6. How?

There has been surprisingly little attempt to identify, let alone classify, methods for addressing the question '*How is the disciplinary and stakeholder knowledge synthesised, by whom and when?*'. One way to think about methods is to use three classes

- dialogue-based
- model-, product- or vision-based
- common metric-based.[1]

A brief description of each is presented next. Who undertakes the synthesis is then examined, followed by when in the research process it occurs.

Dialogue-Based Synthesis

Dialogue-based methods use conversation to 'jointly create meaning and shared understanding'.[2] Dialogue-based synthesis does not always need to use formal methods, especially when only a few people are involved. Structured methods are most helpful when groups start to get large, as they ensure that all perspectives are appropriately heard and included.

Fourteen methods suitable for different types of knowledge synthesis have been identified.[3] Some methods are broadly useful, bringing together different people's judgments about an issue. They include consensus conference, Delphi technique and nominal group technique. For example, the Delphi technique was used to develop an implementation plan for sustainability policies at a Canadian university drawing on the judgments of knowledgeable representatives of students, staff, faculty and administrators.[4]

Other dialogue methods are useful for specific tasks, such as combining different visions about an issue (appreciative inquiry) or reconciling various interests (principled negotiation). For example, a UK research team used appreciative inquiry to engage older people's groups, the hospital trust, voluntary agencies and others to figure out how better to meet the needs of the elderly in transition from hospital back to their own homes. There were diverse visions for better

1 These three classes of methods are unlikely to exhaust the range of ways in which knowledge synthesis can be undertaken. In addition, these classes overlap; nevertheless, it is useful to consider them separately.
2 Franco (2006, p. 814).
3 McDonald et al. (2009).
4 Wright (2006).

post-hospital experiences—for example, regarding flexible care, individual carer responsibility and process coordination, all of which were drawn together using the method.[5]

The range of dialogue methods can accommodate different requirements and preferences for the engagement of disciplinary and stakeholder expertise.[6] For instance, some methods are most suitable for tasks requiring discipline-based experts only,[7] other techniques work best for bringing together stakeholder views[8] and still others are designed to combine discipline-based and stakeholder knowledge.[9]

Model-, Product- and Vision-Based Synthesis

Model-, product- and vision-based methods are related as they use a specific goal as the focus for synthesis. Model-based methods use the development of a conceptual or mathematical representation of a problem as the 'device' for bringing together disciplinary and stakeholder knowledge. In other words, designing the model is used to stimulate communication and capture the shared understandings. For example, the agent-based model on psychostimulant use I described in Chapter 5 brought together epidemiological and ethnographic research insights.[10] As also indicated in that chapter, there are many modelling approaches, from concept mapping to formal system dynamics or agent-based models.[11] The relative advantages and disadvantages of different models for the purpose of knowledge synthesis remain to be investigated and documented.

Building a product or implementing a vision both rely on the same principle as developing a model in that the focused task brings different understandings together. The development of the atomic bomb is an exemplar of product-based synthesis. This combined knowledge from physical scientists, engineers, the military and private industry.[12] The World Commission on Dams framework for decision making about future dams is an example of vision-based synthesis. A

5 Reed et al. (2002).

6 McDonald et al. (2009).

7 An example is the consensus development panel, which was used to bring together discipline-based experts to develop a 'state-of-the-science' statement on prevention, cessation and control of tobacco smoking (National Institutes of Health State-of-the-Science Panel 2006).

8 An illustration is the citizens' jury, which was used to formulate a community decision on the future of a former local wetland, by assisting 16 representatives of the public to come to a judgment based on the best available evidence (Aldred and Jacobs 2000).

9 This is demonstrated by open space technology, which has been used for a range of problems including putting participants from various organisations on an equal footing in generating ideas and plans for the development of the public health workforce in the United Kingdom (Brocklehurst et al. 2005).

10 Moore et al. (2009).

11 Badham (2010).

12 Rhodes (1986).

guiding ideal was proposed for bringing together different perspectives and for deciding on action—namely a globally accepted framework of norms about human rights, economic and social development, and sustainability. These were derived from United Nations declarations and principles. In particular, the Commission used the 'emerging global vision of equitable and sustainable development'[13] to guide the drawing together of the various inputs and to recognise five core values: 'equity, efficiency, participatory decision making, sustainability and accountability'.[14]

Common Metric-Based Synthesis

Common metric-based methods rely on single measures that can be employed to encapsulate the range of relevant disciplinary and stakeholder knowledge about the problem. The best known and most widely used common metric is monetary value. Synthesis can then be based on simple arithmetic or more complex manipulations, such as cost–benefit analysis.

The sort of research problem where common metric-based synthesis might be useful is an examination of the impacts of the encroachment of housing on farmland and bushland on the fringes of cities. This can benefit from the disciplinary expertise of, among others, ecologists, economists, hydrologists, sociologists, soil scientists and demographers. Relevant stakeholders include those affected, such as farmers and recreational users of bushland (whose activities are impinged on by the expansion of housing) and families requiring housing. Stakeholders also include those in a position to make decisions about the issue such as government policy makers, local councilors, regulators and land developers. One way of dealing with the competition for peri-urban land would be to convert the various uses of the land into dollar values and to base decisions on the best financial return. For example, a cost–benefit analysis could focus on the economics of different types of land use. A simple analysis could compare the economic return over a specified period from using the land for farming, maintaining bushland for recreation or building houses. This could be based on the income for local, State and national governments from land taxes and other revenues, such as park entry fees. Involving relevant stakeholders would provide information on other parameters that they consider important, which could include the 'products' of the different types of land use such as food, recreational amenity and contribution to employment through the construction of houses. Alternatively, stakeholders could be involved by being asked about their willingness to pay for the various types of land use.

13 World Commission on Dams (2000, p. 198).
14 World Commission on Dams (2000, p. 199).

A different kind of analysis could use an ecosystem services approach[15] to assess each of the three types of land use—farmland, wilderness and housing development—in terms of goods, such as food, timber and biomass produced; regenerative and stabilising processes, such as water catchment and clean air generation; life-fulfilling functions, such as aesthetic value; and preservation of options, such as species diversity. The important difference from standard cost–benefit analysis is the questions posed, such as 'what services are being provided that people have been overlooking', 'how much of these services do people need' and 'to what extent could technology replace nature's services and at what cost'.

Common metric-based synthesis can also use measures other than money. Other common metrics that have been developed and used for environmental problems include the area of land necessary to sustain a given level of resource consumption and waste assimilation (ecological footprint)[16] and metric measures of carbon dioxide equivalent.[17] For health problems, they include disability-adjusted life-years and quality-adjusted life-years.[18] An example of the use of the ecological footprint for knowledge synthesis is a collaboration between university-based researchers and the Cardiff Council in the United Kingdom to assess policies and practice on sustainability.[19]

Tasks for the I2S Development Drive
Identify and catalogue the full range of methods that have been used for knowledge synthesis, as well as their conceptual bases and case examples of their application. Update and improve existing compilations.

Who Undertakes the Synthesis?

It is often assumed that the synthesis should be a group process; however, even though perspectives are drawn from researchers representing a number of different disciplines and from various stakeholder groups, each contributor does not necessarily have to be involved in bringing the knowledge together. The options for undertaking the synthesis are to involve the whole group or a subgroup or for it to be the task of an individual. In the last case the synthesiser is often the research leader.

15 Costanza et al. (1997); Daily (1999).
16 Wackernagel and Rees (1996).
17 Michaelowa and Koch (2001).
18 Murray et al. (2000).
19 Cardiff Council (2005); Collins and Flynn (2005, 2007); Collins et al. (2006).

Each of these options has advantages and disadvantages. For example, a disadvantage of involving the whole team is that the time it takes can be very demanding. A disadvantage of the synthesis being undertaken by the team leader is that one person is likely to have only a limited grasp of some aspects of the project.

When is the Synthesis Undertaken?

An additional consideration for undertaking knowledge synthesis is when it will be carried out. Just as there is often an assumption that synthesis will be a whole-group process, some people often presume that it will occur at the end of the research, while others suppose that it must be established right from the beginning. But again there is a range of options, each with advantages and disadvantages.

It is useful to begin by exploring two extremes, epitomised by multidisciplinary and transdisciplinary research. In multidisciplinary research, relatively little attention is given to synthesis at the beginning of the project. Each discipline is left reasonably free to define the problem and to apply its methods as it determines to be appropriate. Synthesis at the end of the project can then be particularly challenging, especially when problem definitions and methods do not fit together readily. Indeed multidisciplinary research often leads to the production of a book, with different chapters by different discipline experts, and with the synthesis left to the reader.[20] For this reason, multidisciplinary research has somewhat fallen out of favour.

Transdisciplinary research aims to deal with the limitations of multidisciplinary investigations by getting agreement on a problem definition, along with the contributions of the different disciplines and stakeholders, at the beginning of the research. This often also includes determining the synthesis method up front, although this is not always spelt out. The synthesis is then generally much more straightforward. The price can be lack of flexibility. It can be hard to introduce new perspectives or to change direction as the research progresses and the importance of new dimensions becomes evident. Comparing these two extremes shows that a key challenge for integrative applied research is to find ways to improve the knowledge synthesis success while maintaining flexibility during the research.[21]

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20 The introduction and conclusion may provide some synthesis.

21 These two research approaches are compared in greater detail in Chapter 33.

Task for the I2S Development Drive
Collect case examples of implementation of different options for who undertook the knowledge synthesis and when in the research process this occurred.

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