaluation design at the programme level and more detailed project specific evaluation guidelines. The workshop will also enable project and programme managers to be more explicit about their objectives and how they will achieve them and to be able to share experiences with other projects and programmes.

Stage 3: Results of the workshop are used by the evaluation team to develop an evaluation methodology that can inform both programme level and project level success.

Stage 4: A ½ day workshop that again brings together participants to reassess their progress and the evaluation methodology. This stage is a critical opportunity for projects to learn from each other and adapt their activities if required.

Stage 5: If necessary, evaluators refine methodology based on what has been learnt so far about delivery of KE.

Stage 6: Final ½ day workshop with all participants. This can be used to evaluate outcomes, and reflect on the success of projects. It enables the programme managers to consider what has been learnt from the individual projects and how this should relate to longer term outcomes.

Stage 7: A report is produced by the evaluation team to inform future cycles of projects in the programme.

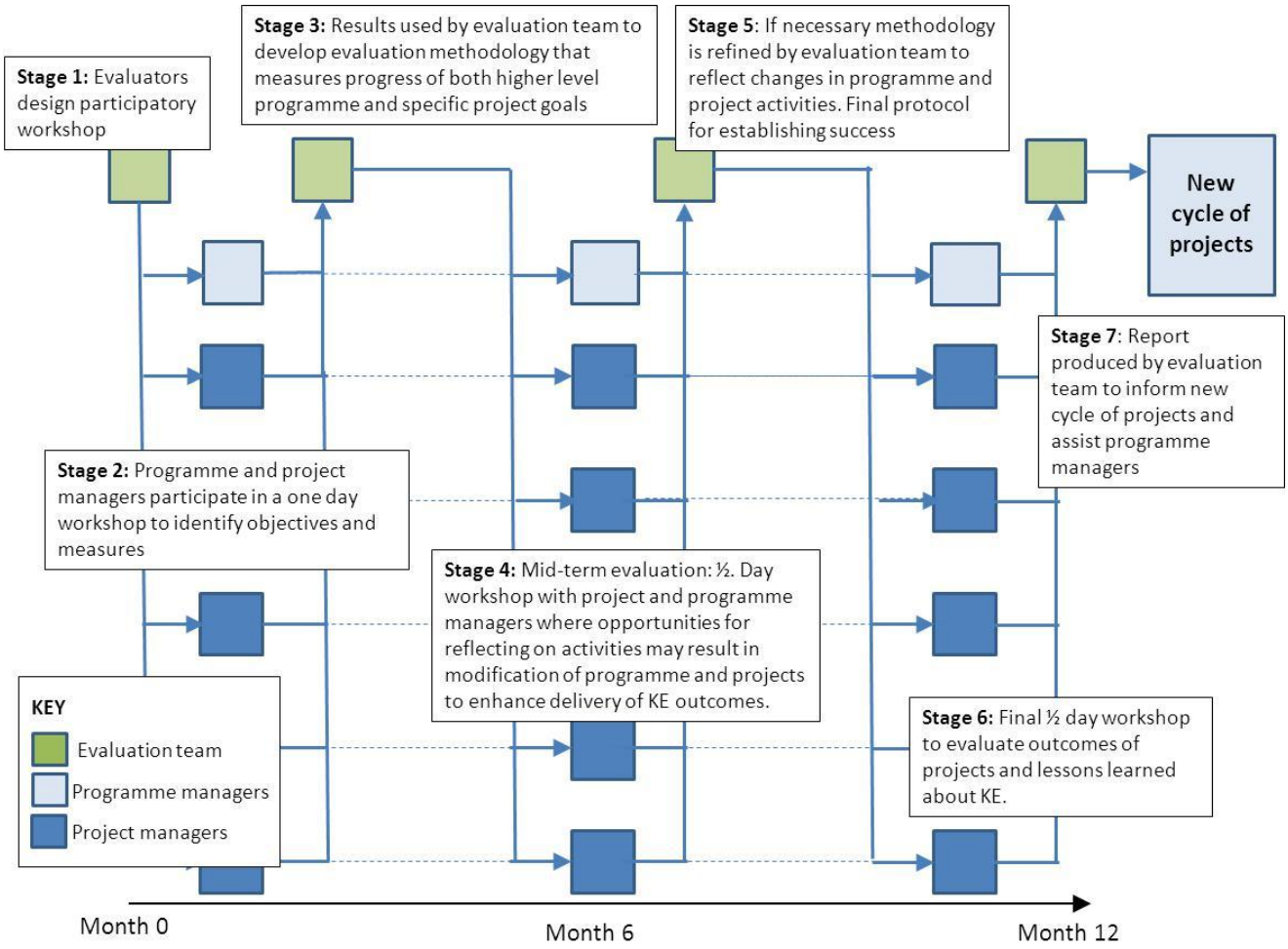

Figure 2: A possible approach for a programme of individual KE projects that encourages adaptive learning from evaluation, participation of key managers and stakeholders, and enables clarity of objectives to be identified. The blue arrows indicate flows of information over a one year time frame.

8 APPENDICES

8.1 Appendix 1: Methods for data collection for the review of literature discussed in Section 2

8.1.1 Method and Sample

An extensive search of the literature was carried out in Scopus using the search terms shown in Table 2. Due to the number of papers involved we excluded 'computer science' from the search result and only included 'article review', 'article,' 'article in press' and articles up to but not including the year 2012. From the 1635 papers identified, 222 were considered to be relevant to understanding evaluation of KE. That is, those which either directly discussed evaluation approaches/methods or carried out an evaluation. Those that only briefly mentioned evaluation were not included. The database was then ordered as follows: 1) alphabetically by search term, 2) chronologically by date of publication and 3) alphabetically by the first author's name. Every fourth paper was chosen and obtained for evaluation, resulting in a final sample size of 53.

Search Term	Number of studies identified	Stage 1 inclusion	Stage 2 inclusion
evaluat* AND "knowledge transfer"	534	62	16
evaluat* AND "knowledge shar*"	488	39	10
evaluat* AND "knowledge exchange"	119	13	3
evaluat* AND "knowledge translation"	214	22	4
evaluat* AND "knowledge management"	4576	57	13
evaluat* AND "co-produc*" AND knowledge	30	3	1
evaluat* AND "co-management"	133	26	6
TOTAL	1635	222	53

Table 2: Search terms used and number of studies identified in each stage of the research process

8.1.2 Questions asked about each of the selected papers

When reviewing the 53 selected papers, information from each paper was obtained on the following: 1) paper identifier, 2) year of publication 3) type of paper e.g. whether it was a review or empirical paper; 4) the general field of research (e.g. medicine, environmental management etc.); 5) about the topic of study; 6) the general aspect being evaluated (e.g. are stakeholders learning from the KE process, or was behaviour being changed); 7) who the knowledge was being exchanged between (e.g. between researchers and policy makers); 8) whether the knowledge flow was one way or multi way; 9) the specific indicators/elements that were

evaluated; 10) what was being measured (e.g. learning, changes in understanding or behaviour) 10) the general approach to evaluation; (11) the key methods being used for evaluation; 12) whether data collected was quantitative, qualitative or both; 13) key findings of the paper; and 14) key recommendations from the studies about evaluation.

8.2 Appendix 2: The 53 research papers reviewed for section 2

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8.3 Appendix 3: Key theories informing KE

There are many different theories and frameworks about KE that influence both assumptions about what makes KE effective and approaches to the evaluation of KE. Nine different theories/frameworks were discussed in the 53 papers in relation to KE evaluation. For each of these theories we provide a brief description and explain their significance for how evaluation of KE is approached.

8.3.1 Mandarano's (2009) performance evaluation framework

Background: This framework (Table 4, Hill *et al.* 2010) provides 11 criteria that help to define and evaluate outputs and outcomes of KE in projects with similarities to collaborative management processes (Mandarano 2009).

Example: Hill et al (2010) involved an action committee and collaborative design process aimed at empowering institutions and individuals through power-sharing, building rules, norms, mutual trust and respect, horizontal linkages and stakeholder engagement. In this study, evaluation was carried out qualitatively and in a participatory manner by the management group, who discussed how effective the project had been in relation to the performance evaluation criteria, deciding on success together.

Implications/recommendations for evaluation of KE: This framework enables a collaborative evaluation of a KE process that takes into account both outputs and outcomes. The evaluation criteria can be used to assess the success of a project throughout or as a final appraisal. Evaluation of KE using this criteria should: a) consider both outputs and outcomes; and b) be participatory and generally qualitative in approach.

		Performance evaluation criteria	**Definition**
Outputs		High Quality Documents	Documents produced through a collaborative process that justify action or identify a clear approach for implementation and are approached by a consensus-based process.
		Collaborative science	Scientifically sound information produced through a consensus based approach that stakeholders understand and accept
Outcomes	Social	Social capital	New and improved working relationships, formation of trust, norms of reciprocity
		Intellectual capital	Mutual understanding, shared problem frames, agreed upon data or scientific information
		Political capital	Ability to work together for agreed ends, end to a stalemate
		Innovation	Strategies, actions, and ideas that are new to the context, break a stalemate or change policy
		Institutional change	Changes in or new attitudes behaviours, actions, decision making processes and institutions that incorporate learning from experience in the collaborative process, spin off partnerships
		Restoration projects completed	Restoration projects completed by the collaboration or indirectly through actions by others
	Environmental	Land protected from development	Lands acquired or otherwise protected by collaboration or indirectly though actions by others

Changes in environmental parameters	Changes in environmental quality appropriate to the collaborations planning, management and implementation initiatives (i.e. land cover, water quality, habitat quality, biological diversity etc.)
Perceptions of improved environmental quality	Participants perceptions of a collaborations success in improving environmental parameters (i.e. water quality) are indirect measures of environmental outcomes

Table 8.1. The 11 criteria proposed in Mandarano's (2009) work on performance evaluation criteria

8.3.2 Complex systems approach

Background: From a complex systems perspective (Plummer and Armitage 2007), there can be no one 'correct' and all-encompassing perspective on a system as it is influenced by a multiplicity of scales (Berkes et al. 2003). It is possible to study complex systems at a particular functional level (eg. local, regional, state, federal) but the perspective from that level will be different from that of another level. For example, evaluation of social systems is difficult without considering its history, as well as its social and political context (Bellamy et al. 2001; Berkes et al. 2003). Thus, evaluation of a study should be carried out from a multiplicity of perspectives (e.g. social, economic, environmental, political and technological) whilst recognising the fundamental importance of context.

Example: The outcome of any evaluation depends on our understanding of the world. Complexity science views the world as continuously adapting and changing in response to environmental feedback. Plummer and Armitage (2007) highlight that trends in resource management and collaborative government suggest we require evaluation processes that are based on complexity thinking. In this situation evaluation places priority on adapting to feedback and the evaluation becomes a key part of the co-management cycle as well as a shared, participatory endeavour. Plummer and Armitage (2007) suggest that evaluation in a complexity context needs to be done in comparison to a baseline and is focused on three elements of interest (the resource, its governance, and associated infrastructure) in a way that assesses connectivity and highlights potential interactions between these elements. Evaluation can be qualitative and quantitative and generally involves both ecological and social parameters.

*Implications/recommendations for evaluating KE: M*onitoring and evaluation of complex KE systems should: (a) link objective to consequence or outcome; (b) consider the assumptions and hypotheses that underpin core policy or program objectives; (c) be grounded in the natural resource, policy/institutional, economic, socio-cultural and technological contexts; (d) establish practical, valid and equitable evaluation criteria to monitor and assess change throughout time; (e) involve methodological pluralism (including both quantitative and qualitative methods); and (f) integrate different disciplinary perspectives (i.e. social, economic, environmental, policy and technological). Furthermore, when evaluating complex systems, evaluation of *impact* (i.e. environmental, economic, social, institutional, and technological) should also be included and seen as a *process tool* that supports effective stakeholder participation; creates improved opportunities for on-going learning processes at individual, organisational and policy levels; facilitates negotiation and mediation processes; and supports moves towards better outcomes and management of problems.

8.3.3 Rowe and Frewer 's (2000) informed approach

Background: In the work of Rowe and Frewer (2000) nine different criteria were proposed as a way of establishing success of KE processes (Table 8.2, Kuper *et al.* 2009). These nine criteria are divided into those addressing the "acceptance" of the exercise to the participants and the wider public (or stakeholders) and those of "good process" which evaluates whether the exercise has been conducted in a manner that can ensure logical, reasonable, consistent (etc.) outcomes.

Criteria	Definition
Acceptance Criteria	
Representativeness	The participants should comprise a broadly representative sample for the affected population
Independence	The participation process should be conducted in an independent (unbiased) way.
Early involvement	The participants should be involved as early as possible in the process as soon as value judgments become salient
Influence	The output of the procedure should have a genuine impact on policy
Transparency	The process should be transparent so that the relevant population can see what is going on and how decisions are being made
Process Criteria	
Resource accessibility	Participants should have access to the appropriate resources to enable them to successfully fulfill their brief
Task definition	The nature and scope of the participation task should be clearly defined
Structured decision making	The participation exercise should use/provide appropriate mechanisms for structuring and displaying the decision making process
Cost effectiveness	The procedure should be cost effective from the point of view of the sponsors

Table 8.2: The nine criteria for evaluating success (Rowe and Frewer 2000)

Example: Evaluation as discussed in Kuper et al (2009) occurred at the end of the KE process and was carried out using the nine criteria with which interviewees (taken from project participants) were asked to strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree. Questionnaires (with open and closed questions) were also used to triangulate answers; all questions were translated into the local dialect.

*Implications/recommendations for evaluating KE: M*onitoring and evaluation of KE using a Rowe & Frewer informed approach should: (a) be acceptable to participants (for example Kuper et al. (2009) made sure evaluation questions were in local dialect); (b) link acceptability to how well designed the process has been; (c) be able to establish a replicable outcome; (d) involve methodological pluralism (including both quantitative and qualitative methods); and (f) be largely based on social science approaches. Evaluation using this approach is carried out at the end of the KE process.

8.3.4 The self-efficacy concept (Bandura 1997)

The self-efficacy concept (Kuper et al. 2009) evaluates a person's belief in their ability to succeed in certain situations. Here, the level of self-efficacy developed by an individual affects how they approach goals, tasks, and challenges. As a result the level of self-efficacy developed influences the outcome of many events, including for example, the long-term sustainability of a knowledge exchange project. Evaluation of knowledge exchange informed by this approach aims to use self efficiacy as a proxy for potential long-term sustainability

of a process, therefore building in a number of experiences to evaluate both the stages of the process and the output of a KE approach. In particular, this focuses on evaluating participant learning and their ability to operationalize their learning as a result of KE (see Figure 8.1).

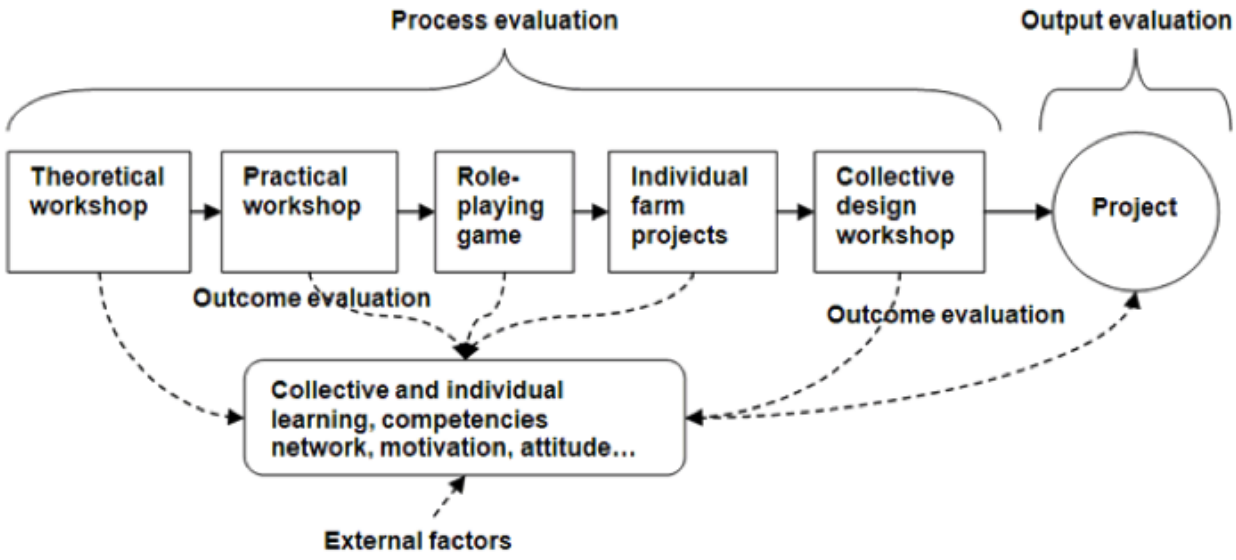

Figure 8.1: A diagram of evaluation based on Bandura's (1997) self-efficacy concept. The aim of evaluation utilizing this approach is to judge how well the process was led and what outputs and outcomes were produced in relation to participant learning.

Example: The evaluation of KE outcomes using the self-efficacy concept is complex because it acknowledges that the outcome of a KE process (for example it's ability to sustain in the long-term) is linked to interventions (which enable learning opportunities and the chance to develop self-efficacy) as well as to other external factors not designed by the process, which also must be assessed (Figure 1). For example, Kuper et al (2009) focused on evaluating both what kind of knowledge farmers had gained about irrigation techniques and land management as well as how (or if) they planned to mobilize this knowledge to undertake concrete individual or collective action. Evaluation was carried out with only a few individuals (to avoid overburdening participants) at three stages of the process using different evaluation tools. First, after role-playing, the participants used a questionnaire to assess how the session had improved their understanding of the complexities of a joint irrigation project. Second, a survey with open questions was conducted before and after farmer-to-farmer visits. Third, a final evaluation was made at the end of the process, using semi-structured interviews with farmers' leaders, and traced back the main steps of the design of the drip irrigation project. The objective was to understand the farmer's process of building self-efficacy and how likely the ideas of the project would be sustained into the long-term.

Implications/recommendations for evaluating KE: Monitoring and evaluation of KE using the self efficacy concept: (a) links experiences, contextual information, and interpretations of participants; (b) identifies how likely participants will be to implement the project; (c) focuses on learning as an outcome of KE; (d) involves methodological pluralism (including both quantitative and qualitative methods); and (f) is largely based on social science approaches.

8.3.5 Social learning (Maurel et al. 2007)

The literature on social learning theory is complicated and terms used are often conflated (Reed et al. 2010). Social learning is said to have occurred when there is a 'change in understanding that goes beyond the individual to become situated within wider social units or communities of practice through social interactions between actors within social networks' (Reed et al. 2010). This is represented in Figure 8.2. This process includes both a social-relational activity [see part 2.2 of Figure 8.2] (e.g. generating social capital, the development of new social practices and norms) and a complex technical task. Social learning also corresponds to the outcomes of this process, which are both technical and relational [see part 3 of Figure 8.2]. It takes place in a specific context in terms of the governance system (depending on actors involved, regulation and cultural norms) and environment (i.e. river basin). Context can be affected in turn by the outcomes showing that KE may have a long-term effect by changing the context of a problem in the long-term i.e. unsustainable land management context, into a sustainable land management context.

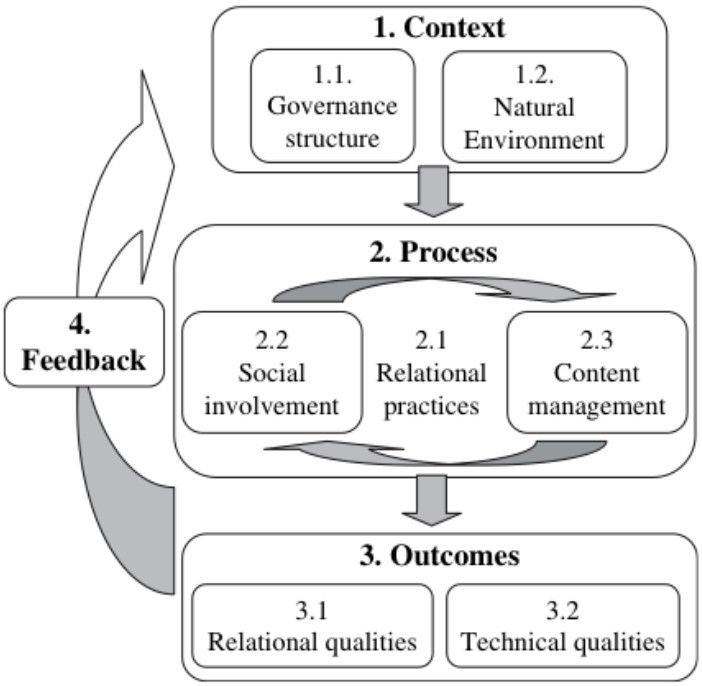

Figure 8.2: Aspects of social learning for evaluation that informed Kuper et al (2009) approach to evaluation, where context (1), social - relational activity (2), and outcomes (3) are linked with a process of feedback.

Example: Where social learning is developed as a result of a knowledge exchange process, damaging behavior patterns may be changed and long-term sustainability may result. Therefore evaluation of social learning acts as a means to assess the impact of a knowledge exchange process on long-term behavior change and culture. To evaluate this, Kuper et al (2009) implemented a participatory approach with four groups of farmers. The KE process was conducted with each group individually, but some activities were conducted jointly to enable interactions between the groups. Evaluation used the same questionnaire and interview guide with each group. Evaluation took into account the context of each farmer group and through interviews compared the learning that occurred between the groups, evaluating whether this was a result of their involvement in the project or the activities of the project (i.e. workshops and farm-farm visits). The project linked the outcomes of

the project (new technical understanding and new relationships) to the participants' evaluation of the process.

Implications/recommendations for evaluating KE: True evaluation of social learning is rare and Kuper et al (2009) only evaluated social learning as part of a wider number of approaches to evaluation. As a result it is still not clear what proper evaluation of social learning looks like in practice. In monitoring and evaluating KE for social learning, a project is likely to have to: a) link context to outcome via the participatory approach taken; b) focus on an evaluation of learning; c) evaluate whether learning has moved beyond the individual to influence wider groups/society; and d) use mainly methods from social sciences for evaluation.

8.3.6 Lewins 'change theory'

Change theory as mentioned by Kuper et al (2009) represents how organisational change occurs, in the context of environmental knowledge exchange processes may focus for example, on change from an undesirable ecological state to one that is desirable. (Table 8.3). The theory is also referred to as Unfreeze-Change-Refreeze. *Unfreeze* involves creating the conditions for change to occur. The challenge is to move people from this 'frozen' state to a 'change ready' or 'unfrozen' state. *Transition* at the psychological level represents a period of confusion. Here old ways are challenged, but there is no clear understanding of the new ways that will replace them. As roles change, efficiency is reduced. The end goal of this stage is to get people to the 'unfrozen' state and keep them there. *Refreeze* represents the re-establishing of stability in a new (and more desirable) state. Refreezing takes people from low productivity in the transitional state to a stable and productive state. As a result this theory relates to KE processes that are aiming to create a substantial change in organisational practice, for example moving to sustainable fishing practices. Evaluation in this context relates to how well each stage has been achieved as a means to assess whether long-term change is likely.

Phase	Action
1. Unfreeze	Create initial motivation to change by convincing people that current state is undesirable.
2. Change	Identify new behaviours and norms. Communicate. Adopt new attitudes and culture.
3. Refreeze	Reinforce new behaviour through reward systems, communications, structures etc.

Table 8.3: The stages of Lewin's (1946)change theory with actions associated with each phase

Example: Evaluating change theory is generally participatory, asking participants to be clear about what they hope the outcomes of the process will be and what avenues they expect change to come from. This approach aims at impact. That is, long-term institutional change, and aims to establish links between an initiative's activities and their expected outcomes. Here evaluation is designed to assess each of the phases and how well they have been achieved. For example, in reform of fishing practices, the critical features of reform must have been defined and specific targets determined with stakeholders for the intermediate and long terms: such as, reducing by-catch, or designating 'no take' areas. To enable evaluation, stakeholders have to be precise about what the activities for each stage, should look like and what outcomes will be required, these can then be evaluated. For example, for 'unfreeze' stakeholders may need to define what form of commitment from officials to the reform plan will be sufficient to proceed to the first implementation step? For 'Change', defining what new behaviors are desirable and assessing these and for 'Refreeze' evaluation of the efficiency of new structures and practices will need to occur.

Implications/recommendations for evaluating KE: Monitoring and evaluation of KE using change theory: (a) develops indicators for evaluation with participants for each stage of the process; (b) is flexible as to whether evaluation methods are mixed, qualitative or quantitative; (c) is carried out through a process, generally linked to each of the stages; and (f) is focused on creating change as a result of the KE process.

8.3.7 Action Research

Action research, as discussed in Raman et al (2011), is an interventionist method that enables hypothesis testing by implementing and assessing change as a result of KE in a real world setting (Figure 8.3). Action research aims to create change as an outcome of the knowledge exchange process. Winter (1989) provides six key principles that help guide action research (Table 8.4). An action research approach recognises that people's actions are based on implicit assumptions, theories and hypotheses, and with every observed result, knowledge can be improved. Evaluation in this context aims to look at how affectively each of these principles have been met.

Principle	Definition
Reflexive critique	people reflect on issues and processes and make explicit the interpretations, biases, assumptions and concerns on which current judgments are made
Dialectical critique	recognises the importance of language and dialogue in constructing reality, and establishes context specific understanding
Collaborative Resource	assumes equal significance to people's ideas and tries to avoid skewing of credibility based on an individual's status
Risk	recognises that people feel fear when facing change and aims to explicitly address this. A participatory approach is encouraged to show that all are subject to the same process, and that whatever the outcome, learning will take place
Plural Structure	demonstrates the importance of including a multiplicity of views, commentaries and critiques leading to multiple actions and interpretations and requiring a multiplicity of methods to research
Theory, Practice, Transformation	highlights that by continuous adaptation as a result of reflection, theory informs practice and practice refines theory.

Table 8.4: the six principles required for achieving affective adaptive management approach to knowledge exchange proposed by Winter (1989)

Example: Action research requires active participation in a KE process of which evaluation is embedded. Raman et al (2011) operationalized Action Research for KE evaluation during several stages, first, the research team gathered responses from attendees of a meeting prior to project initiation. Following the launch of the project a questionnaire was sent out and interviews were carried out with influential individuals to evaluate the first stages of the project. This feedback was used to adapt the project. The project continued to use this cyclic evaluation approach to feed into reflections on the project (Figure 3) throughout.

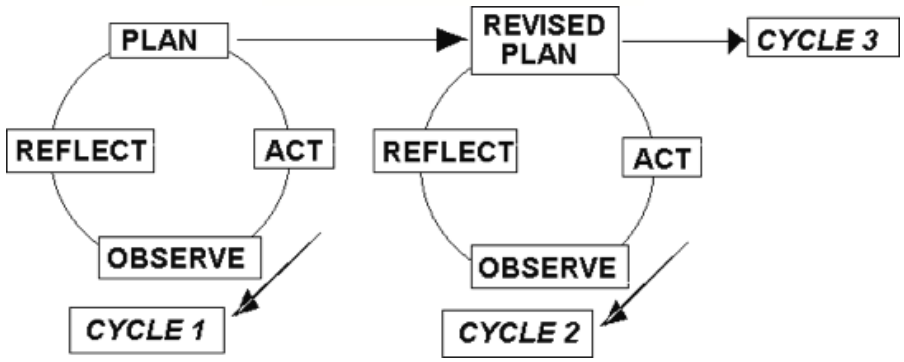

Figure 8.3: a simple diagram of an action research process, evaluation is carried out throughout the process in the 'reflect' stage (Raman et al. 2011).

Implications/recommendations for evaluating KE: Action research informs a KE evaluation approach. Here evaluation is used as an intervention, enabling participants and research teams to reflect on the success of the project to state, and then to plan, the next phase of the project taking into account this feedback. The process is best used for KE processes that are aiming to bring about long term institutional or behavior change.

8.3.8 Community of Practice

Communities of practice (mentioned in Chan et al. 2009; Chantarasombat and Srisa-Ard 2009; Yang and Wei 2010; Yu et al. 2009) (CoP) are formed by people who are engaged in a process of collective learning as part of a shared undertaking: for example a group of academics working on the same research area, or a stakeholders involved in catchment management planning. These groups share a passion, work together, interact regularly and learn from one another in order to innovate. KE processes often aim to create a community of practice as a result of their interventions. Three characteristics are seen as crucial to a community of practice: 1) *The domain:* a shared domain of interest or mission defines a community of practice; 2) *The community:* In pursuing their interest in their domain, members engage in joint activities and iscussions, help each other, and share information. They build relationships that enable them to learn from each other; 3) *The practice:* A community of practice is not merely a community of interest, but are practitioners who develop a shared practice through shared resources, experiences, stories, tools, and ways of addressing recurring problems.

Example: Evaluation informed by the 'Community of Practice' approach involves participants in an ongoing and meaningful way, and frames the evaluation as a learning opportunity. The approach embraces a bottom-up approach of organizing and an evaluation that is used to improve the work of the project and to further build relationships. In this context, evaluation measures and credits achievement of leadership development and capacity development goals as much as other goals, such as goals to inform policy development. Evaluation informed by Community of Practice approaches also takes into account context, such as organizing style and culture of the group. This requires attention to the language and philosophical underpinnings of a given organizing group's approach, recognition of the volunteer-based staffing structure, and the more oral culture implicit in organizing work.

Implications/recommendations for evaluating KE: Evaluation of KE informed by a CoP approach: a) is specifically informed by a detailed understanding of context/culture of the group; and b) aims to build capacity of the group and facilitate learning. If evaluating whether a CoP has been formed as a result of a KE process evaluation may include social network analysis at the start, midway and at the end of a project.

8.3.9 Realistic Evaluation

Pawson and Tilley (1997) developed a theory driven evaluation model called 'realistic evaluation' which was utilised in the sample by Huang and Shih (2009). This theory is centred on outcomes produced from interventions as well as "how (interventions) are produced, and what is significant about the varying conditions in which the interventions take place" (Tilley 2000). Realistic evaluation looks at the contextual conditions that make interventions effective and aims to develop lessons about how these interventions produce outcomes that can inform policy decisions. There are three investigative areas for evaluating the impact of an intervention within any given context (Figure 8.4): 1) *Mechanism*: i.e. what is it about a measure which may lead it to have a particular outcome in a given context? 2) *Context*: what conditions are needed for a measure to trigger mechanisms to produce particular outcomes patterns? 3) *Outcomes pattern*: what are the practical effects produced by causal mechanisms being triggered in a given context?

Example: Rycroft-Malone et al. (2011) used realistic evaluation to understand complex social interactions/interventions. Realistic evaluation acknowledges the importance of context to understanding why KE interventions and strategies work. Here projects are considered in a way that enables evaluation on what it is about them (mechanisms) that might produce a change (impact), and which contextual conditions (context) are necessary to sustain changes. Thus, realistic evaluation aims to outline the relationship between mechanisms, context, and outcomes.

In Rycroft-Malone et al.'s (2011)study the outcomes assessed included:

14) Instrumental use: the direct impact of knowledge on practice and policy in which specific research might directly influence a particular decision or problem;
15) Conceptual use: how knowledge may impact thinking, understanding, and attitudes;
16) Symbolic use: how knowledge may be used as a political tool to legitimatise particular practices;
17) Process use: changes that result to policy, practice, ways of thinking or behaviour resulting from the process of learning that occurs from being involved in research.

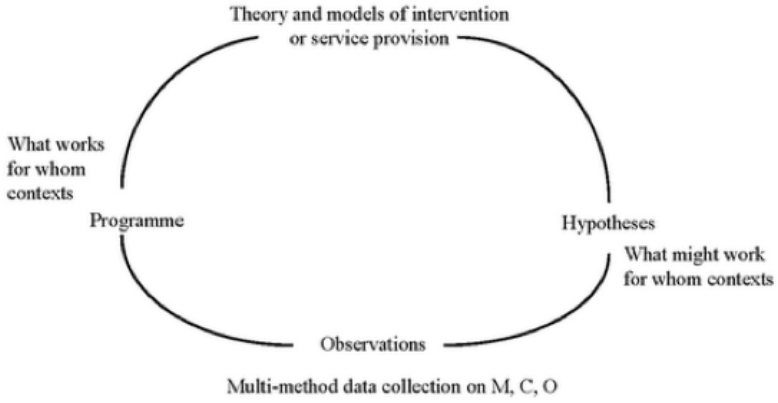

Figure 8.4: Diagram illustrating 'realistic evaluation' based on assessment of mechanisms, context and outcomes (M,C,O), based on Pawson and Tilley (1997)

Implications/recommendations for evaluating KE: Monitoring and evaluation of KE using realistic evaluation should: (a) link theory, hypothesis, data collection and programme context; (b) be flexible in the methods used

for evaluation; (c); have a long term focus on achieving a sustained change as a result of KE (d) utilize methods and views from a variety of disciplinary perspectives; and (f) continually evolve by using the results of the evaluation to inform future theory.

8.4 Appendix 4: Example of survey from the RELU progress reporting used in Phillipson et al. (2012)

REQUIRED FOR RELU PROJECT PROGRESS REPORT

REPORT TO BE SUBMITTED TO RELU@NCL.AC.UK BY 31 JAN 2012 (Please send as Word document)

ANNUAL REPORT 2011

Project Title	
Award No	
Principal Investigator (PI)	
Address and email of PI	
Start / End Dates of Award **Including any extensions agreed with ESRC**	from _____ to _____
Period of this Report	**from 1.1.2011 to 31.12.2011**
Total Research Council Funding	
Co-funding from outside Research Councils	Do **not** include HEFCE or University contributions. Please indicate amounts for each source.
Aims and Methods of the Project:	Max 200 words
Changes to objectives or methodology	One short paragraph explaining any significant changes to objectives, milestones, methodology, etc.
Changes to Award Holders, Research Personnel or Institutions	Please briefly indicate any changes to award holder(s), research staff or institutions in 2011.

Summary of Progress	1 page, comprising three paragraphs covering for Jan-Dec 11: a) Overall Progress of the Project b) Highlights of the research / Important findings c) Highlights of stakeholder or public engagement and impacts on policy or practice Please provide self-contained text in accessible language that can be used in the overall programme annual report and for wider programme publicity.
Difficulties	Describe any difficulties (Jan-Dec 11) encountered or impacting on project progress (e.g. in staffing, access, data analysis) and action to resolve these

PROJECT TEAM

Please indicate the name, primary discipline and sub-disciplinary specialism for ALL academic investigators or researchers currently associated with project. We will use the table as the definitive contact list of your project team.

Name	Address	E.mail	Category (e.g. Principal Investigator, Co-Investigator, Post-Doc Researcher, Sub-contractor, PhD Student)	Primary discipline	Sub-disciplinary specialism

The primary discipline refers to a person's fundamental scientific training and disciplinary orientation. For each person, please select just **one primary discipline** from the list below. Please use no more than 4 key words when describing each investigator's current subdisciplinary specialism. For example, the primary discipline might be physical geography and the specialism GIS; or the discipline might be economics and the specialism environmental economics; or the discipline might be meteorology and the specialism atmospheric kinetics, etc.

1	Acoustics	18	Environmental Modelling	35	Planning
2	Animal Pathology	19	Environmental Physics	36	Plant Biology
3	Archaeology (science based)	20	Epidemiology	37	Plant Pathology
4	Biochemistry	21	Fish Biology (including Aquaculture and Marine Biology)	38	Politics/Political Science
5	Bioengineering	22	Food Science	39	Population Biology
6	Bioinformatics (including Bio-statistics and Biological Modelling)	23	Genetics (including Evolutionary Biology)	40	Psychology (human)
7	Biophysics	24	History	41	Science Studies/Science Policy
8	Civil/Water Engineering (including Earth and Environmental Eng)	25	Human Geography	42	Social Anthropology
9	Consumer Sciences	26	Human Nutrition	43	Social Policy
10	Crop Science (including Pest Management)	27	Hydrology (including Hydrogeology and Sedimentology)	44	Social Statistics
11	Development Studies	28	Animal Science (including Animal Nutrition)	45	Socio-Legal Studies
12	Earth Sciences (including Geomorphology, Geology Biogeochem)	29	Management and Business Studies	46	Sociology
13	Ecology	30	Meteorology (including Climatology and Atmospheric Sci)	47	Transport/traffic engineering

14	Economics	31	Microbiology	48	Soil Science
15	Entomology	32	Oceanography	49	Systematics and Taxonomy
16	Environmental Chemistry	33	Philosophy	50	Veterinary Medicine
17	Environmental Informatics	34	Physical Geography		

STAKEHOLDER ENGAGEMENT

STAKEHOLDER ENGAGEMENT IN 2011 *Please identify all stakeholders that took part in the project during the year Jan-Dec 2011 (please add rows). The data will be used anonymously in presentations and publications on Relu's engagement with stakeholders. Please do not leave any cells empty.*

Name of Stakeholder Contact Where listing composite groups. E.g. farmers, members of public, please specify number	**Organisation or company**	**Nature of Relationship** Project partner Steering group/ advisory group member Research subject (interviewee, survey respondent, focus group member etc.) Event attendee (e.g. workshop, conference) Consultee Exchange of personnel (e.g. visitor to project or work shadow host) Contractor Recipient of research findings/ outputs Other (please specify)	**Contribution to Project** Contributed to objective setting/problem framing Contributed to discussions on project design/planning Contributed to scientific deliberations or analysis Provided access to research facilities, materials, data or study sites Provided information or views as research subjects Assisted in data collection for project Gave feedback on findings Helped to disseminate findings Other (please specify) They made no contribution	**Estimated Time Input to Project** Please give a ball park / approximate estimate, in Days (e.g. 4 farmers each spending 1hr to complete a survey = 0.5 days; 3 Defra staff attending a 1 day conference = 3 days; 20 officials attending afternoon workshop = 10 days; one week's time of a work shadow host = 5 days)	**Impact** **of stakeholder on improving research project's:**		**Perceived impact** **of research project on improving stakeholder's:**	
					scientific quality	**relevance**	**policies or practices**	**knowledge or understanding**
					Indicate if: 1. High 2. Moderate 3. So far None 4. Negative 5. Don't know			
e.g. Alf Lowe, John Adams, Mark Bloggs	Defra water team	4, 8	1, 2, 7, 8	3	1	3	2	2
e.g. 4 Sussex farmers	Farm businesses	3	5, 8	0.5	3	1	5	1

CONTRIBUTIONS TO POLICY AND PRACTICE IN 2011

IMPACTS	Number	Short commentary
1. Strengthening of existing stakeholder-research links or networks		
2. Establishment of new stakeholder-research links or networks		
3. Submissions to government consultations or inquiries		
4. Meetings/occasions where advice, data, or information was provided to policy makers		
5. Meetings/occasions where advice, data, or information was provided to businesses		
6. Businesses trained or advised		
7. Policy makers trained or advised		
8. Memberships of stakeholder boards or advisory groups		
9. New decision support tools, methods or protocols		
10. New material or technological advances (efficiency improvements, new technologies or materials, new processes)		
11. Commercialisation: Spin-outs, licences, patents etc.		
12. Number of stakeholders temporarily visiting or attached with project		
13. Number of researchers work shadowing/placed with stakeholders		
14. Number of interactions/events focused on public participation and engagement		
15. Number of publications aimed at policy makers		

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