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METHODS

Ecological economics as a policy science: rhetoric or commitment towards an improved decision-making process on sustainability

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Abstract

With sustainability issues currently attracting increasing political and policy attention, this paper examines the impact of the rise of ecological economics in the policy world and its potential influence on the decision-making process. This study emphasises that ecological economics development is coevolved with, and modified to fit, specific social, economic, political and cultural contexts. As a policy science, ecological economics is context-sensitive and action-oriented. Explaining why it is so, and what to do about it, has become imperative for ecological economists. This paper attempts to address the questions such as: What are the macroeconomic conditions and political processes that make the formulation and implementation of ecological economic policy possible? How should this alternative social reality engage with the dominant decision-making process? Does ecological economics provide the necessary means for prescribing policy measures to achieve sustainable development? Endeavouring to understand these dimensions of ecological economics has been a dynamic social process, and understanding this complex process might provide an opportunity to bridge the divide between policy rhetoric and reality in practice rather than maintain the status quo. In order to achieve an improved decision-making process on sustainability, it highlights the imperative to explicitly study the institutional setting through which sustainable development policy discourse is mediated.

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The philosophers have only interpreted the world, the point however is to change it. Karl Marx

1. Introduction

As the default vision of continued, unlimited economic growth was increasingly questioned in the light of the rapid depletion of natural resources and

degradation of the environment, the search for absolute, or near absolute, ‘truth’ was gradually replaced by the more pragmatic goal of producing ‘reliable’ knowledge (Daston and Galison, 1992). The emerging field of ecological economics has shifted the focus of the debate on natural resource scarcity from limits to economic growth to sustainable development (Hussein, 2000), which reflects an epistemological change from a belief in the objectivity and certainty of the scientific truth to the recognition of the limits of human knowledge, the need for a contextual view of reality and the need for dealing with uncertainties (Naveh, 2000). All knowledge, scientific or otherwise,

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is produced within a particular culture and set of social arrangements. Members of a society are bound together by shared intellectual orientations, values and perceptions; in most cases they also have common material interests. In this sense, the production of knowledge has become, even more than in the past, a social activity (Nowotny et al., 2001). “By proposing that the various positions within the environmental debate are narratives or stories within a discourse, ‘meaning’ is then not subject to a fixed and final interpretation, but can instead be understood as culturally derived and context dependent” (Meppem and Bourke, 1999, p. 391). As an attempt to integrate the perspectives and methods of social and natural sciences, ecological economics has unfortunately taken its cue more from the natural science end of the spectrum as in thermodynamics and the analysis of material flows. In this regard, Jacobs (1996, p. 14) has termed ecological economics as ‘socioecological economics’ and argued that “economics must be more than ecological. It must be socioecological. That is, not only must the biophysical bases of economic activity be understood, but so must the sociological and political. Economic activity involves the transformation of physical materials and energy, but this occurs through the medium of socioecological structures, the understanding of which is equally important to economic analysis”.

Sustainability issues are currently attracting more and more political and policy attention throughout the world. Sustainability requires clearly understanding the way people and their institutions interact with ecosystems, and it has meaning only in the context of specific temporal and spatial scales (Costanza et al., 2001). Ecological economics has provided an alternative perspective (i.e., to view economy and humans as subsystems of ecosystems) on human–natural interactions. This is an important first step towards effective policies for sustainability. Although the importance of this perspective has been addressed in ecological economics, its implications for policy-making remain elusive. It is important to recognise that the evolution of ecological economics is inseparable from matters such as ideology, institution, culture and society. Current policies developed by a society for sustainable development have reflected the distribution of political–economic power of interest groups within that society. Having a

broad understanding of the political economy nature of this policy process becomes an essential prerequisite for the development of ecological economics as a policy science towards improved decision-making on sustainability. With this in mind, this paper attempts to outline some general ideas on the impact of ecological economics on the contemporary policy world and its potential influence on the decision-making process in a world of evolving and coevolving systems and uncertainty.

2. Limits to the current scientific and policy process

2.1. *Blurring of the line between scientific inquiry and political intervention*

Scientists and politicians more often than not hold divergent views on the role of science. Some scientists value scientific research for its own sake. This curiosity-driven orientation has often been interpreted as indifference to a society’s urgent need to find answers to pressing problems. On the contrary, politicians value science in terms of its tangible benefit for solving identified problems in society (Ford, 2000). This divergence reflects underlying differences in the methods and goals of scientists and politicians. Feminist discussion of epistemology and standpoint theory suggests that this dualistic thinking about science and society can and should be replaced with a fuller picture of human identity and knowledge (e.g., Harding, 1986; Ferber and Nelson, 1993; Nelson, 1997). In addition, constructivist epistemology recognises that scientific inquiry is value-bound (Tacconi, 1998). It would be mistaken to view individual undertakings as somehow beyond the influence of the strong social context in which they operate. As Kenny (1994, p. 17) has emphasised that “there is no value free, objective interpretation of society, and that all intellectual, practical and personal actions are guided by values and interests”. The culture-value-political-free science exists only in what Kuhn called ‘text-book science’. In reality, scientific inquiry is not wholly objective but is partly shaped by the social context in which it is conducted. There are two dimensions, internal and external, to the qualifications of science. ‘Internal’ criteria reflect the structure of a

particular field, the extent to which a scientific field is ripe for further development and its relationships with developments in other fields. These criteria are matters to be judged solely by scientists. In contrast, ‘external’ criteria (e.g., the social, economic, political and cultural benefits of pursuing a particular line of research) are left to the judgement and decision-making of ‘external’ experts whether from industry, government or society at large (Weinberg, 1963). Another term refers to ‘credentialed experts’ versus ‘local experts’ whereby credentialed expertise comes with the blinders of a particular disciplinary perspective and assumptions (O’Hara, 1999, 2001).

The emphasis on problem solving in the context of application to socially identified priorities tends to erode the independence of academic researchers and, consequently, weakens their defences against external influences. As a result, the scientific agenda tends to grow from political developments rather than from scientific findings. Scientific research for its own sake could only be realised if scientists were free to set their own agendas unhindered by political and/or market considerations (Nowotny et al., 2001). From a discursive ethics perspective, scientific reasoning is inseparably linked to and informed by the human experience of a social, cultural and ecological life world, which constitutes the context of human experience. “Discursive ethics is a communicative process in which discourse participants share their concerns, expecting mutual acceptance and respect for their positions. . . Discursive ethics can neither take place in isolation nor can it be purely theoretical. It needs to be practiced, and in its practical dimension it is undeniably political” (O’Hara, 1996, p. 97). Politicisation of science has always been integral to political advocacy. However, political decisions that involve different interest groups are inherently difficult to make, because any adopted policy is bound to infringe on someone’s interest. Thus, the process of achieving a legitimate outcome necessarily involves bargaining, negotiation and compromise. In this sense, knowledge, especially social science knowledge, is subordinated and instrumental. Ideological and political concerns become not merely objectives of study but also various inputs for theorizing in social science (Shi, 2002a; Pickel, 2002). As a result, rather than making politics more scientific, this approach makes science more political. As science becomes another

playing field for ‘power politics’, much of what it can offer policy-makers, and hence society, is being lost (Pielke, 2002).

2.2. *Ideology and policy choice*

“Today’s scientists need to understand the consequences for science of relying on political advocacy as the primary mechanism of connecting science with policy” (Pielke, 2002, p. 368). Ideology remains an important aspect of policy formulation and evaluation of performance. It would be unviable to try to carry out objective and/or detached analysis because “when the research process considers policy issues, detached analysis may result in irrelevant analysis and/or policy inaction” (Tacconi, 1998, p. 103). In this regard, issues of worldview and ideology can no longer be assumed given or excluded from policy analysis. The process of policy development and implementation in existing institutional settings is clearly a political concern, however these processes are not well understood. Since every political action (no matter whether driven by private interests or a real interest in the common good) can be represented publicly in a way that seems to pursue only the goals of justice and the common good, solely private interests are always hidden behind all publicly proclaimed aims (Mueller, 1989; Faber et al., 2002). In a ‘fog of politics’, one can generally count on policies being badly formulated and/or badly executed (Andersson, 1991).

Science as a social institution has its own political–cultural structure. Frequently, political advocates selectively use and misuse scientific data to support their agenda. “The use of agenda power is intentional, and those exercising it are aware of what they are doing” (Gale, 1998, p. 135). It needs to be noted that in many situations economic analysis tends to get ignored or manipulated to achieve political ends, particularly for environmental issues that have political saliency (Goulder, 1995). The existing imbalance of power in society has offered vested interest groups the opportunity to put their individual and short-term interests ahead of the collective and long-term interests of the whole society. As Shapiro (2001, p. 60) points out, “‘knowledge’ based on wishful thinking was given primacy over the tested understanding of scientists”. For example, since the state-sponsored Three Gorges

Dam project is of unusual political importance, its devastating environmental impact is not subject to the possible scrutiny of China's environmental laws. Instead, the problem has been treated by national leaders as a policy issue and as a matter of less importance than that of flood control and power generation (Jing, 2000). MacNeil (1989) stresses that government alone cannot provide the basis for making informed decisions about environment and development.

Because of the close connection between ideology and action, the ability to articulate the ideology becomes crucial in setting the parameters and the content of political activity. Nevertheless, narratives are not constructed or interpreted in a social and material vacuum. As Foucault (1980) has implied, the rhetoric of a dominating narrative will reflect the rhetoric of the dominating power structure. Relations of domination are produced through the unequal empowerment of one kind of knowledge or way of knowing through the use of language and bureaucratic control (Nowotny et al., 2001). Within discourses, certain voices are louder than others and consequently marginal narratives will become subordinate to established dominant narratives (Prakash and Gupta, 1997). Ideology therefore provides a rationale for action. "The legitimacy embodies particular values and ways of knowing that include and exclude various arguments in the policy process, leading to the building of support for the various policies and programs already developed" (Meppem, 2000, p. 51). It is evident that there is a gap or discrepancy between officially promulgated ideology and actually implemented policy. The analytical distinction between pure and practical ideology has provided an approach for explaining apparent conflicts between the ideal world and the reality (see Chen, 1995 for an elaboration).

2.3. *The inadequacy of science for decision-making*

"Assessing the significance of science for policy requires a clear distinction of policy analysis from political advocacy. The former increases the range of alternatives available to decision-makers by clearly associating scientific results with a range of choices and outcomes. The latter seeks to decrease the range of alternatives (often to a single desired outcome).

Because scientific results typically have a degree of uncertainty, and because a range of alternatives can achieve particular policy outcomes, commitment to a particular policy involves considerations that go well beyond science" (Pielke, 2002, p. 368). In this sense, the precautionary principle is regarded as relevant and important in dealing with uncertainty. Mainstream practitioners regard conventional economic theory and method as a fruitful philosophical basis for decision-making and resource management (Söderbaum, 1992). In general, this economic way of thinking argues that public policy should be determined for the purpose of achieving efficient use of resources to maximise production and consumption, not for the moral desirability of the physical methods and social institutions used to achieve this end (Nelson, 1995). This perspective tends to over-value the possibilities, capacities and potential of neoclassical economics. In fact, neoclassical economics fails to address the relationship between environmental degradation and the distribution of wealth and power, and environmental policies built on this perspective tend to promote the welfare of rich households at the expense of poorer households (Leith, 1995; McMahon, 1997). From an epistemological perspective, it would be unwise to build a science on the basis of a limited intellectual behaviour. An important lesson for policy-makers is to avoid ideologically based policy measures that rely exclusively on deductive 'economic' models based upon a neoclassical perspective. In this regard, a variety of perspectives and alternative methods are required to be taken into account in the policy analysis and development.

As science has been increasingly used in policy formation, its role has become more controversial. More attention needs to be paid to the research into the institutional setting of the policy decision-making process. Analysis and decision support procedures for policy must find their place within sociopolitical processes where conflicts emerge and must be resolved between people holding different values. Priorities for policy action depend partly on estimates of the economic and social costs of responses, and partly on judgements made on the basis of interests and power structures, of scientific information and on ethical grounds about the urgency of response (Faucheux and O'Connor, 1998). This means that analytical work in support and evaluation of policies needs

to proceed in recognition of social controversy, uncertainties and plurality of decision criteria. It thus calls for a new interface between science and policy that stresses the continuous updating of knowledge as well as improved communication of risk and uncertainty. Funtowicz and Ravetz (1991) have identified three ‘problem solving strategies’ for science as it is applied to inform policy: (1) microproblems would only require ‘applied science’ for resolution; (2) meso-issues require ‘professional consultancy’; and (3) macro-issues require ‘post-normal science’.

Normal science is often not at the level of understanding necessary for the integration of findings into current methods of decision-making. As a response, post-normal science needs to be developed with a method of integrating knowledge over a larger more heterogeneous area and extrapolating site-specific findings for policy-makers to develop spatially distributed policies (Funtowicz and Ravetz, 1994; Wolosoff and Endreny, 2002). However, real-world problems cannot wait for consensus or the full development of a science, with all the uncertainties that are entailed (Pearce, 1998). This time lag renders necessary scientific information unavailable to policy-makers. Recognising the existence of scientific uncertainties, the justification for any particular policy would depend on more than what science alone is capable of providing. Social science has no authoritative or privileged answers to the political and other normative questions posed by practical problems of policy-making. The widespread, though dishonest use of science for the legitimisation of political claims and normative positions is an example that it has been instrumentalised in political debate (Pickel, 2002). In this sense, science alone is not sufficient to provide a basis for decision-making. “It is urgent that the scientific community changes if it is to prevent science’s contribution to effective policy development from being diminished, and the practice of science from being compromised” (Pielke, 2002, p. 367). Science itself is increasingly challenged by forms of knowledge production, which are subsumed under the term ‘research’, epitomizing its potential for innovation and exhibiting its attraction to politicians and policy-makers (Nowotny et al., 2001). Consequently, more stakeholders and diverse disciplines are encouraged to participate in the policy process. Appropriate policy settings thus need to be established

to ensure that scientific results are appropriately used in policy analysis and decision-making. Moreover, decreasing response time in science to policy will empower well-informed policy-makers to apply the latest peer-reviewed knowledge in developing an effective approach to emerging problems (Wolosoff and Endreny, 2002).

3. Ecological economics as a policy science

Costanza et al. (1991, p. 6) have emphasised that ecological economics research “should not be divorced from the policy and management process, but rather integrated with it”. As a critique of mainstream economic practice, ecological economics is focused on economic theorising for practical policy issues. It is action-oriented to link theory and practice by facilitating the influence of theoretical insights in decision-making processes. This is, of course, a difficult task to realise. In placing environmental management and policy issues in a broad context that integrates human behaviour within ecological and economic systems, ecological economics promotes an alternative conceptualisation of economic development that takes account of resource and environmental limits. However, new ways of thinking and acting are often not situated easily with the modes of instrumental, linear and narrowly scientific ‘problem solving’ that permeated much current decision-making. And research on decision-making is marginal to the social sciences (Clark and Marshall, 2002). Although developing knowledge is a necessary, if not sufficient, condition for improving management of sustainability, ideas and knowledge alone cannot change the world dramatically since other important factors (e.g., power structures, conflict over choice, access to resources and material conditions) determine the course of development and change (Vedeld, 1994).

As a ‘policy-driven science’, ecological economics attempts to identify the structures and processes, which form the relationship between humans and the environment. However, it would be impossible to properly understand the human–natural relations without relating it to the power structures between humans in society. Ecological economics research should incorporate social power relations (Gale,

1998). This social learning process might help to improve the quality and wisdom of the decisions when confronting complexity, uncertainty, conflict and paradox. Ecological economics attempts to define a tractable approach to real-world problem solving. In other words, it tends to deal with policy issues not only in theory but also in practice. A key policy role of ecological economics is to provide the intellectual background of concepts, orientations and intellectual generalisations that inform policy. In particular, it focuses on clarifying distribution issues and identifying trade-offs in policy development. Ecological economics proposes to integrate the ecological and social externalities of the dominant economic rationality into the paradigms of political economy, and to insert the ecological dimension into the planning practices of governments (see, for example, O'Hara et al., 2000; Erickson and O'Hara, 2000; O'Hara, 2001). While the significance of ecological–economic interaction has been addressed, its implications for policy-making remain elusive.

3.1. *Scientific knowledge and policy recommendation*

Traditionally, it was assumed that the problem under investigation could be accurately identified by researchers and policy-makers. However, there is only one possible version (interpretation or construction) of the problem, which is determined by the 'system' (e.g., institutional, organisational, disciplinary and economic) and associated worldview (Ison et al., 1997). A critical realist approach to epistemology recognises that knowledge is always a provisional outcome of a social practice, but at the same time insists that the knowledge so constructed has an object that exists independently of thought about it (Collier, 1994). This perspective has challenged the conventional epistemological assumptions and methodological procedures that represent knowledge as reflection of an exterior reality that need only be observed and recorded. Instead, it is argued that ecological economics itself should be understood as a method of inquiry that has been shaped by the very social relations it seeks to explain. The inquiry of ecological economics stressed modes of behaviour and action that lie outside formal governance structures, as well as the sociocultural factors that support prevailing political–economic systems (Söderbaum, 2000).

The response type of science and policy is differentiated by the methods and objectives used in obtaining scientific knowledge and shaping policy determinations (Wolosoff and Endreny, 2002). Ecological economic issues are complicated by powerful social and political interests that not only have high stakes associated with alternative policy outcomes, but also employ scientific experts to support their positions. Thus, ecological economics needs to address the distinction between scientific findings and policy advice. In general, ecological economics attempts to make contributions in: (1) scientific issues (e.g., establishing an historical perspective on social–natural interactions; finding a common language and set of concepts for the analysis of economies and ecosystems; and offering an area of intersection between natural and social sciences) and (2) political and ethical issues (e.g., a forum and structure for policy analysis; a framework for the ethical analysis of inter-temporal and interspecies choice; and the influence of decision-makers) (Faber et al., 1996). These efforts are particularly important as ecological economics is used not only to answer agreed questions between scientists but also to influence people's values and persuade policy-makers to believe a social, economic and ecological sustainability standpoint. As Spash (1999, p. 423) points out, "the central objectives [of ecological economics] are to combine knowledge across the specialist areas of ecology and economics and see that policy advice on environmental problems be formulated on this basis".

"Ecological economics recognises that ecological and economic rationality are not sufficient to lead to correct decisions, thus environmental decisions must be taken by using a democratic scientific–political decision process" (Munda, 1997, p. 228). Policy-making is a constant discursive struggle, and ecological economics supports different interests in the policy process (Fischer and Forester, 1993; Costanza, 1996). Some work has been done on what constitutes a productive and ethical discourse as opposed to a manipulative discourse (see, for example, Habermas, 1984; Renn et al., 1995; O'Hara, 2001). Traditionally, scientific research findings are presented in a form that is often not compatible with necessary improvement to the policy-making process. This has moved scientists toward experimentation and data analysis

without consideration of real-world needs, and has facilitated policy decisions that are often based upon outdated knowledge and technology (HELP (Hydrology for the Environment Life and Policy), 2000). The policy implications are that if ecological economics did offer a competing paradigm, then it would expect to find not only an alternative view of economy–environment interactions, but also a different set of implications for sustainable development policy. “[S]trong contextualization thrives on communication, a good deal of opportunism and opportunities, and continued interaction with, if prolonged sufficiently, may lead to new approaches or to the definition of new problem-areas. It is in the nature of such interactions that the beliefs of policy-makers and the public may be shaped by scientists, but the latter are also not immune to the projections of scientific and technological advance which policy-makers may have” (Nowotny et al., 2001, pp. 131–132). By virtue of the theoretical as well as the empirical interests, ecological economics has more to contribute than just ‘the facts’. The focus of policy should be technological and institutional measures to reduce the throughput of matter and energy from the environment into the economy and returning into the environment (Turner et al., 1997). In addition, it must take into account institutional conditions that allow us to arrive at decisions on complex problems and that power, information inequalities, and cultural biases of ‘hard facts’ versus ‘soft values’.

Scientific institutions, actors and practices are embedded in a larger political and institutional context. As a result, the scientific community is an area where the role of the scientists becomes unavoidably political. Since policy-makers do not typically revisit policies for their relevance to the latest scientific findings, it is important to make scientific practice self-aware in a policy-relevant way. To become a problem-oriented, policy-relevant science, ecological economics has been challenged to become more involved in the policy-process in order to prevent it from becoming “an elegant and largely irrelevant discipline” (Viederman, 1994, p. 467). Response types of scientists and policy-makers differ in the spatial domain: scientists tend to conduct research within small homogeneous study sites, whereas policy-makers work toward one generalised rule or regulation to be applied over a large geopolitical region.

Moreover, changing biophysical and social dimensions are posing a moving target for science and policy. This calls for the coordination of science and policy (Wolosoff and Endreny, 2002). Ecological economics provides a new way of thinking that scientific consideration and ethical and political judgements necessarily bear on each other in the evaluation of possible policies and courses of action. Decision-making for sustainability in this way can be understood as a collective argumentative process, with different questions and possible priorities put forward, evidence gathered and arguments built for and against different positions (Faucheux and O’Connor, 1998). “The decision process would thus conform to a sort of procedural rationality, taking place through an iterative process of trade-offs and compromises with the aim of ending up with a solution that is satisfactory in terms of economic, social and ecological imperatives” (Funtowicz et al., 1997, p. 90). Key to this process is to make sure that diverse groups of actors are engaged in the assessment process, particularly those voices that are commonly unheard have a place at the table (O’Hara, 1995, 1999). This implies that political action based on this kind of policy process may offer the opportunity to adopt environmentally sound alternatives (e.g., the adoption of ecological agriculture in China; see Shi, 2002b, 2003).

3.2. *Trans-discipline and trans-science*

“While many environmental economists would accept the relevance of considerations outside their analysis, they claim to leave these to the mythical ‘decision-maker’. The potential of ecological economics is to include these as essential aspects of analysis” (Spash, 1999, p. 432). Ecological economics attempts to improve scientific understanding of the natural and social processes relating to human interactions with the environment and at the same time providing information useful to decision-making on sustainable development (Shi, forthcoming). The difference between pure science and ecological economics is that research in ecological economics is issue driven, and therefore the components of a synthetic framework will be prescriptive rather than descriptive or explanatory (Smith, 1997). Conventional disciplinary thinking in policy circles limits the capacity of decision-makers to unravel the com-

plexity of all real world environmental policy and management problems. The merits of an ecological economics trans-disciplinary perspective are to facilitate the reconciliation of currently divergent opinion and policy processes (Meppem and Gill, 1998). An extended ‘peer community’ is therefore necessary for the effective quality assurance of the scientific inputs into the decision process aiming to help in resolving social conflicts and environmental distributional choice (Costanza et al., 1996).

“Ecological economics is at present only one of a number of integrative enterprises attending sustainability problems, and the nature and scale of those problems justify and demand a diversity of approaches. For now, ecological economics would do best to remain diverse and evolving, and to seek additional perspective outside of its existing catchment” (Dovers et al., 2003, p. 9). It should be noted that as ecological economics expands to address complex issues such as sustainability, the field itself will change as it is exposed to a larger domain. As a policy science, ecological economics cannot be validated as reliable by conventional discipline-bound norms; it must be sensitive to a much wider range of social implications. Strong contextualisation requires a common understanding about the nature of an issue or problem and of the role of research in dealing with it. By treating research as a social and political activity, rather than a strictly ‘scientific’ one, it may be possible to develop a trans-disciplinary framework that is also socially and politically relevant (van Kerkhoff, 2001). Trans-disciplinary research implies an enlargement of the number of participants in research and the widening of what is defined as research. Ecological economics emphasises trans-disciplinary research that transcends narrow disciplinary boundaries for solving problems which brings together the efforts of scientists, policy-makers and local people in the process (Shi, forthcoming).

Ecological economics is action-oriented as it responds to the requirements of sustainable development. As Meppem and Gill (1998, p. 124) argue, “it is now time to move beyond the need for consensus on the normative meaning of sustainable development and to focus instead on practical process”. It is important to note that, when sustainable development becomes a social and political

movement, it is not just confined in fields of scientific inquiry. Sustainable development is essentially a ‘trans-science’ problem, which involves questions that can be asked by scientists but cannot be answered entirely by science (Miller, 1993). Scientific positivism cannot adequately address the political and cultural issues concerned when designing action for sustainable development (Hutchcroft, 1996). Ecological economics promotes the application of a holistic systems approach to understanding the relationships among the natural and human components of sustainable development. Under contemporary conditions, the more strongly contextualised a scientific field or research domain is, the more socially robust is the knowledge it is likely to produce. This has led to the emergence of a socially distributed system of knowledge production, which is no longer confined to knowledge bases organised strictly along disciplinary lines. A socially distributed expert system needs to create and nourish a truly pluridisciplinary knowledge base, which in turn can develop trans-disciplinary methods of translating knowledge into action (Nowotny et al., 2001). Ecological economics offers the potential for individuals to be specialist in one area while being mindful of other perspectives (Spash, 1999). It attempts to provide an alternative framework that enables people to better appreciate the diversity of value in social and natural worlds and better address the complexity of relationships among people and between people and nature (McMahon, 1997). As an effective framework for policy, ecological economics is multidisciplinary and works closely with other disciplines. It is not intimidated by the complexities and uncertainties of dialogue and action with a wide range of non-scientific people. As the policy process becomes a dialogue, ecological economics encompasses the multiplicity of legitimate perspectives and commitments, and provides new norms of evidence and discourse, which transcends science in its conventional sense.

4. Limited impact on the mainstream policy process

As a means to rational and effective decision-making for sustainability, ecological economics pro-

vides a valuable interface that allows ecological and economic knowledge to be integrated into policy-making (Armsworth and Roughgarden, 2001). It is this promise that gives ecological economics its policy impact and influence. However, to construct ecological economics as an all-encompassing corpus of criticism effectively limits its scope for practical implementation (Howarth, 1998). “If a particularly suitable policy instrument or technology is available, there remains the question of whether its application would be acceptable. This requires cognisance of moral, political, social or economic objections or difficulties” (Dovers, 1995, p. 98). Actually, ecological economists are reluctant to enter the policy arena because they are uncomfortable with the often inconsistent use of scientific recommendations. One key challenge is to better understand the ways in which ecological economics can influence the sustainable development policy debate.

Compared with neoclassical economics, ecological economics generally only has a marginal influence on decision-making. The fact of the incorporation of human–natural interaction ideas into the mainstream policy process indicates that ecological economics is compliant with dominant ways of thinking rather than posing any radical sea change in policy direction. This implies the difficulties of achieving change in pursuit of goals, which challenge dominant economic and political interests. Thus, ecological economics only achieves a place on the policy agenda if it does not challenge these interests fundamentally. In reality, ecological economics has to follow the political line favoured by the central government, at least in tone and rhetoric. A dilemma in Chinese ecological economics is that in theory, economic development and environmental protection are considered to be capable of harmonious development, but in practice trade-offs have to be made to meet the priorities in the political agenda. Ecological economics is a scientific inquiry as well as a political rhetoric in China (see Shi, 2002a).

“The modern discipline of neo-classical economics is the ideological structure that promotes the interests of existing power elites. Ecological economics is engaged in a struggle, therefore, not only against neo-classical economic theory, but also against the concrete interest that are served by that

discipline. Ecological economics must thus develop a critique not only of neo-classical economics, but of the social institutions and structures that support and validate its world view” (Gale, 1998, p. 137). Reid (1995) has identified the following barriers in progressing sustainable development: the lack of awareness of the issues, the political unacceptability of most action, the opposition of entrenched interests and the inadequacy of institutional mechanisms for integrating environment and development. To some extent, ecological economics is not a fundamental challenge to the dominant economic discourse but simply another perspective that is useful in the pursuit of ‘economics as usual’. Although the role of ecological economics is becoming more prominent, the domination of economics on public policy discourse is virtually unchallenged. As a result, the influence of ecological economics on sustainable development policy to date has been limited. “To make a difference, ecological economics must identify the major institutional obstacles to the achievement of this goal [sustainability], challenge the agents that benefit from and support existing, unsustainable social structures, and offer theoretical support to those social forces constructing sustainable alternatives” (Gale, 1998, p. 132). This new perspective, at least in the academic community, is becoming part of the paradigm for practitioners.

5. Potential role in the decision-making process

5.1. *Dual role of the ecological economist*

Post-normal scientists should not claim ethical neutrality and push forward their arguments on the basis of the prestige of ‘objective research’, nor should they be indifferent to the consequences of their arguments toward policy (Funtowicz and Ravetz, 1994). In the same vein, “[e]cological economists cannot remain with a technocratic, value-neutral paradigm lacking a critique of existing political economic structures and forces” (Gale, 1998, p. 137), they “should strive to address prevailing values and decision-making processes by increasing the awareness of institutions and persons about ecological sustainability” (Costanza et al., 1991, p. 12). “What is perhaps most important for the construction of a policy science

is the ability of its practitioners to address existential problems of concern to the public” (May and Sellers, 1988, p. 403). The challenge for ecological economists is to move from the normative sphere to the positive sphere (Prakash and Gupta, 1997). In this process, ecological economists are required to take more responsibility of enlarging a trans-disciplinary context in which the contextual nature of knowledge is clarified and more scientific knowledge are communicated and advanced. It is time for ecological economists to break out of the ivory tower. More attention needs to be paid to understanding the culture of science and bridging the differences between science and policy.

Scientists have become indispensable facilitators in the realisation of all kinds of social objectives, many of which cannot be categorised even approximately as ‘scientific’. They have also become the protagonists or antagonists of powerful social, economic and political interests (Nowotny et al., 2001). Nevertheless, acquiring scientific knowledge about how the ecological–economic systems work does not necessarily lead to an understanding of how ecological economics itself works in the real world. In the same vein, gaining knowledge of the politics and sociology of ecological economics alone does not lead to a scientific understanding of the human–natural interaction. The key question is how can ecological economists promote the responsible use of scientific information and concepts in the policy-making process? The challenge for ecological economists is to weave these two dimensions (theoretical scientific inquiry and practical policy implementation) together so that they reinforce one another. The objectives of ecological economists are not only to expand knowledge in the field, but also to resolve important policy issues. They should be realistic to “look at how policy may be changed in the real world rather than the world of textbooks and journals, coffee bars and conference rooms” (Pearce, 1998, p. 40). Therefore, ecological economists need to assume more responsibility for placing the significance of their research into a policy context. They are ‘experts’ that need to respond to the imperative of the ‘immediate’ and work to very tight deadlines imposed by politicians. The growing importance attached to the capacity to translate knowledge into action has been observed by Jasan-

off (1997) in terms of how freely the processes of scientific fact-making have accommodated themselves to the demands of politics. By improving the understanding of the constraints imposed by the political system, ecological economists can help design more efficient policies that have a higher probability of being implemented.

Groups holding similar value systems may express them as an ideology and represent and advance them through institutions such as political parties, special interest citizens groups, or scientific societies. Ecological economists are one part of the sustainable development policy-making discourse dominated by voices of economists. Ecological economists need to do more than simply develop good ideas to influence policy. They need to understand how the political process affects outcomes, and actively market the use of appropriate instruments for promoting more efficient sustainable development policies. So far, ecological economists have enjoyed limited success in seeing their ideas translated into practices. The formal spread of human–natural interdependency concerns within economic circles is one scenario to get the message of ecological economists across to politicians and fellow economists. Ecological economists need to find ways to institutionalise their power in certain policy settings and become more at ease in advocating their policies. Although ecological economists are not frequently cited by other disciplines and are not often called upon to contribute to the policy-making arenas, mainstream economists who engage in environment–economy debate are beginning to adopt the rhetoric of an ecologically sensitive approach to recognise and cope with the new problems of economics (Funtowicz and Ravetz, 1994).

5.2. Potential policy influence

Ecological economists must recognise that scientific research does not take place within a vacuum, but is embedded within geographical, cultural and political contexts. In the past, ecological economists developed policy proposals without considering how to implement them within society. “In reintroducing the ethical element as an integral part of economics, and recognising the narrowness of reducing such issues to an engineering equation, ecological economics is taking a distinct and neglected path to economic

policy” (Spash, 1999, p. 430). Powerful policy proposals derived from ecological economics may support restructuring political decision-making. In a wider sense, ecological economics is a science of social change dealing with the question of how to design an institutional framework for evolving sustainable production and consumption patterns (Renner, 1999). The practical usefulness of this ecological economics approach is dependent on the existence of political consensus within society. McCloskey (1985) has analysed economists’ ‘appeal to authority’ as part of the art of persuasion and the rhetoric of economics. In this sense, ecological economics can be developed into a new powerful platform for those engaged in sustainable development. As Munda (1997) states, ecological economics is concerned with the policy consequences of its arguments, openly claims ethical positions rather than neutrality, accepts that values can be disputed and incommensurable, recognises distributional issues as a primary concern and perceives the ecological concept of scale as limiting material growth. Such sustainable development policy discourses reflect, and have the potential to change, the social structures of power. “Participation and public discourse is seen as a learning process for all involved and the result of this interaction process will more often than not improve the decisions taken in terms of results and acceptance or legitimacy” (Söderbaum, 1999, p. 297).

The current ecological economics community still exerts little political influence in sustainability policy arenas. A major role of this community in the future is to critically re-examine practitioners’ methods to prevent policy-makers and their advisors from adhering to misplaced conceptual comfort zones. The transdisciplinary nature of ecological economics allows approaches to transcend the positive/normative debate so that effort is focused on facilitating institutional frameworks to operationalise sustainable development (Meppem and Gill, 1998). The driving force to incorporate ecological economic rationality into policy-making must come from the learning that ensures through a well facilitated process of active public participation. Ecological economists must take their research results directly to policy-makers and the general public. Only when ecological economic principles become an integral part of economic planning and political decision-making, is there a chance of

achieving sustainable development. In improving the current policy process, more communications between scientists and policy-makers are essential. Even an ecological economic paradigm could not remove obstacles arising from economic interests and the power structures that sustain the economic growth rationality, it will, at least, invalidate many of the ideological defences that legitimate current rapid economic growth.

6. Concluding remarks

This paper has argued the importance of the rise of ecological economics as a policy science and its potential influence on the decision-making process. Existing socioeconomic and political structures determine existing valuation structures and resulting policy decisions. As a result, decision-making about natural resource issues and environmental management is often driven by the short-term imperatives of economic gain and political expediency, and there is little interest in identifying remote implications of decisions. However, the potential for such avoidance of ecological constraints is absolutely limited by thermodynamics. An ecological economic perspective that contains a realistic conception of the dynamics of human–environmental interactions has offered an operational basis for effective policies towards sustainability. The application of a conceptual framework consistent with the reality is a necessary prerequisite for effective policy-making. However, the main concerns and obstacles to achieve this goal are political and economic interests, social attitudes and cultural perceptions, not the lack of a scientific theory on sustainability. Since the way institutions are designed and have evolved strongly influences dynamic human–natural interactions, substantial attention should be paid to the transformation of values and institutions to reconcile ecological and economic priorities in the sustainable development policy discourse. As a policy-oriented, problem-driven science, ecological economics should be concerned not only with the latest scientific findings needed to inform policy-makers, but also with the potential impacts and measures on improving decision-making processes, which are crucial for the successful sustainable development policy formulation. Only through being actively engaged in

these efforts can insights of ecological economics be ultimately implemented in society. Without doubt, ecological economics still has a long way to go to actually achieve the goal of better management of sustainability.

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