

# A future social-ecological economics

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## I. Introduction

This paper describes the need for and content of an emerging paradigm termed Social Ecological Economics (SEE). In this paper we argue that SEE is the essential future direction for the economics profession, not least because of the social-ecological crises facing humanity and the need for transformation of capital accumulating economic systems. Economics as a discipline is a failure because of a long running inability to address, and tendency to marginalise, such things as power relations, social inequities and injustice (across gender, class and race), ethical social provisioning, the role of care and reproductive processes, the social implications of advancing technology, treatment of others with silent voices (e.g. future generations, children, the non-human world).

SEE draws upon a wide range of literature with links to classical political economy and critical institutional economics. It relates environmental problems to economic structure via the work of Kapp (1950) on social costs and cost shifting, and Georgescu-Roegen (1971) on thermodynamics and dialectics, and connects to ecology to identify mechanism arising from ecosystem structure and function (Spash and Smith, 2019). These are common roots with some branches of ecological economics, but the fundamental difference is the emphasis placed on social structure. In this respect SEE shares concerns with feminist economics over care, reproduction and the role of unrecognised labour, and Marxist political theory over power, class and exploitation. The need is recognised for a social theory as well as a philosophy of science, neither of which have been adequately addressed by ecological economics.

The philosophical basis of the approach is argued to be closest to critical realism. Core aspects of correspondence here are depth ontology raising the profile of both structure and mechanisms as opposed to a sole focus on empirical facts. Structure as a metaphysical reality with multiple causal mechanisms operating in open systems then poses challenges for how economics conducts itself as a science. While following critical realism in its epistemic pluralism there is also a recognised need for structuring interdisciplinary research and uniting diverse fields via common ontological understanding leading to a structured methodological pluralism (not the eclecticism of constructionism and conventionalism). Potential methods for research are selected on the basis of the qualities of an object of study and research question and as such remain open and diverse (quantitative/qualitative, intensive/extensive, see Sayer, 2010). Economic science is then neither deductivist, empiricist nor reducible to a set of idealised methods.

We start this explanation of SEE by taking issue with the hegemonic definition of economics based on choice and offer an alternative based on social provisioning. This clarifies the failure of economics to address different forms of economies both in theory and as actualised and operational both historically and at present. The relationship of economies to needs and their satisfaction with an associated material and energy throughput then becomes part of economic analysis. As noted, a clarified relationship between the ecological economic and the

social is required and we explain some basic aspects of the relationship to social reality. This coverage is an outline of the ontological commitments of SEE, that is how reality is understood, its key constituents as far as an social-ecological economic system is concerned and some of their relationships. Next we outline the way in which economics can be conducted from the perspective of two other aspects of philosophy of science, namely epistemology and methodology.

## **II. Economics as the study of social provisioning**

A rather obvious approach to defining what constitutes economics as a subject is to determine its primary object of study. Economics as an orthodoxy has for some time been dominated by a neo-Austrian dogma that was introduced significantly via Lionel Robbins (1932) and adopted into the mainstream, not least in microeconomic theory. This placed the concepts of resource scarcity and individual choice at the centre of a liberal political economy that was supposedly value free. The economic problem became meeting unlimited and competing wants and the supposed solution was meant to be resource allocation via “the market”, soon supplemented by (macro-)economic growth. In fact a single institutional process associated with capitalism was being advocated, namely, what Karl Polanyi (1957) termed, the price-making market. Robbins neo-Austrian definition then merged into Chicago school neoliberalism, where choice in a market setting, subject to price incentives, became the essence of economics and this has since permeated its meaning. This approach permitted an imperialistic expansion of economics into all sorts of subject areas, simply based on the idea that humans must make decisions as individuals so that any decision became an economic topic, e.g. equating everything from buying a cup of coffee to suicide (as infamously proposed by Becker, 1976).

In stark contrast, an older tradition regards the core of economics as determining the social and institutional arrangements for providing the needs of a community (or nation). Here the aim is to achieve a common good or well-being of all. What constitutes the good/well-being for a group then requires explicit ethical judgment. Modern times reduced the goal of seeking the “common weal” (i.e., the ability to fare well, prosper and have good fortune) into accumulating wealth and making money. Economics then simply became the study of capital accumulation using money and market prices and ultimately leading to economists’ claims of being able to determine optimally efficient public policy.

SEE immediately takes issue with reducing the subject down to studying something as singular as *the* economy, as if there were only one such entity or form. The term “the economy” is merely unthinking code for market capitalism, while denying actualised varieties of capitalism and that this is only one form of economic system (Hodgson, 2016). So rather than reduce economics to the study of one generic form meant to approximate the currently dominant system, a far broader approach is required, and not least so because this system **is** failing and creating catastrophic social and ecological crises.

A more comprehensive approach is to define economics as the study of social provisioning to meet human needs within an ethical framework of care and justice for others, both human and non-human. Social provisioning is a necessary activity for any social group whether a household, village, town, city, region, nation state or global collective. It concerns the ways in which people organise as social groupings to satisfy their needs. Markets as mechanisms for allocation are merely one form of arrangement and themselves diverse in structure.

Economics can then be seen as concerned with the variety of institutions for ensuring the satisfaction of needs and the reproduction of a society. Institutions here are to be understood as inclusive of conventions, norms, rules and regulations (Vatn, 2005). This immediately opens up economics for the consideration of alternatives and potentialities rather than the nihilistic claim that there are no alternatives.

A common objection to a focus on needs is that this is deterministic and fails to allow for the variety that appears evident in human society. Such a claim can be seen as confusing objective requirements with subjective means of their fulfilment. Thus Max-Neef (2009 [1992]) makes the distinction between needs and the satisfiers that enable their actualisation. He identifies nine fundamental needs – subsistence, affection, understanding, participation, leisure, creation, identity, freedom – that are regarded as universal and only changeable over extremely long time periods of species evolution (Max-Neef, 2009[1992]: 138). Meeting needs is regarded as a necessary prerequisite for human flourishing, while their means of fulfilment is socially contextual and varies across space and time (Rauschmayer and Omann, 2017). Satisfiers relate to the institutions, norms and practices that structure the satisfaction of needs, and will influence how economic goods and services contribute to their fulfilment or inhibition (Max-Neef, 1992). As such, while needs remain objective, how they are expressed, perceived, and fulfilled will always be subjective, conditioned by institutional arrangements and wider social and cultural contexts. This embeddedness and emergence of an economy from and with social structure forms one of the foundational ontological commitments of SEE.

In turn, social and economic systems are understood as being embedded in, and fundamentally constrained by, biophysical structures (Spash, 2017; Spash and Smith, 2019). All economic processes interact with their environment. There is a straight forward and basic dependency of economic systems upon flows of materials and energy as well as sinks for the necessary removal of waste material and energy. Economies are open social-ecological systems. Their processes operate within a set of limits prescribed by ecosystems structure and functioning, and social structure represented by actors and their institutional context.

### **III. The biophysical in economics**

A basic fact, although absent from most economic thinking, is that natural resources and waste sinks are required to ensure social provisioning. The reproduction of societies must address the maintenance of ecosystems structure and their functioning or fail. Production fundamentally requires energy, or, more precisely, available energy termed “exergy”. That is, humans require energy capable of performing useful “work”, which is defined, as in physics, to mean the exertion of a force against some form of resistance (Ayres and Warr, 2009). Such work can be performed by humans, animals or machines, but will always require some input of exergy, whether it is the solar radiation embodied in food that fuels human and animal labour, or fossil fuels to power a heat engine. This dependency of societies on flows of energy and materials is captured in the concept of “social metabolism” (Krausmann, 2017). There is no single social metabolism because it will vary depending upon the structure of an economy and its social provisioning mechanisms, and there-in lies the potential of alternative social-ecological economies.

The metabolic nature of human societies emphasises the role of materials and energy in their reproduction. This makes the laws of thermodynamics central to any economic process as explored by Georgescu-Roegen (1971). The first law of thermodynamics stipulates that

energy is neither created nor destroyed but transformed from one state to another. In turn, the second law states that when used, available energy dissipates and becomes less useful. This is a qualitative and irreversible process, which implies that exergy is bound to diminish, while entropy, as a measure of energy dissipation, or disorder, will inevitably increase in an isolated system (i.e. where there is neither exchange of energy nor materials with any other system).

Human, and non-human, survival depends upon material and energy exchange which means on being open systems. Giampietro (2019) notes how Schrödinger described living organisms and ecosystems as having the capacity to seemingly avoid, or even reverse, entropic decay through interaction with their surroundings but this requires gathering available energy and concentrated materials from, and disposing of waste into, other systems. Entropy is not actually reversed because it continues in the larger system with which living organisms interact and are dependent. As biophysical entities living organisms are open systems. In general, open systems can maintain organisation, a given size and level of activity, but this has consequences for the systems with which they must interact. The growth of any organism, ecosystem or population is therefore fundamentally limited by the biophysical structure of its environment. These are termed horizontal limits by Devictor (2017: 120-121), because they relate to the spatial-temporal boundary for a given population, assemblage or ecosystem. The same principle applies to human societies and their economies, which depend upon ecosystems for flows of materials and energy as well as sinks for the waste they generate. Giampietro (2019) remarks that this implies that the processes ensuring the reproduction of elements of a “technosphere” (i.e. a social economy) must not interfere with the reproduction of elements in its associated “biosphere” (i.e. ecosystems structure and function) upon which they depend for maintaining a given scale of activity and organisation. Different societies have attempted to address this requirement in different ways with varying degrees of success in sustaining themselves.

Human history consists of a long period in which social provisioning was organised by free roaming, migratory, hunter gatherers prior to the rise of sedentary agricultural settlements. The former appear highly sustainable, long lived and relatively low impact, although some extinction of species is implicated. The latter consisted of small bioregional economies, with regional material flows and solar radiation as the main source of exergy, reliant on agriculture and forestry for various reproductive processes. The industrial revolution marked the start of a major transformation of social metabolism in human social and economic systems. The use of fossil fuels – coal then gas then oil – became the main source of exergy driving production processes, while increasing use of concentrated minerals replaced solar dependent plant and animal materials. This expansion of production, along with the development of artificial fertilizers, facilitated the growth of economic activities and populations beyond their previous limits (Spash, 2017).

This social metabolism appears highly unsustainable. After a few hundred years operating in just parts of the global provisioning system the results appear headed towards catastrophic collapse. The move away from exergy derived from solar radiation to finite stocks of concentrated minerals, combined with economic growth, has meant the social metabolism of industrialised human societies rapidly depleted the “entropic dowry” upon which it depends (Georgescu-Roegen, 1971). As a physically closed system, the Earth exchanges flows of energy but not of materials with its surrounding (at least not in any significant sense), while the reproduction of biospheric entities is made possible by the existence of various climatic systems that dispose of thermal energy into outer space, maintaining favourable conditions for life (Mayumi, 2017). Once used the stocks of low entropy are in effect irreversibly lost. In

theory, the flows of exergy from solar radiation could be harnessed to reverse the dispersal of available energy on Earth, but to date this remains science fiction, while the ability to reconcentrate all dissipated materials to original quality on a substantive scale appears equally implausible (Spash and Smith, 2019). Recognising the biophysical reality of the economic process then leads to the inevitable conclusion that industrial economies are dependent on finite stocks exergy and their continued operation, let alone continual growth, is impossible over any extended period of time.

While the exhaustion of finite resources remains an ultimate limit on human activity, an arguably more pressing limit is the accumulation of waste. Industrial social metabolism “merely transforms low entropy into waste” (Georgescu-Roegen, 1971). As such, pollution should not be treated as a problem outside the system (i.e. an externality), or an anomaly, that could somehow be solved through increased efficiency, or correcting prices, but as an integral part of the economic process (Spash, 2021b). The Laws of Conservation indicate the inevitability of pollution because mass remains the same, but the quality of materials, like energy, declines. Ecological economists such as Daly (1992) have emphasised the scale of impacts from human activity (e.g. waste accumulation). What has been given less attention is the qualitative aspect arising due to the creation of artificial substances and interventions that would not have otherwise occurred and to which natural systems and entities are unable to adjust. Such unnatural impacts on the biosphere and ecosystems lie at the heart of the ecological crisis, such as the on-going mass extinction of species. Thus, not just the scale of human activity (e.g. quantity of waste, population size) but also its qualities determine the consequences for the environment and functioning of ecosystems. The importance of the form of intervention is why technology is never neutral, and also what determines the extent to which something is unnatural (Deckers, 2021). Humans are then engaged in processes of change not equilibrium and stability.

The development of ecology in the 1970s brought new insights into the structure of complex systems and their interconnections. This was mainly driven by the realisation of the disruptive impact of human activities on ecosystems’ structure and function, which in turn affected human systems (Spash and Smith, 2019). Contrary to previous views of ecosystems as isolated, self-regulating and stable systems, they became recognised as complex and dynamic open systems. The potentiality to change ecosystem structure dramatically following systems collapse was highlighted by Holling (2009[1986]), who described this organisation and reorganisation process as part of a cyclical pattern. The evolution of an ecosystem or population can be chaotic with abrupt changes in trajectory. Besides the “horizontal limits”, mentioned earlier, “vertical limits” are emergent and arise due to interactions between ecological levels and dependencies between different components of the system (Devictor 2017). Human activities interacting with ecosystems have uncertain and indeterminate consequences for their structure and function. In the face of such partial ignorance and indeterminacy over human intervention, public policy would better be precautionary than risk taking (Stirling, 2017), and society prepared to adapt rather than lock itself in to a specific “optimal” pathway (e.g. infrastructure, technologies, energy and materials).

#### **IV. The social dimension of economics**

Social reality is the dynamic outcome of human practices from which it emerges and by which it is reproduced (Lawson, 2006). However, emergence means that social structure while dependent upon is not reducible to human practices (e.g. individual behaviour). Social

structure enables coordinated interactions through collective practices. Collective practices refer to accepted ways of doing things in a community, and can emerge in various ways, notably because of their functionality, but also simply by chance or repeated occurrences (Lawson 2012). They form a basis for individuals to form expectations as to the appropriate course of actions to follow in order to coordinate with others. Interconnected obligations and rights may evolve that are relationally constituted and constitutive of social positions (Lawson 2006). For example, the positions of employer and employee exist in relation to each other and entail associated rights and obligations for both parties.

How, and to what degree the actions of agents are pre-determined by social structure, as opposed to being autonomous, is a fundamental point of debate. Mainstream economics reduces “society” to being an aggregation of individuals who act purely out of individual self-interest (i.e. maximising their own personal utility) and are basically identical (both ethically and psychologically). As such it cannot explain the historical variety in social provisioning systems – production and consumption patterns – throughout history and across contemporary cultures. This requires understanding human variety and social relations as emergent and mediated through institutions and values that interact with, shape and form economic structures. Human action is always relative to a particular context in space and time and set within social structure. While agency is restricted it is neither denied nor entirely pre-determined.

Following Jessop’s (2001, 2005, 2007) “strategic-relational” approach, structure and agency can be viewed as dialectical concepts beyond an artificial dualism. He considers structures as *strategically selective*, but not *absolutely constraining*, leaving some room for agency. His main argument is that structures generally tend to favour some actions over others. In this sense, he emphasize the importance of a strategic context for action: agents will strategically reflect on their (usually incomplete) understanding of structural constraints and opportunities and act accordingly. Action is therefore both structured, and “structuring” as it tends to reproduce structures and their patterns of strategic selectivity. These recursive interactions between agency and structure create tendencies because structures are not absolutely constraining. There is then only relative and temporary stability to patterns of strategic selectivity, with the possibility for actions to circumvent structural constraints or change them.

As structures are the product of human agency, they are dynamic and are open to change (Lawson, 2012). Through their practices and interactions, humans continuously (and often unintentionally) reproduce and transform the social structures that influence these practices. The employer-employee relation for example has evolved, with a changing set of rights and obligations as unions have negotiated better working conditions. Likewise, the social positioning of women has changed as emancipatory movements have fought for equal rights as citizens.

That major social structures can change (if generally only slowly) is evident from the contrast between modern society and archaic societies. For example, Sahlins (1972) described how hunter-gatherer economies were characterised by a high degree of underproduction and disdain towards accumulating material possessions. Modern industrialised societies promote over production and waste in a throwaway, fashion conscious mode of conspicuous consumption. Thus, modern consumer behaviour is not an ahistorical trait of human nature, but a specific form of social structure which helps reproduce the capitalist mode of production. The change in economic and social structure during the rise of capitalism and associated market economies has sometimes been described as a change in terms of the extent to

which “the economy” is embedded in society. A prime example is the work of Karl Polanyi (1957) which argues that such modern market economies should be understood using a “formal” economic approach (i.e. individual choice in price-making markets). He regards most of human history as having been spent in “primitive” economies, where market exchange was largely or totally absent, and distribution occurred via reciprocity and kinship groups (Polanyi, 1957). Economic (provisioning) activities were described as being embedded in social relations and institutions. Understanding such economies required a “substantive” approach to economics in contrast to the formal approach, which he accepted as valid only for modern economies. The latter are governed by rational logic, efficiency, self-interest and prices which he believes means they can be regarded as disembedded from social relations (Gemici 2008; Polanyi, 1957).

While Polanyi highlights aspects of institutional differences between capitalist market economies and past economies, the division he draws between socially embedded primitive economies and socially disembedded modern economies is erroneous and only serves to reify the utopia of the “self-regulating market” that he painfully attempted to deconstruct (Spash, 2019; Gemici, 2015). The notion of (dis-)embeddedness fails to capture the changing qualities of social provisioning, and ultimately denies their social aspects. This encourages the separation of the social and economic, rather than their conceptual distinction and actual connection. Modern market economies are instituted differently than their historical counterparts, but market relations remain embedded-in, and built upon networks of social relations (Granovetter, 1985).

Indeed, the reproduction of capitalism and price-making markets depends upon various social mechanisms. Capitalism is embedded-in, and the functioning of markets requires, very specific social institutions that include well-defined private property rights guaranteed by a legal system, judiciary and State authority. As noted by Polanyi (1957[1944]), Nature and labour are “fictitious” commodities, since they cannot be produced within the capitalist system, but are essential to its reproduction. The formal definition of the economy therefore obscures the large range of care and reproductive activities that occur outside of markets, and that are generally undertaken by women and has been noted by feminist economics (Spash, 2020). Who gets paid and what is not an aspect of efficiently functioning labour markets but discriminatory practices involving gender, class and race.

Price-making markets have little, or in fact nothing, in common with perfectly competitive markets, where each firm has no power to set prices or control other factors of production. Actual market economies evidence oligopoly and monopoly power institutionalised in the corporation. Prices are the result of power relations and that includes the power to structure markets and regulations in ones own favour. Multi-national corporations and the Davos elite do not wait to be regulated; they lobby and influence government action in their favour opting for self-regulation when other choices are unavailable.

Power in the market place also means creating demand for products. Large firms have means to manipulate social attitudes, and therefore to manage what consumers buy and at what price (Galbraith, 1979; Kapp, 1978 [1963]; Spash and Dobernig, 2017). Promotion of dissatisfaction is the essence of modern marketing via normalising comparison with others, status-seeking (i.e. keeping up with the Jones's), fashions, in-group/out-group identity, shopping as therapeutic and possessing the latest technology. Rather than industrial production leading to material satiation, and the need for less work, the consumer society has evolved with more work and more disposable products. This process has long been

recognised as involving conspicuous consumption (Veblen 1991 [1899]) and manipulation by corporate and business enterprises (Galbraith 1969 [1958], 2007 [1967]; Kapp 1963).

## V. Philosophy of economic science

Mainstream economics has attempted to employ and maintain discredited philosophical approaches to conducting itself as a science. On the one hand it aspires to finding objective truths through empiricism as if theory was unnecessary and data could speak for themselves. On the other it promotes a form of deductivism that places abstract mathematical models at its core with unquestionable foundational axioms divorced from any reality. Sometimes the two are combined in a pseudo logical empiricist approach,<sup>1</sup> or claims to some vague form of positivism with epistemological positions such as a fact-value dichotomy, a naïve objectivism and the search for universal laws (Spash, 2012). None of this has been neutral, but has rather hidden an implicit conceptualisation of reality. Thus, the particular worldview of mainstream economics has tended to favour regarding economies as physically isolated, mechanical, self-regulating, equilibrating and predictable systems. Leaving an ontology to be defined by a methodology (whether deductivist or empiricist) means falling foul of the epistemic fallacy. That is, objects and their relationships only become accepted as valid, or even recognisable as relevant, if they conform to the methodology, e.g. if something cannot be measured it is ignored, effectively not existing in the analytical approach. Thus mainstream economics is blinkered by its methodological choices and methods (e.g. cost-benefit analysis) come to dictate understanding of reality (e.g. Nature must have a monetary price to be of value). In addition, contrary to the approaches of mainstream economists, the second half of the 20<sup>th</sup> Century saw a general recognition that science operates in a social context, and that our knowledge is fallible. However, the failings of mainstream philosophy of science are not the primary concern here (see Tacconi, 1998; Lawson, 2006; Spash, 2012, 2020), but rather we aim to suggest what would be a way forward in relation to SEE.

Ecological economics emerged as a critique of mainstream's economics inability to account for the complexity of economies, and particularly of its underlying biophysical processes such as the Laws of Thermodynamics (Puller and Smith, 2017). However, the field has suffered from a misguided commitment to pluralism, or anything goes, that has resulted in claiming validity for knowledge claims based on opposing and contradictory assumptions and methodologies (Spash, 2012). Notably, the field has struck an uneasy line between criticism of mainstream economics and adoption of its methods and models, which has been justified as being pragmatic (Spash, 2013). The resulting confusion has left the field with a weak identity (Røpke, 2005), which has neutered its radical potential and left it open to co-optation and "passive revolutions".<sup>2</sup>

The search for philosophical foundations led Tacconi (1998) to propose a combination of post-normal science and constructionism. However, in its strong form constructionism denies realism and is incompatible with the ontological commitments of ecological economists to a biophysical reality independent of the human mind. Post-normal science is also not a

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<sup>1</sup> Logical empiricism, originating within the Vienna Circle, was a diverse philosophy of science with diverging opinions among the members of the Circle (see Spash, 2012).

<sup>2</sup> The concept of passive revolution originates from the Marxist theorist Antonio Gramsci and relates to the passive integration of counter-hegemonic elements by various means (often small concessions) to neutralise their revolutionary potential and leave the overall power structure unchanged. For an extended discussion on this topic in the context of ecological economics see Spash (2021a).



philosophy of science, but an epistemological critique of traditional naïve objectivism in the natural sciences and its transference into the social sciences. As Tacconi (1998) seems to recognise his mixture of inconsistent approaches results in contradictions. Puller and Smith (2017: 19) summarise the problem as follows:

“Ecological economists seem to be searching for a way to combine a perception of the world as independent of our knowledge, while at the same time admitting the social construction of knowledge and the role of meaning-making in the social realm”

They then detail how a philosophical well-grounded approach can be found in critical realism, which combines ontological realism with epistemic relativism.

The form of critical realism of relevance here is associated with the early works of Roy Bhaskar (1975 [2008], 1979). As explored by Lawson (1997) in relation to economics, a strong emphasis is placed on the importance of addressing ontological issues. More specifically critical realism propose a depth ontology that goes beyond empiricist and actualist philosophies to give place to structure and the causal powers of their mechanisms. Structures and mechanisms make events happen. What is actualised is merely part of the potential and the result of which mechanisms and counter mechanisms are operative and which ones dominate. The empirically observable is then merely a subset of what is actualised based on human ability to take events into account.

While social structures are human constructs they are no less real for that. Capitalism is, for example, a recognisable system with real mechanisms and effects (as described earlier). Reality is further conceived as stratified, with hierarchically ordered strata, starting from a physical dimension, followed by chemical, biological, social and economic dimensions (Collier 1994b). All biological entities are physical, but physical structure is independent of biological structure. Similarly, the co-dependent social and economic strata are dependent upon the biological, the chemical and physical, but not vice versa. However, as consistent with the earlier discussion, higher strata are irreducible to lower from which they are emergent. Similarly, Georgescu-Roegen (2009[1979]) exemplifies such properties by considering how an elephant is composed of physical and biological structure but its behaviour (an emergent property) cannot be explained purely from physics or chemistry. As we have noted society is not simply the aggregation of the individuals of which it is composed.

This stratified and layered understanding of reality also results in a concept of causality that differs from traditional realist approaches. Instead of being explicable as event regularity, critical realism explains actualised events using the concept of causal powers of mechanisms based on structures and mechanisms (Collier 1994a). In open systems, there are multiple mechanisms at play that can either enable or prevent the actualisation of potentialities. Rather than seeking universal and timeless “laws” of Nature there are law like conditions where certain tendencies of mechanisms become actualized (Puller and Smith, 2017).

Bhaskar describes the scientific process as “the social production of knowledge by means of knowledge” (Collier, 1994a: 54). In this view, “transitive” knowledge or thought objects, provide the concepts, models and theories that are simultaneously the raw material and the product of science, and which seek to explain “intransitive” reality or real objects (Sayer, 2010). Science seeks descriptive and explanatory knowledge of natural and social entities, phenomena, events and their relationships. While social structure is subject to change it is not

so easily or quickly, it has durability (Lawson, 2006), and that means the same transitive / intransitive approach to understanding knowledge can be applied. Those who emphasise change as undermining all knowledge (e.g. Goddard, Kallis and Norgaard, 2019) fail to allow for durable structure and mechanisms which are the essence of the ability to know anything. There is also a tendency to over play the role of social scientists in affecting their objects of study.

As Sayer (2010: 33) states “social scientists and historians produce interpretations of objects, but do not generally produce the objects themselves”. He argues that a clear distinction is required between an object of inquiry and our knowledge of it, which consists in the language, concepts or images that we use to describe reality. Thought objects are therefore referents to their “real” counterparts, but he regards knowledge of true correspondence as impossible, i.e. all knowledge is fallible.

Experience of the external world consists of ideas (percepts, sense data, qualia) involving socially contextual conceptualisation (e.g. language, culture, prior knowledge). The extension of knowledge involves reconceptualization and involves the role of metaphors and analogies which relate to existing ways of thinking e.g. the current prevalence of computing metaphors and analogies. The transitive or thought object in critical realism involves weak constructionism and is termed epistemic relativity or (sometimes) epistemological relativism. This weak constructionism contrast with the radical relativism of strong constructionism where knowledge is simply a matter of shared conventions among researchers. In such accounts the relation to real structures, mechanisms and objects is regarded as irrelevant or even the existence of a reality beyond the human mind is denied.

Although knowledge is fallible, it is not equally so. Choices can be and are made between difference explanations and descriptions. Representations of the world are of practical use and their employment in our actions and practices has consequences which can be evaluated, help us navigate it and enable us to have an impact on it. We judge what works well and what does not. In Sayer’s (2010: 48) terms intersubjectively shared conventions must prove themselves to be practically adequate, so that our expectations about the world and results of our actions are actually realised. This is more than just the usefulness of a theory, because the adequacy of knowledge is also judge in terms of descriptive realism relative to the structure of reality. Thus critical realism is distinct from instrumentalism (such as found in American Pragmatism) because the aim is not simply prediction but causal explanation. Prediction can be equated with explanation only if one assumes event regularity, which fails to hold in open systems like economies. Indeed, prediction is unnecessary for the explanation of a phenomenon (Collier, 1994a).

Investigation of open systems requires a distinct approach from the idealised laboratory experiment which tries to create a partially isolated system through controlling mechanisms. The limited applicability of such methods for social phenomenon means alternative methods are typically required, such as the use of counterfactuals. However, as Danermark et al. (2002b) point out, there is no specific “method of critical realism”. Indeed the method for investigation is relative to the object of study and research question. Critical realism also recognises a wider range of modes of inference than the traditional induction and deduction. It includes the roles of retroduction and abduction (see Danermark et al., 2002a), as forming part of the process of providing causal explanation, which opens up the methodological toolbox of social sciences and changes understanding of methodology as supposedly (but not actually) conducted in traditional sciences. An inference always implies a form of

generalisation and can either refer to extrapolation in an empiricist sense or to conceptualisation of the “hidden essence of things” in a realist sense. Danemark et al. (2002a: 100) suggest five strategies that can help us discern the hidden underlying structures and mechanisms: (1) counterfactual thinking; (2) social experiments; (3) studies of pathological cases; (4) studies of extreme cases and (5) comparative studies.

There are also grounds for judging which methods are appropriate. Methods and related theories must be adequate to their objects of study (Puller and Smith, 2017; Spash, 2012). For example, evolutionary theory, and its associated tools for analysis, is inadequate for understanding the operation of a mechanical clock. Thus, Hodgson’s (2008) argument that evolutionary theory should replace mechanistic theory in economics is flawed because it simply repeats the same mistaken belief that all objects of relevance to economic must be of one form (i.e. evolutionary rather than mechanical). Similarly the imposition of mathematical formalism as defining economics fails not because the methods is inherently wrong but because it cannot address the object of study, i.e. the characteristics of economic systems. More specifically quantifying everything with arithmomorphic concepts excludes all qualitative aspects (Georgescu-Roegen, 2009[1979]). This indicates the need for a structured methodological pluralism, where theories and methods are informed by the qualities of the object under study and cooperation occurs between those with common understanding (Spash, 2012).

A final aspect of note is the emancipatory role of social science research. Investigating the real (structural) cause(s) of a social phenomenon means the explanation of the social scientist will inevitably clash with the existing ideas of some people, that is new evidence may appear, theories brought into question, previously confirmed positions be undermined. Such is the nature of scientific research. Social scientists criticise those holding fallacious ideas. If there are institutions holding those false ideas then the research is also a criticism of them and the social scientists has a role in removing wrong beliefs. Collier (1994a) argues the role of the social scientist is not just to criticize but should be to undermine institutions promoting false ideas. Emancipation is then seen as transforming structure. When considering environmental research the case being made here is clear because research showing beliefs about the benefits of economic growth, fossil fuels, chemicals, plastic, asbestos, genetic modification and so on, to be false then criticise the institutions promoting such things. Research is neither neutral nor value free and facts have ethical implications for both the researcher and society.

## **VI. Conclusion**

The multiple social, ecological and economic crises of our age, and the failings of mainstream economics to explain or address the structural causes of these crises, means new approaches to economics are essential. SEE has been outlined here as a necessary and emerging paradigm. Economics has become increasingly detached from its object of study and the orthodoxy is fundamentally flawed as a social science because it advocates a prescriptive methodology while lacking any serious engagement with epistemology and ontology. The resulting epistemic fallacy means it promotes a narrow implicit world view as if a factual truth. Failures here include imposition of limited quantitative methods and mathematically formalist methodology that exclude qualitative aspects of reality and the use of isolated/closed systems thinking for an open system reality.

Economies are the socially structured institutional process involving the interaction of humans with the natural world. Social reproduction is achieved only within the bounds of the given structure and mechanisms of biophysical reality. The form and scale of economic processes depends upon a set of spatially and temporally contextual social institutions. That is economics concerns the form and function of social provisioning process which can take various forms and are far from limited to price-making market or capitalist institutions. Starting from processes of social provisioning, economics becomes the study of plural historical, actual and potential economies with their underlying institutional arrangements and biophysical basis rather than a singular abstract idealised “economy”. This broadens analysis not only to what institutions, norms and values shape the economic process and agents’ behaviours, but also to what are socially desirable and ecologically sustainable systems of social provisioning. Economics is neither value free nor ethically neutral but its stance on both should be made explicit. It must also be realist about how economies are reproduced via social and ecological mechanisms. That means linking to both power relations and ethical and just means of provisioning, but also material and energy throughput that respects others (human and non-human). The aspirations of economists to provide for the well-being of humanity, if taken seriously, mean a revolutionary change in economics is long overdue.

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