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ANALYSIS

Institutional ecological economics

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Abstract

New institutional economics and its forerunners have, we argue made important contributions to the evolving agenda of ecological economics. The conceptualisation of environmental problems as instances of interdependence and the acknowledgement of positive transaction costs are key insights into the nature of environmental problems. We also discuss how plurality of behavioural motivations and limited cognitive capacity have important implications for environmental decision making and its analysis. We show how evolutionary and collective action theories offer complementary takes on the choice and change of environmental governance institutions and how the concept of social capital can enrich analyses of environmental governance. We conclude that an emerging institutional ecological economics has the greatest relative advantage in analysing the design, implementation and effectiveness of environmental governance solutions.

Keywords: Environmental governance; Institutions; Interdependence; Transaction costs

JEL classification: Q20; D78; B52; Z13

1. Introduction

One of the major challenges of ecological economics has been how to understand and examine the design of environmental policies and governance institutions. Institutional economics in all its guises has been an influential source of ideas for ecological economics. Ecological economics has turned to institutional economics for sophisticated models and understanding of human behaviour (Dodds, 1997; Söderbaum, 2000) and for explaining the role of institutions in collective action and environmental outcomes (Adger, 1999; Hodge and McNally, 2000; Randhir and Lee, 1996; Spash and Villena, 1999). Institutional economics has also been a source of alternative views regarding policy analysis and the

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normative basis of policy prescriptions (Hukkinen, 1998; Söderbaum, 2000; Bromley, 1998). While the influence of institutional economics has been profound, we believe that a comprehensive review of the conceptual foundations of institutional economics can provide new insights and important new directions for ecological economics.

Ironically, environment has not been a central concern for new institutional economics which has focussed on industrial organisation, public choice, and economic history. However, new institutional economics has informed a significant body of interdisciplinary research on local common property arrangements and international environmental conventions (Baland and Platteau, 1996; Berge and Stenseth, 1999; Bromley, 1992; Keohane and Ostrom, 1995; Ostrom, 1990; Ostrom et al., 1994, 2002; Young, 1994, 2002). This interdisciplinary body of research encompassing economics, political science, sociology, and anthropology has demonstrated under what circumstances environmental governance institutions are likely to be effective. It has also identified a number of design principles that characterise successful governance institutions.

We argue that this interdisciplinary body of new institutional literature offers a useful and widely applicable platform for research on environmental governance. By environmental governance we mean the management of all environmental resources, including conventional renewable and non-renewable natural resources such as forests, groundwater, and minerals; recently recognised environmental resources such as biodiversity, the ozone layer, and atmospheric sinks; and the quality of environmental media such as air and water. Environmental governance involves the establishment and enforcement of governance institutions for the resolution of environmental conflicts (Young, 1994, p. 15). Governance institutions range from informal to formal, and their scale varies from local to international (Adger et al., 2003). Environmental governance may entail the creation of new organisations such as environmental agencies to undertake governance activities or the delegation of authority to undertake governance activities to existing agents (Paavola, 2002a). Finally, governance is what governments do. Sometimes–as when resource users govern themselves under customary institutions–environmental governance does not involve the state. On the other hand, the state is intimately involved even in the establishment and operation of the so-called new voluntary measures for environmental protection.

New institutional research on environmental governance has significant growth potential. It has traditionally examined local and international levels of governance and there is, as of yet, relatively little research on national environmental governance solutions. Moreover, interactions between the levels of governance have only recently been recognised as an important area for research and governance practice (see Young, 2002). For example, international agreements on desertification, deforestation, or climate change do not directly translate to national policy strategies. Ostrom et al. (1999) have in turn argued that local governance solutions are tied to and influenced by other levels and areas of governance and cannot be simply scaled or sealed up. We argue that ecological economics and institutional economics can together achieve important intellectual developments by combining their insights on issues such as interdependence, complexity, resilience, scale, governance, and institutional design.

The next section discusses the concept of interdependence as the foundation of new institutional approach to environmental issues. The third section investigates the implications of transaction costs for environmental governance and the fourth section shows how and with what implications plural behavioural goals and limited cognitive capacity can be crafted to the new institutional approach. We then compare evolutionary and volitional approaches to the change and choice of governance institutions and outline the role of social capital in environmental governance. Each of these areas, we argue, can contribute to "institutional ecological economics" as a synthesis of institutional economics and ecological economics.

2. From externality to interdependence

New institutional economics has evolved in part as a response to (and critique of) welfare economics and thus conventional environmental economics. Coase (1937) developed the concept of transaction costs–of foundational importance to new institutional economics–already in the 1930s when he tried to explain why

firms exist. It was however, his (Coase, 1960) critical response to Pigou's (1920) treatment of externalities–which are at the heart of conventional environmental economics–that launched new institutional economics as an intellectual programme. Later Coase (1974) assaulted the second cornerstone of conventional environmental economics—the theory of public goods. Guido Calabresi (1961) in turn developed a new institutional approach to risks.

It thus seems that new institutional economics has had its own approach to the environment from the outset. Today research on the management of natural resources under customary common property institutions (see Baland and Platteau, 1996; Bromley, 1992; Ostrom, 1990; Ostrom et al., 1994) and research on international environmental governance (see Keohane and Ostrom, 1995; Young, 1994, 2002) are the core areas of new institutional environmental research. However, we need to examine new institutional literature more broadly to clarify the conceptual foundations of environmental governance research.

We argue that new institutional economics differs from environmental economics in two central ways. First, new institutional analysis of environmental problems is based on the concept of interdependence rather than that of externality. Interdependence exists when a choice of one agent influences that of another—a situation overlooked in conventional economic analysis which assumes that agents are independent. Interdependent agents cannot simultaneously realise their incompatible interests in scarce environmental resources and their conflict must be resolved by defining (or re-defining) initial endowments. This can be done by specifying private property rights as in the so-called "Coase Theorem" (Coase, 1960) or by establishing environmental regulations which create other kinds of rights. Second, new institutional economics acknowledges positive transaction costs. They make informal and formal institutions necessary for individual and collective pursuits and influence economic and environmental outcomes. In this section we examine the concept of interdependence and discuss transaction costs in the next section.

Following Pigou, environmental economics conceptualises environmental problems as externalities or physical effects between agents, for which no price is paid and no compensation is received (Mishan, 1971). Partial equilibrium analysis indicates that efficient allocation of resources is not achieved when externalities prevail. Pigou's suggestion was to impose a tax on the generators of negative externalities and to subsidise the generators of positive externalities in order to reach the efficient allocation of resources. Institutional critics have argued that such reasoning is illegitimate because it distinguishes allocative decisions from distributive ones although the two are inseparable—Pigovian taxes and subsidies are policy interventions that alter initial endowments and thus redistribute wealth and income (Calabresi, 1991; Dragun and O'Connor, 1993; Vatn and Bromley, 1994).

Economists have failed to recognise "externalities" as instances of interdependence despite the obviousness of this in the classic externality examples. Factories belching smoke limit the ways in which laundries can dry their linen, but if the options of laundries are kept open, those of factories must be limited. Similarly, steam locomotives driven across the countryside generate sparks and expose farmers to the risk of fires, but the elimination of these risks by regulating the use of locomotives would limit the freedom of their owners. Hardin (1968) analysis of the "tragedy of the commons" in the use of rangelands and fisheries also boils down to interdependence. Rangelands and fisheries are rival in consumption. Resource use by one agent precludes it by another, potentially instigating a race for the appropriation of resource units, which maybe individually rational but can lead to over-exploitation of the resource. The essence of these examples is that one agent's choice limits the range of choices available to other ones or influences the choices made by them.

Coase (1960) acknowledged that interdependence underlies what are usually regarded as externalities but did not pursue this analysis to its conclusions. He argued that when an externality exists, it is necessary to choose whose interests are to be protected. He suggested that this could be done by assigning private property rights to one of the involved parties. But he also recognised that there are other ways to protect interests, such as the establishment of environmental regulations. Coase demonstrated that under Pigou's own assumption of costless transactions, the establishment of private property rights is all that is needed: interdependent parties can reach the efficient alloca-

tion of resources by negotiating after initial endowments have been defined. This is the essence of the *Coase Theorem* as it is usually understood (Paavola, in press). However, Coase *also* showed how the initial assignment of rights influences and can determine the allocation of resources when transaction costs are introduced. Coase also argued that regulation can entail lower transaction costs than private property rights and markets (Coase, 1960, pp. 17–18).

Interdependence has two distinct sources: the attributes of the resource and the attributes of the resource users. Rivalry or non-rivalry of use and the ease or difficulty of exclusion are the most important resource attributes that create interdependence: they divide goods into four main types which are often called "private goods", "common-pool resources", "toll goods", and "pure public goods" (see Table 1). These goods can also have other resource attributes such as amenability for multiple uses, mobility, stability or fluctuation of yields, and amenability for storage (Schlager et al., 1994, pp. 294–299; Schmid, 1987). Rival use generates interdependence because two users cannot use a fish or a litre of clean air: use by one agent precludes that by another. Non-rivalry enables several agents to use a resource, such as landscape amenity simultaneously. However, non-rivalry creates an interdependence regarding whose preferences count because the quantity and quality of goods subject to joint consumption cannot be individually provided. Difficulty of exclusion in turn introduces the possibility of free riding—using a resource (which can be subject to either rival or non-rival consumption) without contributing to the costs of its provision. One agent's choice to ride free increases the costs of provisioning to others and decreases their willingness to participate in provisioning. This demonstrates how different types of goods and resources create different kind of governance challenges.

The second source of interdependence is the attributes of resource users such as their number, heterogeneity, and social capital. When only a small number of agents are involved in or affected by the use of an environmental resource, they can observe the behaviour of others and maintain accountability for it. Large numbers make individual behaviour difficult to observe and facilitate free riding, increasing the cost of collective action and potentially undermining collective action altogether (Olson, 1971, pp. 11–12). Heterogeneity of interests, income levels, goals, and values, translate into conflicting preferences with regard to environmental resources. Social capital can help to overcome problems associated with large numbers and heterogeneity by fostering trust and reducing transaction costs.

Table 1
Attributes and types of goods

	Rival consumption	Joint consumption
Low exclusion costs	Private goods	Toll and club goods
High exclusion costs	Common-pool resources	Pure public goods

The implications of the interdependence have seldom been fully worked out. Interdependence creates environmental conflicts when agents have incompatible interests. We have to resolve these conflicts and to choose between the involved interests by establishing, reaffirming, or changing governance institutions (Bromley, 1991). That is, governance institutions affirm or redefine initial endowments and have both allocative and distributive consequences. Coase has shown that allocative efficiency will be reached after initial endowments are (re)defined. Distributive and governance outcomes are thus the key variables in collective environmental decisions (Calabresi, 1991). As Coase (1960, p. 43) argued: "the choice among different social arrangements . . . must ultimately dissolve into a study of aesthetics and morals."

The notion of interdependence is important for ecological economics firstly because it explains the existence of institutions, such as property rights and environmental regulations, independently of transaction costs: institutions have to be adopted to resolve conflicts whether or not transaction costs are acknowledged (Bromley, 1991). Second, interdependence reasoning, especially a detailed analysis of resource attributes and the characteristics of resource users as generators of patterns of interdependence, sheds light on the design of governance solutions (Dolšak and Ostrom, 2003; Paavola, in press). For example, the current trend towards devolution and decentralisation in the governance of environmental resources may be counter-productive when interdependence transcends the local context. When interdependence *is* local, national solutions may be

wasteful. When interdependence is complex, governance may need to be carried out at multiple levels or through multiple, overlapping governance institutions (Ostrom et al., 1999). Finally, interdependence reasoning underlines the importance of social justice in environmental decisions, reminding that ecological impacts of decisions are distributed in space and in time, imposing losses both on present and future resource users (Proops et al., 1999). In particular, it draws attention to intra-generational equity which has been neglected in environmental scholarship in comparison to the attention given to inter-generational equity.

3. Transaction costs in environmental governance

Coase (1937) explained the existence of the firm by arguing that it was cheaper to carry out some transactions within the firm than over the market. Coase defined transaction costs as costs of using the market system in this context. Other new institutional economists have elaborated that voluntary market transactions between agents are costly because they require information, negotiation, drawing up of contracts, and monitoring and enforcing compliance with those contracts (Dahlman, 1979; Barzel, 1985). Environmental governance more typically involves administrative transactions rather than market transactions. These interactions are often non-voluntary and involve a legal superior and subordinate (Schmid, 1987). But such transactions equally entail transactions costs, incurred as a result of collecting information, making decisions, formulating institutional rules, monitoring compliance with these rules, and enforcing these rules (Paavola, 2002c).

In essence, transaction costs exist because information is costly to obtain (see Dahlman, 1979; Barzel, 1985). This explanation ties transaction costs to the basic competitive model of microeconomics by suggesting that transaction costs occur because of a deviation from the situation of perfect information. That is, when information is imperfect, agents have to devote resources to searching for needed information about goods and potential partners before completing transactions. However, this explanation opens up a further question: what makes information costly to obtain? We argue that there are at least five distinct sources of significant costs of information:

1. Limited cognitive capacity makes gathering information costly.
2. Self-interested agents do not have incentives to disclose their preferences or plans.
3. Environmental resources have attributes which can only be learned over long period of time if at all.
4. The existence of real time means that adjustments require learning, time, and resources. These are not needed in neoclassical models which assume instantaneous adjustments and ignore real time.
5. Institutions make information gathering costly by scattering information, or by denying or limiting the authority of agents to obtain it.

Transaction costs have several implications for environmental governance. To begin with, governance institutions cannot be designed perfectly *ex ante*: it would be prohibitively costly to do so (Williamson, 1985). Therefore, governance institutions are likely to miss some prevailing interdependencies and to fail to anticipate emerging ones. When these interdependencies result in environmental conflicts, they are then addressed *ex post* in courts or other social arenas. The level and distribution of transaction costs shape policy advocacy and change. If the transaction costs of acting collectively are low enough for interest groups who are not served by the *status quo*, they can challenge and force change on governance institutions in political arenas through legal means, or through changing public opinion.

Transaction costs also influence the effectiveness and outcomes of environmental governance. Many resource attributes, such as size and mobility, and user characteristics, such as numbers and heterogeneity, increase transaction costs and present challenges for environmental governance. Institutional solutions also influence transaction costs. For example, salmon fisheries in the northwest United States involve a score of jurisdictions and agencies as the fish migrate between river and ocean over their life course (Singleton, 1998). Such complexity makes it costly to transfer information from one institutional context to another and institutional barriers also complicate decision making.

Transaction costs and the effectiveness of governance solutions are influenced by different aspects of institutional design. First key design issue is how well the governance institutions address the prevailing interdependences. Sometimes particular interdependences are ignored because their governance would entail high transaction costs. This may render governance solutions ineffective and unable to achieve their intended goals. For example, the U.S. Clean Water Act of 1972 did not provide for the control non-point sources, although they were responsible for a half of many pollutant loads (Freeman, 1990, pp. 109–110). The legislation focussed attention on point sources because the costs of identifying and monitoring non-point sources of pollution were prohibitively high. The second key aspect of institutional design is the organisation of governance functions and the third one the formulation of particular institutional rules: these aspects of institutional design influence the level and distribution of transaction costs as well as governance outcomes (Paavola, 2002b,c). To give an example, the U.S. water pollution control legislation in the 1950s and 1960s prescribed a cumbersome conference procedure as a precondition for federal enforcement action. The costs of this consultation made the enforcement of water pollution legislation effectively impossible (Paavola, 2004b). Policy makers consider transaction costs when deciding on policy design. For example, effluent and emission charges are not widely used despite their theoretical attractiveness because the measurement of effluents and emissions is costly. Instead, environmental charges are usually formulated as input fees because the measurement of inputs is relatively straightforward.

Thus, while the nature of interdependence sets basic requirements for governance institutions, transaction costs also influence the choice of institutional responses. Local governance solutions, for example, are common in developing countries because states often lack capacity and are weak, non-transparent, and unaccountable. Yet local governance solutions remain vulnerable if interdependence extends outside their jurisdiction. Fisheries, rangeland, and forests are increasingly co-managed worldwide on the basis of government–civil society partnerships and devolution of government responsibility. One reason why co-management is popular is that it combines local relative advantages with the relative advantages of the state in environmental governance (Berkes, 2002; Brown et al., 2002).

To conclude, the concept of transaction costs contributes to institutional ecological economics by facilitating detailed analysis of policy problems and governance solutions. Policy problems–which are constituted by the physical attributes of environmental resources and the characteristics of their users–largely determine the level of transaction costs. However, governance institutions influence transaction costs, particularly their distribution, and, ultimately the governance outcomes. Transaction cost reasoning clarifies the implications of institutional design for the implementation and effectiveness of governance solutions. It explains why governments frequently use institutional solutions that appear inferior in the light of the received theory and why some other institutional solutions either frequently fail or are not used at all.

4. Expanding motivational and cognitive assumptions

New institutional economics (NIE) shares conventional economic assumptions on how agents are motivated by their utility or personal welfare. NIE also acknowledges that agents choose with imperfect knowledge but it frequently attributes imperfect knowledge to factors external to the agent such as the attributes of goods. This line of reasoning has generated important insights regarding how institutions are adopted and designed to cope with ignorance and uncertainty (see Akerlof, 1970; Barzel, 1982; Williamson, 1985). As we outline below, the incorporation of both plural motivations and limited cognitive capacity enhances the attractiveness of new institutional approach further.

Agents are conventionally understood to be motivated by the improvement of their personal welfare or utility with welfare and utility often used interchangeably. Early proponents of alternative notions of utility as either pleasure and usefulness disagreed on the possibility of interpersonal comparisons (Cooter and Rappoport, 1984; Georgescu-Roegen, 1968; Sen, 1991). But both approaches associated utility with some notion of agents' welfare. Pleasure was associated with psychological satisfaction and usefulness

with material enhancement of welfare. More recent definition of utility as the degree of preference satisfaction (Hicks and Allen, 1934) does not have such an unambiguous relationship to agents' welfare: it allows for preferences which do not directly relate to the personal welfare of agents and thus it leaves 'utility' without substantive meaning.

The conventional motivational assumptions are problematic for several reasons. On one hand, self-centred seeking of pleasure or usefulness is too restrictive an assumption, because it does not admit motivations such as regard for the welfare of other humans or non-humans or for particular outcomes irrespective of their welfare implications. Yet these motivations are intuitively acceptable and appealing in many circumstances (Sagoff, 1988). On the other hand, preference utilitarianism leaves the connections between motivations, preferences, and choice unclear (Bromley and Paavola, 2002). Preference utilitarianism also commensurates values underlying preferences although they may not be commensurable. Economists often argue that agents have to make trade-offs under fundamental scarcity and that in doing so they commensurate alternatives in their willingness to pay (see Hanley and Shogren, 2002). This may indeed be true—but only retrospectively. A willingness to pay can be inferred from choices to avoid adverse environmental impacts or to gain access to environmental amenities. However, this does not mean that these choices were actually informed by the consideration of benefits and costs and that they could be explained in cost–benefit terms (Holland, 2002). The possibility of attributing monetary valuation on choice *ex post* does not mean that such calculation guided the choice *ex ante* (Bromley and Paavola, 2002).

We argue that environmental decisions can be understood only by respecting the potential incommensurability of values that underlie agents' preferences and choices. This means acknowledging and making space for pluralism of values in the analysis. *Intrapersonal pluralism* means that agents may hold many values and that they decide which values are to inform their preferences in a choice situation. For this reason, Kavka (1991) has argued that the impossibility theorems of social choice also apply to individual choice. *Interpersonal pluralism* means that agents may be informed by different values in the same choice situation, and arrive at either same or different choices. Substantive pluralism does not pose difficulties for standard economic analysis as long as values are self-centred and welfare-centred. Differences in attitudes concerning, for example, the importance of environmental amenities for personal welfare is a source of benefits from trade. However, values also differ in more significant ways. In many choices agents are primarily concerned about their own pleasure or material welfare. But there are also choices governed by concerns for the welfare of others. Still other choices are informed by what are considered intrinsically valuable outcomes—preservation of a species from extinction could be an example. Finally, agents may consider certain choices right or virtuous without regard to any of their consequences.

The admission of motivational pluralism has several important implications. First, if–and as exemplified above–preferences can be informed by utilitarian, non-utilitarian consequentialist, and deontological considerations, choices do not reveal preferences (see Bromley and Paavola, 2002). There are always several possible explanations for a choice which complicates the use of valuation methods to price environmental resources. Second, the existence of non-welfarist motivations justifies behaviour that reduces welfare and questions the moral force of cost–benefit arguments. That is, we may have good reasons to act collectively to preserve a species or a habitat, for example, even if doing so would reduce some notion of social welfare. Third, there is no single common metric for different ethical premises. The implication is that *all* algorithmic solutions for social choices may be questioned. At the same time, it highlights the importance of *procedural solutions* such as aggregation and decision rules which enable agents to overcome incommensurability and to translate values that gain support into institutional rules. Fourth, pluralism calls for a movement from universalism to contextualism: institutions resolve conflicts so as to realise those values that are deemed decisive in the context of a particular conflict or decision. Fifth, values are embedded in and perpetuated by institutions. For example, welfarism is embedded in market institutions while rules that confine the operation of market logic are typically informed by non-welfarist values (see Bromley and

Paavola, 2002; Hodgson, 1997; Radin, 1996). Finally, as manifestations of values, institutions influence agents' preferences, choices, and actions as well as aggregate economic and environmental outcomes.

We now move on to discuss limited cognitive capacity. Research on limits of cognition within psychology demonstrates several deviations from conventional economic assumptions such as the use of rules of thumbs, preference reversals, the influence of framing and irrelevant alternatives, and asymmetric valuation of gains and losses (Bell et al., 1989; van den Bergh et al., 2000; Tversky and Kahneman, 1986). This suggests that there is clearly more to individual decision making than standard economic models have been able to shed light on. The conventional notion of rationality sets a substantive requirement that rational choices should maximize the welfare or utility of the agent making the choice. In contrast, Simon (1955, 1978, 1986) has argued that agents often have multiple goals, use these goals to eliminate alternatives from the choice set in order to make choice more manageable, and satisfy their goals rather than maximise their utility. Tversky (1972) suggested, in parallel with Simon, that individuals use aspects of choice alternatives to reduce the size of choice set. Simon has also suggested that agents may revise their ambitions when they learn about alternatives and that their ambitions may be influenced by the order in which they encounter alternatives (Simon, 1955).

Heiner (1983) has argued that a gap between our cognitive capacity and the challenges of decision-making creates uncertainty and forces agents to use a narrow set of behavioural and decision rules. This uncertainty, according to Heiner (1983), explains the existence of many social institutions. Earlier we indicated that conflicts of interest are a primary driving force for the emergence of many institutions. Interest conflicts result from interdependent but incompatible interests and often pose a collective choice problem akin to a Prisoner's Dilemma. Heiner's uncertainty explanation for institutions refers to solving coordination problems in which the interests of involved parties are often in agreement. These situations often share the features of assurance games (see Schelling, 1978).

These views on limited cognitive capacity suggest that agents need time for learning and for clarifying their goals and preferences. They also highlight the importance of procedures for learning, participation, and deliberation in environmental decision making. These issues are considered important in governance and policy practice. The Intergovernmental Panel for Climate Change (IPCC) is an example of an instituted learning process for public policy (see also Norgaard (2004) and Social Learning Group, 2001). The guidelines for the preparation of National Adaptation Plans of Action (NAPAs) in turn seek to institute a participatory process into planning for adaptation to climate change. These processes are already widely used in planning for water resources, fisheries, and local hazards (Singleton, 1998). The rationale of these procedures is not apparent in conventional economic analysis but the acknowledgement of limited cognitive capacity provides an explanation for their popularity.

Simultaneous consideration of plural motivations and limited cognitive capacity generates additional insights for ecological economics. When agents have plural motivations–of which self-centred welfare maximisation is but one example–and their ability to detect the motivations of other agents is limited, then the act of signalling intentions becomes a means to elicit reciprocal behaviour. Axelrod's (1984; see also Gintis, 2000) observation on the good performance of the "tit for tat" strategy attests this. Many experiments also document the importance of fairness for choice outcomes (see Kahneman et al., 1986). The detection of "fraudulent" signals and an ability to demonstrate one's sincerity also become important. Frank (1988) and Loewenstein (2000) argue that this is where emotions play a role. These insights can be used, for example, to examine the behaviour of interest groups in international political arenas where collective environmental decisions are made and in the design of local resource strategies for multiple use resources (Barrett, 2003). Institutions also demarcate fields of action where different rules are supposed to apply. In other words agents not only take behavioural cues from each other, they also read them from the institutional context of their actions. However, institutions do not determine behaviour. Markets can sustain other-regarding behaviour as demonstrated by solidarity boycotts and fair trade consumption initiatives. Similarly, corruption is an example of self- and welfare-centred behaviour in polities.

5. Change and choice of environmental governance institutions

We have argued above that interdependence, transaction costs, pluralism, and limited cognitive capacity shed light on the role of institutions in environmental governance. However, these concepts do not explain how institutions emerge and change. Institutional change and choice are, we argue, becoming increasingly critical for environmental governance as industrialisation and commercialisation of the use of environmental resources have reached a global scale and have presented new governance challenges beyond the experience of governments (see Ostrom et al., 1999).

Some approaches understand institutional change as a result of evolutionary macro-processes (Langlois, 1986; Nelson and Winter, 1982; Schotter, 1980; Taylor, 1987), while others view institutional change through the lens of collective action and choice (Olson, 1971; Sandler, 1992). Both of these broad strategies exhibit wide internal theoretical diversity. Evolutionary theories are based on insights ranging from Marx to Hayek (Hodgson, 1993) and collective action and choice theories range from reformist (Commons, 1950) to libertarian (Buchanan and Tullock, 1965). We discuss below the central features of both evolutionary and collective choice and action theories.

A common denominator of evolutionary theories is that their "analysis is expressly dynamic" (Dosi and Nelson, 1994, p. 154). Evolutionary economics has its roots in early neoclassical economics, Austrian economics, historicism, and institutionalism (Foster, 1997; Hodgson, 1993; Nelson and Winter, 1982). Evolutionary economics has inherited an emphasis on institutions and their change from historicism and old institutionalism. Neoclassical legacy includes the conception of scarcity and relative prices as drivers of institutional change while Austrian and Schumpeterian influences give the same role to technological change.

A Darwinian evolutionary framework identifies a fundamental unit or "genotype" of selection, such as behaviours or institutional arrangements (Dosi and Nelson, 1994). Learning and discovery introduce variation to genotypes as well as into higher level units (phenotypes) such as households, firms, or human communities that directly face selection. Selection processes such as market competition eliminate underperforming phenotypes and, indirectly, the genotypes responsible for weak competitiveness. In essence, this model suggests that human communities face selection pressures and that their relative performance is influenced by their institutional solutions. This reasoning has been used to explain the emergence of institutions for sustainable use of natural resources (Ostrom, 1990): communities have either succumbed or learned to improve their environmental governance institutions. Differential survival can also be attributed to "sorting" or "Lamarckian evolution" (van den Bergh and Gowdy, 2000). A stylised evolutionary model is often used as a heuristic to explain change over shorter periods of time (Adger, 1999). Whichever form they take, evolutionary models can be used to investigate a variety of phenomena. For example, Veblen (1899) examined the role of consumption choices in gaining status and power in the society while Alchian (1950) argued that competition weeds out firms that do not maximise profits.

If the natural and social worlds both evolve, there can be synergies, symbiosis, and coevolution between them (Norgaard, 1984). In ecology, coevolution means simultaneous evolution of interacting species or ecosystems, while in economics coevolution refers to mutual adjustment and development of ecological and economic systems (Adger, 1999; Erickson and Gowdy, 2000; Fairhead and Leach, 1995). Learning, adaptation, and selection processes "fine-tune" economic systems to their resource base. The resource base is not a given but rather co-evolves with human use. For example, resource bases of rotating slash and burn agriculture, Alpine pastoralism and Asian rice culture are constructed by human action and environmental feedbacks (Bray, 1986; Gunderson and Holling, 2002). Social systems in turn reflect the peculiarities and constraints imposed by the resource on which they depend (see Harris, 1974).

Public choice theories extend new institutional analysis into administrative and political decision making by treating politicians and politics akin to firms and markets (Laver and Shepsle, 1996; Orchard and Stretton, 1997; Shepsle and Weingast, 1982, 1984). For the public choice paradigm, non-market institutions are adopted as responses to market failures and agents act strategically within the incentive structures created by them (see Shepsle, 1989). The

public choice approach is sceptical of non-market institutions and their efficacy in promoting social goals, highlighting rent seeking, and government failure (Krueger, 1974; Shepsle and Weingast, 1984, p. 417). The scepticism of public choice calls for a recognition that institutions are not ideal and that their assessment should be based on careful and detailed analysis in the light of goals that they are supposed to forward (see Demsetz, 1969). If taken to its logical conclusions, the scepticism of public choice tradition may foster broad-based comparative institutional analysis by divesting both market and non-market alternatives of the sanctity they enjoy in the eyes of their devoted proponents. It also suggests that same factors such as transaction costs, social capital, and the rule of law affect the performance of both kinds of institutional alternatives.

The theory of collective action, pioneered by Olson with his *The Logic of Collective Action* (1971), offers a more detailed account of the behaviour of interest groups seeking to influence or participate in public choice. Collective action scholars recognise that the characteristics of collective goals create interdependence (Sandler, 1992). However, they often consider public goods or "club goods" as the only pertinent sources of interdependence, despite the existence of more nuanced accounts (Schlager and Ostrom, 1992; Schlager et al., 1994; Schmid, 1987). Because of the centrality of interdependence reasoning, collective action scholars rely heavily on game theory (Sandler, 1992). Game theory and its experimental applications accommodate plural motivations and clarify their implications for collective action (Gintis, 2000) but they make it more difficult to make use of transaction cost reasoning.

To summarise the standard reasoning, the pursuit of public goods such as institutional change creates an interdependence among affected agents. Differential effects of institutional change or/and heterogeneous preferences divide agents into coalitions or interest groups. Those agents who stand to benefit from institutional change are influenced by the choice of others to join or not to join collective action. Those who stand to loose face a pressure to organise themselves because of the proponents' collective action. While all stand to benefit from collective action, individuals still have incentives to ride free because of the nonexclusive character of public goods: when made available for one agent, the benefits of a public good can be enjoyed also by others who do not contribute to its provision. If exclusive side benefits cannot be provided or motivations altered so as to avoid free riding, the public good will not be offered, at least not in optimal amounts. Small groups stand a larger chance of providing a public good than large ones. Actors who have large stakes or intensive preferences may also afford to provide the public good for themselves and for free riders, although not in optimal amounts (see Olson, 1971). This stylised account indicates that the theory of collective action makes several contributions to ecological economics. First, it sheds light on the implications of behavioural goals for collective action and choice. Second, it highlights that collective action takes place within institutional framework and that choices are made according to particular decision rules. It is easy to extend these ideas outside the public good context on the basis of more nuanced accounts of sources of interdependence.

To conclude, new institutional economics recognises population growth, technological change and changes in relative prices or scarcity, power structure, and preferences as factors that explain institutional change. Yet it tends to focus on collective action motivated by private interests and to ignore other sources of change (see North, 1990; North and Thomas, 1973). Evolutionary approaches identify a broader range of pressures for institutional change in their macro-level explanations. Evolutionary approaches make only weak assumptions of rationality and cognitive capacity: agents are understood to learn as if by trial and error. Collective choice and action theories are more prone to overemphasis of volitional explanations of institutional change. However, weaknesses of the evolutionary approach mirror its strengths: it has a weak grip on volitional action and the institutional framework within which it is embedded. The evolutionary and collective action approaches to institutional change and choice, we argue are best considered complementary.

6. Social capital in environmental governance

We have shown that new institutional economics offers an understanding of the relationships between

agents, institutions, and the resource base on which they depend. Economics and other social sciences have had difficulties with these relationships when seeking to identify and prescribe interventions calculated to improve human well-being and to sustain environmental resources. Relationships between agents are increasingly conceptualised as networks, agreements, and flows of information (Dolšak and Ostrom, 2003). Some networks emerge from economic activities, but many do not. The density of networks and rate of these information flows have been termed social capital. But should we really consider social relations a form of capital? Arrow (2000) argues that social capital is a misnomer as it does not share the characteristics of other forms of capital. Ostrom (2000, p. 188) in turn argues that social capital, though useful, 'is not easy to find, see and measure as is physical capital.' We argue that the concept of social capital is useful for new institutional economics as well as ecological economics and should be integrated into them.

There is some confusion over whether social capital is a public good bound up with institutions or an asset which can be created and passed on by individuals. Dasgupta (2003) argues that social capital is often misunderstood because its private and public dimensions are conflated. The private dimensions reside with individuals and resemble human capital. For example, social capital is largely a private productive asset for agricultural traders (Fafchamps and Minten, 2002). Public dimensions of social capital reside in networks that enhance overall economic performance rather than that of specific agents. Private and public aspects of social capital have been studied in empirical analyses which have documented how they reduce transaction cost by creating trust and by facilitating the circulation of information (see Narayan and Pritchett, 1999).

This conceptualisation of social capital is important because it expands our understanding of the sources of human well-being. Social capital contributes to human welfare and well-being in the same manner as conventional factors of production and natural capital. Natural capital is the set of unpriced environmental goods and services on which economic processes and human and non-human life depends (Ekins, 2000; Daily, 1997). Social capital, even if it does not share all the attributes of other forms of capital, influences individuals' and communities' access to natural capital. Traditional institutions for the management of fisheries, forests, and rangelands, for example, are based on rules, knowledge and obligations mediated through social capital (see Acheson, 2003; Lansing, 1991). Ecological knowledge is a form of human capital (Berkes et al., 2000). But the networks and cross-scale linkages that form environmental governance are, by contract a manifestation of social capital.

Social capital is often associated with bonding among the members of a close-knit group. This kind of social capital is also called *bonding capital*. While bonding capital is important for successful collective action in small, homogeneous groups, other types of social capital are needed in large and heterogeneous groups for successful collective action and for the attainment of desirable economic and other outcomes. For example, *bridging capital* helps to tie different communities together with weaker, cross-cutting ties. *Linking capital* in turn binds groups or organisations together across hierarchies or levels of power and status (see Adger, 2003). The amount of bridging capital influences the ability to overcome the challenges of heterogeneity and linking capital underpins rule of law as well as effective environmental governance and provision of public services.

Social capital and networks of reciprocity assist in coping with the impacts of floods, droughts, and other environmental stressors (see Pretty and Ward, 2001). Social capital is also central to strategies for adaptation to environmental stress such as climate variability and change (see Adger, 2003; Paldam, 2000). For example, migration based on networks and shared information has been used throughout human history to promote resilience of both home areas and migrant receiving areas (Adger et al., 2002). It has helped small island states to cope with extreme weather events and to maintain the stability and resilience of their populations (Barnett and Adger, 2003).

Social capital does not emerge in a vacuum: social capital being the 'capacity of social groups to act in their collective interest depends on the quality of the formal institutions under which they reside' (Woolcock and Narayan, 2000, p. 234). Quantitative

cross-national studies using political freedom and indicators or government performance as proxies of social capital often find that social capital is associated with positive growth experience and lower rates of poverty and inequality (Knack and Keefer, 1997). Some studies suggest that social capital may be even more important to economic growth than human capital because of its effects on the performance of government. Social capital can reduce corruption, improve the effectiveness of public service provision, and ameliorate health and educational inequalities (Bayart et al., 1999; Mohan and Mohan, 2002). Bhattarai and Hammig (2001) and Deacon (1994) have found that proxies of social capital also explain differences in rates of tropical forest cover loss between Latin America and other regions.

To summarise, the concept of social capital extends new institutional analysis to the relationships between culture, beliefs and behaviour on one hand and the institutional, economic, and environmental outcomes on the other hand (Ruttan, 1999, 2001). Although the social capital scholarship has been criticised as intellectual imperialism by economics (Ruttan, 2001), we argue that new models and understandings of policy problems and solutions can only be beneficial.

7. Conclusion

We conclude that new institutional economics contributes to emerging institutional ecological economics by shedding new light on urgent areas of environmental policy and governance in several ways. The institutional approach helps us to examine how the attributes of environmental resources and their users create interdependence and conflicts. Environmental conflicts can be resolved by making collective choices that are implemented by establishing, changing, or reaffirming governance institutions. The approach can be sensitive to motivations that actually inform collective environmental decisions and to the limitations that cognitive capacity imposes upon such choices. Theories of institutional change and social capital further highlight the importance of macro-level and social factors and balance individualistic and volitional explanations of change of environmental governance institutions.

These general features of a broadly conceived institutional ecological economics point to an expanding and innovative agenda for research. First, the concept of interdependence can be used to characterise environmental problems and to design institutional responses to them in the increasingly complex and globalising world. Interdependence often spans geographical levels and requires governance responses at each level simultaneously. Environmental problems such as climate change and biodiversity loss are often functionally linked to each other. This justifies and requires multiple and overlapping governance solutions and suggests that "magic bullets" do not exist. For example, mitigation of greenhouse gas emissions and adaptation to climate change are intimately related. The level of greenhouse gas emissions determines the impacts of climate change and ultimately the pressures for adapt. The capacity to adapt and the capacity to mitigate emissions are co-determined because both involve institutions, learning, technological diffusion, and cognition of risk. Yet simple trade-offs between mitigation and adaptation are not meaningful (Azar and Schneider, 2002). Both require their own, albeit overlapping governance solutions.

Second, the institutional approach sheds new light on policy implementation and factors that influence governance outcomes. The conventional economic approach has been silent on implementation because it conflates all policy concerns to the choice of the policy instrument. By contrast, the institutional approach sheds light on the compatibility of governance solutions and patterns of interdependence as well as on the transaction cost implications of the institutional design of governance solutions. It also highlights that social capital influences transaction costs and the effectiveness of governance solutions. These kinds of institutional factors largely explain the weak performance of early water pollution control policies in the United States, for example. The institutional design of state and federal policies did not create clear and enforceable rules of water use before the 1970s. State agencies implementing the state policies often involved key stakeholders but their decision-making was not transparent or accountable for the public at large. Changes in the standing of civic groups in court proceedings in the 1960s and the 1970s

created pressure for greater transparency and accountability and also resulted in changes in federal water pollution control legislation in the early 1970s. While the new federal policy framework was much more comprehensive than earlier, it still omitted important sources of pollution.

Third, the institutional approach has important implications for environmental decisions and analytical frameworks for studying them. Environmental economists often attribute the absence of environmental policy interventions to lack of information, especially lack of information on the monetary values of environmental benefits. The institutional approach draws attention to how interdependence creates environmental conflicts and problems in the absence of clear entitlements. It reminds us that the definition of environmental entitlements is not an exercise of optimisation and that for this reason the valuation of environmental benefits is not going to be a panacea for environmental protection. For example, the conversion of wetlands in Asia is largely driven by the insecurity of entitlements and the future of these wetlands depends on who will have what kind of entitlements in them—rather than on knowledge of the value of the functions of these environmental resources (see Adger and Luttrell, 2000). The institutional approach suggests that more attention ought to be given to processes and procedures in environmental decision making in order to guarantee adequate learning and fair representation of affected parties and legitimacy of environmental decisions.

Fourth, instead of limiting policy analysis to the welfare implications of governance alternatives, the traditional approach in cost–benefit analyses, institutional ecological economics helps us to assess governance solutions and outcomes in the light of governance goals that are actually held by diverse decision makers and stakeholders. The analytical understanding of institutional ecological economics on the relationships between resource attributes, interdependence, environmental conflicts and institutions highlights the importance of intra-generational social justice in environmental decision making and governance, both for its own sake and for the sake of effective governance. For example, the European Union's habitat's protection program has had the valuable goal of preserving biodiversity and endangered species. However, it failed to inform the public of its goals and implications and to respect other viewpoints and interests. Implementation of the program was compromised by civic protests in several member states because of its perceived distributive and procedural injustice (see Paavola, 2004a).

Thus we argue for "institutional ecological economics" as a promising cross-over between a new institutional economics and ecological economics. The learning process involved in making the cross-over real would assist ecological economics to take us further towards sustainable solutions for persistent ecological problems.

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