7. Discussion

The purpose of this chapter is to provide an integrating discussion of the material presented so far, and to provide a critical assessment of the PEM methodology. There are five main sections to this chapter: in the first, a discussion of the overall methodological development is provided; the second section provides an analysis of the methodology, in terms of its effectiveness in implementing a transdisciplinary approach, while the third provides a review of its strengths, weaknesses, opportunities and threats (a SWOT analysis). A methodology that predates PEM by some 20 years, Adaptive Environmental Assessment and Management (AEAM), is reviewed in the fourth section. It has been noted by some people that PEM is similar to AEAM, and the latter is reviewed here in order to compare and contrast it with PEM. The chapter closes with some general comments about PEM.

7.1 The Development of the Methodology Reviewed

In order to progress this discussion, a diagrammatic representation to encompass the evolution and dimensions of the methodology will be used. The purpose of the diagram is to show explicitly how the various perspectives that have been addressed in the main body of this thesis fit together in a unified whole.

The first stage of the diagram (Figure 7.1) provides a representation of the overall context for the thesis, and is based on the literature reviewed in Chapter 2. In the centre of the diagram is (the item) *Sustainability Issues* (addressed in Section 2.1), reflecting the important place that these have in the present work. *Ecological Economics* (Section 2.2) and *Integrated Resource Management* (Chapter Four, including ICM and IEM) are each connected with double-ended arrows to *Sustainability Issues* to reflect that these areas of investigation both respond to, as well as influence, the central issue of sustainability. *Systems Chaos/Complexity* (Section 2.3) is also connected to *Sustainability Issues* with a double-ended arrow reflecting that this theoretic framework is heavily influenced by the natural world (including environmental aspects), as well as providing insights into the complexity of sustainability issues. Both ecological economics and IRM are substantively influenced by systems theoretic considerations, and this is represented by the respective connections.

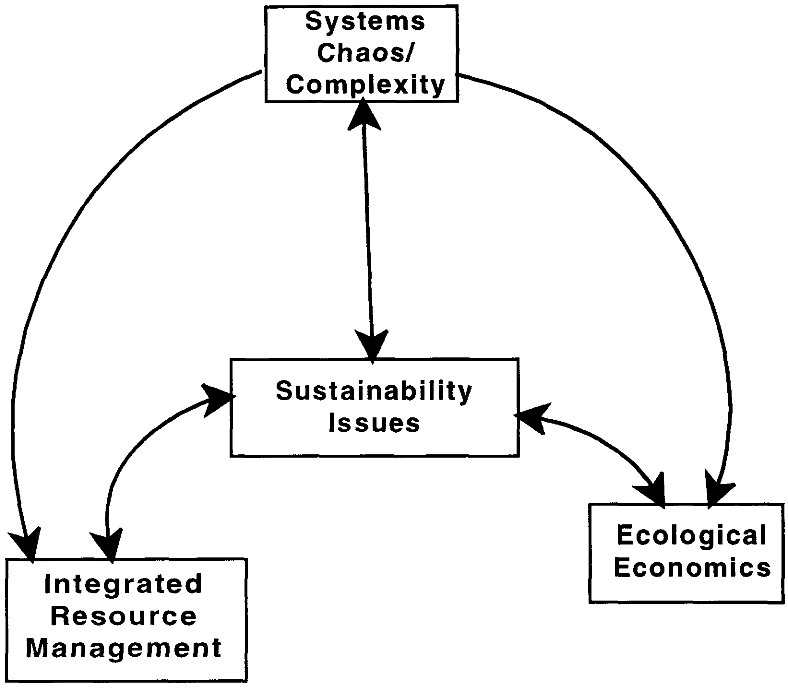

Figure 7.1 The overall context for the thesis

The fact that ecological economics and IRM have similar perspectives on many environmental matters, suggests the possibility that the former (as a [trans]discipline) could provide an improved methodological framework for applied work in the latter. In particular, the need to integrate across the social, ecological and economic dimensions of problems has been explicitly recognised in the literatures on sustainability, ecological economics and IRM. However, as pointed out in Research Problem One, the lack of a general consensus about how to achieve this integration, means that a definitive methodology has yet to be articulated (see Figure 7.2). Nevertheless, the potential exists for such a methodology to be emergent from ecological economics, resulting from its transdisciplinary and holistic foundations.

The transdisciplinary nature of ecological economics has been addressed in some detail in Section 2.2.1. Here, it was noted that whereas the rhetoric of ecological economics points to a transdisciplinary approach, there has been little attention paid to the epistemological foundations of this and to how it might be implemented in practice. This lack in ecological economics has been noted as part of the second research problem.

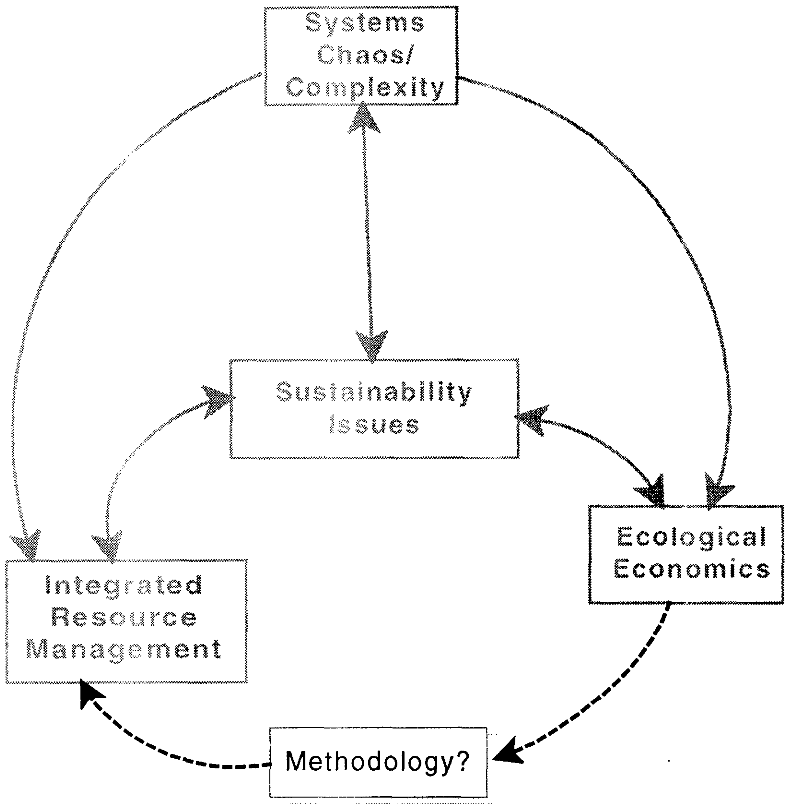

Figure 7.2 The problem – lack of a suitable methodology

These research problems led to the identification of the objectives for the research. Taken together, the research objectives amount to articulating, developing and demonstrating a methodology that can provide the link between ecological economics and IRM (the dotted arrows and box in Figure 7.2).

The first task in articulating the methodology has been to explore transdisciplinarity in some detail. In Section 2.2.2, a thorough review of the literature has been reported. Noteworthy here was the paucity of authors who have tackled this issue, and that the ecological economics literature itself contributes only marginally to an understanding of the concept. The focus on transdisciplinarity is represented in the diagram (Figure 7.3) by the simplified graphic of the disciplinary to transdisciplinary transition (previously described in Chapter Two and drawn in full at Figure 2.1). The exploration of transdisciplinarity resulted in the articulation of key indicators (Table 2.3) that can be used as pointers to a transdisciplinary methodology. These epistemological principles provide a part of the foundation of the PEM methodology developed in Chapter Four.

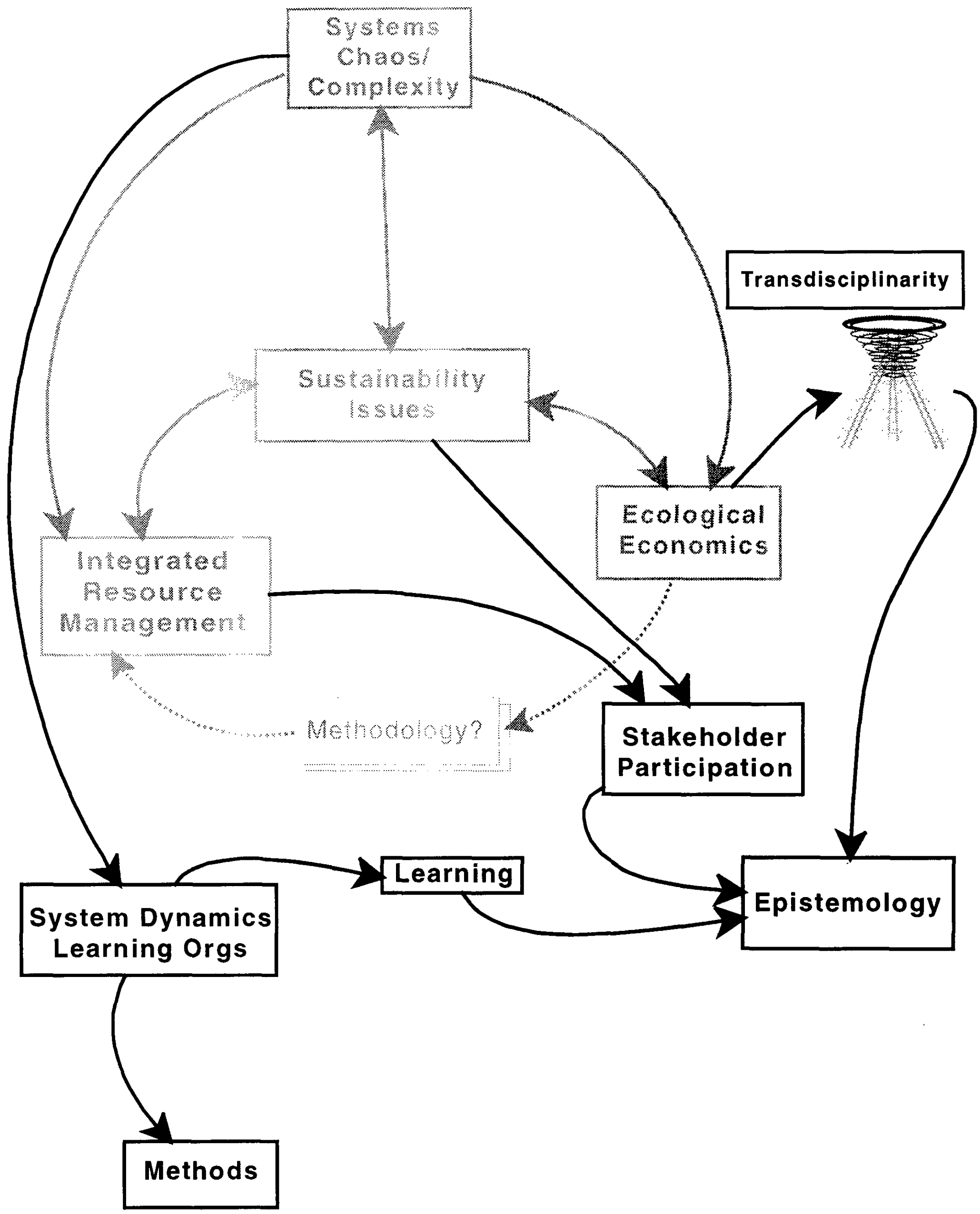

Figure 7.3 Towards a new methodology

Whereas transdisciplinarity has been developed as the main basis of the epistemology, there have also been general principles adopted from the IRM and systems literatures. The need for active stakeholder involvement in creating and implementing policy and management decisions has been identified. This has been based on the IRM literature which strongly advocates such involvement (Section 4.2), the general literature on community participation (Section 4.3), and the fact that stakeholder involvement has been identified as a critical success factor within the sustainability literature. The need to take a systems approach has been adduced from the general systems literature, although in the diagram, it is captured in the link from *Ecological Economics* since this field is explicitly predicated upon the adoption of a systemic stance.

Another component of the new methodology is the methods that are employed to implement the general principles identified in the epistemological foundations. To this end, the fields of system dynamics and learning organisations have been explored (Chapter Three) and relevant methods adopted. A link from *System Dynamics/Learning Orgs* through *Learning* to *Epistemology* is also drawn to make explicit that the system dynamics/learning organisations framework has contributed to the epistemology of the methodology, particularly in regard to the need to adopt a learning stance when dealing with complex systemic problems.

Based on the above, a new methodology – Participative Environmental Management – has been articulated (Chapter Five). A point made explicitly in Figure 7.4 is that the methodology of PEM is based on an epistemology articulated as discussed above, and that it draws its methods from the area of system dynamics and learning organisation theory. A point that has been made earlier is that once the methodology is articulated, it needs to be developed so that it can be applied to real problems. In Figure 7.4, a strong two-way link between PEM and the case studies is indicated. This reflects the role the case studies have had in the testing and development of the methodology. The five-part methodology described in Chapter Five and given diagrammatically in Figure 5.1, is the outcome of a number of iterations resulting from feedback during the case studies. These iterations have occurred over some three years, and have involved a re-evaluation of both the methods employed and the epistemological framework. In the latter case, it was not a matter of arbitrarily modifying the theory to fit observations. Rather, feedback from the case studies led to continuing critical evaluation of the construction of the epistemology, and subsequently to incremental changes in its form. It is suggested that this process of continual reflection and critical review has led to the development of an epistemological foundation that is reasonably robust. (Note the closure of the feedback loop in Figure 7.4 by the arrows from *Case Studies* to *Methods* and *Epistemology*.) No doubt, as further experience in the application of the methodology is gained, further real-system information will lead to future reflect-evaluate-modify cycles.

This completes the review of the development of the methodology. The next section provides a critical evaluation of the methodology in terms of the stated objectives of the research, and this is followed in Section 7.3 by a general assessment of its effectiveness using a SWOT analysis.

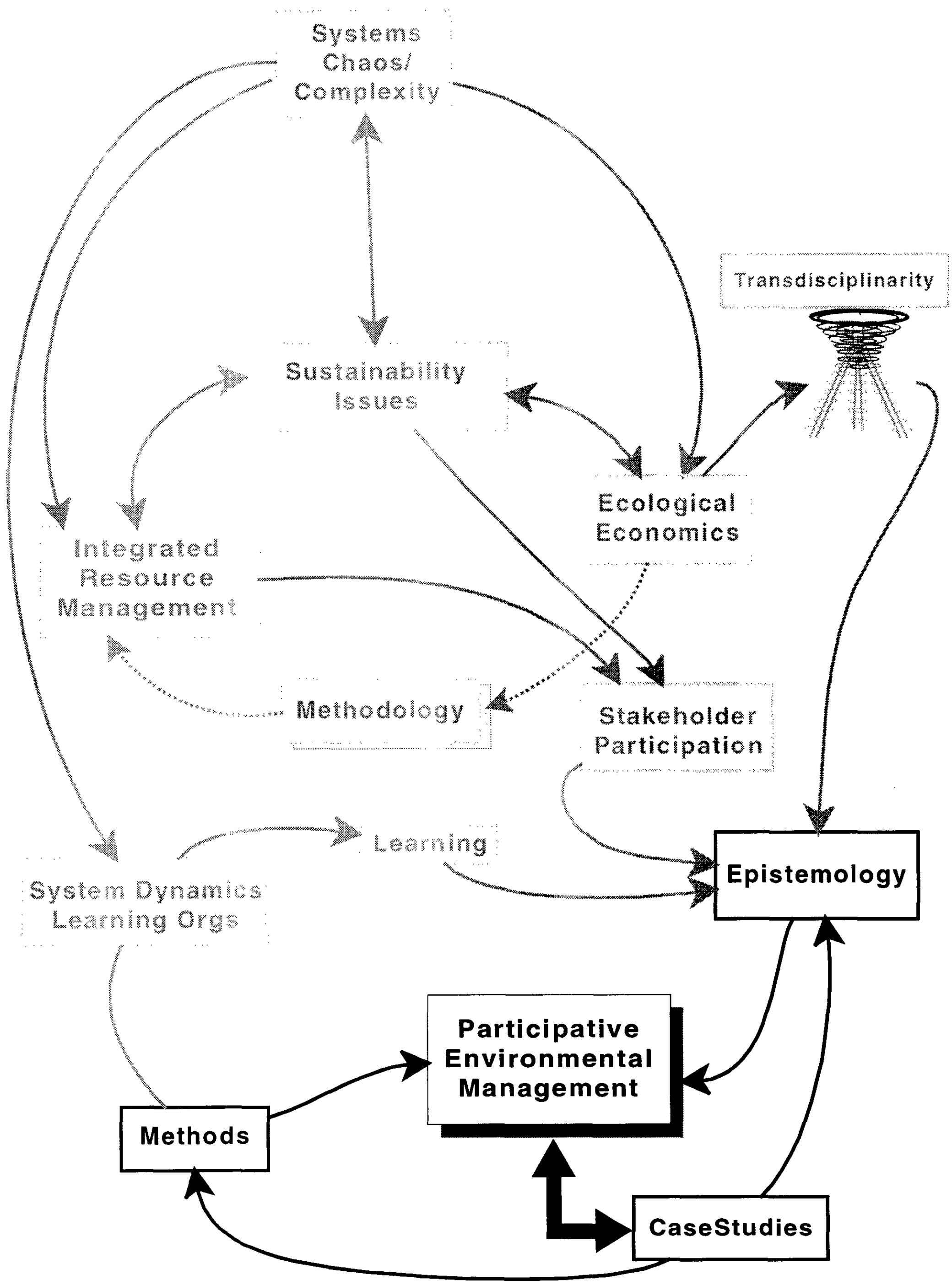

Figure 7.4 The PEM methodology as articulated, tested and refined

7.2 A Transdisciplinary Methodology?

A main theme of this thesis has been to articulate a transdisciplinary methodology for application to IRM as a potential extension of, and support for, the practice of ecological economics. The PEM methodology has been developed to fulfil this objective. It has been constructed based upon the general principles of transdisciplinarity identified in Section 2.2, and, hopefully, is a valid implementation of them. As part of the review of transdisciplinarity, a number of indicators of transdisciplinarity were identified in Table 2.3. It was noted that these indicators could be used to assess the methodology to determine the extent to which it has successfully implemented the principles of transdisciplinarity. The purpose of this section is to present this critical appraisal.

In Chapter Five, it was noted that PEM is transdisciplinary in nature. There are two elements of transdisciplinarity that can be identified in PEM; its foundational principles and the way it is applied. Each of these will now be addressed.

PEM has been developed as a synthesis across a number of disciplines or areas of practice. The mud maps are analogous to Chambers' (1997) influence diagrams which are used within Participative Rural Appraisal, a methodology which is itself eclectic and transdisciplinary. There are also similarities with Eden's (1994) cognitive mapping techniques, drawn from the business management area. The facilitated workshop approach is a common technique that is applied when it is desired to elicit input from a group of people (e.g. Chamala and Mortiss 1990, Kaner *et al.* 1996, and Vennix and Gubbels 1994). The concept that searching for patterns of relationships within an holistic framework is a legitimate way to understand reality has been adopted from institutional economics (Wilber and Harrison 1978 provide a review of this field). The need for a systems approach has been asserted based on the literatures on ecologically sustainable development, integrated resource management and ecological economics, as well as within the systems literature itself, which have all been reviewed in Chapters Two, Three and Four. The main tool of PEM, system dynamics modelling, has been adopted from the discipline of system dynamics, while the notion that group learning is important has been identified in the literatures on integrated resource management, ecosystem-based management and learning organisations.

In application, PEM can also be seen to be transdisciplinary. Perhaps the best way to demonstrate this, is to apply the indicators of transdisciplinarity developed in Chapter Two (Table 2.3). The entries in that table are in no particular order other than that in which they appeared in the text. It would simplify their application if they were summarised in some way, and to this end, the questions in Table 2.3 can be grouped under the following general headings:

A. The blurring and melding of disciplinary boundaries;

B. The use of a systems approach;

C. The search for synergistic opportunities; and

D. The harnessing of creative tension.

Appendix C contains a detailed listing of each of these headings, and the items that have been included in each. Based on the four categories A to D, PEM can be broadly assessed for consistency with principles of transdisciplinarity.

Category A – The blurring of disciplinary boundaries. The method of capturing information means that insights and knowledge from various disciplinary perspectives are included seamlessly with all other information. Moreover, there is no one disciplinary stance that is invoked to analyse the information; rather analytic techniques from various disciplines can be included at relevant parts of the model as required. Not only are disciplinary boundaries blurred, it is usually extremely difficult to associate any given system insight generated within PEM with one particular discipline.

Category B – The use of a systems approach. PEM is clearly utilising a systems approach; the whole process from stage one through five is predicated upon eliciting system relationships and understanding the problem within its system context. The system dynamics modelling techniques are unambiguously part of a systems approach, as is the mud mapping or system drawing stage.

Category C – The search for synergistic opportunities. The opportunity to capture synergies is also evident in the process; as the system exploration proceeds through the participative mud mapping and qualitative and quantitative modelling, any system failures such as malfunctioning feedback mechanisms are likely to be identified. This is pursued through a systematic process of cross-disciplinary and cross-stakeholder introspection involving the questioning and surfacing of many assumptions that would normally remain at best implied through alternative disciplinary methodologies. This makes it possible to direct effort at fixing these system failures, thereby allowing the system to work more effectively as a whole and thus to generate synergy.

Category D – The harnessing of creative tension. Finally, there is plenty of opportunity to harness creative tension. The facilitatory technique employed means that people with contradictory views are able to express these views in such a way as to enhance group understanding about the complexity of the issues. Contradictory positions serve an important function, that of highlighting the existence of different perspectives about a problem. Systematic exploration of these differing perspectives is useful because it helps to reveal the assumptions underlying the opinions and beliefs that people have. Once these assumptions have been surfaced, the opportunities for learning are enhanced (Senge 1992).

The above points to PEM as a good implementation of transdisciplinary methodology. However, it would be presumptuous to make too much of this at this stage. The transdisciplinary epistemological foundations developed in this thesis have not, due to their very newness, been subjected to extensive criticism and debate. They should therefore be regarded as tentative propositions that need testing. However, the fact that these propositions now exist within the putatively transdisciplinary field of ecological economics, at least provides a substantive basis for such a debate. The assessment of the PEM methodology is given to show how the indicators can be used to assess particular work. If the transdisciplinary approach is indeed of such fundamental importance to environmental management as the early rhetoric of ecological economists would suggest, then a method that enables such work to be clearly identified will prove invaluable in furthering the application of this approach.

7.3 SWOT Analysis

During the development and application of the PEM methodology, it has become apparent that the approach has a number of characteristics that make it well suited to the task at hand. On the other hand, there are a number of factors that could mitigate against its effective use. In order to address these issues systematically, an assessment of the strengths, weaknesses, opportunities and threats will now be given (a SWOT analysis).

7.3.1 Strengths

PEM has an explicit focus on *facilitating broad stakeholder involvement* in environmental decision making. This is an obvious strength given the high degree of interest that can be found in the literature (i.e. IRM, sustainability) about that involvement. Moreover, since PEM includes a systematic approach to stakeholder involvement, it can provide a substantive basis from which to organise such participation.

The ability to *integrate the social, economic and environmental factors* more easily than alternative approaches is also a part of PEM. The transdisciplinary cross-stakeholder approach provides an ideal forum for the identification of the relevant issues and the way they interrelate. The system dynamics modelling tools enable a comprehensive integrated analysis of the various factors to be undertaken as required. Importantly, from the perspective of continuing stakeholder involvement through the analysis stages, model development is vertically integrated with the initial qualitative system mapping that is undertaken. This means that the entire process can be undertaken as an integrated whole, thus minimising the potential for using analytical techniques that do not accurately reflect the collective group knowledge. These characteristics of PEM are congruent with the indicators of effective integration proposed in Section 4.3.3.

The use of the system dynamics modelling tools within PEM to explore various options and scenarios is called a "management flight simulator" approach within the system dynamics literature (see discussion at the end of Section 3.1.1). As such, PEM will include the strengths of such an approach which include the ability "... to give people first-hand experience of how cause and effect can be distant in time and space, and how well intended interventions can cause more harm than good" (Roth and Senge 1995, web page). That is, PEM includes the facility to provide an analytic framework for developing an holistic understanding of how changes in various aspects of a system will impact on other parts of the system through feedback. This assists in the identification of non-intuitive or counter-intuitive relationships.

The process that is employed is *highly conducive to consensus building and developing shared ownership* of the problem and strategies to address it among the participants. Whereas consensus might not be a sufficient condition for sustainability, it is arguably a necessary one. The alternative to consensus is a confrontational approach, and, in the words of Paul Perkins, Chair of the Environment Management Industry Association of Australia, "... fighting won't lead to sustainable outcomes" (Perkins 1998, speech). The consensus approach serves to minimise unproductive argument, thus allowing the group to move more quickly to problem articulation and solution generating tasks.

Experience in the application of PEM, including both the reported case studies as well as other applications, shows that consensus building seems to be a natural outcome of the process. In comparison to many meeting techniques and facilitation procedures, this is unusual, to say the least. There are no doubt some logical reasons why this consensus is generated so regularly.

Mitchell (1987, p.23) refers to "Getting to Yes" (Fisher and Ury 1983) in which the authors outline techniques pertinent to bargaining, negotiation and compromise. They argue that separating the characteristics of the people involved from the characteristics of the problem is useful. This is because too often people react to the people rather than concentrating on the problem. Another possible reason is provided by Forrester (1987, p.137): "By debating assumptions independently from resulting behavior, there is less inclination for people to differ on assumptions with which they actually can agree merely because they initially disagree with the dynamic conclusions that might follow". The consensus building might also be attributed to the efforts that are taken to ensure that all participants develop a shared mental model of the system of interest, and then to use this to underpin the search for sustainable strategies.

Since PEM is a process that can be modified to suit the particular institutional, political and environmental realities, it is *readily adaptable to the problem at hand.* This means that once the general philosophy of the need to take an integrating, stakeholder-inclusive approach such as PEM is accepted, it is an easy step to adapt the general process to the particular problem.

Transparency about the way that decisions are to be made, and the factors that will influence these decisions, is an important part of PEM. As discussed in Chapter Four, it is important that empowered decision makers are included as direct participants in the system exploration workshops. Provided that these people have a genuine commitment to transparent decision making and community involvement, their involvement alongside other participants will tend to generate a team approach in which all are involved and have ownership of the problem and its solutions. Of course, they may not want a transparent process and this will cause problems, an issue that is addressed under the heading "Threats".

Finally, the PEM approach is explicitly based on a systems theoretic framework, and is designed to focus attention on the *potential to capture system synergies.* Arguably, this maximises the opportunity to harness synergies within the system, and to exploit them as part of the management strategy. As yet, there has been no attempt to determine whether the systems approach inherent within PEM will result in outcomes that evidence synergy. This is an obvious area for further research.

7.3.2 Weaknesses

Whereas the literature about sustainability, ecological economics and IRM is supportive of integrative cross-disciplinary frameworks, one finds in practice that many people nevertheless appear to have difficulty in coming to terms with how such a transdisciplinary framework should be implemented. Moreover, one tends to observe that integration is done *via* an "aggregation of experts" rather than through the development of genuine synergistic outcomes that embed effective integration (as discussed in Section 4.3.3). A weakness of PEM is that it *requires a paradigm shift* away from this expert-driven model for solving problems, towards a partnership-based transdisciplinary approach. In particular, those with responsibility for making decisions about the environment, usually local government officers and environment-related agency personnel, must recognise the need for a change in approach and also be prepared to take a chance on alternative ways of addressing these problems. There is some evidence that such a shift in attitude is occurring, and this has led to a number of further opportunities to employ PEM, some of which are detailed under the heading of "Opportunities". If this trend continues, then this weakness may fade in significance. It might even happen that if PEM can facilitate a paradigm shift by at least *some* empowered people, then their changed view of how to approach complex environmental problems (i.e. from a participative learning stance) could lead to real improvements in the environment. Thus might a weakness be transformed to a strength.

PEM has been developed as a tool to support the development of policy and management strategies in respect of complex environmental problems. However, more spatially dependent issues have not yet been incorporated explicitly within the PEM framework. For example, the way that a Geographical Information System (GIS) might be used in parallel with PEM has not been explored. Clearly, there is an opportunity here to develop PEM such that it can function as an adjunct to the use of spatially contexted approaches such as GIS.

PEM is a facilitated approach to environmental management. A point made when articulating the methodology in Chapter Five, was that facilitation for PEM must be based on a systems theoretic framework, rather than the presently dominant 'brainstorm and flipchart' approach. There are *very few facilitators who presently possess these particular skills*, and this could prove to be a limiting factor in the application of PEM. However, it is envisaged that as the approach gains more general acceptance, the increased demand for this type of facilitation will lead to more people becoming proficient in it.

A further difficulty with the facilitation process has to do with the *objectivity of the facilitator* who, in order to support effective transdisciplinary work, must be able to maintain independence from capture by disciplinary or vested interests. There is a problem with respect to who initiates the PEM process. If the facilitator is engaged by a particular interest group (e.g. by a Council, a specific government department of a green lobby group), then that facilitator will have to overcome an inevitable perception of bias from some sections of the stakeholder community. This points to a need for a transparent mechanism of process initiation such that the wider stakeholder community is comfortable with the relative objectivity of the facilitator and the process.

Extensive community consultation is always costly, adding significant costs to projects. The *PEM approach could also be construed as a costly addition*, especially since it necessitates the use of trained facilitators. However, if the process leads to consensus and the capture of synergies, then it is feasible that it could reduce costs in other areas. If this is so, then it can no longer be self-evident that PEM represents an extra cost in the overall project or management task. No formal attempt has been made to quantify the potential savings from such a consensus based approach, and this would be another good future research project. In the absence of formal analysis, anecdotal evidence suggests that PEM is relatively cost effective, although this is hardly conclusive.

Since PEM focuses on system interrelationships, there is a procedural risk that these *relationships could be overemphasised* at the expense of detail about individual system elements. There is no *a priori* way to assert the correct balance required here, other than that the stakeholders themselves should be encouraged to pay attention to this issue. Furthermore, it is not clear how one might assess the impact of such a bias in terms of overall outcome, and thus this issue is likely to remain moot.

A particular difficulty with implementing PEM has been the *tendency for people to fixate on the approach as a model building exercise* – something which often conjures up strong negative reactions from the non-academic and non-technical people who usually dominate catchment management committees. Early representations of the approach, such as used for the Throsby Creek case study and reported in Section 6.1.3, tended to focus on the modelling capabilities of the software and the way these could be exploited by the stakeholder community. Unfortunately, this emphasis on the software led to the inevitable result that people developed the perception that this is fundamentally a modelling process. Subsequent 'selling' of PEM has involved far more emphasis on the communicative aspects of the work, the integrating systems stance and the role of learning and adaptation. The modelling component is then brought in as an enhancement that allows and supports the systematic analysis of options. Whereas the overall process that is being described is the same, the shift in emphasis to stakeholder-inclusive aspects of the approach has proved successful in gaining the support of stakeholder communities.

The PEM methodology has been created explicitly to facilitate stakeholder-driven decision making. Whereas this is feasible at the local or even regional scale, *it is not clear how such an approach could be adapted to global problems such as the greenhouse effect.* Some ideas have been developed as to how this might be achieved, but these really only provide the germ of an approach. If PEM is able to be utilised at the larger scale, the benefits could be significant. There appears thus to be an important research opportunity here.

7.3.3 Opportunities

A number of opportunities presently exist for the application of the PEM methodology. Some of these have already been realised in the form of funded projects, others are at the final project proposal negotiation stage, while the remainder are being pursued as early research ideas. The six projects described below as either underway or in the final stages of development, have all been prepared in collaboration with Dr Roderic Gill, who has been the main supervisor for the present research.

There are four projects now underway or shortly to commence.

- The Malpas Dam Community Catchment Planning Project involves a merging of interests from the Landcare movement, Armidale Council, Guyra Council, the Department of Land and Water Conservation and the Malpas Catchment Committee. The aim of this project is to facilitate a genuinely integrated, stakeholder-driven, approach to management for Malpas Dam catchment. This project has been reported in the case studies, but is included here as it is work in progress and will continue for some time yet. A general purpose of the project is to provide a demonstration of the PEM methodology so that it can be assessed for use by other catchment management groups. This project has been funded through the Australian National Heritage Trust.

- Another project is being carried out in conjunction with Coffs Harbour Council and the Department of Land and Water Conservation. The project is titled "Integrated Strategic Flood Mitigation Planning: A practical transdisciplinary decision support system", and seeks to articulate an integrated strategic planning process for flood management professionals. This project will adapt and use the general PEM methodology to guide the community involvement aspects of strategic flood plan development. This project has been funded by the Australian Research Council in conjunction with the above mentioned organisations.

- A further project funded by the Australian Research Council is titled "The Development and Implementation of an Ecologically Sustainable Regional Planning Framework for the Upper Hunter Region of New South Wales". It involves collaboration with, and co-funding by, the Department of Urban Affairs and Planning and the Hunter Catchment Management Trust. This represents yet another adaptation of the general principles of PEM, this time focused on the questions of regional planning.

- The fourth project now underway is called "Community Based Development and Evaluation of Sustainability Indicators". This has been funded through the National Heritage Trust in conjunction with the Department of Urban Affairs and Planning. As the name suggests, it is proposed to undertake a community-based process for the development and evaluation of key sustainability indicators within a strategic natural resource management framework. This initial research will provide a pilot study in facilitating community empowerment in adopting sustainability indicators to evaluate alternative natural resource management scenarios.

There are two projects in the final stages of negotiation for funding.

- A project focused on the significance of roads for regional development, and the way that federal funds ought to be allocated in support of this, is presently under review for funding by Austroads, a peak industry body that supports road research of national import. The project, titled "Road Infrastructure and Regional Economic Development: Getting the mix right" has strong support from the Queensland Roads Department as well as the Australian Local Government Association, the peak council body. This work will explicitly involve an implementation of the PEM methodology to develop a general integrated decision support model to assist road policy planning.

- A related project will look at ways that a sustainable road infrastructure might be achieved for low population rural areas. In conjunction with the NSW Premier's Department and Guyra Shire Council, the researchers propose to link the PEM framework with the latest thinking on Strategic Environmental Assessment in an effort to provide a more systematic approach to this difficult issue.

In respect of early research and/or application ideas, interest in PEM has been shown by senior staff of the NSW Department of Land and Water Conservation and the State Forests of New South Wales department. Their interest involves the more general application of PEM within the catchment management framework and strategic forest management respectively. These project ideas are still in the early stages, and await further in-depth discussions with the departments concerned.

Another potential application is in the area of research prioritisation. Part of the system modelling process includes the identification of systemically important but poorly researched and understood system components or relationships. The stakeholders must make explicit decisions about the relative importance ascribe to such aspects in terms of overall system impact. This use of the methodology provides a good basis for prioritising research. The potential to use the methodology in this way has been identified by Ronan Palmer, Chief Economist of the Environment Agency of England and Wales (Palmer 1998, pers. comm.).

Finally, PEM has the opportunity to be influential in the process of managing the environment more effectively. At the 1998 conference of the Environment Institute of Australia, a recurring theme was the importance to effective management of strategic partnerships and the interaction of people. Many speakers made this point explicitly (for a report of this, see Wolfenden 1998). Don Henry, the Executive Director of the Australia Conservation Foundation, identified "civil society engagement" as a contemporary trend in decision making processes, and called on people to work together to deal with the systemic problems that the world faces. Paul Perkins, Chair of the Environment Management Industry Association of Australia, highlighted the need to move from adversarial to partnership approaches. Jan Karel Mak, Managing Director of the international environmental consulting firm Arcadis and Chair of the Dutch Association of Environmental Professionals, pointed to the need for professionals to develop skills in the area of policy process management. He sees that this is important to facilitate people working together to form a common view of problems and from this basis of shared understanding to develop better solutions. The PEM methodology is fundamentally a process-focused approach.

It is based on a philosophy, and incorporates techniques, all of which are conducive to the achievement of the issues identified above. Clearly, there is great opportunity here to provide enhancement of present approaches so that these outcomes can be achieved.

7.3.4 Threats

The most obvious threats to the further development and application of PEM will come from those who are themselves threatened by the approach. The two groups most likely to be affected in this way are those who do not want transparency in decision making (i.e. those with vested interests and/or hidden agendas), and those who are hostile to a transdisciplinary approach (i.e. those with an unrelenting commitment to reductionism). The latter group may well be dedicated disciplinarians of high repute who have contributed valuable insights and advances in knowledge. Their antagonism may not even be intentional or malicious, but simply inevitable because of fundamental differences in paradigmatic perspectives.

Whether these potential threats will eventuate is an interesting question. Experience to date has not resulted in active opposition to PEM that could be attributed to these factors, although one project may have been adversely affected by the inability of a collaborator to come to terms with the transdisciplinary methodology.

The main problem faced is in getting potential users of PEM to recognise its utility as a group decision support framework, a problem that is associated with the need for a paradigm shift that was identified under weaknesses. This is not so much an actual threat, as a factor that will tend to constrain the use of the methodology.

7.4 Adaptive Environmental Assessment and Management (AEAM): a similar approach

It has been pointed out by various people that PEM is similar to an existing systems-based approach to environmental management, Adaptive Environmental Assessment and Management (AEAM). AEAM is an extant methodology applied to catchment management and other environmental issues, and has a number of features in common with PEM. Following is a review of AEAM, with particular attention to its similarities and dissimilarities with PEM.

AEAM was first proposed by Holling (1978) as an approach to environmental management that "... integrates environmental with economic and social understanding at the very beginning of the design process, in a sequence of steps during the design phase and after implementation" (Holling 1978, p.1). It embodies explicit allowance for uncertainty, and as a strategy to reduce uncertainty advocates the use of "... qualitative and quantitative data ... to construct models that can serve as 'laboratory worlds' for the testing and evaluation of intrusions, developments and policies" (Holling 1978, p.7). It uses system techniques such as "... computer modeling of dynamics systems, mathematical analysis, optimization, utility analysis, and communication" (Holling 1978, p.13). Coordination and integration "... comes from the development of a series of steps, each of which is initiated by a workshop that brings together key cooperators for short periods of intense interaction" (Holling 1978, p.13.).

AEAM has been applied in Australia as part of the developing management strategy for the Macquarie Marshes in New South Wales. This work has been reported by Norris and Jamieson (1990, p.3) who observe that:

> AEAM uses a workshop procedure to establish a modelling framework for an experimental approach to resource assessment and management. It is based on the construction of a computer model, which simulates the key interactions of the system being studied. ... The technique is therefore applicable to the management of dynamic systems with strong feed-back mechanisms.

They describe AEAM as a

> ... toolbox of techniques which have their origins in the following three components of resource and environmental management:
>
> 1. Adaptive management ... (incorporating an) adaptive response to unexpected events.
>
> 2. Systems analysis – a collection of tools that are qualitative and quantitative in nature and enable the characterization and simplification of dynamic processes.
>
> 3. Modelling workshops – intensive system orientated sessions that efficiently utilize available expertize [sic] and knowledge.
>
> (Norris and Jamieson 1990, p.37)

They also observe that "... an AEAM model is focused on understanding the dynamic interactions between the various components of a system (for example, ecological, hydrological, economic and sociological components)" (Norris and Jamieson 1990, p.38, brackets in original)

AEAM has also been applied in Victoria in the Latrobe River catchment, and the Goulburn and Broken River catchments. Reported in Grayson *et al.* (1994) and Grayson and Doolan (1995), these applications are consistent with the features identified above. It is noted that:

> AEAM is a process aimed at developing links between people with a common problem and utilising the existing knowledge about the system in question as efficiently as possible in order to develop and evaluate management options. The focus of the process is the development of a computer simulation model of the system which can be used to evaluate the effects of various management options.
>
> (Grayson and Doolan 1995, p.3)

The also offer the observation that:

> ... the AEAM process appears to be highly suitable for use in catchment planning and management. The development of the model provides the capacity to base decisions on the best available technical information. The workshop process offers the opportunity to develop a cohesive group of people with common understanding and commitment. The process overall provides a mechanism for integrating ecological, economic and social considerations.
>
> (Grayson and Doolan 1995, p.5)

The above comments by the various authors have been reproduced to show the extent to which AEAM is similar to PEM. It adopts a systems stance, is applied to catchment planning and management, uses stakeholder workshops, and seeks to integrate across ecological, economic and social considerations. Whereas there are many similarities between the two approaches, there are some significant qualitative differences, and these are addressed below.

AEAM was developed in the 1970s with the then prevailing systems theories and computer techniques. It is an explicit systems modelling approach, with all efforts directed towards developing the systems model. Although it is not the model that is the end in itself, but rather the group learning that can be derived from it, it remains a computer model focused approach (Grayson and Doolan 1995). The computer models are built using QuickBASIC software, and make use of core modules that are reused in different applications.

In contrast, PEM is a methodology developed from a new generation of theory and technology. Whilst also adopting a systems theoretic perspective, it draws from recent scholarship in the system dynamics and learning organisation fields. This leads to an explicit focus on group learning as a key component and provides a set of well articulated tools and processes to achieve this (AEAM asserts group learning but is comparatively poorly equipped to facilitate it). Whereas PEM is vertically integrated with a computer-based system modelling phase, it is not, unlike AEAM, explicitly focused on this. Rather, the facilitated process is designed to deal with management issues using an appropriate level of sophistication. The five stage process (see Figure 5.1) is applied in a stepwise manner, with the group deciding whether or not it is worthwhile to proceed to successive stages.

PEM also involves some very specific and particular guidance with regard to the management of group meetings that are, at best, only implied for AEAM. For example, the independence of facilitators under PEM is explicitly required, but is not asserted for AEAM.

PEM would often involve a greater emphasis on the preliminary system scoping stages (or mud mapping) than AEAM. It is often the case that those participating in PEM may derive sufficient benefit from mud mapping to preclude the need for subsequent computer-based analysis. AEAM would *always* involve the implementation of the computer modelling stage, since the whole process is geared around specifying a computer model.

Finally, the *ithink* software adopted for PEM is highly intuitive in operation, transparent to diverse stakeholder participants, and provides maximum potential for full understanding by all stakeholders. This should be contrasted with the BASIC programming language used in AEAM, which, despite the claim that "The direct involvement of all participants in the model development de-mystifies computer modelling for those who are not computer literate..." (Grayson and Doolan 1995, p.4), remains a non-transparent representation of the group's ideas, and must take on the characteristics of a 'black box' for many. One can compare the excerpt from the Macquarie Marshes model (Figure 7.5) with the model fragments given in Chapter Five (e.g. Figure 6.18). Whereas the intent of the algorithm is transparent in the latter, one must be a competent programmer to be able to decode the former. It should be noted that the programming code given for the AEAM model is an example of good BASIC programming, using conventional internal documentation. However, it seems unlikely that a person who has had no previous exposure to computer programming is going to be enlightened when confronted with program code such as "`inun(i,j)=0`" (from Figure 7.5).

```
     WATER ALLOCATION MODEL

     REINTIALISE THE # DAYS INUNDATED
10   FOR i=1 TO nrow
         FOR j=1 TO ncol
             inun(i,j)=0
         NEXT j
     NEXT I

     SET INITIAL VALUES
     AnnualFlowToMarsh=0
     AnnualRelease=0
     UnfilledDemand=0
     AnnualAgWater=0
```

Figure 7.5 Excerpt from the AEAM model of Macquarie Marshes

Another area of substantive difference is in the ability of the two approaches to include the 'soft-variables' of the human dimension. Whereas each approach claims the ability to integrate across the economic and social dimensions, AEAM only achieves this in a tokenistic way compared to the ability of PEM to include variables like "commitment to environmental management" and "community perceptions". This critical comment about AEAM is based on the following evidence (and thus might only be applicable to the examples reported).

In the report of the application of AEAM to the Macquarie Marshes, it was asserted that "... the focus of the AEAM model is ... on understanding the dynamic interactions between the various components of a system (for example, ecological, hydrological, economic and sociological components)" (Norris and Jamieson 1990, p.38, brackets in original). However, an investigation of the model code reveals that the model only refers to hydrology, agriculture (including value of production), and marsh ecology. There is NO reference to sociological factors nor other issues related to human activity. Moreover, the actual AEAM model itself was found to confuse participants, and, having achieved its objective of developing a common understanding, "... was formally buried" (Geering 1997, p.2, and Geering 1998, pers. comm.). As an outcome of this case study, it was observed that desirable outcomes such as consensus building do not necessarily require the building of a formal computer model, but that "... a qualitative model may be just as effective and more feasible" (Geering 1997, p.4). This is in accord with the approach taken in PEM, and points to the need for an evolution of AEAM to bring it more in line with the principles underlying PEM.

In the models developed by Grayson and others in Victoria, economic indicators were not even included in the model due to insufficient data (Grayson and Doolan 1995, p.9 and p.17). This was despite the fact that they were identified by the stakeholder groups as important issues! The non-inclusion/inclusion of substantive data-poor issues is an important difference between the approaches. Using the system dynamics approach to modelling, if an issue is important, it goes in the model even if detailed information about the problem is not available. Thus, the model can respond to the best information that *is* available, even if that information is not of ideal quality. This reflects the real-world problem faced by decision makers of having to make decisions in a data- and information-poor environment.

Although the above comments might appear to be relatively harsh on AEAM, it is not intended to discredit or otherwise impinge upon the general utility or reputation of AEAM. The main difference is that PEM has been developed 20 years after AEAM and thus has been able to exploit the latest techniques and theoretical underpinnings. Whereas PEM has evolved from a different intellectual stream than AEAM, there is nevertheless much convergence in terms of objectives and application of modelling tools. In effect, AEAM has already established the principle and potential benefits of using a system simulation approach to support learning about complex environmental management issues; PEM provides a more sophisticated and up-to-date approach that reflects current thinking on genuine stakeholder empowerment and involvement, uses insights into process developed from the learning organisation framework, exploits the possibilities provided by the modelling tools of system dynamics, and bridges the various economic, environmental and sociological issues that must be addressed within a transdisciplinary framework.

7.5 General Observations

PEM provides a substantive methodology to support approaches to IRM and even to the general territory of environmental management where the need to integrate across economic, ecological and social issues has been identified. It is vertically integrated in that it articulates from an informal mud mapping construction stage through to building models for system simulation and scenario testing. It also provides horizontal integration across disciplinary and stakeholder groups.

The need for an effective meta-methodology to advance the transdisciplinary stance of ecological economics has previously been addressed. PEM was developed as an explicit attempt to fulfil this need, and the epistemological foundations of PEM can be construed as developing out of this attempt to clarify the nature of transdisciplinarity as it relates to ecological economics. Returning to the diagramatic conceptualisation of PEM, the final diagram in the series (Figure 7.6) provides an image of the way that PEM might fit into the overall environmental management context.

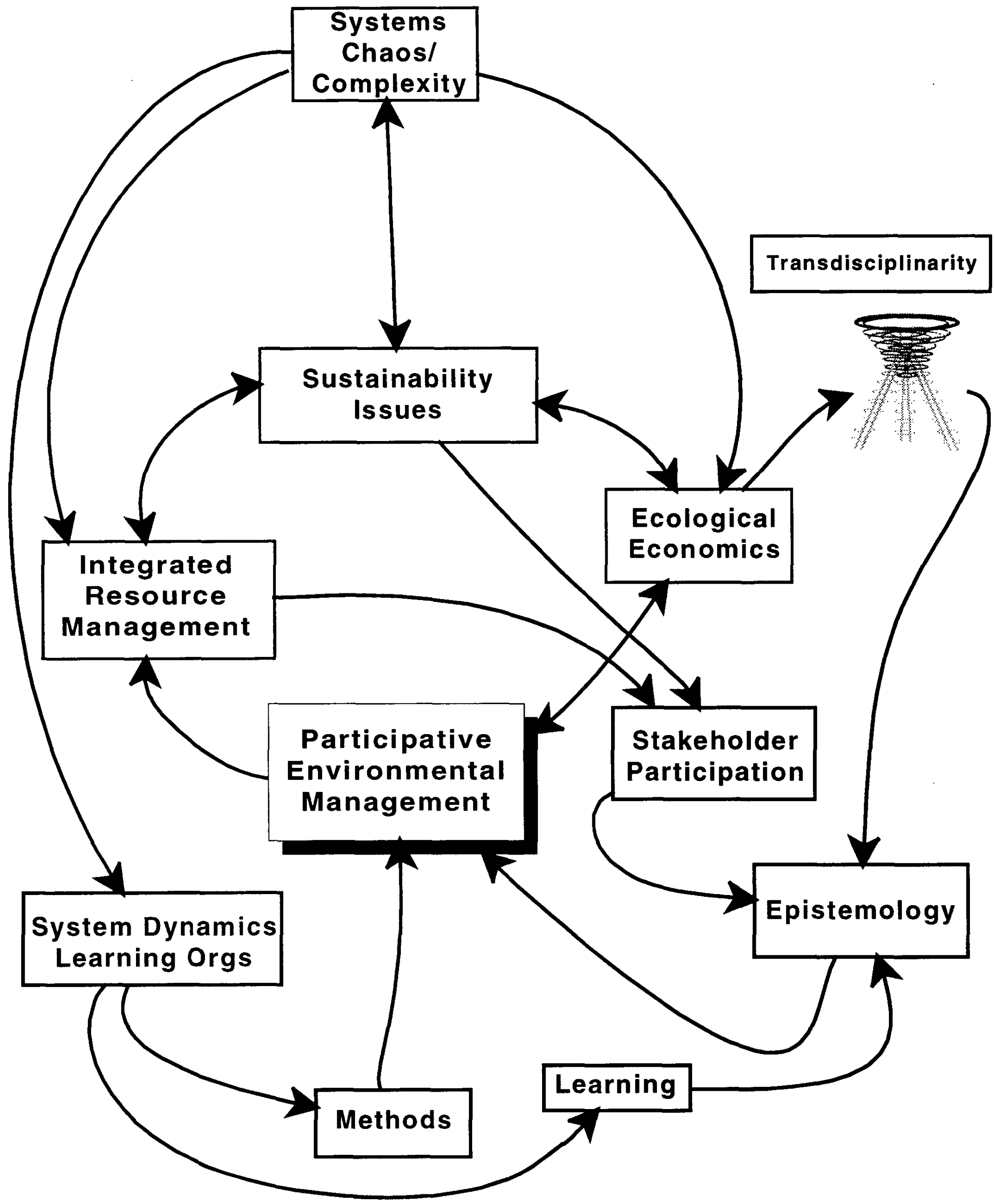

Figure 7.6 Participative Environmental Management – fitting it all together

In the diagram, PEM has taken the position of the 'missing methodology' depicted in the previous diagrams. One important change in the diagram is that there is now a two-headed arrow connecting ecological economics with the methodology. It has been constructed like this to highlight the possibility that PEM may end up influencing the theory and practice of ecological economics, as well as being a product of it (as noted in the report on research priorities for ecological economics (Land and Water Resources Research and Development Corporation 1996)). This idea is addressed further in the final chapter at Section 8.6 "Implications for Theory".

8. Conclusions and Implications

8.1 Introduction

This thesis has been written in the context of two key factors: the need to take an integrated approach to environmental problems; and the concurrent lack of a general consensus about a methodology for achieving this. The previous chapter contains a detailed discussion of the way that the PEM methodology has been built up throughout the thesis – constructed so as to provide a structured approach to the integrated management of natural resources. The methodology has been critically reviewed in respect of its internal consistency with a transdisciplinary approach. Within the context of the transdisciplinary epistemology that has been developed and in accordance with the insights provided through the case study applications described previously, the methodology appears to be robust. The SWOT analysis reported in the same chapter reflects on the significant strengths of, and opportunities for, PEM, while the identified weaknesses and potential threats are not likely to cause insuperable problems. The point was also made that PEM can be regarded as a next generation articulation of the established AEAM process, although this assertion may require testing through a much larger case study review of contemporary AEAM applications.

In this final chapter, the research problem and research objectives will be revisited, and comment made, in Sections 8.2 and 8.3 respectively, about the way in which the PEM methodology has addressed them. Limitation of the research are addressed in Section 8.4, while Section 8.5 gives some pointers to opportunities for future research. As indicated in Figure 7.5, the new methodology is both informed by, and is designed as an articulation of, ecological economics. It also has the potential to influence the future directions of ecological economics. Moreover, PEM has implications for IRM and related approaches, and may well affect future practice. These implications for theory, policy and practice, are addressed in the final two sections.

8.2 Conclusion about research problem

The general research problem identified in Chapter One was that whereas integration and a transdisciplinary approach are thought to be applicable to complex environmental problems, there is no general consensus on how to put these into practice. This was divided into two related problems: the lack of an agreed methodology within the ecological economics community; and the lack of an epistemology for the transdisciplinary approach that could provide the required methodology.

These research problems were addressed at some length in Chapter Two, where a general paucity of relevant material was observed in the ecological economics and related literatures. Following from the review of the various literatures, the original observations about the research problem are demonstrably well founded. It thus follows that these provide a valid basis for the articulation of the research objectives that have been addressed in this thesis.

8.3 Conclusions in relation to the research objectives

Two research objectives were identified based upon the research problems discussed above. These are now addressed, with comments on how each of them have been achieved in the thesis.

Research Objective 1

> To refine and develop a transdisciplinary meta-methodology, so that it can be readily applied to complex environmental problems. This methodology will be applied in the field of integrated resource management to demonstrate its relevance and effectiveness as an approach to dealing with complex environment problems. Within this context, the proposed methodology should have the potential to result in the effective integration of the economic, ecological and social dimensions to achieve outcomes consistent with those broadly defined sustainability objectives that are at the core of the integrated resource management as well as the ecological economics agendas.

Chapter Five provides an articulation of a methodology (PEM) that has been refined and developed during the course of this research. PEM has been applied to a number of case study examples as reported in Chapter Six, and its relevance and effectiveness for use in the context of dealing with complex environmental problems demonstrated at least in principle. In addition to demonstrating the use of PEM, the case studies served to provide feedback about the process so that it could be improved. The iterative nature of this development process is expressed in Figure 8.1 where the linkages are made explicit.

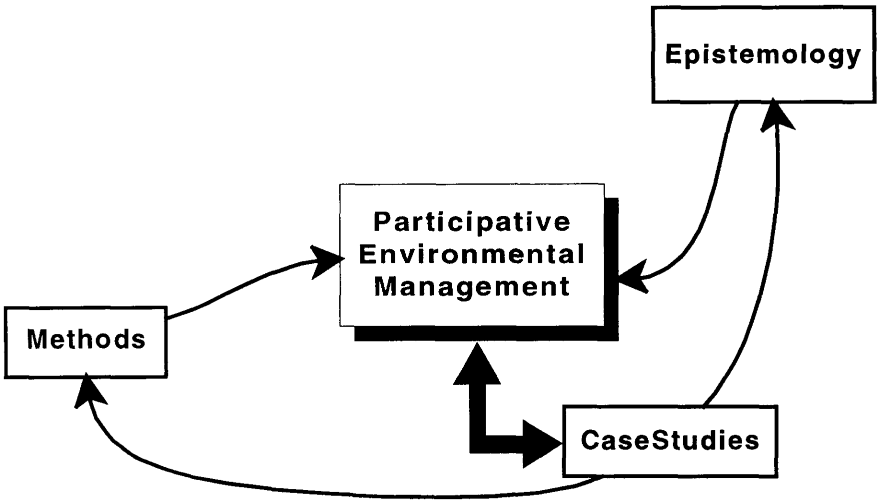

Figure 8.1 The articulation and refinement of the methodology (cf. Figure 7.4)

The above figure shows that PEM has been developed as a synthesis of the transdisciplinary epistemology articulated in the thesis, and the methods adopted from the systems dynamics area. It has been refined and developed through case study application, in which complex environmental management problems needed to be addressed. Information gained and insights generated from the case studies led to a re-evaluation of both the methods employed and the epistemological framework. Thus, the development and demonstration of the methodology have been achieved in an evolving manner, with each influencing the other in a mutually-causative relationship.

The notion of *effective integration* has been discussed and three pointers to effective integration suggested (Section 4.4.3). The use of PEM has been demonstrated within the context of integrated resource management *via* the mechanism of three case studies. In the Throsby Creek case study, the way that PEM can be used to explore and quantify the implications of various policy options within an integrated framework has been explored. In the other two case studies, the ability of the approach to provide a qualitative integrative framework was recorded. Whereas these examples might not prove that PEM facilitates effective integration as discussed in Section 4.4.3, they nevertheless demonstrate that the applications of PEM were congruent with the indicators of effective integration, and feedback from the Malpas Dam catchment community indicates that such integration is occurring. It thus seems that it is reasonable to assert that PEM certainly has the potential to facilitate effective integration across the social, economic and ecological dimensions of environmental problems. It is of course recognised that effective integration can occur without a systematic framework such as PEM, however through the application of the PEM approach, it should be possible to realise such integration much more reliably.

Research Objective 2

> From the specific focus applying to Objective 1, an attempt will be made to develop a set of common principles and methodological recommendations that can be generalised to support ecological economics work relating to areas other than IRM.

There are potentially two major contributions that the present work can make to ecological economics. One of these is the set of indicators of transdisciplinarity which have been developed from a detailed review of the literature. The other is the PEM approach itself. Each of these will now be discussed.

The exploration of transdisciplinarity within this thesis has led to the identification of a number of principles that ought to underpin transdisciplinary work. These have been discussed at length in Chapter Two where a number indicators of transdisciplinarity were articulated. These indicators can be summarised into four general categories as follows: the blurring and melding of disciplinary boundaries; the use of a systems approach; the search for synergistic opportunities; and the harnessing of creative tension. A detailed listing of each category is provided in Appendix C.

This particular perspective on transdisciplinarity is unique in the literature, and is presented as a contribution to scholarship in the area. To date, there has been no mechanism for critically assessing work in the ecological economics tradition with respect to the extent to which it manages to achieve a truly transdisciplinary stance. This lack of a mechanism for structuring or assessing transdisciplinary research may well have hindered the ability of ecological economists to implement transdisciplinary scholarship. Hopefully, the articulation of transdisciplinarity provided herein will go some way towards overcoming this lack and will thus enable advances in the ability of ecological economists to adopt such an approach.

The need for a stakeholder driven, participative learning approach to environmental problems has been explored in this thesis. Such an approach has been identified as an integral part of a transdisciplinary approach to environmental management, and has been explicitly embedded within PEM. The potential of PEM to be an effective approach to complex anthropo-environmental problems has already been addressed at some length.

Whereas the applied focus of this work has been in integrated resource management, a number of similarities between the objectives of IRM and those of ecological economics have been identified, as well as their common links with the literature on sustainability (see discussion in Chapters One and Four). It thus seems reasonable to suggest that a transdisciplinary, integrating approach developed within the context of IRM may be suitable for general application to other sorts of problems encountered by ecological economists, especially those related to ecologically sustainable development. PEM is consistent with ecological economics in that it is a systems approach that is focused on integrating across the economic, social and ecological dimensions of environmental problems. Moreover, it provides a mechanism whereby those with different disciplinary backgrounds can dialogue about a problem, in order to build a common framework of understanding, from which they can explore the potential for synergistic solutions that might emerge from their new shared knowledge. In this way, a transdisciplinary approach to such problems can be supported.

8.4 Limitations

The PEM methodology is difficult to describe. Experience has shown that attempts to communicate its efficacy using the written word are likely to be poorly received. One possible reason for this is that it is difficult for the reader to locate PEM within the more conventional expert-based paradigm of disciplinary research which often prevails within IRM and other approaches to environmental management. In a world where the written word dominates the transfer of information, this is a critical issue. PEM is premised on experiential learning and a stakeholder-driven consensus approach to problem solving. These are concepts that are largely foreign to most empowered decision makers, and it is thus difficult to communicate in writing the potential benefits of the approach. The main strategy employed to overcome this problem has been to engage people on a direct basis, talking about their environmental management problems and exploring their interest in alternative approaches. This generally proves quite effective, and is the way that the present funded projects involving PEM have been developed. As more instances of the use of PEM become known, it is hoped that the 'word of mouth' recommendation method will lead to an exponential growth in the application of the approach.

Another limitation has to do with the modelling component of PEM. In recognition of the need to be inclusive of all stakeholders, the modelling software selected to do the modelling has the feature of a transparent modelling language that is relatively easy to understand. Through the development of a model that is vertically integrated with, and inclusive of, the stakeholders, it is possible to simulate various scenarios and thus to test different policy options. The model will include a variety of elements drawn from the economic, ecological and social dimensions of the system under management, and these are allowed to interact so that desired policy options can be tested within an holistically-derived simulation environment. This "management flight simulator" approach was described within the documentation of the Throsby Creek case study. This analytical technique supports the learning of the stakeholder group so that they are able to implement policies and management strategies based on a good understanding of the way that the various factors interrelate.

Although the modelling approach is highly effective in capturing diverse information, it will nevertheless inevitably be constrained by available knowledge, and if this is inadequate, then poor guidance will be received. In this case, it is the inadequate understanding that ought to blamed, not the methodology.

> The model is simply (1) synthesizing and (2) drawing out the implications of current understanding. When interactions become very complex, modeling is about the only tool for augmenting mental faculties and examining implications. The model, correctly scaled and formulated, is at least a faithful servant of ignorance.
>
> (Cairns and Crawford 1991, p.40)

However, this limitation may well be a disguised advantage of PEM. The modelling approach means that where uncertain assumptions and relationships are part of the system, they must be made explicit if they are to be modelled. Users have the opportunity to explore the quantification of relationships as "matters of fact" or "matters of conjecture", and to identify each explicitly. Should it be decided that a particular poorly understood system relationship is highly significant to the overall problem, the group could then decide to allocate this a high priority as a research agenda. PEM can thus function as a research prioritisation mechanism so that IRM groups can identify important research that needs to be supported.

8.5 Implications for further research

There are a number of opportunities for future research that are emergent from the present work. A short discussion of each of these follows.

As discussed in the previous chapter, it would be interesting to develop a technique to assess whether the systems approach inherent within PEM will actually result in outcomes that evidence synergy, and to be able to estimate the overall benefit of capturing that synergy. The ability to quantify this effect, would even if only roughly, be an important enhancement of the methodology, and would allow the potential benefits of its use to be conveyed more effectively. Related to this is the need to test the methodology for efficacy in comparison to alternative approaches that are, or might become, available. Such research could involve the undertaking of 'twinning' studies in which alternative approaches are used in different catchments that have similar characteristics. However, it is not clear that it is even possible to test the relative efficacy of an approach like PEM which is so context-dependent in its application. Indeed, it is likely that any such research would need first to identify an appropriate methodology, which task may well compromise a significant research project in its own right.

PEM has been developed for use at the regional or local level where it is feasible to assemble in the one meeting a group of stakeholders who are generally representative of various aspects of the system. However, it would be virtually impossible to achieve such a stakeholder meeting where the problem under consideration is on a national or global level. Early investigations point to some modifications that could be made to PEM so that it would be amenable to such large scale participative approaches. Given the emphasis on the need for stakeholder involvement in dealing with environmental problems, the extension and adoption of PEM so that it can handle larger scales would be a worthwhile research agenda. A possible methodology that could be adopted so that larger scales of enquiry can be addressed is that of a "policy Delphi" as articulated by Vennix *et al.* (1994). This technique is a hybrid between stakeholder workshops and remote knowledge elicitation using written feedback from participants.

The functioning of a facilitated stakeholder group in such a way that consensus is often achieved is an interesting aspect of PEM. There are a number of sociological and psychological phenomena involved, and the potential exists to explore these further. If the facilitation techniques that are employed could be analysed and described by someone trained in the relevant disciplines, it would enable a much easier extension of the techniques to others.

A drawback of PEM that has been identified in Section 7.3.2 is that is deals with generic, non-spatial issues. It could be useful to explore ways in which PEM could be extended so that explicit spatial factors can be addressed within the overall learning framework. This issue is presently being addressed in part as a component of a research project entitled "Integrated Strategic Flood Mitigation Planning: A practical transdisciplinary decision support system" (previously described in Section 7.3.3). One of the objectives of this project is to explore ways in which information from a GIS can be utilised alongside the strategic planning functionality of PEM.

Finally, the reason that stakeholder involvement is a prescribed as part of PEM is that the system theoretic perspective demands that system agents be involved in managing the system. This is distinct from a political science approach in which community participation is advocated from a sense of fairness, or occurs as people attempt to assert their own point of view (see discussion at Section 2.3.3). It would be interesting to explore the possibilities for genuine public involvement that are offered by PEM from a political science perspective. In particular, how do notions of participative democracy fit with PEM, and/or to what extent is PEM an effective implementation of such notions?

8.6 Implications for theory

The present work has clear implications for the theoretical basis of ecological economics. This 'transdiscipline' is now more than a decade old, but as yet no serious attempt has been made to articulate a systematic transdisciplinary approach for research and practice. That is, there is little guidance on how to "do" transdisciplinarity. For a field which is predicated on the notion of being transdisciplinary, this represents a significant barrier. The transdisciplinary methodology articulated herein clearly has the potential to contribute to this area. For the first time in the context of ecological economics (at least to the knowledge of the present author), epistemological foundations have been articulated that could form the basis of future transdisciplinary research. Moreover, these foundations might also lead to the identification of further new techniques and methods that have previously not been forthcoming due to a lack of a structured methodology. It is intended to publish the work on transdisciplinarity within the ecological economics literature, with a view to generating debate about this issue. It is hoped that such debate will result in improvements in the epistemology, and a greater interest among ecological economists in understanding the importance of transdisciplinary work. Overall, this could lead to a shift in emphasis within ecological economics, with more attention paid to issues of stakeholder involvement, learning and the transcendence of disciplinary boundaries – a situation implied by the arrow pointing towards *Ecological Economics* from *Participative Environmental Management* in Figure 8.2.

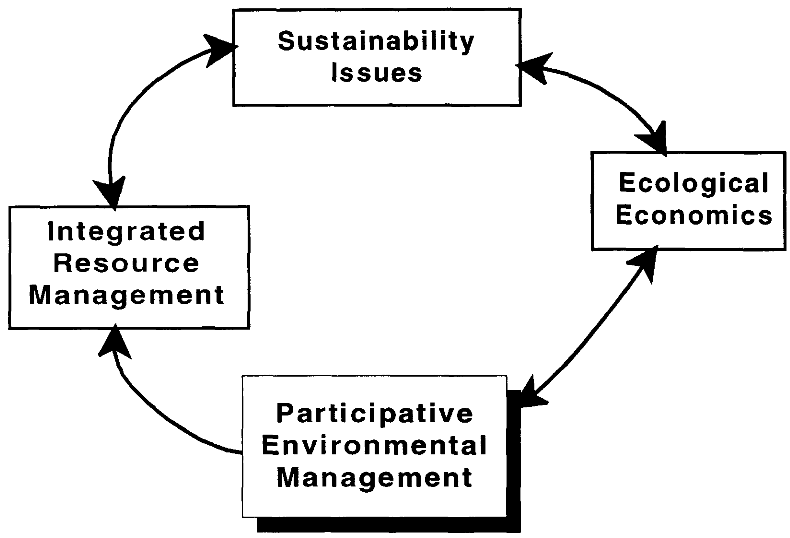

Figure 8.2 Implications for theory and practice (cf. Figure 6.5)

8.7 Implications for policy and practice

Through ongoing applications, PEM is proving to be highly portable and applicable to many areas of environmental problem solving in addition to those within IRM. It means that the often heard call to "take an holistic approach" can now be adopted in a pragmatic way. This has major implications for the alternatives society has when it comes to tackling complex public management problems. The explicitly transdisciplinary foundations, along with a focus on stakeholder participation and a comprehensive methodology to support this, means that PEM can provide a more structured basis than is presently available for tackling environmental problems.

Using the techniques built into PEM, it is now possible to address policy questions, particularly for regional and local scale problems, in a much more holistic and inclusive way than has generally been achieved previously. In fact, as indicated during the discussion on "opportunities" in Chapter Seven, a number of present applications of PEM were described. Each of these represents a real impact of the way that policy issues are being addressed.

In terms of the diagram at Figure 8.2, PEM is seen to have an influence on IRM as well as ecological economics. Whereas IRM (and the related IEM and ICM) explicitly advocates the inclusions of stakeholders within the integrated management process, there is no generally accepted method on how this might be achieved (AEAM provides support in this area but is not widely adopted). Since PEM advocates such stakeholder involvement, and argues for it from a systems theoretic and learning organisation perspective, it provides a substantive theoretical basis from which to support such involvement. This could provide an important adjunct to present practice in the IRM field.

To the extent that IRM and ecological economics are changed by PEM, they in their turn will have an effect on the way that sustainability problems are addressed. Hopefully, this will lead to better quality decisions in which the full range of social, economic and environmental issues are accounted for in an integrated manner.

Of course, as the PEM methodology is applied in its own right, it will have a direct impact on the way that environmental issues are handled (Figure 8.3). As well as having the potential to influence the conduct of both ecological economics and IRM, PEM is proving to be a powerful toolbox for application to many and varied environmental problems. It is hoped that the journey towards sustainability will be made a little easier through the conceptual and practical innovations within PEM.

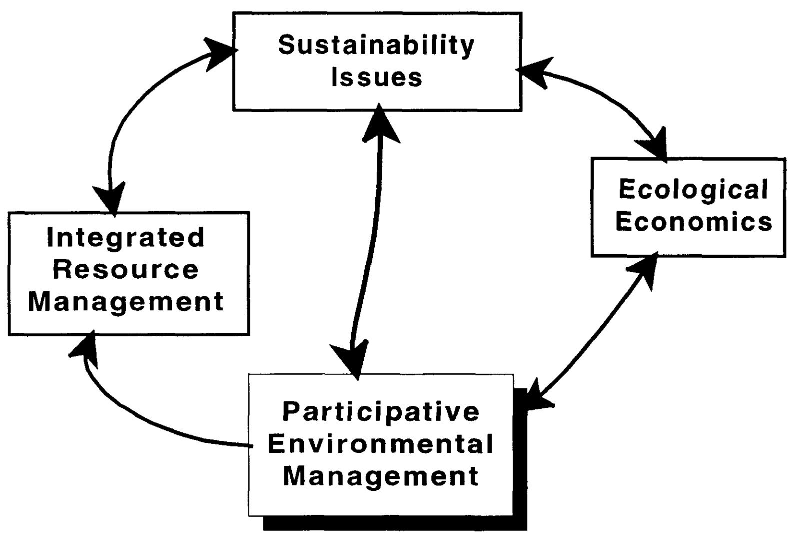

Figure 8.3 PEM – directly influencing sustainability