Another Look at Economic Approaches to Environmental Management and Policy with Reference to Developments in South Africa

Editorial

Martin de Wit

School of Public Leadership, University of Stellenbosch

Abstract

The wide acceptance of economic approaches to environmental management and policy, masks increasing heterogeneity in the field. This editorial addresses the question whether the economic approach is still warranted and under which conditions. A broad outline of the trends in both orthodox and heterodox economic approaches is also presented. The traditional split between environmental and ecological economics is not doing justice to recent developments in the field. Instead it is proposed to rather refer to Environmental, Resource and Ecological Economics (EREE), Ecological-Economic Systems (EES) and Socio-Ecological Systems (SES) approaches as well as Heterodox approaches to Environment and Sustainability (HEES). The contributions made to this special issue are placed within their respective subfields of influence. It is concluded that a deeper, self-critical exposition of moral philosophies and values as well as models of reality are needed. A strategy of engagement in an attitude of self-criticism, humility and in participation with others is proposed as a viable way forward. For such a process to be successful two conditions are required, namely valuing the human person and accepting the reality of a non-determinate world full of meaning.

Key words: environmental management, environmental policy, environmental economics, ecological economics, heterodox economics, sustainability, ethics, values, ontology, participation

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1 Introduction

In recent years, both internationally and in South Africa, the economic approach to environmental management and policy has become widely accepted and has become the norm in the green economy. At the same time, other researchers point towards a crisis in natural resource and environmental management; a failure to explain resource collapse and continued environmental deterioration and rising impacts. It remains uncertain whether the economic approach to environmental management and policy accurately represents reality and what is valuable.

However, the question posed in the book *Sustainable options: Development lessons from applied environmental economics* (Blignaut & De Wit, 2004) is still relevant: “Could economic development and the principles of prudent environmental management be honoured simultaneously in a developing country?” There is no evidence that sustained economic growth guarantees a country to outgrow its social and environmental problems (Blignaut & De Wit, 2004:29). Lumby (2007) asked, more specifically, how the demands of modern economies can be reconciled with biophysical constraints. In many instances, environmental problems have economic costs that cannot be mitigated at firm or household level only. The challenge, therefore, became increasingly centred on finding macro- and sector-level policy solutions that are cost-effective and environmentally sustainable, that are within biophysical limits, while being sensitive to social and ethical concerns. More and more micro-level valuation studies that measure individual willingness-to-pay for environmental quality, have been used to inform macro-, sectoral and spatial level tools and policies towards sustainable development. We argued that internalising externalities or “getting the prices right”, is not a sufficient condition for prudent environmental management. It is also necessary for policy instruments to adhere to ethical norms outside

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economic efficiency and adaptive and flexible environmental policy should be designed to account for changing realities (Blignaut & De Wit, 2004:439).

How have these conditions played out in South Africa in the last decade or so? Is the economic approach to environmental management still warranted? If yes, under which conditions? If no, what viable alternatives are there in a globally economised world? This editorial discusses the progress made in employing an economic approach to environmental management and policy with reference to the South African experience. The objectives are (i) to present a broad outline of trends in the economic approach to environmental management and policy, (ii) to place contributions made in this edition within the broader narrative of such an economic approach, and (iii) to highlight the opportunities and limitations of the economic approach to environmental management and policy.

This task would not be possible without considering the definitions of the various economic schools of thought in support of environmental management and policy that have emerged in the last decade or so. First, the traditional split between environmental and resource economics and ecological economics is no longer deemed useful and a classification as Environmental, Resource and Ecological Economics (EREE) more accurately describes these shared theoretical foundations. Second, the rise of systems approaches to environmental management have led to two related, but distinct schools of thought, namely the Ecological-Economic Systems (EES) approach and the Socio-Ecological Systems (SES) approach. Lastly, various strands have developed that are called the Heterodox Economics of the Environment and Sustainability (HEES) approach, notably biophysical economics and social ecological economics, and also the more traditional heterodox economic approaches such as Evolutionary-, Post Keynesian-, Institutional- and Marxist Economics (Douai, Mearman & Negru, 2012).

2 Environmental, resource and ecological economics (EREE)

The central focus of the economic argument is to locate the rise of environmental problems within the failure of markets and capture the true costs of economic activity on the environment. The two main strategies that have been followed are (i) to correct costs of natural resources and the environmental quality through a regime of taxes, charges and subsidies, or (ii) to assign property rights to common or publicly held natural and environmental resources. These approaches led to a large number of studies to assess the costs of environmental damage and the value of natural resources owned privately or publicly, mostly relying upon non-market values generated through shadow pricing, proxy measures for market prices, preferences revealed through behaviour or measuring preferences asserted (willingness-to-pay) through surveys (Blignaut & Lumby, 2004). Economic theory holds that when the true value of a natural resource is included in the price, the resource will be allocated to the most efficient users.

Economic evaluation tools, such as cost–benefit analysis and cost-effectiveness analysis, are expanded to include the value of natural resources and the cost of environmental damage. Black, Turpie & Rao (2016) compare conventional engineering and ecosystem-based adaptation techniques for wetland rehabilitation in pastoralist systems adapting to climate change using a cost-effectiveness analysis (CEA). They conclude that conventional engineering of wetlands is more cost-effective from the land-owners' perspective, but when additional social concerns like poverty alleviation are included, ecosystem-based adaptations are more viable. The results suggest dedicated policy intervention to achieve broader social objectives.

The normative value governing an environmental and resource economics approach is to achieve economic efficiency by allowing for the unpriced damages of environmental externalities and the optimal use of natural resources. In theory, sustainable development would be achieved if the total stock of capital remains constant over time with the assumption that natural and environmental resources can be substituted by other forms of man-made capital (Solow, 1993). Economic policy proposals, therefore, tend towards improved monetary valuation of individual willingness-to-pay, internalising external costs through enhancing the efficiency of market-based policy instruments and strengthening the institutional capacity to assign and enforce property rights (Nahman, Wise & De Lange, 2009). The theory (known as the Environmental Kuznets Curve (EKC)) is that as incomes rise, the willingness-to-pay for environmental quality will rise and countries will experience a reversal of environmental damage over time (Grossmann & Krueger, 1995). There is no evidence to support the idea that developing countries will automatically be able to "tunnel through" an EKC, suggesting the need for deliberate policy to respond to increasing environmental damages as the economy grows (Blignaut & De Wit, 2004:11-12). Although still contested, empirical research also does not find a robust relationship between rising income and declining pollutants (Stern, 2004; Harbaugh, Levinson & Wilson, 2002). Likewise, support for an EKC in South Africa is at best ambiguous – implying that if an EKC does not exist the country will have to sacrifice growth to reduce emissions (Nasr, Gupta & Sato, 2015).

This finding is supported by the study by Van Heerden, Blignaut, Bohlmann, Cartwright, Diederichs & Mander (2016). They calculate the impact of the recently-introduced carbon levy on the national economy using a dynamic computable general equilibrium model (DCGE) and concluded that it will have a negative impact on GDP. The manner in which the tax revenue is recycled back into the economy plays a major role in reducing the net costs to the economy, suggesting the need for careful design of carbon tax and revenue recycling schemes. Kohler (2016) is concerned with water scarcity in South Africa and proposes an economic approach to water demand management. Kohler uses decomposition analysis to calculate water use intensity, and regression analysis to calculate the main drivers of change in the South African economy. He concludes that water use generally reflects the level of capital stock in the country and that capital stock is only very gradually becoming more water efficient. He suggests the use of a mixture of water management options to incentivise innovation and technological adoption of water saving measures. Both aforementioned studies (Van Heerden et al., 2016; Kohler, 2016) point to the fact that economic activity, environmental damage and the use of natural resources are closely associated and can only be changed through deliberate policy interventions.

Persistent critiques against the "market solution" of environmental problems are that environmental goods and services are not priced efficiently enough to avoid the degradation of natural resources and the environment, and that intergenerational welfare is not guaranteed (Lumby, 2007). Ecological economics has emerged as an alternative, more precautionary approach, starting with biophysical limits on the economy and the ability of technology to circumvent them (Costanza, 1989). Production processes are subject to the laws of thermodynamics. Therefore, biophysical rules are needed for the management of renewable- and non-renewable resources and pollutants to ensure long-term sustainability (Daly, 1992). Environmental quality can be diminished through economic activity, but only if there are no ecological thresholds in danger of being breached. The normative value governing an ecological economic approach is to achieve ecological sustainability, which is defined in terms of ecological stability and resilience (Holling, 1973). Like ERE approaches, monetary valuation techniques are used, but focussing on the value of ecosystem services aggregated across time and space. Aggregated values are typically much larger in magnitude than marketed goods and services in the world economy (De Groot, Brander, Van der Ploeg, Costanza, Bernard, Braat, Christie, et al., 2012), in effect increasing the shadow prices used for evaluating the impact of economic expansion on the environment. The assumption is that increased prices for environmental quality will send out signals that would change behaviour towards sustainability. The argument continues that the benefits of ecosystem services from public- or common goods does not mean that such services should necessarily be privatised. Sustainable development would be achieved if the stock of natural capital (or at least what is referred to as critical natural capital) remains constant over time (Ayres, 1998). Ecological economic policy proposals tend to favour an allocation of resources through market incentives, but only in a policy hierarchy after issues of ecological scale or damage as well as distribution have been regulated in the political process (Cumberland, 1994).

Environmental, resource and ecological economics as outlined here, adhere to the same foundations in theories of capital and value. Rebranding the combined research field under the term “sustainability economics” has been suggested by some (Baumgartner & Quaas, 2010), but dismissed by others as a process already ongoing within the field of ecological economics (Spash, 2013). Common and Perrings already argued in 1992 that Solow- and Holling-sustainability are disjointed. Price changes may alter the optimal allocation of natural resources, but it is not clear how this will achieve ecosystem stability and resilience. Efficient prices may yield Holling-sustainability, but it is not an obvious outcome. The key difference lies in concepts of value; efficiency achieved through prices (or measuring contingent value in the case markets fail) or through biophysical concepts derived from ecosystem stability and resilience.

3 Ecological-economic systems (EES) approach

Both environmental and resource economic and ecological economic approaches start with an abstraction that the natural environment can be represented as capital, although using different rules of substitutability between forms of capital. Valuing and managing the stock of wealth in a firm, household or country is a concept well-documented in the classical and neo-classical thought on economic development and growth. When coupled with growth factors such as savings and investment, these provide the basis of all macro-economic accounting and growth modelling. By using the capital theory approach, the EREE methods keep the door open for a conversation with mainstream economics on environmental management and policy. In such a capital-theory approach (CTA) several accounting frameworks and indicators have been developed that provide useful, but partial, information to policymakers. The complexity and dynamics of ecosystems as well as the social contexts are not integrated into the capital theory approaches of EREE (De Wit, 2000). In an effort to better understand the flow of services from natural capital, it is argued that integrative and dynamic modelling methods that include environmental, economic, social and institutional realities would better recognise complexities of sustainable development at disaggregated levels and over time. These have been proposed as the real contribution of an evolving ecological economic approach (Perrings, 2006). Integrated ecological-economic system dynamics modelling was developed as an answer towards bridging the gap between Solow- and Holling-sustainability through a combination of economic optimisation models and system dynamic simulation models (Hediger, 1999). The focus on quantitative accounting and modelling for decision-making and control remains, as is also evident in more static versions of the CTA. Modelling steps are closely controlled by either the modeller him or herself or the broader group of research participants and decision-makers. For example, boundaries for space and time are chosen by the modelling team and should theoretically be sufficiently long for dynamic behaviours to be seen (Ford, 1999). The focus of such integrated and dynamic approaches is to influence the decision-making processes and policies of natural and environmental resource managers or market participants aimed at enhancing control and management. System dynamics stock–flow modelling approaches share a worldview of an objective, ordered reality with neo-classical economics and can be successfully employed to study integrated ecological-economic questions (Crookes & De Wit, 2014). Integrated EESA modelling is an extension and enrichment of the CTA to sustainable development.

These trends and debates have also run their course in South Africa. From an ecological point of view it has been argued that monetary valuation studies should estimate values based on a better understanding of ecological systems (Turpie, 2004). In the last few years world-wide and in South Africa, a proliferation of studies were done on integrated ecological-economic system dynamics modelling using the language of ecosystem services as an integrative concept (Le Maitre, O’Farrel & Reyers, 2007). These ecological-economic models are generally focussed on a better understanding of the benefits derived from a stock of natural capital through the flow of ecosystems services over time (Crookes, Blignaut, De Wit, Esler, Le Maitre, Milton, Mitchell et al., 2013). The outflow of this work on a micro-level is to adjust prices for the benefit and damages on ecosystem services. On a macro-level it is to include the value of ecosystems and natural resources in environmental impact assessments, green accounting, integrated environmental economic indicators and macro-economic modelling approaches.

Several studies in this edition contribute to a better understanding of ecological-economic interactions using a system dynamics modelling (SDM) approach. Three of them (Morokong Blignaut, Nkambule, Mudhavanhu & Vundla, 2016; Mudavanhu, Blignaut, Nkambule, Morokong & Vundla, 2016; Vundla, Blignaut, Nkambule, Morokong & Mudavanhu, 2016) use SDM to support cost–benefit analyses that include the dynamic interaction between economic and ecological sub-systems. Morokong et al. (2016) consider the feasibility of clearing invasive alien plants (IAPs) to improve the flow of water rather than building the De Hoop dam in the Olifants River catchment in South Africa. They calculate the Unit Reference Values (URV) over the life-cycle of the two options – an integrated indicator of net present value (NPV) and water yield – and concluded that the clearing of IAPs is a cost-effective option for catchment management in the Olifants River. Mudavanhu et al. (2016) and Vundla et al. (2016) consider the use of IAPs as a resource for both electricity generation and value-added products respectively. Mudavanhu et al. conclude that the production of electricity using Rooikrans at the De Hoop Nature Reserve in South Africa is feasible as a biomass electricity generation strategy when compared to a diesel generation option. Vundla et al. (2016) conclude that the cost of clearing IAPs can be reduced through the development of a public-private co-financing partnership with industries that benefit from value-added products.

Crookes and Blignaut (2016) use a predator-prey system dynamics model to simulate the dynamics between steelmakers, the automotive sector and the iron ore industry in South Africa. The Lotka-Volterra model they employed, has its roots in population ecology and was first used to describe the dynamics of biological systems in which two species interact. It has however been applied in various ways in economics. This approach explicitly allows for alternatives for steelmakers, whose growth is restricted because of capacity constraints. The authors conclude that steelmakers do not have to forfeit their business, but can rather opt for less resource-demanding technologies. An eco-labelling scheme for steel is proposed as a policy option.

Van Loeper, Musango, Brent & Drimie (2016) respond to the relevant question of how smallholder farms can play a role in improving food security in the South African context. They develop a system dynamics model on the underlying forces between participants in agricultural value chains in South Africa and conclude that banks can play a key role in stimulating/ encouraging smallholder farm production.

Much of this work on integrated ecological-economic systems modelling points toward a need to strengthen the institutional environment and the governance of ecosystems. These are needed before ecosystems services can be effectively allocated through economic incentives (such as Payments for Ecosystem Services (PES)) within the boundaries of environmental sustainability. Policy instruments such as PES can play a role in improving environmental governance, but it cannot be expected that they can completely solve complex policy problems (Muradian, Arsel, Pellegrini, Adaman, Aguilar, Agarwal, Corbera, et al. 2013). In other words, the EES approach contributes a great deal in better understanding the interaction between physical process and value judgements made in economy-environment interactions, but does not solve questions on how to engage with the social realities of actual human behaviour, institutional functioning and governance. EREE and EES approaches all tend towards a normative approach to economic policy, whether focussing on efficiency alone or allowing for other values such as ecological sustainability and justice. The realisation that institutions and property right regimes are pivotal in environmental and natural resource management is not new, but have recently joined with a systems approach in what has become known as the socio-ecological systems approach.

4 Socio-ecological systems (SES) approach

The SES approach, rooted in both a systems approach and new institutional economics, emphasises the role of institutions and property rights in the management of natural resources such as fish, water, land, grazing and forests (Berkes & Folke, 2000). Apart from man-made and natural capital, explicit distinction is made for cultural capital which refers to "the factors that provide human societies with the means and adaptations to deal with the natural environment and actively modify it" (Berkes & Folke, 2000:6). Humans are seen to be specifically included in the ecosystem where feedback from the environment and learning processes inform and shape policy and management. Traditional knowledge and local expertise are seen as valuable resources in environmental management. Socio-ecological systems (SES) are conceptualised as resource users who self-organise to maintain resources and achieve sustainability under certain conditions (Ostrom, 2009). The modelling approach is bottom-up by allowing macroscopic properties of complex adaptive systems emerge from the non-linear dynamic interactions of humans in relation to each other and at lower levels to their environment (Levin, Xepapadeas, Crépin, Norberg, De Zeeuw, Folke, Hughes, Arrow, Barrett, Daily, Ehrlich, Kautsky, Mäler, Polasky, Troell, Vincent & Walker, 2012). Modifications to the system are focussed on achieving greater sustainability, increasing resilience and co-evolution, but not excluding human intervention. Technological innovation can at times be required to enhance resilience (Farley & Voinov, 2016). The prescriptive expectation is that human values and ethics will have to adapt to be in tune with the development of societies that are ecologically sustainable (Berkes & Folke, 2000:431). Such prescriptions have led to the critique that the SES approach needs to include aspects of power and competing values to better be able to address the question for whom resilience is desired and at what cost (Cote & Nightingale, 2012).

5 Heterodox economics of the environment and sustainability (HEES)

Not everyone is comfortable with the close association between ecological economics and neo-classical economic approaches, despite more realistic interpretations of complex and dynamic human-environment interactions in the EES and SES methods. Some have argued that such developments do not go far enough and that the future of ecological economics lies firmly among heterodox economic schools of thought and in ideological opposition to existing institutional structures (Spash, 2012). Some ecological economists are in discussion with more traditional heterodox economic schools of thought such as Post-Keynesian Economics, Marxist Economics and Institutionalism (Douai et al., 2012). Three strands of thinking are highlighted here, namely biophysical economics, social ecological economics and evolutionary economics.

5.1 Biophysical economics

The biophysical economic approach uses basic ecological and thermodynamic principles to analyse the economic process (Cleveland, 1999). This is a vastly different approach to valuation and implies different ethical positions from neo-classical economics (Ayres, Van den Bergh & Gowdy, 2001). Solow- and Holling-sustainability differ on the substitutability of natural capital with other forms of capital, such as human labour and man-made capital. Standard production function models allow combinations of inputs and per definition admit perfect substitution, yet the possibility and limits of substitutability between factors such as capital, labour, energy and other forms of economic activity are questioned (Ayres, 2008). The argument is that limits to a continued supply of natural resources, a clean environment and energy need to be explicitly acknowledged and included in growth modelling approaches. Material and energy flows through the economy are important indicators of system sustainability and cannot just be assumed to be an outcome of applying capital and labour to natural resources. Environmental constraints are treated as normative prescriptions to economic activity and human actions need to conform to the physical realities for the good of mankind (Cleveland, 1999).

Empirical testing of the relationship between movements of market prices for material and energy and indicators of material and energy scarcity (such as EROI) is required before such a claim can be generalised as norm. The increasing scarcity of oil, for example, is already included in market prices that would stimulate a transition away from oil towards alternative energy, although such price signals are not sufficient to guarantee a smooth transition (Heun & De Wit, 2012). The reality of non-perfect substitutability and limited time frames of transitions point towards the need to steer towards smoother transitions.

5.2 Social ecological economics

Social ecological economics rejects neo-classical principles altogether, is located in modern political economy, and provides an ideological and methodological critique on economic approaches to environmental management and policy (Spash, 2013; Spash & Ryan, 2012). The economic system is "regarded as totally infused with power relationships and embedded within social structures" (Spash & Ryan, 2012:1100). The implication is that social and environmental problems are seen as inseparable.

5.3 Evolutionary economics

Evolutionary economics has developed on the premise of change in technology and economic organisation and the analogy of natural selection for profitable firms in markets (Nelson & Winter, 1982). It seeks to develop from an evolutionary basis of human behaviour and morality (Hodgson, 2012a). Theoretical concepts such as co-evolution, bounded rationality, path dependence, diversity and selection as well as the process of technological change and innovation constitute the evolutionary economic approaches to environmental management (Van den Bergh, 2007). Evolutionary economics has revealed an extended neglect of environmental and natural resources. Biophysical limits are acknowledged, but are rather seen as starting points for innovation (Faber & Proops, 1990). Economic policy emphasises diversity rather than efficiency or even ecological sustainability. A diversity of options would provide the space for adapting to changing circumstances and preferences through selection and new innovations (Van den Bergh, 2007:60). Policies aimed at transitions towards sustainability are therefore not a search for an optimal policy, but instead suitable environments for innovation and selection. Transitions are not merely technical, but operate across multiple levels in various economic, social and political contexts (Baker, Newell & Phillips, 2014).

6 Discussion on the opportunities and limitations of economic approaches

The main opportunity for economic approaches to environmental management and policy is its general acceptability and application in the formulation of environmental policy. In the words of Harrington, Morgenstern & Sterner (2004:1): "If in fact we are all environmentalists now, the central issues today are what works, what doesn't, and what it costs". Economic approaches are also used to support South Africa's transition to greener growth, most notably policy instruments such as carbon emissions taxes, fuel taxes, feed-in-tariffs for renewable energy, water pricing, waste water discharge charges, levies on plastic bags, deposit-refund schemes on recyclables, payments for ecosystem services, and biodiversity offsets. In certain cases cap-and-trade systems have developed, most notably water trading schemes among farmers (Nieuwhoudt & Armitage, 2004). Balancing the norm of economic efficiency with other norms such as justice and sustainability remain an important focus area in developing economies like South Africa, characterised by high inequality and high ecological footprints. Investment into ecosystems and greener urban infrastructure to increase the chances of a steady flow of ecosystem services, and attribution of value to dis-incentivise exploitation (e.g. through PES schemes) are important opportunities for using economic approaches to environmental management and policy.

Apart from those who argue that economic approaches are not sufficient to achieve stronger forms of sustainability – an ongoing debate between Solow and Holling definitions of sustainability – a main limitation of mainstream economic approaches to environmental management and policy, lies in its claim to be value-free. Contrary to much of modern economic thought, ethical analysis does play an important role in understanding how economies function. Not only do the values of human beings influence both behaviour and economic outcomes, but their moral convictions are also influenced by the way economists analyse and describe them (Haussmann & McPherson, 1993:674). In an earlier editorial for this journal, Blignaut (2002) pointed towards notable progress achieved by the application of economic theory to environmental and natural resource management, but concluded that the search for a new economic system away from the contemporary Newtonian/Smithsonian had to continue. In another contribution, he argued that such a system is characterised by a Kantian/Rawlsian rule-based economic ethic and system of governance that emphasises values of fairness and justice (Blignaut, 2004). Developments in ecological-economic systems approaches have emphasised complexity and dynamics in response to the reductionism and static approach of neo-classical economics. Managerial and contractual approaches are mainly used in the hierarchical governance model. Developments in socio-ecological systems approaches have also embraced a theory of complexity and dynamics, but have propagated in favour of a decentralised and collaborative governance approach. In contrast, a Veblian/Darwinian system of self-organisation and complex adaptation, with a keen focus on micro-level human behaviour, is continually developed in the heterodox fields of evolutionary, institutional and complexity economics, with a network-orientated governance approach (Beinhocker, 2007; Van den Bergh, 2007). Biological and cultural foundations for morality have been proposed as an alternative to the metaphysical/transcendental foundations of Kantian/Rawlsian morality and the utilitarian morality of mainstream economic theory (Hodgson, 2012b).

Despite only touching on the subject of morality and ethics, it is clear from this short discussion that a deeper exposition of moral philosophies and ethical theories in the further development of economic approaches to environmental management and policy is needed. The distinction between facts and values, central to the development of economics at least since the Enlightenment, cannot be assumed to hold as a heuristic principle. Another limitation is that the methodologies and models used by economists, which are only partial interpretations of reality, are regarded as reality itself. This poses a real risk to economic, social and ecological systems, as decisions are made on the basis of a caricature of reality. The models of reality (ontology) that are used, need to be exposed and interpreted in terms of reality itself. The mandatory choice between objective and subjective realities will be challenged. Spash (2012) argues that such a rethink on ontology will have a ripple effect on epistemology, methodology and ideology.

Yet, there is a difference in an approach that falls into what can be referred to as “untenable idealism”, which is rooted in some form of “transcendental control of human development” or an approach that takes both transcendent and immanent norms “of realized possibilities of a practice as it enters in human living” (Sauer, 2003:19). An understanding of economic approaches to environmental management and policy is a process of correlation between transcendent norms and actual practice. Such a process is open, fallible and reflective as it is “inherent in the human condition” (Soros, 2013). Such a reflexive system does not choose between objective or subjective realities, but leaves place for both in a two-way relationship. Without a doubt, this will generate tension, but the controls of understanding and value judgement are not closed prematurely through a focus on either empirical reductionism or moral idealism. One way to bridge the gap between modernistic objectivism and post-modern hyper-subjectivism is to engage in a process of self-criticism done in humility. Economists need to expose their models of reality (ontologies), epistemologies, methodologies and ideologies to criticism, pondering what the late South African theologian David Bosch states as “the possibility that Truth may indeed differ from what we have thought it to be” (Bosch, 2010:360).

7 Conclusion

The objectives of this editorial were as follows: (i) to present a broad outline of trends in the economic approach to environmental management and policy, (ii) to place contributions made in this edition within the broader narrative of such an economic approach, and (iii) to highlight the opportunities and limitations of the economic approach to environmental management and policy.

First, it can be concluded that at the same time as the mainstream economic approach to environmental management and policy have become accepted in the new green economy and the results are becoming clear, a deeper critical reflection has emerged that cannot be addressed with categories used even ten years ago. Ecological economics is largely becoming a subset of mainstream environmental and resource economics and can more fruitfully be referred to as Environmental, Resource and Ecological Economics (EREE). This field is deepening in its acceptance of complexity and dynamics focussed on Ecological-Economic Systems (EES) and Socio-Ecological Systems (SES), respectively. These shifts have also brought a clearer articulation of heterodox positions, notably biophysical economics, socio-ecological economics and evolutionary economics that are in discussion with traditional orthodox economic schools of thought.

A second conclusion is that contributions to this South African edition are largely leading to a better understanding of Ecological-Economic Systems using a system dynamics modelling approach as well as evaluating the impact of natural resource limits and pollution taxes on the broader economy. Researchers working on economic approaches to environmental management and policy in the EREE and approaches are increasingly faced with matters relating to institutions and governance, components that are central to research arising from the new institutional economics and Socio-Ecological Systems (SES) approaches.

Third, economic approaches to environmental management and policy are being accepted worldwide and in South Africa. These are exciting times to work on such approaches and great opportunities are presented to contribute towards greener economies, communities, households and individual behaviour. Yet, there are serious limitations in the treatment of values and morality in economic thought as well as the views on reality assumed in human behaviour and economic modelling.

The way forward amidst such heterogeneity is to actively engage various economic approaches to environmental management and policy within strongly scientific empirically grounded research and applications, while correlating the research with deeper questions on value, ontology and epistemology. This means not to reject objectivity nor subjectivity *a priori*, but rather deploy a strategy of engagement in an attitude of self-criticism, humility and in participation with others. Research programmes that involve various disciplines and include participation from various role-players are important for moving in this direction (Esler, Downsborough, Roux, Blignaut, Milton, Le Maitre & De Wit, 2016). One challenge to such approaches is that a reflective process on values, morality, ontology, epistemology and even the methodology of the natural sciences and economics is not possible without a well-developed sense of disciplinary self-criticism and professional humility by the participants. Several approaches in the natural sciences and mainstream economics share a worldview of an ordered, objective and material reality and may very likely see any form of subjective reality and contingency as a slippery slope into subjectivism. This does not have to be the case, as accepting contingency does not mean that everything becomes contingent and is thus devoid of logical necessity. However, to test the proposal made in this editorial for a way forward would require an open, fallible and reflexive process that attempts to correlate both actual practice and norms into a fruitful process of learning. Such a process would require at least two conditions, namely valuing the human person and accepting the possibility of a non-determinate world full of meaning.

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