The Praxis of Labour: A Pluralistic Approach to Value Theory in Ecological Economics

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Abstract

This thesis addresses challenges in quantifying environmental values and resources by advocating for an interpretive approach to ecological economics, embracing pluralism. The research question explores whether economic pluralism can enable new techniques for the valuation of human ecosystem benefits, focusing on 'water purification'. Economic value theories are reviewed, highlighting limitations of the widely used Marginal Utility Theory and its applications in ecological economics. Alternative value theories, including Karl Marx's labour theory of value, Praxeology and subjective value theory, and manahau as a Māori value theory, are proposed. Interpretivism is introduced as a necessary tool for economic pluralism, emphasising an open-minded approach to subjective variances.

Freshwater ecosystems and ecological concepts are examined, emphasising freshwater metabolism as a key indicator for water quality and purification processes. Current freshwater valuation methods, predominantly relying on marginal utility theory, face challenges. The need for a value theory acknowledging context and subjectivity is underscored, with interpretivism as a crucial tool. The Praxis of Labour (PoL), a circular model grounded in praxeology, subjective value, and Marxian labour theory is introduced. The PoL's applicability to ecological economic problems is discussed, offering arguments for greater accuracy in valuing environmental goods and services.

Due to the ambitious scope of this thesis, the PoL is conceptually applied to a theoretical case study featuring a sheep and beef farmer named Barry, highlighting the necessity to map the conceptual space for the PoL framework before being grounded in the real-world, using actual data. The case-study conceptually illustrates how Barry's engagement in water purification projects is valued based on labour units, considering downstream benefits. Political and systemic implications for public and private policy and decision-makers, such as private ownership accountability and the PoL's potential in Environmental Social Governance (ESG) reporting, are discussed. Monitoring and evaluation, essential for fair resource distribution, are addressed under the PoL. Limitations, including anthropocentrism, resistance to change, and fundability, are acknowledged.

Concluding thoughts highlight the need for a mandate incentivising environmentally friendly behaviours and charging extractive practices. The PoL is emphasised as a transparent tool for reporting individual values towards the environment. Future research directions include grounding the PoL in a real-world scenario, applying the PoL to other human ecosystem benefits, and incorporating interpretivism and subjective value arguments for a more culturally pluralistic understanding of value. Caution is highlighted on the generalisation of values that occurs when economic principles are applied to environmental contexts. Ultimately, the PoL is presented as a tool for navigating sustainable development in the face of global challenges.

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Signed: Ben Youngman 04/02/2024

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'In the constitution of the rational being I see no virtue that counters justice: but I do see the counter to pleasure – self-control.' – Marcus Aurelius, Meditations – Book 8, page 78.

Chapter 1: Introduction

1.1. Context

As society enters into the third decade of the 21st century, the realities of an extractive capitalistic economic system, defined by utility maximisation and a laissez-faire attitude to market regulation, are being met with a global decline in the quantity and quality of the very resources the system requires for survival. The natural ecosystems we as humans rely on for economic wealth and well-being are undergoing significant change, forcing a reconceptualisation of how natural resources are treated and distributed, ultimately to ensure future generations to come have access to these resources.

In July 2023, the United Nations Sectary General António Guterres declared 'The era of global warming has ended; the era of global boiling has arrived*'* (UN Climate Blog, 2023), highlighting the global consciousness waking up to the fragility of natural systems and the impacts human action and behaviours have on the environment. However, this is not novel rhetoric.

Since the Brundtland Report of 1987, the popularisation of the term *sustainable development* has lead governments, policy makers and businesses alike to adopt quantitative measurements for what is deemed sustainable development. The Brundtland report defines sustainable development as 'development that meets the needs of the present without compromising the ability to meet those of the future' (Brundtland, 1987. P.39).

In June 1992, at the Earth Summit in Rio de Janeiro, Brazil, more than 178 countries adopted Agenda 21, a plan to build a global partnership for sustainable development to improve human lives and protect the environment (United Nations, 1992). Fast-forward 23-years, 2015 saw the 2030 Agenda for Sustainable Development, with 17 Sustainable Development Goals (SDGs) being adopted by member countries. Goals such as *6. Clean Water and Sanitation*, *12. Responsible Consumption and production* and*, 13. Climate Action,* are high-level examples of these goals (UNGA, 2015). In December 2022 in Montreal, Canada, 196 governments from around the world came together for the UN Biodiversity Conference to set new goals to guide action through 2030 to halt and reverse nature loss (UN IB, 2023).

Of similar vein, and to directly address SDG number *6. Clean Water and Sanitation*, 2023 saw a UN Global Water Conference, held in New York – the first water-related forum in a generation. What emerged from this assembly was *the water action decade* – which highlights the inextricable link of water to the fundamentals of life and in turn the three pillars of sustainable development: societies,

economies, and environments. With climate change profoundly affecting these three pillars, water is recognised as the biggest deal breaker to achieve internationally agreed goals, including those encapsulated in the 2030 Agenda for Sustainable Development (Biswas & Tortajada, 2023).

New Zealand is one of the 178 countries to adopt Agenda 21 and the proceeding UN climate forums – including 2030 Agenda for Sustainable Development. In response to commitment, and to align with the sustainable development goals and agendas, the New Zealand government has implemented various environmental strategies such as the Biodiversity Strategy (Department of Conservation, 2020) which aim to guide direction and set the high-level strategic values and goals of the country towards these environmental resources. To guide direction and achieve strategic goals, central government sets National Policy Statements – such as Freshwater Management (Ministry for the Environment, 2020) and Indigenous Biodiversity (Ministry for the Environment, 2023a) which set environmental regulations and national minimum standards for biodiversity protection and freshwater health.

Within New Zealand, freshwater underpins existence. *Te Mana o te Wai* or *the mana of the water*, is about recognising the importance of clean, healthy water for maintaining the health of our waterbodies, freshwater ecosystems, and the communities that rely upon them for their sustenance and wellbeing. Yet despite regulation aptly named *Te Mana o te Wai* (Ministry for the Environment, 2020) recent reports indicate that New Zealand freshwater is under threat (Ministry for the Environment, 2023b). There is an increasing need to better quantify and manage these valuable freshwater resources to ensure their quality can be enhanced and their quantity can be used and distributed sustainably.

A problem that the water profession faces is that it has been making incremental advances in resource management over the last 10-20 years, yet it is becoming increasingly complex to manage, therefore requiring innovative solutions. However, the profession is still clinging to ideas that are 70-80 years old such as *integrated water resources management* or *integrated river basin management*, which are not relevant anymore, particularly for macro and meso-scale projects (Biswas and Tortajada, 2023). This can be seen in *Figure 1* below.

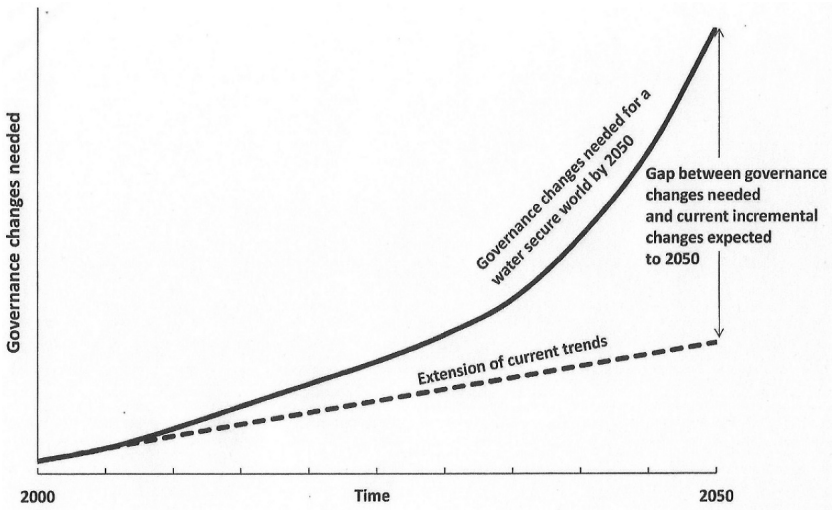

Figure 1: Increasing gap between incremental advances and changes needed to ensure water security. Source: (Biswas and Tortajada, 2023).

There is no easy answer, and seldom do governments, policy makers, and private leaders get it right. Partly it is an issue of inadequate resource management and partly an issue of inappropriate policy (UNGA, 2021). Both of which are a symptom of not understanding the problem correctly. It is a problem of *human action*, and the relationships humans have with the natural world. To address resource management problems and questions, the relationships and values that humans hold toward environmental resources need to be understood, established, and in some instances quantified.

This thesis, by that token, seeks to address exactly these challenges. This thesis highlights the complex and challenging terrain that unravels when seeking to combine and measure the shifts and exchanges of value that take place between humans and the natural world. From a resource management perspective, quantification of these values is desirable as it allows for the accounting of these values in the case of Environmental, Social, Governance (ESG) corporate reporting, natural asset valuation, policy construction, and economic modelling. Thinkers and practitioners alike have theorised for decades on how best to capture and quantify these interactions and values. One answer to such quantification is to amalgamate the affairs of humans in the form of economics, and the affairs of the natural world in the form of ecology.

Ecological economics, in that sense represents ‘a transdisciplinary effort to link the natural and social sciences broadly, and especially ecology and economics’ (Costanza, 2008 p.999). The main goal of ecological economics is to: ‘Develop a deeper scientific understanding of the complex linkages between humans and the rest of nature, and to use that understanding to develop policies that will lead to a world which is ecologically sustainable, has a fair distribution of resources (both between groups and generations of humans and between humans and other species), and efficiently allocate scarce resources’ (Costanza, 2008).

By conceptualising and quantifying the various areas of biocentric sustainability – such as the ability for water to purify itself, in terms of capital valuation, or the species diversity of a native forest – ecological economics offers a practical framework for measuring these values quantitatively within capitalistic models and decision making. Proponents of ecological economics hold that it offers a tool for measuring and managing important aspects of natural and social wealth and well-being (Costanza, 1996)

Within ecological economics, value theories and associated measurement approaches are tools used to capture and quantify the flows of value between humans and the rest of nature. However, due to the ethical and cultural foundations of the concept of *value*, these theories of value are vastly different and can yield different outcomes depending on what theory and methodology is employed as part of the research. Each theory of value requires a different approach and paradigm of thought that ultimately decides how one conceptualises value.

However, as will be highlighted in latter sections of this thesis, there has been a prevailing singular theory of value that has dominated western economic thought, and subsequently, how economics is applied to ecological problems. *Marginal utility theory* and its associated methodologies remain unchallenged within Western economics which in turn, determines its inevitable use within ecological economics.

Whilst considered a *theory*, marginal utility is associated within a certain *paradigm.* A paradigm, in this sense, 'sets the standards for legitimate work within the science it governs' (Chalmers, 2013.p.108). A paradigm coordinates the puzzle-solving activity of the scientists who work within it. According to Thomas Kuhn, paradigms will also include standards of applying the fundamental law to a variety of types of situations, and further, paradigms consist of general meta-physical principles that guide work and thought within (Chalmers, 2013). Under this frame of reference, marginal utility theory sits within a paradigm of *reductivist positivism*. Specifically, it follows the prevailing mode of thought as endorsed by common scientific thought – *mechanistic materialism* which reduces observations and explanations down to mechanical inputs and outputs of matter (Chalmers, 2013).
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What this means for economic thought is that when addressing research questions and seeking to understand and explain observations, a singular lens of marginal utility theory is used, generalising and perceiving the observations to fit within the rules and structures that underpin the school of thought – the mechanics of utility and self-interest (Mosselmans, 2020).

However, despite its omnipresence and convenience, marginal utility theory has its limitations. As will be highlighted in *Chapter 3.5.* of this thesis, the valuation of freshwater suffers the same demise. When used to inform policy and decision making, the data has limitations and inaccuracies that ultimately lead to inappropriate policy and uninformed goal setting and actions. There is a clear need to reconceptualise how to address the valuing of environmental resources to better inform management and policy if the use and distribution of such resources is to be aligned with the goals and values of *sustainable development* (Bruntland, 1987). Such a reconceptualisation would take seriously the contextual and subjective variances and relationships that individuals have with the natural world, how this interacts with observed behaviour, and ultimately, understand and interpret the values that individuals hold towards environmental resources. This is of the utmost importance if countries wish to achieve and report on their achievement towards the UN SDGs and wider global agendas.

In attempts to look beyond the rigid lens and structures of positivism, thinkers and practitioners alike employ *economic pluralism,* which can be defined as:

> '… an openness to engagement with diversity – seeking value and understanding (often through dialogue) across lines of difference. Such an approach recognises that different schools of thought within economics (Neoclassicalism, Keynesianism in all its varieties, Institutionalism, Austrian, Feminist, and a host of others) potentially have insights of value that will enrich the discussion of particular issues' (Warner, 2018, p. 359).

When understood through this definition of economic pluralism, one can gain an understanding of how and why the conceptual underpinnings of diversity within economic theories need to be retained wholly in themselves, whilst not dismissing or negating other theories of value that seek to explain phenomena in different ways. It takes seriously the need to understand context and *value* through an appropriate lens, rather than a singular, rigid framework that seeks to act as the 'silver bullet' for all economic questions and queries.

1.2. Research question and structure of this thesis.

This thesis seeks to address some of the challenges experienced in the quantification of environmental values and resources. It is argued that by taking an interpretive approach which recognises the subjective nature of value, one can embrace economic pluralism in value theory and overcome some of these challenges. By working with economic pluralism, the realities of individual subjective

differences and diversity are better understood and accounted for. Realities of the economy in which simple supply and demand and a singular rigid lens cannot reflect. There is simply more to the economy than can be explained by supply and demand. Human psychology, power dynamics and social dominance hierarchies, respect and dignity, spirituality and friendship – all of which are left unaccounted for or generalised under a singular marginal utility lens.

With that in mind, this thesis seeks to answer the research question:

Can economic pluralism be operationalised as a valuation framework to enable economic compensation for water purification?

To begin to answer this research question, *Chapter 2 and Chapter 3* will begin with a literature review of the relevant theories to answer the research question posed above. By engaging with literature through the Auckland University of Technology (AUT) online library access, scientific journals and articles through *Google Scholar*, textbooks, national and international policy and discussion documents, a systematic review of the relevant literature will be undertaken. Key words such as 'Ecological Economics', 'Value Theory', and 'Marginal Utility Theory' were initially explored to gain a general understanding of core concepts and previous research ideas. To build on these concepts and direct research and review to the specifics of the research question, prompts such as 'value theory in ecological economics', 'limitations of marginal utility theory' and 'the economic valuation of freshwater' were used to gain a more specific and nuanced exposure and understanding to the literature surrounding the research question. The first point of search will be *Google Scholar* due to the power of the search function and scraping ability across many online repositories and journals. However, *Google Scholar* does not recognise the accessibility privileges required by the scholarly journals and so in the instance of the requirement of a subscription, the journal article or textbook title was then copied to the AUT library search engine to gain access to the content. Where access was not granted, the resource was unable to be referenced and so the literature reviewed here is subject to accessibility privileges granted by AUT and their subscriptions to academic journals. Because of this, there is a limitation to the reviewed literature and subsequent discussion, as will be briefly discussed in *Section 2.3* on Marxian Labour Theory of Value.

That in mind, to illustrate the research question, economic theories of value will be reviewed in *Chapter 2*, beginning with a description of ecological, intrinsic and extrinsic value. *Section 2.*2 will then see an in-depth review of Marginal Utility Theory, highlighting key philosophical underpinnings and applications. I will then demonstrate its widely used application to ecological economics, highlighting key research concepts such as natural capital and ecosystem services, and methodologies such as Willingness to Pay (WTP) and Contingent Valuation (CV) that underpin the discipline. From

there, practical and theoretical shortcomings are discussed, largely centred around the over-generalisation that occurs when valuing environmental goods and services as pure utility, the lack of subjective value variances, and the oversimplification of human behaviour that occurs under a marginal utility approach.

Three further economic theories of value are then offered as alternatives to marginal utility: Karl Marx and his labour theory of value (*Section 2.3*); Praxeology and the subjective theory of value (*Section 2.4*); and Manahau, a Māori cultural theory of value (*Section 2.5*).

Interpretivism and hermeneutics is introduced as the philosophical groundings of praxeology and manahau and represents an alternative, older paradigm of thought to that of science and positivism, defined by storytelling and narrative. Interpretivism is highlighted as an important tool for a value framework as it allows for openminded analysis, provides the foundation for economic pluralism due to the openminded approach, and allows for contextual and subjective variances in value judgements to be better understood because it focuses on the narrative of the individual as opposed to the narrative of the market.

In *Chapter 3*, the discussion then shifts to the importance of freshwater ecosystems in New Zealand and sets out freshwater metabolism as an indicator for freshwater health and an important metric to represent the water purification ecosystem service (*Sections 3.1 and 3.2*). Key processes and interactions underpinning the concept are explained (*Section 3.4*), with core determining variables highlighted. Further, some important management practices and interventions for freshwater metabolism improvement are discussed, drawing on local and international examples (*Section 3.4*). The intention is to integrate freshwater metabolism and offer an argument for why the functional approach to system health and ultimately, and what should be measured and prioritised in decision making. In the case of economic valuation, there is a need to understand how processes and systems function before a human value is assigned to them.

From there, current ecological economic examples of valuing freshwater ecosystems are drawn upon, highlighting marginal utility theory as the standard approach. Challenges and limitations posed by addressing questions of freshwater valuation in this manner are then discussed.

A summary of value theories is provided, highlighting the need for a value framework that takes seriously the value in context and subjectivity and works with economic pluralism as opposed to against it. Interpretivism is reinforced as a necessary tool for enabling such pluralism due to the open-mindedness of the approach.

In *Chapter 4,* an alternative framework is then set out, working with economic pluralism by combining praxeological arguments of subjective value, the deductive argument of human action as necessary truth and revealed preference, and Marxian labour theory of value. The alternative value framework is introduced as the Praxis of Labour (PoL). Under the lens of PoL, value is subjective and contextual, and price is considered a misleading representation for true perceived value. By rooting the framework in interpretivism, there is a strong focus on the individual and revealed preferences based on historic transactions and behaviours. The framework builds on the praxeological deduction that *human action* is the only *necessary truth* in economics and so is the foundation for which valuations can be based upon. Within the PoL, *human labour* is considered as *human action* as it is purposeful, chosen behaviour where a value judgement is made. Therefore, *human labour* is a *necessary truth* and so valuations and judgements can be based off *human labour*. Following this logic means the framework is grounded in the necessary truth of human labour, enabling individual human labour added to be considered as necessarily human value added. The PoL is framed as a circular and iterative model – where value judgements determine whether to add human labour to goods or not, constantly adjusting and revising the value.

In *Chapter 5,* it is discussed that there is a necessity to apply the newly introduced value framework (the PoL) by way of a case study. However, due to the ambitious scope of the thesis, a theoretical case study is needed to map out the conceptual space for the framework before application of such concepts in a real-life situation. Such a situation will be required at a later stage to turly evaluate the applicability of the PoL. Within *Chapter 5,* it is highlighted that when applied to ecological economic problems, the PoL has the potential to provide greater accuracy and credibility given to the valuation of environmental goods and services. This is framed around the notion that there is the *necessary truth* of *human labour* to capture value added to these assets.

Due to the ambitious scope of this thesis, the conceptual space for the PoL is mapped out by way of applied ethics, which applies the theories discussed to a hypothetical case study. This case-study introduces *Barry*, a fictional dairy and pasture farmer whose farm borders the Waimakariri River in Canterbury. This case study shows that if Barry engages in management practices that help improve freshwater metabolism and water purification, then the value of that purification project to Barry is the sum of his labour units up until that point, including materials purchased or contractors hired. However, the value of such ecosystem service as a whole is the sum of the labour units up until that point, plus the downstream benefits received by others at point of water extraction due to the labour cost savings or opportunity cost savings of not needing to treat water due to lack of purity. In the case of the Waimakariri, it is the cost savings that Christchurch City Council experiences in not needing to treat urban water due to increased natural water purification services. No concrete figures were able to be referenced from Christchurch City Council, however an external modelling project is referenced to

gather some data around the costs and projections of Christchurch having to treat its water for nitrates. The value of the Waimakariri River water purification process is highlighted as NZD$158,940.40 per km/year, based upon the external projections and figures.

In *Chapter 6,* the discussion begins with political and systemic implications of the PoL framework – firstly, around the ability for the PoL to be applied to other ecosystem services and not only water purification. The implications of the praxeological notion of private ownership of goods is discussed, largely focusing on the accountability of management that private ownership entails. However, this is met with the clarity of data that a labour theory of value enables, and the propensity for the PoL to add value to companies in the case of ESG reporting. Regulation requires labour and under a marginal utility lens, this labour is unvalued. The PoL is highlighted as providing a methodology for valuing such labour that is demanded to meet regulation.

It is then discussed in *Section 6.2* that there needs to be increased monitoring and evaluation to ensure that these management initiatives and valuations are accurate and transparent, ultimately aiding in the fair distribution of resources. Such monitoring and evaluation requires labour, and under the PoL, this labour is valued and accounted for. At this point, Marginal Utility Theory is reintroduced to highlight its usefulness in the cost-benefit analysis of environmental restoration, however, is only so because there is no reference to Willingness to Pay or other Contingent Valuation methodologies, and the inaccuracies they bring with them.

In *Section 6.*3 the limitations of the PoL are discussed, centred around anthropocentrism, resistance to change, and the fundability of such an approach given the large amount of value society receives from the ecosystem service *water purification*. Concluding thoughts reflect on the ambitious scope of this research project and highlight the direction for future research efforts focusing on using PoL for other ecosystem services and using interpretivism and subjective value arguments to incorporate other cultural value frameworks to better contextualise and understand value through that lens. Caution is given around the generalisation that inevitably occurs when economic principles are applied to an environmental and ecological context.

Chapter 7 concludes by leaving the reader with a call for mandate to ensure desirable behaviour towards the environment is incentivised and damaging, extractive behaviour is penalised or rendered undesirable. With mandate comes a necessary requirement of transparency, and the PoL is reinforced as a crucial tool encapsulating and transparently reporting on where individual values lie towards the environment.

As the global community becomes increasingly connected and acutely aware of the urgent environmental, economic, and social challenges faced, the PoL provides focus and navigation to the convoluted and complex realm of sustainable development, whilst advancing the primary goal of ecological economics – biocentric sustainability.

Chapter 2: Theories of value

This chapter begins with a brief overview of value theory to provide context to the concepts of exchange and use value. From there four economic approaches to value theory will be discussed. Marginal Utility Theory is discussed and highlighted as the dominant theory of value in economics and subsequently ecological economic applications. The challenges when valuing ecological goods and services are then illustrated. Three alternative approaches to value theory are then framed in terms of their differences to marginal utility theory and how they help overcome some of the challenges posed by marginal utility methodology. The chapter then swings to discuss interpretivism as not strictly a value theory, but rather an epistemological structure that underpins both praxeology and manahau, and an open-minded and contextual approach to value theory that leaves the door open for conceptual economic pluralism.

However, it is difficult to discuss and understand value within the realm of ecology without first understanding what ecological value is, and what it means to have value contained within the ecosystems humans so closely rely on for the very functioning of society and ultimately, fundamental existence.

2.1. Ecological, Intrinsic and Extrinsic Value

Ecological concepts consider something as having value with regards to how it contributes to the achievement of some system goal (Straton, 2006). However, the definition of ecological value is often convoluted and involves uncertainty depending on how it is used within the literature (Amador-Cruz et al., 2021). In their review of the natural ecological value of wilderness, Cordell et al., (2005) define ecological value generally as 'the level of benefits that the space, water, minerals, biota, and all other factors that make up natural ecosystems provide to support native life forms' (p.206).

Amador-Cruz et al., (2021), agree with this notion, however in their systematic review of 209 articles containing the term *ecological value*, they explicitly add that ecosystem value is a term that is highly related with the intrinsic values of the landscape. The concept of intrinsic value presupposes that there exists value within the natural world and ecosystems that lie beyond the interests of human beings (Park, 2000).

Richard Routley is regarded as the pioneer of applying intrinsic value discussions to the natural world by putting forth his famous thought experiment *the last man example*. In this thought experiment, Routley invites thought to be cast to a dystopia where there is only one single human left on the earth

(Routley, 1980). Routley then asks if it is wrong for that human to cut down and exhaust all the remaining natural resources and living plants and animals on earth?

Routley intuits that this is morally wrong behaviour and assumes that most people would deem the behaviour of the last man to be morally wrong too. Because most people would believe this behaviour to be wrong, there must be value that lies inside nature and outside of the needs of the last man. This is the *intrinsic* value of the tree as it is a value that is non-instrumental to the last man.

However, value theories borrowed from economics tend to involve an anthropocentric, instrumental view of value, meaning that systems of value are measured by their benefits provided to humans, for human sustenance and well-being. This is known as *extrinsic* value: value that is instrumental to human well-being and needs. A common way to conceptualise the extrinsic value of an ecosystem is through an ecosystem services approach.

Ecosystem services are the benefits that people obtain from ecosystems. These can be provisioning services such as drinking water and food, regulating services such as erosion control and water purification, cultural services such as recreational and spiritual; and supporting services such as nutrient cycling and production of atmospheric carbon (Millennium Ecosystem Assessment (Program), 2005) All 24 ecosystem services are summarised in *Figure 2* below.

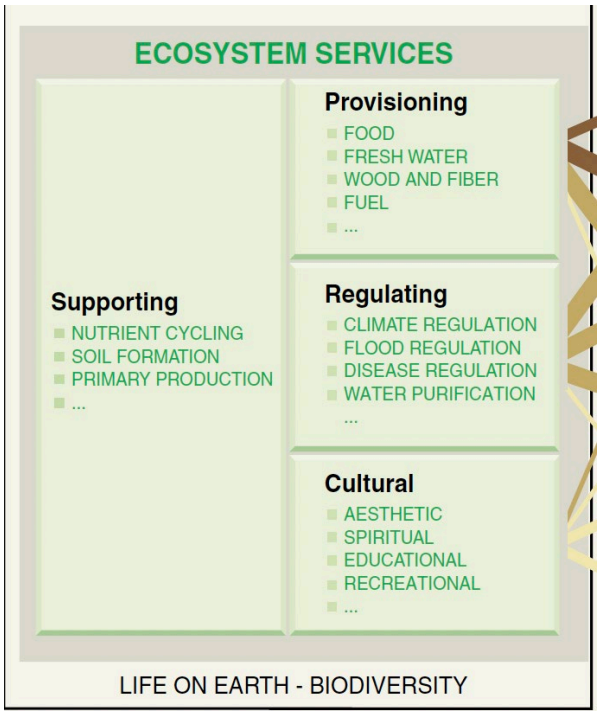

Figure 2: Ecosystem services classification. Source (Millennium Ecosystem Assessment (Program), 2005)

Because of this, there lies a different interpretation of ecosystem value when economic valuation techniques are employed by researchers and practitioners alike. To understand these notions of value, theories need to be stripped back to their basic concepts in order to understand the foundations and objectives of value and their associated valuation techniques. To do this, there is a need to understand the dominant paradigm of economic thought that underlies modern economic principles and models concerning the political economy.

The chapter now turns to Marginal Utility Theory, a theory which, as will be discussed, has provided a longstanding theory for understanding economic value, and the human behaviours associated with it.

2.2. Marginal Utility Theory

2.2.1. Philosophical Grounds of Marginal Utility Theory

From a philosophical standpoint, Marginal Utility Theory begins with ontological belief that humans are pleasure seeking beings, directing behaviour towards pleasure and away from pain (Pirgmaier, 2021). This belief stems from the early works of Aristotle and his conception of *the good life*, in which the ultimate purpose of life is for one to direct behaviour towards the fulfillment of subjective happiness. 'Instead of work, moderate pleasure-seeking and happiness form the centre of economic actions, according to Aristotelian and Thomistic philosophy' (Kauder, 2016., p. 9).

On these grounds, Kauder writes, a certain sense of hedonism is integrated into Aristotelian theory of the good life. If pleasure is the purpose of economics, then following the Aristotelian concept of the good life requires all economic principles, including valuation, to derive from this goal of pleasure seeking.

This notion of the good life as exercised through the pursuit of pleasure was reinforced by modern philosophers such as the utilitarian thinkers Jeremy Bentham and his close friend John Stuart Mill. Bentham held that in the pursuit of pleasure, man ought to assure that additional pleasure prevails over additional pain (Kauder, 2016). Marginal utility theory, in that sense, is an extension of that pain and pleasure dichotomy.

2.2.2. Value in Use and Value in Exchange

It is generally accepted that Aristotle formed the first foundations for the concept of utility through his creation of value in use (Kauder, 2016). Aristotle's claim is that for something to have value in use, one must gain a certain quantity of pleasure from its use. In his discussion on trade, Aristotle broke down goods into two uses which he deemed one proper use and the other improper use. Value in use, Aristotle claims, is the proper use of something, whereas value in exchange is the improper use (Russell, 1979). A knitted sweater can be worn to keep one warm, that is its proper use, or it can be exchanged, which is its improper use. However, without perceived value in use, one does not have any grounds for exchange. If one were to offer shoes for fish in an exchange or trade, then both sides of the exchange need to have a use value for each commodity. If not, then there would be no trade. If one already had a pair of shoes, they would have little use for the other pair offered up in the exchange.

However, consider a hypothetical scenario where one had a need for shoes, and had fish to trade for the footwear. How many fish should one exchange for the pair of shoes? It has been determined that both parties have a use value for each of these commodities, however the value of the shoes with regards to fish, or vice versa has not been determined. In this light, exchange value is the quantitative worth, or ratio between any two commodities (Schumpeter, 2006).

This phenomenon led thinkers of the classical economic period such as Adam Smith to delve further into exchange value. Smith put forth the paradox of value (also known as the diamond-water paradox), which highlights that although water is the fundamental basis of life on earth and has great use value, in an exchange with diamonds, diamonds command a much higher exchange value. Smith used this paradox to discredit the idea that exchange value is determined by the use value of such commodity. Smith further laid out his cost of production thesis for exchange value, whereby the exchange value of a commodity is determined by wages, profit and rent (Blaug, 1997). In the context of the diamond-water paradox, if one gram of diamonds has the equivalent cost of production to one thousand litres of water, then the exchange value of water to diamonds is 1000 : 1. Or furthermore in the fish/shoes example above, if the making of a pair of shoes has the equivalent cost of production of catching fifteen fish, then the exchange value of fish to shoes is 15 : 1.

However, this logic is broken with only a small thought experiment. Suppose there is a wide-spread drought. Suddenly, the ratio is flipped, and water has a higher exchange value than diamonds. Smith's explanation of exchange value as the cost of production is brought to a halt. It was not until the utilitarian thinkers Hermann Heinrich Gossen, Carl Menger, William Stanley Jevons, and Léon Walras suggested contemporaneously that it was utility and scarcity that determined exchange value and solved the diamond-water paradox (Blaug, 1997).

2.2.3. Marginal Utility Theory – the hedonists theory of value

Gossen, Menger, Jevons, and Walras are seen to be the contemporaneous creators of marginal utility theory (Kauder, 2016). Menger proposed the idea that humans have ordered needs and desires based on the subjective importance for such (Blaug, 1997). These include water, food, shelter, and clothing. Gossen postulated that in order for satisfaction or pleasure to be maximised from a good, such as money or labour, there must be an allocation of that good across different uses to match their marginal utilities in each use (Blaug, 1997). This means that if one has a finite amount of labour or money to spend or give away, then that time or money will be shared between various needs and desires to ensure that maximum utility is obtained.

For example, let us say you have $3 to spend at a burger joint. If purchasing one cheeseburger yields +1 pleasure unit (or utility) and costs you $1, you purchase it. Suppose you feel like another cheeseburger because you are still hungry, however this time it yields +0.5 pleasure unit (or utility), you still purchase it at $1 because the marginal utility is still positive. However, you still have $1 to spend, but now another cheeseburger will give you +0 or perhaps even -1 utility or pleasure because you are full and may even develop indigestion due to overeating. You would not purchase another cheeseburger due to neutral or negative marginal utility. You can however purchase a drink for $1, and you are thirsty after consuming two cheeseburgers and so this $1 spent on a drink would yield +1 utility or pleasure. This is a very simple example of marginal utility theory; however, it clearly highlights the notion that value and utility diminish in intensity with each additional unit. Further, given the subjective needs or desires of the decision-maker, one distributes resources to ensure maximum utility is received when faced with decisions.

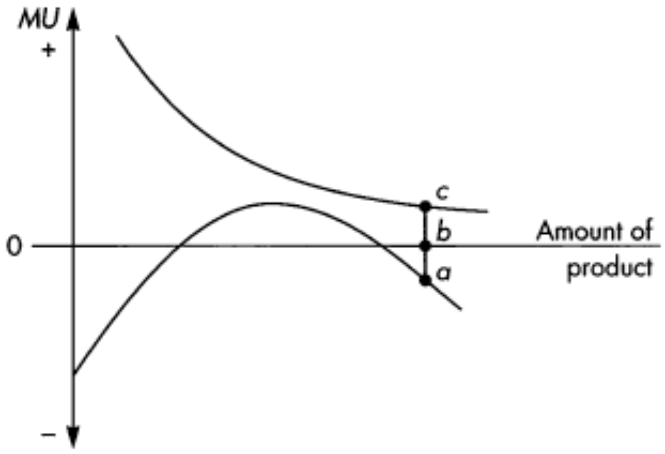

Figure 3: Marginal utility curve showing diminishing returns. (Blaug, 1997 p. 298)

Marginal utility theory assumes that, generally, the desire for, or the utility received from one additional unit declines with each successive unit (Blaug, 1997). This highlights the principle of *diminishing returns*, the foundation of marginal utility theory. One receives less intense pleasure with each additional unit. Value and price are determined at the intersection of decreasing marginal utility and increasing marginal costs (as disutility).

The importance of the concept of marginal utility lies within the idea of consumer preferences and behaviour. Because of the notion of marginal utility and diminishing returns, and due to the finite nature of resources, the general assumption underlying economic models is that humans make decisions to optimise pleasure or utility. This is deemed *rational* behaviour and forms the basis of *rational action theory* (if the reader is unfamiliar with rational action theory, see; Kauder, 2016., p. 115). On a practical and empirical level, it highlights to researchers how much of a good a person is willing to purchase at a certain price. The price represents the marginal costs to the individual as that is what they are willing to give up or sacrifice for the utility or pleasure gained from consumption of that good or service.

2.2.4. The Epistemology of Marginal Utility Theory

From an epistemological perspective, marginal utility theory is grounded within the paradigm of *mechanical materialism* and extends the *logical empiricism* school of thought on knowledge acquisition (Mosselmans, 2020). By that token, marginal utility theory requires the mechanical quantification of values, and embraces pricing methods such as Willingness to Pay (WTP) for the acquisition of utility or pleasure from a good, or Willingness to Accept (WTA) compensation for relinquishing the utility or pleasure, both of which known as Contingent Valuations (Hanemann, 1991). These values have become the measure for price determination and utility as it involves a subjective internal weighing up of the utility gained for the utility sacrificed when faced with a decision. Or in other words, the marginal utility gain from the marginal costs.

For example, researchers may put forth a survey asking respondents to highlight how much they are willing to pay for 1 litre of clean water, 2 litres of clean water, 3 litres of water and so on. This gives the researchers quantitative insights into how much pleasure or utility an individual receives from various quantities of water, and how much utility cost is attributed to each litre of water. Further extrapolated across many recipients, and these measures become a reasonable average of what people are *willing to pay* for clean water and thus there is the exchange value of water.

2.2.5. Marginal Utility Theory in Ecological Economics

From a capitalistic perspective, ecological economics centres around four pillars of capital (Natural, Social, Human, Manufactured) (Costanza, 2006). The valuation of these capitals is deemed to be vitally important for the sustainable management of the ecosystems that ultimately provide social and natural well-being (Costanza, 2006). What gets measured, gets managed.

Addressing value theory within the sphere of ecological economics is no light task, and seldom do researchers and professionals claim to engage in perfect theory or research construction. Farber, Costanza and Wilson, (2002); and later Pirgmaier, (2021) have provided dialogue on the matter and contributed significantly to the convoluted aspects of value theory in ecological economics. On the one hand, Farber, Costanza and Wilson (2002) highlight marginal utility theory's application in ecological economics by suggesting that capital valuation, or money, has become the standard metric for assessing use values within the wider ecosystems:

> 'The significance of the marginal utility theory of value to the evolving concept of ecosystem service valuation is that it can be used to measure use values, not just exchange values, in monetary units… money can thus be used as a standard measure of use value' (p.378).

In this light, marginal utility theory is employed to value and understand the four capital pillars contained within the ecosystems in question. Further to this, marginal utility theory helps establish a hierarchy or typology of ecosystem goods and services that ultimately carry use values beneficial to human well-being and prosperity (Pirgmaier, 2021).

Ecological economists typically employ WTP and WTA methods as a form of Contingent Valuation (CV) to determine the marginal utility and price of certain environmental goods and services (Farber et al., 2002). This involves deployment of a consumer or household survey structured to encapsulate respondents' marginal utility of such goods and services.

For example, Costanza et al. (1997) led a team of natural scientists and economists where they set out to value the entire worlds ecosystem services and natural capital. Costanza et al. (1997), estimated the capital value to be in the range of US$16 – 54 trillion per year. They suggested that the average operational quantity of natural capital was US$33 trillion per year, with a global gross national product of human economies of $US18 trillion per year, highlighting a US$15 trillion surplus of natural capital goods currently untapped by market economies. The valuation tools employed by Costanza et al. (1997), were willingness to pay surveys, where respondents were asked individually how much they would be willing to pay for ecosystem services such as water supply, gas regulation, and pollination.

Another further example of ecosystem service valuation can be seen in such structures as Payment for Ecosystem Services (PES) (United Nations Environmental Programme, 2008). Such structures allow one to receive payments, generally by governmental agencies, for the ecosystem services that they contribute or promote to society. A classic example of these structures could be pulled from any existing carbon credit or emissions trading scheme. In New Zealand, and indeed in many countries world-wide, landowners who plant trees that have a *registered* carbon sequestration rate are able to register these trees in an emission trading scheme and receive payments per ton (1T) of carbon that is sequestered by their trees. Carbon sequestration or *climate regulation* is the desired ecosystem service that society as a whole benefits from, and the landowners or forest owners who own such trees are paid for this ecosystem service. There are many other ethereal examples of how PES structures work, such as the potential for society to pay landowners for erosion control on their land margins that boarder highways and important transport and access routes, or perhaps, the purification of water (as will be discussed later in *Section 3.4*). However, another existing example that is currently implemented can be pulled from biodiversity credit schemes. Such schemes work similarly to carbon credit or emissions trading schemes where landowners are paid for the biodiversity values they promote and ultimately, provide to wider society. There are examples of these schemes currently in operation (eg. Victoria Government Biodiversity Credit Scheme in Australia). New Zealand on the other hand, is currently reviewing public discussion on the matter (Ministry for the Environment, 2023c).

This is an example in the highest tier of ecological economic valuation, encapsulating a large, macro capital valuation. There are further examples at a smaller, micro level where businesses or local councils seek to value the benefits provided by their natural assets.

For example, White, Bennett and Hayes (2001), employed WTP surveys to establish quantitative, monetary figures for the conservation of four mammalian species in Britain. Their study suggested that the average individual's WTP for the conservation of all four species was €20.54. Their sample represented 0.08% of the North Yorkshire population, and so when extrapolated to represent the entire population, there results a total expenditure figure that can be used as guidance for local government conservation efforts for these species.

However, not all marginal utility theory applications in ecological economics lead to a capital or monetary valuation. For example, Farber, Costanza and Wilson (2002) demonstrate the ecological value of applying marginal utility theory in flood prevention. They suggest that there exists an ecosystem critical threshold in which the state of the ecosystem should be kept above to provide resilience against certain uncontrollable environmental forces like storms or fire.

The authors suggest that there is a certain level of environmental flood protection provided by a certain number of trees that can be expressed as a form of cost-benefit relationship. However, there is a diminishing return when the stocking rate per hectare reaches a point where additional trees planted only marginally reduce the flood severity. This can be viewed in *Figure 4* below. The argument here is the same as with traditional marginal utility theory applications in economics. There is a certain point where the value or utility of additional units does not significantly change. However, the ability to identify a critical threshold is of paramount importance as it sets a quantitative figure to which the ecosystem should be kept above. If the quantity falls beneath the critical threshold, then there is the chance for the ecosystem to receive irreparable damage that will see value and utility of these services drop significantly. T* in the figure below represents the state ecosystems should be kept at to avoid falling behind the critical threshold in the case of an adverse event.

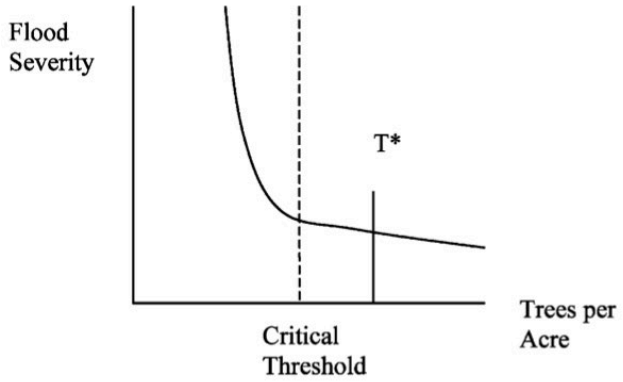

Figure 4:Flood severity vs trees per acre with critical threshold (Farber, Costanza and Wilson, 2002. P. 384)

However, marginal utility theory can be used to represent social values within ecosystem services, not just ecological values. In their same research report, Farber, Costanza and Wilson (2002) highlight the aesthetic value of a forest based on tree density per hectare. This can be viewed in *Figure 5* below. Similarly, there is an identification of a critical threshold and significant diminishing returns after the critical threshold, where additional stocking density results in only marginal improvements in aesthetic value.

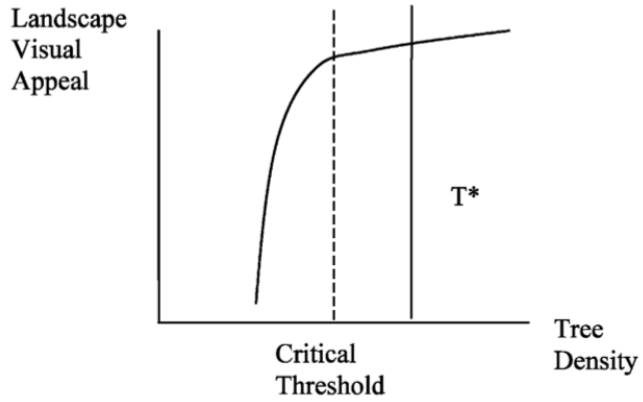

Figure 5:Landscape visual appeal vs tree density with critical threshold (Farber, Costanza and Wilson, 2002. P. 385).

2.2.6. Limitations of Marginal Utility Theory in Ecological Economics

Despite the overall usefulness and application that marginal utility theory has within ecological economics as outlined above, there exist limitations that need to be taken into consideration before using the methods to value ecological goods and services.

1.) *The paradox of Hedonism*

First and foremost is the underlying assumption of hedonism within the system. As highlighted above, the underlying structure of marginal utility assumes that humans exhibit behaviour that maximises pleasure. This is deemed rational behaviour. However, two thinkers will be discussed that highlight the paradoxical nature of hedonism, highlighting first that constant pleasure-seeking does not necessarily lead to the greatest actual pleasure or happiness, and second, that pleasure does not always direct behaviour and decision-making.

Aristotle was perhaps the first western thinker to express thoughts on the pursuit of pleasure. In his writings *Nicomachean Ethics* he suggests that pleasure is not continuous, but rather a symptom of activity:

> 'How, then, is it that no one is continuously pleased? Is it that we grow weary? Certainly, all human things are incapable of continuous activity. Therefore, pleasure is not continuous; for it accompanies activity. Some things delight us when they are new, but later do so less, for the same reason; for at first the mind is in a state of stimulation and intensely active about them, as people are with respect to their vision when they look hard at a thing, but afterwards our activity is not of this kind, but has grown relaxed; for which reason the pleasure is also dulled' – Aristotle in Nicomachean Ethics as cited in (Russell, 1979 p. 182).

Here, Aristotle is suggesting that pleasure arises from successful activity. However, that pleasure is not directly attainable, but the product of living a life that is active. When one focuses on the pleasure itself, often that pleasure is lost as it becomes the sole focus and so it becomes the end, rather than the means. If one conducts themselves in a necessarily 'good' manner, and the activity and behaviour of that individual is directed in a virtuous manner, then what arises from this activity is a feeling of pleasure.

As a further refutation of hedonism and the underlying assumptions of utilitarianism, in his book entitled *Anarchy, State and Utopia,* philosopher Robert Nozick put forth a thought experiment called *The Experience Machine*, whereby he invites readers to conceptualise themselves being plugged into a machine that can stimulate the brain to experience as much pleasure as one desires, however whilst plugged into the machine, they will be floating in a tank "as an indeterminate blob" (p.43). He then asks the reader whether they would plug into the machine or not.

Nozick suggests that there are grounds to refuse being plugged into such a machine. First, there is the notion that humans want to *do* certain things, not just experience them, much like Aristotle's argument above. His second argument is that humans want to *be* someone or *be* a certain way. Nozick suggests:

> 'There is no answer to the question of what a person is like who has long been in the tank. Is he courageous, kind, intelligent, witty, loving? It's not merely that it's difficult to tell; there's no way he is. Plugging into the machine is a kind of suicide' – (Nozick, 2001, p.43)

Here, Nozick is suggesting that humans care about what or who they are, not just what they experience. It is not the experience of pleasure that guides human behaviour, but rather the activity of becoming something or someone that pleasure complements. Finally, Nozick suggests the third reason for not plugging into the machine is that the machine 'limits us to a man-made reality, which is no deeper or important that which people can construct' (p.43). By putting forth these arguments for not engaging or 'plugging in' to the experience machine, Nozick is aiming to show that there are things that matter outside of pure experience and pleasure. If conceptualised through a hedonistic perspective, then one would have no grounds to refuse plugging into the experience machine, if pleasure maximisation was the controller of behaviour and decision-making. But because there are grounds for refusing to plug into the machine, then by *modus tollens*, experiencing as much pleasure as we want is not all that we want.

These examples highlight that there are other forces out there that drive and direct human behaviour and decision-making beyond purely utility maximisation and pleasure seeking. When applied to resource distribution and used to inform policy and decision-making, the underlying assumptions can

yield results that are not representative of reality. This can lead to inadequate policy and resource distribution, which highlights marginal utility theory's inability to perform the task it was conceptualised for. It fails to recognise the underlying values that direct behaviour that are incapable of being understood or captured by such a generalised, mechanically materialistic theory. There exist individual forces, not to mention cooperation between individuals, that direct behaviour which marginal utility theory would deem irrational, when in actual fact, this behaviour is completely rational given certain environmental conditions (see Colman, 2003, on cooperation in rational game theory). It fails to recognise the *how* and *why* of phenomena and behaviour, and seeks to only establish the *what*, and perhaps in some circumstances, the *when*. This comes down to the generalised nature of marginal utility and its associated valuation outputs, which as discussed above, is capital, or money. This too has been addressed, in detail, by thinkers interested in the political economy.

2.) *The Commodification and Commensurability of Nature*

One of the practical advantages of marginal utility theory is its capacity to generalise diverse values down to a single, representable output. Within the political economy of the capitalistic system, that output is money. However, as highlighted above, there exist other values within these ecosystems that are intrinsic, and to generalise down to a dollar figure, is to neglect these other underlying values.

Human geography scholar Noel Castree (2003) compiles and reviews the processes involved in valuing nature systematically in his paper *Commodifying What Nature?* Castree highlights that through a series of processes such as abstraction, valuation, alienation and privatisation, nature is being realised for value outside of its intrinsic qualities. Once an entity is valued or subject to valuation, there is a transition that takes place to estimate a theoretical value for physical phenomena. Within a capitalistic society, this valuation is an estimation of capital. The valuation process has been used to commodify a physical entities value or intrinsic qualities and measured in terms of production output in the form of a dollar value. This results in the commensurability of goods and services across the board, not restricted by classification or nature. A generalisation of nature down to a fungible state where it is replaceable and tradable (Castree, 2003).

For example, when purchasing a farm, not only is it share acreage that is considered in the price, but the productivity of the land in the form of stock units. If the land is more productive, then the farmer can graze more stock on the land and thus be more productive and profitable. The farmer purchases animals with money at a price based on breed and genetics, which ultimately determine production or growth. The farmer can further decide to plant trees in un-grazable aspects of the land, purchase these trees at a price based on species and purpose, register these trees to claim carbon credits for the ecosystem service of climate mitigation, and receive money in exchange for this service per unit of

production (per ton of carbon sequestered). This example clearly highlights the valuation of various aspects of nature and ecosystem services in the form of money, and the commensurability of various taxonomic classes of goods that results from such capital valuations.

Another further example can be pulled from any existing emissions trading scheme currently in place globally. The ability of trees to provide an ecosystem service of climate regulation is valued in terms of its ability to sequester carbon, because the global community is emitting too much carbon into the atmosphere. When trees are generalised down to their ability to sequester carbon, which ultimately rests on their contribution to human well-being, species diversity and other ecosystem services are not recognised and so the behaviour results in the planting of species that are superior at carbon sequestration. Within New Zealand, that is fast-growing exotic pine tree species. There is no recognition or accountancy of other intrinsic qualities that ultimately lie within the diversity of such forests.

Within both limitations outlined thus far, marginal utility theory and its subsequent valuation techniques are dangerously anthropocentric, and when applied to ecosystem services and ecological value, the value of other incredibly important intrinsic qualities are not recognised due to the focus on a single anthropocentric value of maximum utility. However, despite these general issues, marginal utility is still the leading theory of value within ecological economics today, and its methods extrapolated out to inform public and private policy and decision-making. This leads to the third and final limitation of marginal utility theory.

3.) *Extrapolation and Hasty Generalisations.*

The final limitation of marginal utility theory that will be discussed has to do with methodological applications and underlying structures.

In basic logic, inductive reasoning risks the use of hasty generalisations. It uses the positive instances of a sample to make generalisations about the wider population or future instances. For example, if within a sample, findings suggest that all swans are white, then by inductive reasoning, all swans in the world population are white. Regardless of one's ecological education, this statement is quickly falsified as we know that there exist black swans, albeit rare. There are ways to avoid hasty generalisations, and these lie in the enumeration principle, which in statistics, is having a sample size of 30 or more. The larger the sample size, the greater the representation of the population and thus fairer conclusions can be drawn. However, when quantifying certain services or goods in terms of capital value, things can slip away.

WTP methods are prone to similar pitfalls by drawing generalised inferences about people's values from samples that might not hold in other contexts, given the diversity of human populations. For example, preferences about WTP for preservation of a bird species could be drawn from a sample that is affluent, then transposed onto very different populations who hold very different views about the value of nature (such as lower-socioeconomic groups, developing country citizens, or Indigenous communities).

A related issue is that WTP methodologies are often additive, simply summing up the preferences of individuals or households to the national level. For example, in an assessment of WTP for endangered species in the USA, Stanley (2005), established what households are willing to pay for the conservation of Riverside Fairy Shrimp. The authors deployed WTP surveys and concluded that each household would pay US$25 annually to protect this species. However, when extrapolated across the total number of households in the USA, which, according to the 2019 census, is 120,756,048 (2019 US census). When extrapolated, $25 x 120,756, 048 = US$3,070,000,000 per year to protect one single endangered species. This figure is simply unrealistic, and furthermore, assumes that every household is able or willing to pay US$25. The hypothetical scenarios created for such surveys are far removed from actual intention or reality. When push comes to shove, households may not be willing to pay the resultant figures alluded to in the survey. In this light, the methods and principles of marginal utility theory within ecological economics fail to correctly and practically inform decision-making and policy. At worst, it creates false expectations of investment that are unlikely to eventuate, and which crowd out other types of valuation that are more likely to result in actual payment.

2.2.6. Systemic and political implications of marginal utility.

As highlighted above, marginal utility theory within ecological economics helps inform public and private policy and decision-making. When a capital valuation takes place, there becomes a question and systematic process of privatisation and ultimately resource allocation and distribution (Veblen, 1908). However, care needs to be taken when employing such valuation methods to ensure correct and practical data is obtained and used to inform policy and decision-making measures.

If ecological economics has a primary focus on biocentric sustainability, then ensuring resources and ecosystem services are managed correctly and efficiently should be of top priority. In this light, although the scalability and efficiency of employing marginal utility theory through WTP methods is advantageous, care needs to be taken and perhaps other methods of research undertaken to contextualise the results given by marginal utility in ecological economics.

There are other methods, despite marginal utility's popularity and proliferation, that can be used which do not rely on WTP. The discussion now turns to a second valuation approach in economics that, like marginal utility, bares its roots in the works of Adam Smith and the concept of exchange value.

2.3. Karl Marx and a Labour Theory of Value

This section lays out Karl Marx's Labour Theory as an alternative theory of value to marginal utility. Due to the limitations of time and resources, this analysis relies on the received version of Marx's theory of value, as derived from the secondary literature, especially the renowned Marxist scholar David Harvey. Because of this, the discussion is open to contestation about the interpretation of Marx's actual views, as derived from a careful reading of *Das Kapital*. A comprehensive and original analysis of Marx's own theory of value, as described in *Das Kapital*, was beyond the scope of this thesis. Caveats aside, the discussion begins with the philosophical underpinnings of Karl Marx's labour theory of value, highlighting its empirical basis, materialist construction and ontology. From there, nuances of Marxian use and exchange value will be discussed with reference to key differences to that of marginal utility theory. Marx's labour theory of value is then introduced and applications to ecological economics are discussed. Limitations are then highlighted, and political and systemic implications are explored.

2.3.1. Philosophical grounds for Marx's' labour theory of value

It is the ontological roots of Karl Marx that can be seen as the foundation for his conceptions of commodities and the valuation of such. Marx regarded himself as a materialist, which proposes that knowledge is gained from the experience of the object, however he further argues that traditional materialism is wrong in suggesting that sensation or perception is passive (Russell, 1979). For Marx, it is the handling of things, or the subjective perception of the object, that ultimately guides knowledge acquisition:

> 'The question whether objective truth belongs to human thinking is not a question of theory, but a practical question. The truth, i.e. the reality and power, of thought must be demonstrated in practice. The contest as to the reality or non-reality of a thought which is isolated from practice, is a purely scholastic question… Philosophers have only interpreted the world in various ways, but the real task is to alter it' (Marx & Engles, 1969 p.13)

Here, Marx suggests that it is the relationship between humans and matter that is the ultimate construction of reality. Of which, the most important is the human mode of production and

transformation, highlighting Marx's materialism and epistemology becoming his economics. This is an important point in the works of Marx as the human relationship to matter is in a constant state of flux and therefore represents an ever-changing knowledge structure. How humans view the world and ultimately, produce capital through the commodification of matter, changes with the values and dialectic of the time.

2.3.2. Marxian Use Value

Much like the utilitarian thinkers considered in *Section 2.2.3* above, Marx believes that the material side of a commodity lies within its relation to human wants and needs through the concept of use value (Harvey, 2018). Marx stresses the idea that use value can be perceived from two angles based around qualities and quantities.

If quantities are identified, then a definition of the requirements of social reproduction can follow. By social reproduction, it is meant the quantity of commodity production that satisfies industrial requirements, such as steel for construction, cars, and tools. When a society is in reproduction, the inputs and outputs are in equilibrium. To Marx, the idea of social reproduction is of paramount importance because without reproduction, society would not survive. It is from this notion that Marx suggests that the physical aspect of social reproduction is captured by the labour process, which can be defined as; (1) the personal activity of humans (work itself); (2) the subject of this work and; (3) its instruments (Harvey, 2018 p. 64).

The importance of the third point of social reproduction is worth a mention here: its instruments, or the technologies available to organise and, ultimately, to produce. If there are certain technological advances in production, then the socially necessary labour to reproduce society is reduced. Furthermore, it highlights the interrelated concept of use value and its ability to alter the labour process.

2.3.3. Marxian Exchange Value

As with marginal utility theory, Marx believes that exchange value rests, in part, on the use value of commodities. Without use for such commodity, there are no grounds for an exchange or trade, forming the foundation for Marx's theory of value (Harvey, 2018). However, Marx differs from the utilitarian thinkers in that he believed there exists an omnipresent character or quality of commodities that ultimately drives the price and the exchange of such commodities, as opposed to utility and scarcity. Transactions, Marx would argue, provide signals that guide both production and

consumption decisions (Harvey, 2018). Producers or consumers decide how much of a commodity they want to consume or produce given a certain price or exchange value.

Marx believed that exchange value cannot be understood without reference to the nature of money and its ability to project exchange value as a price. Commodities, according to Marx, can represent an *equivalent* and a *relative* value (Harvey, 2018). When money is understood as a commodity (which it commonly is within Marxian literature and theory), it is done through historic exchanges within society. When a society measures the value of a good that is acquired, against the single value of a good that they are willing to dispose of in exchange, the good they are disposing of functions as its equivalent form of value (Harvey, 2018). Traditionally speaking, communities or societies have commodities that operate as the universal equivalent form of value.

Within capitalistic societies, this universal equivalent has become money, which historically would have been gold, hence the term *the gold standard.* When the value of all other commodities is represented by this universal equivalent, the value becomes its relative value. In other words, the quantity of the universal equivalent that is contained within these other commodities. In this light, value acquires a socially accepted measure, and when money becomes the socially accepted measure, it assumes value itself, both exchange and use value (Harvey, 2018). Its exchange value is determined by the socially necessary labour time taken for its production and is dependent on the social and physical conditions of the labour required to produce it. Therefore, the exchange values of other commodities are measured by the universal equivalent of the labour conditions present in the production of money.

To understand this in terms of the diamond–water paradox discussed earlier, diamonds have a higher exchange value than water, not because of their utility function or scarcity, but because of the socially necessary labour required to produce them as a commodity. If there are technological advances in diamond mining, then the price of diamonds will decrease as there is less labour time contained within it, with reference to the universal equivalent of money or gold. If the paradox is flipped as above, in times of drought or scarcity, there is more labour time required to produce water as a commodity. This is a key difference between the marginal utility theory thinkers and Marx; however, both seem to solve the diamond–water paradox sufficiently.

2.3.4. Marx's Labour Theory of Value

As outlined above, Marx believes that it is within the conception of exchange and use value that draws the conclusion that it is labour that drives value. More precisely, it is the labour required to

create and form commodity values (Harvey, 2018). This seems like a circular argument, however the distinction lies between what Marx deems concrete and abstract labour. *Concrete labour* is the actual embodied labour contained within production or a task. *Abstract labour*, or socially necessary labour, is the average amount of labour time contained in production or in a task given the technology, science, and worker skill of the time in a particular society (Harvey, 2018 p. 78). Marx believes that it is abstract labour that becomes a measure of value, however only when wage labour becomes general in society. He arrives at this conclusion by highlighting that in order for profits to exist through the M-C-M model for surplus value, there must exist a commodity that has the ability to produce more value than what it is worth (the reader is directed to Harvey, 2018 p. 93. if unfamiliar with the M-C-M model).

Marx believes that labour power is such a commodity, as the industrial owner pays the worker less than the product of their labour is worth (Harvey, 2018 p.94). Workers sell their labour power to owners at an agreed rate, to which the owner benefits from the transaction in the form of value added in production that is effectively unrealised at the worker level. The worker, however, is not disenfranchised by this as they have willingly agreed to sell their labour power in exchange for the agreed rate.

For example, the owner of a building company charges their worker out at a standard market rate of $50 per hour to the client for their labour. This is the socially necessary labour time. The worker has sought work from the owner and agreed to an hourly wage of $35 to be compensated for their labour. This is the worker's labour power. Whilst taking into account administration fees and various taxes and levies, the owner makes *x*-amount profit off the worker as they are paying for the abstract labour or labour power of the worker as opposed to the concrete, embodied labour. If one were to pay for the concrete embodied labour, there would be no profit or surplus value created in the exchange.

What is highlighted here is the distinction between *concrete* and *abstract* labour. Concrete labour itself can have no value because it cannot value itself, nor create any surplus value. However, socially necessary labour can be used as a yardstick for value due to its socially constructed properties. As was discussed earlier on Marxian use value, once a commodity is used as a universal equivalent and is socially agreed upon, this can give relative value measures of other, unrelated commodities. It is important to note here the socially constructed aspect of Marxian value theory. Whilst it highlights a quantitative aspect of value, it only does so with reference to historic social structures that are fundamentally qualitative. It presents a way of averaging labour costs across a society given the current state of technology, science, and worker productivity. Moreover, it can provide grounds for analysing the production capacities and pricing points of competing companies.

2.3.5. Marxian Value Theory in Ecological Economics

Within ecological economics, Marxian labour theory is widely discussed however from a practical perspective, it is largely absent. Pirgmaier (2021) argues for why Marxian labour theory should be used in ecological economics, largely resting on the notion that Marx's labour theory is the only theory of value that critiques capitalism by suggesting that it is an economic system in which people serve. This opposes the classical and neoclassical conception which suggest that capitalism is an economy that serves people by delivering well-being.

Pirgmaier argues for the validity of Marx's conceptions of use and exchange value, and the need to keep them dialectically separate. He concludes with the need to bring further radical social science understandings in ecological economics to help break out of the mainstream neoclassical models like marginal utility theory. Whilst providing fruitful dialogue, Pirgmaier does not apply the Marxian labour theory of value to ecological economic scenarios, nor reference to any works of the kind.

There have also been thinkers argue for Marxian reasoning and logic to be applied to ecological economics, however these have been broadly focused on the wider aspects of Marxian ideology rather than labour theory of value specifically. In his book titled, *Marxism and Ecological Economics*, (Burkett, 2006) Click or tap here to enter text.Click or tap here to enter text.evaluates how Marx's approach to economics can be applied to ecological problems, largely resting on the ability for such approach to conceptualise environmental values not as free value provided to humans in externality, but rather identifying at what point environmental values are recognised within the capitalistic system. Burkett debunks the counter arguments that highlight Marxism as a way of justifying free extraction of natural resources by arguing that, under a Marxian lens, there is no dismissal of nature's intrinsic values, but rather a recognition of a value shift that takes place as soon as human labour becomes intertwined with such resources. Burkett further extends this argument towards sustainable development by highlighting the ability for Marxian logic to be able to conceptualise and account for environmental value that lies beyond a human value structure. Again however, there is no application of Marxian labour theory to ecological economic valuation problems specifically.

By the same token, Basu and Das (2012) put forth a defence against claims that Marxism is an anti-ecological framework by pointing to arguments in *Capital* (vol 1) that stress the destructive nature of capitalism and its ability to rob the soil of fertility through agricultural development, which in the long run leads to loss of fertility. Douai (2009), shares this view and further argues for the need of Marxian logic to advance the field of social ecological economics and provide critique of marginalist, neo-

classical applications within the field. Huber (2017) provides a compelling defence for Marxism within ecological economics by highlighting the ability for it to understand human alienation from nature under capitalistic modes of production. Furthermore, the author suggests that Marxism helps understand the commensurability issues that arise from using money as the value metric for environmental goods and services. Again, this argument largely rests on problems of abstraction and generalisation of value.

What becomes apparent in the literature is that there is little to suggest that Marx's labour theory has been practically applied to ecological economic questions. There is evidence of back and forth between scholars on the contributions (or lack thereof) Marxism has made to the theoretical aspects of ecological economics as a discipline, however a framework for how labour theory could value ecological goods and services remains missing. This could be due in part to the debated nature of value within the literature as discussed above, or to a downright rejection of labour theory within the discipline. Regardless, the question remains, what would this framework look like?

Let's say one is wanting to value a native forest that they are planting as part of a farm restoration project. Labour theory of value would suggest its value would equal the socially necessary labour time contained within the forest. This would require highlighting tasks that are required for the planting and maintenance of the forest and getting the average necessary labour cost to undertake these tasks. In addition, the socially necessary labour cost of the seedlings, which will have been accounted for in the price formation under a Marxian lens. These would be added up across the forest, and then the value that would arise would be the total socially necessary labour time embodied in the forest as a whole. In this light, the framework encapsulates value added to the forest by way of abstract labour. It does not reject intrinsic values of the forest; it simply does not include these values within the exchange economy.

This notion opens the door to a slew of ethical questions such as whether intrinsic value should or should not be included in such valuations, or whether human labour constitutes value added to the ecosystem. These questions must be parked for now, however it could be postulated that the only value that should be exchanged within capital market structures is the value created by humans. These notes aside, there must exist limitations and criticisms to Marx's labour theory of value that have left it largely absent from value theory discussions within ecological economics. It is to these the discussion turns.

2.3.6. Limitations and Critique of Marx's Value Theory

1. Prometheanism

Perhaps one of the sharper criticisms of Marx's value theory are the accusations of promethianism, which suggests that one favours human and industrial development over everything else. Giddens (1981), highlights that Marx's arguments for the exploitation of human labour does not translate to the exploitation of nature (p. 59), and that when valued in terms of human labour, there is no recognition of the quantity of natural resources, or the values that lay outside of socially abstracted labour. This can lead to further extraction of resources that one deems free for use, without considering the needs for future generations. This goes against ecological economics core principle of *biocentric sustainability* and could prove to be detrimental to the common resource pool. However, there do lie retorts to these claims, such as; Basu and Das (2012); Douai (2009); and Huber (2017), which were discussed above.

2. Lack of applicability to some environmental goods

Another key limitation to Marx's labour theory discussed in the literature is the notion that abstract socially necessary labour cannot be applied to aspects of nature that do not have any abstract human labour contained within it. Huber (2017) notes that while 'neoclassical economic value theory allows the possibility of nature attaining value, Marxian value theory lays bare the impossibility of such a project under capitalism' (Huber, 2017, p. 44). The value of a polar bear or dung-beetle cannot be identified under labour theory, nor could the climate system as such. However, Huber (2017), goes on to save Marx by suggesting that 'Rather than lambasting Marx for ignoring nature, we should point out that Marx's value theory contains an implicit critique of the neoliberal belief that we can harness the market as a means to adequately value the contributions of ecological processes' (p. 44).

What can be highlighted from this is that labour theory is a theory to value capitalistic exchanges of commodities that contain socially abstracted labour, rather than applying socially abstracted labour as a metric to value all goods and services. It merely focuses on the process of value creation in the form of abstract socially necessary labour and attaches a value to that aspect of the good or service. Moreover, it opens the door to question whether such entities as a polar bear or dung-beetle should have a *market* value attached to it. Indeed, they have intrinsic value, however, do they need to be recognised for their exchange capacity within a capitalistic market economy? In other words, do they need a monetary price?

3. The ensuing problem of commensurability and abstraction

The third and final critique of Marx's labour theory is one that Marx first pointed out himself, however, which has been reinvigorated in more modern arguments. This pertains to the idea of value monism and the commensurability of goods and services, which was discussed earlier as a problem for marginal utility theory, however, stands as a challenge for Marxian theory too. Marx believes that in the process of valuation there is an abstraction of value that takes place, as discussed earlier in regard to abstract socially necessary labour. When something has abstracted value, it has value that is apart from itself, that is not wholly theirs anymore. When that value is abstracted down to a single metric, there is a loss of other values contained within such an entity, which are only recognised for their abstracted value. This was discussed in the works of Castree (2003) and the example of the farmer purchasing various environmental goods above in *Section 2.2.6*, so no need to repeat it here.

2.3.7. Systemic and Political Implications of Marx's Labour Theory

It seems rather difficult to highlight the systemic and political implications of Marxian value theory because there are simply no practical applications of the value theory, nor a framework of how a labour theory of value would be applied to ecological economics. Granted that from a theoretical standpoint Marxist value theory highlights the innerworkings of capitalism and challenges its fundamental concepts, however these criticisms lay largely in theory and not practice. As was highlighted above in *Section 2.3.5*, there are discussions of how a Marxist lens could help advance ecological economic theory towards better conceptions of the neoclassical, marginalist status quo. The implications of this lie predominantly in the challenging of the current system, and a reconceptualisation of what is deemed *rational* behaviour.

Furthermore, if a labour theory of value were to be considered, it would result in the classification of some environmental goods that effectively can and cannot be valued. The value of a planted regenerating forest can be valued based on the socially necessary labour time required to establish and manage the forest, however the fecundity of kiwi cannot. Unless perhaps differences between a migrating and self-introducing kiwi were compared with a breeding and reintroduction programme. Perhaps then value added to the kiwi in the form of socially abstracted labour could be calculated. What can be said is that the implications of Marxian labour theory have the potential to reconceptualise exchange value entirely and provide a significantly different perspective to the problem of value within ecological economics and society.

However, it would require significant ethical inquiry into what can and cannot be valued, and whether human labour is value creating for nature at all. It seems that from the discussion above, Marx would suggest that it is only the value added in the form of abstract human labour that can be priced and

exchanged accordingly. When humans have not added any abstract labour, there is no value to exchange. Whilst this may seem anthropocentric, it could be argued that it is less so than neoclassical reasoning whereby it is not neglecting environmental or intrinsic values, it simply postulates that they should not be valued with reference to capital exchange. Whereas neoclassical models take an entity's intrinsic qualities and value them with reference to their contribution to human well-being. This presents an exciting area for future research and discussion, however the conversation must digress now to the third theory of value learnt from the Austrian school, praxeology.

2.4. Praxeology

What is introduced in this section is an in-depth analysis of praxeology and the subjective theory of value, highlighting key concepts and philosophical underpinnings. Examples of praxeological thought within ecological economics are then drawn on, with key limitations discussed – largely resting on the restrictions or ordinal rankings and the privatisation of environmental goods and services. Political and systemic implications of praxeological praxis are then discussed.

2.4.1. Philosophical grounds of praxeology

Praxeology is widely considered as the Austrian economic method. Its founder, Ludwig von Mises, sought to engage in economic theory that was not rooted in objective positivism (Lavoie, 2011), unlike marginal utility theory and Marxian labour theory. Instead of advancing western positivism, von Mises sought to ground an understanding economic theory in an interpretive, qualitative way and called on *hermeneutics* to bring historical knowledge forth into the present to understand economic phenomena and relations (Lavoie, 2011).

Narrative thought, or interpretivism, is a paradigm derived from story-telling and interpretation through rich metaphor. This paradigm represents an earlier stage of knowledge derivation than empiricism, where knowledge is shared through generations by way of mythology and narrative, often expressing normative knowledge and values about how individuals and society ought to act and behave. Knowledge acquisition under interpretivism is concerned with meaning and understanding as opposed to laws and explanations like empiricism is. Perhaps the most important piece of interpretive praxis is what is known as *accessus ad auctores* (Mantzavinos, 2020), a typology of seven questions that simply ask:

1. Who (is the author)?

2. What (is the subject matter of the text)?
3. Why (was the text written)?
4. How (was the text composed)?
5. When (was the text written)?
6. Where (was the text published)?
7. By which means (was the text written or published)?

By asking these questions in a systematic manner, one can gather key contextual information for the legitimacy of the texts or information one receives. This method of systematic interpretation is known as *hermeneutics*, and is what much of modern Western interpretivism is derived from. Knowledge is relative under interpretivism, meaning that asking questions such as those in the *accessus* typology above, ensures the knowledge is time, context, culture, and value bound. Because of this, praxeology is purely qualitative and contextual, and so if inputs are qualitative, then the outputs and conclusions are too (Rothbard, 1976).

Von Mises was a proponent of Immanuel Kant, in that the epistemology of praxeology is concerned with establishing not so much *a priori* knowledge, but rather the notion that reason and logic can bring forth necessary truths and knowledge (Selgin, 1990). What praxeology seeks to do is refute the implications of historicism and empiricism by establishing universal laws that rest on the necessary truth that humans exhibit purposive *action* (Selgin, 1990; Rothbard, 1973; (Rothbard, 1973)). Von Mises defines this as the *action axiom,* which is based on the reality that the choice of means in the pursuit of attainment of the ends distinguishes all mental and therefore human activity (James, 1950., cited in Selgin, 1990. P. 14).

What this alludes to is the subjective nature of praxeological research and epistemology, and indeed thinkers have drawn parallels with the epistemological doctrine of subjectivism or idealism (eg. Selgin, 1990; Fox, 1992; Lavoie, 2011). Praxeology holds that within the realm of *human action*, there exists observed phenomena, particularly market phenomena, that exist only because of the consciousness of purposeful individuals (Selgin, 1990). Due to this notion, value, profit gains, and losses are all products of human thought that bare no objective roots.

2.4.2. Praxeology – the subjective theory of value

Praxeological subjective value theory, as discussed above, begins with the logical fact that people *act*, and employ means to try and attain ends (Rothbard, 1973). As a methodology, it recognises that valuation is a subjective, individual process and seeks to prove this through deductive reasoning. An

example of praxeological deduction can be seen in its line of reasoning proving that valuation is a subjective act specific to the individual. The argument is as follows:

P1. Valuation creates an ordinal preference relation.
P2. When valuation spawns from action, there is always a choice that takes place.
P3. When there is a choice taking place, there is an analysis of trade-offs.
C1. Therefore, opportunity cost or the cost of the trade-off is the subjective valuation of the most preferred alternative - (Fox, 1992).

This description of value is an example of praxeological deductive reasoning at work. It seems difficult to refute the claim that opportunity costs are the valuation of the next best alternative based on the preceding premises. What is important to note is P1, in that valuation creates an ordinal preference relation. This notion will be revised in due course, however for now it should be pointed out that this is a main difference between praxeological subjective value theory, and the other two objectivist theories covered earlier in this work. As alluded to above, praxeology is purely qualitative, and so its outputs are qualitative too. It cannot value entities in a numerical way, nor does it seek to (Rothbard, 1976). Praxeology rests on the idea that people value things for many different reasons, and values cannot be compared between individuals, or to the same individual over time for that matter (Fox, 1992). By this token, praxeology recognises that preferences are not constant, they are ever changing through space and time. This is where praxeology embraces an interpretive, hermeneutical approach by calling forth historical knowledge to analyse and understand individual preferences.

Praxeology holds that price and valuation are distinct concepts and should be kept that way. The price of a good or service reflects a real historical phenomenon whereby an actual exchange of property between real people has taken place (von Mises, 1949)Each price for each exchange is unique and encapsulates an array of circumstances particular to the time and place, including the preferences of the participants in the exchange. If there is an exchange of property that has taken place, praxeology would suggest that both parties valued what they traded less than what they received (von Mises, 1949). This conclusion rests on the underlying axiom of *human action*. Because there was an action (of exchange), there must be inequality in the exchange as action does not spawn out of indifference (Rothbard, 1973). This opposes both marginal utility and Marxian labour theory in that they both rest on equality of exchange, rather than inequality. Furthermore, praxeology recognises the misleading nature of price in that when considered in an exchange it constantly either over or under-estimates value.

For example, consider a scenario where a car has been sold for $5000. The seller has put a price of the exchange at $5000, however putting it up for that price suggests that they in fact value their car

less than that as they are willing to accept $5000 in exchange for such vehicle. The buyer has paid $5000 for the vehicle as they value the car to be worth more than the $5000 they exchanged for the car. The price of the exchange is $5000, however one side of the exchange values the car less than the price, while the other values the car greater than the price. Because the *action* of exchange has already been committed, such an inequality must exist as *action* does not result from indifference (Rothbard, 1973). As can be gathered by this scenario, price is misleading and does not accurately encapsulate or represent value in exchange.

This example shows that, whilst overly simplistic, the price of the car masks the actual value that both sides of the exchange have towards the car. However, what becomes apparent from such argument is the question of whether price and exchange require the privatisation and exclusion of goods. This brings forth a key theorem in praxeological reason, the *impossibility theorem*. The impossibility theorem states that prices do not exist outside of the market, they are strictly a market phenomenon, and they cannot be constructed synthetically (von Mises, 1949 p.395). Praxeology holds that it is a dead end constructing hypothetical scenarios of what price would be given different environmental conditions. The fact of the matter is that the conditions were not different, and any attempt to construct a contingent valuation, in that sense, is a drastic inaccuracy. The basis for this statement rests in the praxeological conception of private property, to which holds that private property is necessarily essential for economic calculation. von Mises writes:

> '… it is not possible to divorce the market and its functions in regard to the formation of prices from the working of a society which is based on private property in the means of production and in which… the landlords, capitalists and entrepreneurs can dispose of their property as they see fit' - (von Mises, 1949 p.137).

It is this claim of a necessary role for private ownership in economic calculation that highlights the inaccuracies of contingent valuations such as WTP. Contingent valuations are measures of a hypothetical exchange involving people in a hypothetical scenario. If von Mises is correct with this claim, then the prices that result from contingent valuations provide no useful information that can be used in economic calculation simply because the people do not own the goods. It would hold that one of the main tools used to convey marginal utility theory and measure value does not represent this value correctly. The implications of such inaccuracies were discussed in the limitations of marginal utility *(Section 2.2.6).* This opens the door to discussions of the nature of private property and the classification of goods based on various degrees of ownership. It is to this question that we now turn as we analyse praxeological methods within ecological economics.

2.4.3. Praxeology in Ecological Economics

Within the literature, there is scant research regarding praxeology and its applications to ecological economics. This could be due to marginal utility's domination in the realm of valuing environmental and ecological goods and services.

However, of the praxeological practitioners, Fox (1992), sought to discuss how praxeology and subjective value theory could be applied to the pricing of environmental goods and services. As touched on above, praxeological analysis enables an ordinal ranking of choices when valuation takes place. It can be used to analyse individual subjective preferences of environmental goods and services by referring to action that has taken place in the market based on either historical market exchanges between individuals, or the choices an individual makes when faced with a trade-off and conceptualisations of opportunity costs.

For example, consider a scenario of a farmer who has engaged in a restoration project on their farm. The farmer spent $100,000 on afforestation on their land, planting trees in areas of the farm that were lying in marginal gullies with small streams that proved to be un-grazable for stock as it accumulates significant amounts of water and becomes puggy when grazed. The farmer was faced with a decision to either plant native rātā as the predominant species, a native fuchsia species kōtukutuku (Fuchsia *extorcata*), or exotic pine. The native rātā and kōtukutuku have the same seedling price of $2, however the exotic pine seedlings are $1. The farmer decided to plant the kōtukutuku as the primary species and let natural succession take place from there. And so, the farmer bought the kōtukutuku seedlings from a nursery for $2 per seedling, planting 50,000 across their land. What praxeology would hold is that the farmer values not only the kōtukutuku greater than the rātā or exotic pine, but that the farmer believes that the subjective value of the kōtukutuku is greater than the $2 they have traded for the seedlings. Further qualitative analysis could help understand why this is, and when such research is done, it could be found that the farmer knows that the berries of the kōtukutuku are edible and have many uses outside of the intrinsic qualities or other ecosystem services the species can provide.

Furthermore, although perhaps planting such an area in exotic pine may prove to be more profitable with such schemes as the emissions trading scheme and the eventual logging of the trees for timber sale, the farmer decided to plant a species of tree that although will not be as fruitful fiscally, it indicates that they have a value structure that lies outside of pure profits that cannot be encapsulated by a cost-benefit analysis or standard utility formulation. This would indicate that there is intangible value that lies within this decision that is otherwise forgotten or simply unaccounted for within the standard marginal utility methods. From a praxeological perspective, it was purposive action that was internalised, and a subjective valuation took place that considered the planting of the kōtukutuku species to be of greater value to the farmer than the planting of the other two species. To understand

this rationale, one must engage in qualitative, interpretive research such as *hermeneutics* to truly understand the value of such a decision or trade-off that lies outside of the pricing mechanism. If the market sees an increase in demand for the kōtukutuku seedlings, whilst supply is held constant, then by deductive logic, the price will increase in the same direction as demand, by how much cannot be forecasted, only the observation of the relationship between price and demand (Rothbard, 1973).

Although Fox (1992) engages in fruitful dialogue on the application of praxeology to the valuation of environmental goods, there is no application of the theory practically. The concluding remarks, and indeed the underlying argument of the discussion, rest on a criticism of how contingent valuations are inaccurate and inappropriate for the valuation of environmental goods, based on the techniques and methodologies resting on hypothetical scenarios and do not constitute a true exchange of private property. The synthetic prices that result from such methods distort the process of economic calculation as they have no relationship with ability to pay, much like the WTP example discussed above in *Section 2.2.6* with the fairy shrimp.

Controversially, praxeology suggests that if resources are to become economic goods that have a price attached, then such resources need to be privately owned. This is because if they have a price attached, then this suggests there has been a voluntary exchange of private property between two parties. This is the only accurate measure of price that can be referenced as it is a historical transaction that has occurred, rather than a hypothetical synthetic price of property that is not privately owned by those in question.

Further on the discussion on how subjective value can be applied to ecological economics, Fox embraces the praxeological notion of the *impossibility theorem* by highlighting that if valuation and pricing takes place on environmental goods and services, then there needs to be an element of private ownership of such environmental goods for such valuation to take place. Fox suggests that: *'The ability to exercise power to exclude is correlated with the structure of ownership of an economic good. Laws and other social institutions have created a range of modes of ownership' (Fox, 1992. p. 252-253).*

Fox believes that the state of ownership and private exclusion can be viewed as a continuum as seen in *Figure 6* below. This is clearly an oversimplification, as many private property rights are now embedded in public land, notably the concessions regime operating over public conservation land, including many local government reserves. However, for the sake of argument and clarity of Fox's thesis, this concept is left simplified for the time being. [1]

[1] I would like to thank Reviewer 3 for their diligence in raising this important point.

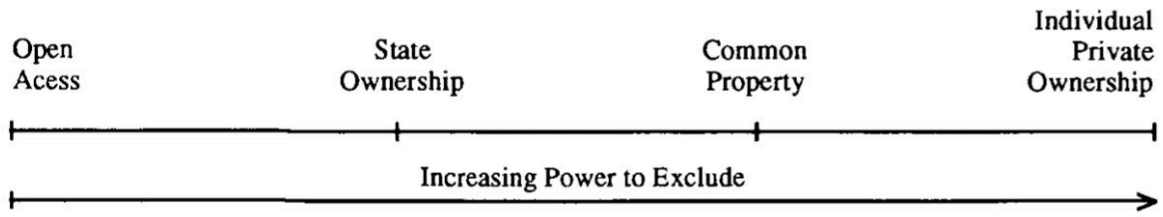

Figure 6: Types of ownership structures of economic goods (Fox, 1992, p. 253)

Fox suggests that open access is a situation in which there is no position to exercise exclusion and ultimately accelerates depletion of an economic resource, whereby competing users recognise the scarcity of the resource in question and direct action towards extracting such resource and hoarding to get ahead of the competition. Examples of such open access to natural resources are rare, however can be seen in the historic exploitation of fish populations, land grazing, or perhaps more abstractly, air and freshwater pollution.

State ownership of natural resources suggests exactly what the name portrays, that the state has the power to exclude, however Fox believes that state ownership is often met with significant political obstacles which limit the state's power to exclude. What results from this is a lack of control and protection under state ownership. While it is an improvement over open access, the level of stewardship that state-owned property receives is less than the quality of management exercised by private owners. Fox believes that this is because the state can hedge losses by levying taxes, whilst private owners cannot. Fox writes:

> 'The ability of private owners to acquire property or to sustain losses is limited by the wealth gained through voluntary exchange. Possession of the power to tax relaxes this constraint for the state as an owner. Losses can be offset by levying taxes. This reduces the need for efficient management of property relative to a private owner' (Fox, 1992, p. 254).

An example of this could be seen in the state-owned reserves and national parks. Whilst there is exclusion of the resources contained within reserves or national parks, such as the ability for the public to take plants or animals from within these state-owned areas, the restoration and maintenance of such resources is often lacking. These aspects of land can be subject to minimal pest control initiatives and management of scrub species that provide tinder for wildfires. Both factors can have a damaging effect on the natural resources, and the value contained within such.

Fox further believes that state ownership leads to problems of cost control of resources due to the politicisation of management in that state enterprises are rarely allowed to fail. What this means is that

consumers of the state-owned resource can invoke pressure on the state to resist changes in the way such resources are managed, to keeps things within the status quo, so to speak.

Moreover, state ownership is faced with a problem when it comes to the valuation of resources. The praxeological theory of subjective valuation puts weight on the ordinal ranking of outcomes according to preferences (Fox, 1992; Rothbard, 1973). Fox suggests that the state does not have an integrated set of preferences because neither it nor society possesses a consciousness, and because preference and choice are expressions of consciousness, collective valuation of state-owned economic goods and resources is not possible.

The following two ownership structures refer to private ownership either in a group, as with common property, or as individual private ownership. Fox believes that the defining quality of private ownership is the strength between authority and responsibility. That is, private owners, whether an individual or groups, must deal with the consequences that result from the management decisions made with regards to their property. Unlike state ownership, if mistakes are made, then the private owners cannot hide behind levied taxes - they must bear the brunt of their losses. However, if innovative ideas are successful, then the owners gain wealth.

It is this notion of loss, or prospective loss, that introduces a sense of urgency and better management not expressed in state ownership. It is this idea of private ownership that leads to better management of the resources in question as private owners cannot afford to have their property maintain a loss, and so more effective strategies are implemented to ensure the longevity and sustainability of value within such resources. This gives rise to a key praxeological idea that private property means there is more exclusion, however less exploitation (Fox, 1992). Similar arguments can be seen in *Tragedy of the Commons* metaphors made famous by Garrett Hardin (Hardin, 1968).

However, Hardin's work is contested and criticised. One key contestation can be pulled from Elinor Ostrom and her work entitled *Governing the Commons* (Ostrom, 1990). A key thesis in Ostrom's *Governing the Commons* is that commons need not to be considered tragic at all, nor held in private ownership specifically, particularly when considered under instances where a community can manage common resources of limited scope. Much more can be said about Ostrom's work, however due to the scope of the thesis, this cannot be elaborated on further. However, this notion will be briefly discussed in the following section below in the discussion of limitations to praxeology and property ownership in common with respect to indigenous communities.

Fox (1992) argues that the only way to achieve full cost accounting towards a sustainable future and accurate pricing is through the private ownership of economic resources. This idea opposes current

public opinion, particularly in Western developed nations, a line of critique which will be discussed in the next section on the limitations of praxeology.

What is missing from the literature is a direct application of praxeological methods such as the theory of subjective value to the valuation of environmental goods and services. This opens the doorway for a framework to be developed that includes praxeological methods and applying them to the valuation of environmental goods and services. However, there is a reason why it has not been done yet, and that in part rests on the controversial nature of private ownership of resources, and in part on the nature of the interpretive, hermeneutical methodology. Everything about the praxeological methodology is against the status quo of quantitative empiricism, which is perhaps why opposers to praxeology call it 'mythical' and 'aprioristic' (Rothbard, 1973, p. 3).

2.4.4. Limitations and Systemic implications of Praxeology and Subjective Theory of Value

1. Restrictions on Ordinal Rankings

The first limitation of praxeology and the subjective theory of value is a limitation of the theory, as opposed to its applications to ecological economics. This has to do with the restrictions on ordinal rankings that follow praxeological methodology. While subjective valuation can highlight preferences of goods, it struggles to highlight a ranking of rejected alternatives as only the most preferred option is available for analysis (Fox, 1992).

For example, with the farm regeneration example in *Section 2.3.4* above, it can be deduced that the farmer values the kōtukutuku species over the rātā and exotic pine species, however nothing is known about whether the farmer values the rātā greater or lesser than the exotic pine. Only a direct decision or transaction between the two species would enable the acquiring of such information. Moreover, it does not provide any quantitative information about how much more the farmer values the kōtukutuku over the rātā, or exotic pine for that matter.

As discussed above, the inputs of praxeological subjective theory are purely qualitative and so the outputs will be too. Whilst this may seem illogical, it highlights the reliance that capitalistic society has on numbers and quantities, rather than allowing subjective processes reveal preferences to the researcher. Perhaps it is not the lack of quantification praxeology provides, but the lack of correct

methodology or questions asked by researchers that allow them to arrive at these conclusions or limitations of praxeology.

2. Private Ownership of Environmental Resources

A second limitation of praxeology is the notion of private ownership of environmental resources. As discussed above through the *impossibility theorem,* praxeology holds that if a correct valuation or pricing of environmental resources takes place, then the only way such a value can be attained is through the voluntary exchange of private property. This idea brings into question the ownership of natural resources and, given that ecological economics is concerned with the valuation of environmental goods and services by subscribing a dollar value or price to such, then under a praxeological lens, these environmental goods and services need to be privately owned if a correct, accurate price is to be obtained.

This notion of private ownership of environmental goods and services provides a perspective that is counter to the current political visions of many western developed nations, where state ownership of such environmental goods is a common trend to this day. Take the Three Waters Scheme that is currently under consideration within New Zealand for example. Whilst local councils have historically overseen the assets concerning waste, drinking, and stormwater, the Sixth Labour Government (2017 – 2023) proposed to merge and manage all three of these departments and provide centralised, state control and management. To suggest that such assets should be decentralised and managed privately would prove to be counterproductive to their message and could create public divide on the matter as much of liberal political values are against the privatisation of goods and services. Many people within these western developed societies are suspicious when it comes to the private ownership of natural resources.

In New Zealand, again, there is the state ownership of national parks, with forests and freshwater ecosystems, marine reserves, and many other resources that ultimately restricts the private ownership of these resources. Regardless of whether the presuppositions of praxeology and its arguments for private ownership are correct, these state-controlled exclusions are a matter of fact, and if praxeology and subjective theory of value were to be embraced, the result would be a considerable restructuring of how natural resources are governed. Moreover, the state would experience considerable relinquishment of the power to exclude that which it currently possesses.

However, private ownership does not necessarily mean individual ownership. As discussed in the section prior, there are other private ownership structures such as common property which is private property owned by a collection of people or entities. These collections could be communities,

cultures, local non-governmental bodies, among others. What becomes important is the exclusion of such goods, regardless of whom is in ownership of such. Many communities and cultures hold strong environmental values that resonate sustainable attitudes and stewardship. The Māori cultures within New Zealand hold strong environmental values as integral aspects of their philosophies and ethos, for example.

2.5. Manahau – A Māori Theory of Value

What will be offered in the following section is a summary of manahau and its key philosophies and rooted ideas according to Mika et al., (2022). That in mind, manahau will be introduced as an alternative cultural framework that helps contextualise and value cultural aspects of observed market behaviours. There is a future opportunity for manahau to combine with the other theories of value, however this should be conducted by an expert to ensure the process is honoured and done correctly. I do not claim to be such an expert, and so by introducing manahau here in this research, the door is left open for how cultural value frameworks can combine with the new framework that is being introduced and argued in this research.

2.5.1. Philosophical grounds for Manahau

Manahau is a tentative Māori theory of value that roots in the indigenous culture and knowledge. It combines the cultural philosophies of *mana*, which is 'broadly conceptualised as power, authority, prestige, honour, status and influence' (p.10); and *hau,* which is the 'vitality of a person, place or object through the embracing of gift giving and reciprocal exchange' (Mika *et al.,* 2022. p. 11).

From an epistemological perspective, manahau, similarly to praxeology, is rooted deep within the *interpretive* school of thought as it holds that value is understood through the subjectifying of consciousness and is encoded through culturally established narratives and values. Many indigenous perspectives follow this notion and hold that value is ubiquitous; it is ever-present and can only be understood through the engaging of cultural narratives that have been defined by such value structures over time (Mika *et al.,* 2022).

2.5.2. Manahau as an Economic Construct

As a concept guiding economic behaviour and decisions, *mana* can be conceptualised as a system that guides such behaviour and decisions regarding investment, production, consumption, and wealth distribution towards those that enhance the mana of people and the environment through collective

well-being (Mika *et al.,* 2022). *Hau,* on the other hand, alludes to an economy of *mana*, which sustains four types of well-being: spirituality, environment, kinship, and economy. These four types of well-being are seen to constitute four types of capital: spiritual capital, ecological capital, kinship capital, and economic capital (Mika *et al.,* 2022). It is believed that when the four types of well-being and capital work in conjunction, they do so according to a system of reciprocity between spiritual, ecological, and human societies (Mika *et al.,* 2022).

Manahau is therefore defined as '…an axiological agent Māori entrepreneurs employ to synergistically negotiate cultural and commercial imperatives to achieve multidimensional well-being, human potential, and relational balance in multiple sites, sectors, and scales' (Mika et al., 2022. p. 12). This means that under the guiding principles of manahau, economic decisions are made by considering the wellbeing of not only the one who is making the decision, but holistic wellbeing at individual, cultural, and ecological levels.

For example, consider the farm regeneration scenario from earlier. The farmer was faced with a decision to plant one of either two native species (kōtukutuku and rātā), or exotic pine. Even though the pine trees would yield more fiscal profit for the farmer through the various schemes and eventual harvesting of the timber, they chose the kōtukutuku. Under the lens of manahau, this decision could be seen as a valuation of such species for the wider community, cultural, or ecological values the kōtukutuku species holds outside of the pure dollar value return. The flowers of the kōtukutuku provide ample pollen for native bees, which transform the flowers into edible berries that provide a food source for native birds and the local human communities. They provide a strong canopy structure for the surrounding rivers which provide organic matter and water purification services for the freshwater ecosystem, which further enhances the wellbeing of the surrounding communities of both plants and animals, including the surrounding human communities. All of which eventually trickles down to enhanced economic wellbeing.

By embracing the concept of manahau as a guiding principle for their economic decision making, the farmer has enhanced the wellbeing and capital of the surrounding ecosystem, provided spirituality wellbeing through the flourishing of native species and the behaviours that follow, enhanced communal and environmental kinship, all of which whilst enhancing economic wellbeing and resilience too. By conceptualising such a decision through the lens of manahau, the purportedly irrational decision to reject exotic pine through a marginal utility lens suddenly has substance and value that cannot be captured through the traditional functions of utility or pleasure and scarcity.

Mika *et al.,* (2022) conclude that manahau is both a means and an end to value creation processes, where value is defined as collective wellbeing, human potential, and relational balance.

2.5.3. Manahau and Ecological Economics

As manahau remains a relatively new framework, albeit drawing on old ideas, there are no explicit applications to ecological economics. However, this does not mean some dialogue cannot be provided.

As mentioned, manahau is rooted in the notion of holistic wellbeing when economic decisions are made, and behaviour is directed. When one seeks to value ecological goods and services, the decisions one makes would be centred around the promotion of the four wellbeing and capitals identified above (spirituality, environment, kinship, and economy). This is taken as collective wellbeing and so the economic actor seeking to value such natural resources under the lens of manahau will do so with regards to these wellbeing elements, rather than act out of self-interest.

If these notions were combined with that of private ownership of natural resources as postulated by praxeology, then the idea of private ownership of these resources becomes less controversial and daunting to the outside eye. In fact, if manahau were to be embraced by any form of consumer or *owner* of natural resources, there would be significant trust within the system as the guiding principles of manahau would ensure that such resources are managed and distributed in a manner that aligns with sustainability and fairness.

Moreover, manahau can provide stepping stones for understanding the value structures of decision-makers that engage in economic transactions, valuations, and behaviour by alluding to values that lie outside of that of pure utility and fiscal turnover. Whilst the concept may not provide quantitative measures of such values, it provides context and direction for further research that can enable other measures to take place to understand such value within the economic system. Value that is currently unaccounted for in traditional marginal utility functions and methods that currently drive decision-making and policy in many capitalistic societies. This was clearly highlighted in the farmer example with the kōtukutuku above.

2.5.4. Limitations of Manahau

Due to the emerging nature of manahau, there exist no formal limitations that are discussed in the literature. However, this does not mean that limitations cannot be postulated.

1. Manahau as culturally specific.

One key limitation is the cultural specificity of manahau in that it is embedded in Māori ontology. This raises questions of how non-Māori people can engage with and use manahau, considering they will not understand the concepts of *mana* and *hau* from a meta-physical perspective. Moreover, it raises the question of how non-Māori people might recognise and make space for manahau, even if they are operating in a different type of value economy. This would be a similar line of argument across many culturally specific frameworks.

It raises the question of whether such a value framework should be used to understand *all* market phenomena, or does it simply provide a lens to contextualise and provide enlightenment for agents within the market that are of Māori descent? The specificity of such has the potential to provide valuable insights into the innerworkings of the Māori agent within the market economy, however, these questions raise an important point about the appropriateness of the value framework that is being used to conceptualise and understand value. Manahau would not be able to explain the behaviours and workings of a self-interested capitalist, nor would marginal utility theory be able to explain the market behaviours of an individual of Māori decent and practice. It comes down to the appropriateness of the value theory for the task at hand, and its ability to provide context and understanding to the observed (or projected) market behaviours.

Understanding the contextual nature of value and behaviour is vitally important for informed decision making and modelling. As noted above, value is a dynamic concept that changes across both time and space, between and within individuals. Whether understood through a Western lens, the lens of manahau, or a combination of the two, it is the contextual elements that inform the snapshot of value in that moment of transaction or value-judgement. This is true for all value theories discussed above. Yet when approaching the question of value, it is the subjective, contextual elements that are often left undiscussed. It is these elements that need to be understood to create informative models and policy, however, there is no *economic pluralism* to combine value theories to understand the contextual aspects of value-judgements. They remain mutually exclusive. This requires a deeper research methodology, or epistemology, to unpack and interpret the meaning and understanding of value within a transaction and to create mutually inclusive value theories.

When considering the arguments and discussions on value theory above, there has been a prevailing theme around the lack of structure and recognition from the perspective of marginal utility and labour theory. Due to being grounded in reductive positivism, both marginal utility and Marx's labour theory of value fail in providing context or comparability when implemented. Of the value theories discussed above, a praxeological approach and epistemology arrives closer to highlighting the contextual nature of individual value judgements through a western interpretive lens. Manahau too provides the

gateway for understanding and incorporating such contextual factors into questions of value from a Māori interpretive perspective. Interpretivism and hermeneutics then, provides an avenue to contextualise such value judgements and enhance the explanatory power of the valuations. The interpretive paradigm allows one to ask *who* was the individual making such value judgement, *why* were they valuing such the way they had, and *how* have they reached that value. Interpretivism, in that sense, allows for fluidity and *pluralism* in what perspective or paradigm could be used to best understand the value judgement. It allows for one to approach the task in an open-minded manner, and asks what value theory or combination of value theories best encapsulate the narrative of the person or entity engaging in the value judgement.

2.6. Summary of value theories

What has been offered in the sections above is an in-depth overview of four economic value theories that lend themselves to considerably different epistemological and ontological foundations. Initially, marginal utility theory was highlighted as the prevailing economic theory of value in western, capitalistic societies. Its ontology rooted in self-interested hedonism, and epistemological structures following that of empirical scientific methodology and explanation. Marginal utility theory, and its contingent valuation techniques such as willingness to pay (WTP) were then framed with regards to ecological economics. From there, limitations of marginal utility theory were discussed in terms of the conceptual underpinnings of hedonism and the overbearing weight placed on pleasure seeking as the driver of rational human behaviour. The limitations of inductive reasoning and the valuation techniques were discussed in terms of making sweeping generalisations (all swans are white), and that the resulting valuations are drastically inaccurate as was witnessed by the example of the fairy shrimp in the United States.

From there, Marx's labour theory of value was discussed, fleshing out nuances in the different ontological and epistemological structures to that of marginal utility theory. It was highlighted that a labour theory of value holds that the value contained within a commodity is the abstract labour required to take raw materials and form them into a product (or service). This abstract labour is based off the socially-necessary labour cost as defined by the social and technological structures of the society at the time. Applications of Marx's labour theory of value to ecological economics were described as scant, with no direct formal applications present in the literature – apart from the advocacy of (Pirgmaier, 2021), largely centred around the propensity for labour theory to bring criticisms of the capitalistic system and its application to ecological economic questions. Further applications from Burkett (2006) were discussed, highlighting Marxian labour theory's ability to

compartmentalise and recognise the value shift between nature and humans that takes place once human labour becomes intertwined with the natural world - resulting in a reclassification of environmental goods that are either market or non-market goods. Limitations of Marx's labour theory of value included anthropocentrism and promethianism, highlighting the tendency for valuations to be with reference to humans as the central entity of concern. Further, there is a tendency, as with marginal utility, to generalise and distil all values down to that of human labour values, leading to a commensuration of commodities and nature that would otherwise be incommensurable.

Next, praxeology was discussed as an alternative western theory of value that is interpretive in nature, as opposed to marginal utility and Marx's labour theory, which are rooted in reductive positivism. The power of praxeology conceptualised by the notion that the only necessary truth to which valuations can be understood and based off is human action. This is the action axiom. Within the market, it is historical transactions that inform this human action. Praxeological applications to ecological economics were again scant, however of those that were discussed, the common theme was the classification of environmental resources as private and exclusive to ensure ownership and therefore incentive to look after and increase the *value* of such resources. Incentives that are not apparent when in common access or state ownership. The limitations of praxeology were highlighted as exactly this point, that the concept holds that environmental resources would be best held in private ownership – which is against the current political western ideologies and trajectory.

Manahau was then introduced as an alternative Māori value theory, combining the philosophical concepts of *mana* and *hau*. The strength of manahau was highlighted as its recognition of collective and community values within entrepreneurial business decisions. Further, it helps provide context to the alternative values present that influenced such value judgement or market behaviour. Values that lie out of the pure self-interest as defined by marginal utility and, implicitly, Marx's labour theory. However, due to the infancy of manahau as a construct, it has not been directly applied to ecological economics, but there is a strong case for application due to its contextual elements and further, this would help provide confidence in private ownership due to its ontological beliefs of ecological custodianship. Limitations on manahau rested on the cultural specificity to the Māori culture.

However, before discussions begin around how to address economic pluralism in value theory, and how it can be used to understand and value ecosystem services, some background theory on freshwater metabolism and its relationship with the ecosystem service of *water purification* will be discussed. This will help to wholly inform and highlight the complex and contextual nature of the functional ecosystem processes and subsequent relationships to human wellbeing and value structures.

Chapter Three: Introduction to freshwater metabolism

This chapter turns to freshwater metabolism as an ecosystem process that ultimately provides value to the functioning and production of human wellbeing. First, this chapter offers an introduction to the concept of freshwater metabolism, highlighting its key conceptual underpinnings and processes. Following this, a discussion on its determining variables and factors that affect rates of metabolism. Finally, current techniques and methodologies that are employed to value freshwater ecosystem goods and services will be outlined, drawing on international and domestic examples within New Zealand.

3.1. The Importance of New Zealand Freshwater Ecosystems

Freshwater, whether it be from the perspective of plants or animals, is fundamental to sustain life on earth. Without water, plants cannot grow. Without water, animals cannot drink nor eat if plants do not grow. Within New Zealand, there lies strong cultural value and significance towards freshwater ecosystems as they act as an important food and drinking water source, food source, hold strong indigenous cultural values, and provide irrigation for agricultural and domestic use, industrial use, and power generation in the case of hydroelectric dam schemes (New Zealand Conservation Authority, 2011).

Despite this, recent reports indicate the New Zealand freshwater environment is under threat (Ministry for the Environment, 2023b). However, this is not a novel finding. For decades the diminishing health of New Zealand's freshwater has been referenced due to poor management practices through anthropogenic land uses – predominantly urban development, agricultural development, and exotic pine forestry (Allan, 2004). This degradation is due to factors including, but not limited to, nutrient and effluent runoff from urban and agricultural development, sedimentation, and direct deposition of waste and stormwater, resulting in pollution (Allan, 2004).

Understanding how freshwater ecosystems respond to such external, anthropogenic pressures is paramount for developing effective and sustainable management practices and to ensure the parties involved are well informed of the trade-offs associated with changes in land use. Typically, structural measures such as biotic community analysis and water quality have been used to map how freshwater ecosystems respond to change (Young et al., 2006). However, functional indicators such as freshwater metabolism have become increasingly common in theory and practice and are believed to be a more accurate measure of freshwater health (Clapcott et al., 2010). It is here that the discussion on freshwater metabolism begins, which as will be demonstrated, represents the ability for a freshwater ecosystem to use and manage incoming energy from external sources.

3.2. Freshwater Metabolism

Generally speaking, freshwater metabolism represents the movement or flux of energy within the ecosystem. Specifically, it defines the fixation and breakdown of organic carbon (Dodds, 2002). Fixation of inorganic carbon to organic carbon results from the photosynthetic growth achieved by plants within the ecosystem, known as autotrophic fixation or primary production (P). Organic carbon within the ecosystem refers to the organic matter present within such, and the breakdown or mineralisation of organic carbon resulting from organisms is known as respiration (R) (Hall Jr & Hotchkiss, 2017).

Nutrients that are added to the ecosystem from outside sources such as nutrient and effluent runoff, sediment deposition, and surrounding canopy cover all contribute to the nutrient availability for autotrophic production and respiration (Young & Huryn, 1996). This will be unpacked further in the following section on factors affecting freshwater metabolism. However, for now, oxygen levels present in the freshwater ecosystems are generally used as a proxy for measuring carbon cycling due to the association between the oxygen and carbon cycles (Odum, 1956).

Freshwater metabolism can therefore be defined as the net ecosystem production (NEP) and can be represented by the total amount of primary production less ecosystem respiration (NEP= P – R).

Freshwater metabolism is essential for understanding how an ecosystem functions and responds to external pressures, as it allows insight into how organisms use and contribute to organic matter levels and energy fluxes (Hall Jr & Hotchkiss, 2017). Ratios of production: respiration (P: R) can be used to determine the state and rates of production within a freshwater ecosystem. A ratio of P: R > 1 suggests that there are greater rates of production than respiration, indicating the ecosystem is in a state of growth (Odum, 1956). This is referred to as an *autotrophic community*. If rates of production continue to increase, the water is at risk of *eutrophication* which results in the toxification of the water through reduced oxygen levels (Trolle et al., 2011). One example of such a process can be witnessed in the Selwyn River system that feeds Lake Ellesmere in Canterbury, New Zealand. This system is under considerable pressure from surrounding land use, predominantly agricultural intensification and urban development, that has led to considerable accumulation of algae through autotrophic fixation and as a result, a loss of diversity of flora and fauna within the region (Trolle et al., 2011).

Heterotrophic communities on the other hand have a P: R ratio < 1, indicating that the ecosystem in question is using up more energy through respiration than it is producing through primary production

and outside sources combined (Odum, 1956). Heterotrophic systems tend to be older and represent a complex community, intertwined by the fluxes of energy that ultimately define the ecosystem (Odum, 1956). It is believed that as the ecosystem evolves temporally, it moves from a state of autotrophy / production and disorder, into a more stable state of maintenance / respiration as the system adapts to its new environmental variables (Odum, 1956). Whilst being the dominant theory of freshwater ecosystem succession, it assumes a functional approach and has limitations to its explanatory power such as the existence of highly productive, ancient ecosystems like many freshwater wetland regions (Kayranli et al., 2010). This highlights important contextual factors and the unique capabilities individual ecosystems possess to shift energy around the system and respond to environmental pressures.

As alluded to above, freshwater metabolism represents these shifts of energy within ecosystems. How these systems receive and transport energy is highly contextual, indicating a multitude of environmental factors that ultimately determine rates of metabolism. It is to these factors the discussion now turns.

3.3. Factors affecting freshwater metabolism.

It should be noted here that due to the scope of this research, there will be some oversimplification as to the factors affecting freshwater metabolism. The factors described below are not an exclusive list, but rather a selection of factors that provide the reader with a general understanding of how freshwater metabolism works within a system, without overcomplicating the descriptions for non-subject matter experts reading this thesis. There are other factors, such as heat and energy input and biomass within the ecosystem that ultimately play a role in the overall metabolic rate of freshwater systems. However, the list below represents a strong indication of what can be measured and managed with general ease, to ensure metabolic rates are understood.

3.3.1. Organic Matter and Invertebrate Abundance

As briefly touched on above, organic matter is believed to be a key contributor to freshwater metabolic rates, as the mineralisation or breakdown of organic matter is important for ecosystem respiration (Hall Jr & Hotchkiss, 2017). Changes in land-use and riparian vegetation alter the diversity of organic matter supplied to the freshwater ecosystems, determining the level of organic matter production through primary production, rates of respiration, and the transport of energy within freshwater (Young & Huryn, 1999). Furthermore, the diversity of surrounding flora supplies the system with a range of organic matter and differing leaf litter available for decomposition (or mineralisation)

through respiration. Take a system surrounded by a monoculture crop or forest, the system would only receive the singular species of leaf litter, say exotic pine, for example. The composition of organic matter determines the species of invertebrates within the system that are available to breakdown such organic matter, not to mention the abundance and richness of species.

Invertebrates within freshwater ecosystems play a significant role in the mineralisation and breakdown of organic matter (carbon) to inorganic carbon, affecting rates of respiration within the community (Marshall & Hall, 2004). In this light, invertebrates act as regulators of primary production through the consumption of the photosynthesised matter, which in turn, contributes to the metabolic rate (Huryn, 1998).

3.3.2. Turbidity

Turbidity refers to water clarity and can be defined as 'the amount of suspended particles in water, or absorption of light by those particles' (Dodds, 2002. p.501). Turbidity results from the fragmenting of light by organic and inorganic particles in the water, thus affecting the amount of light available for autotrophic use in growth and production through photosynthesis, in turn affecting rates of metabolism (Dodds, 2002). However, high levels of turbidity usually result from suspended solids which are natural parts of all freshwater environments, some having naturally higher levels of turbidity than others (Dodds, 2002).

The level of turbidity present within a freshwater ecosystem can be attributed to a number of factors. Many believe that turbidity has a positive relationship with erosion. It has been demonstrated that storm events which trigger erosion contribute significantly to the levels (Lawler et al., 2006; Sun et al., 2001). These erosion events result in an influx of sediment into the water system and thus control levels of turbidity.

Within New Zealand, some habitats are naturally highly turbid compared to other regions around the globe. This is due to factors including steep slopes, high rates of tectonic activity and volcanism, generally high rainfall, and common high-intensity rainstorms (Basher, 2013).

However, there are other habitats that are highly turbid due to anthropogenic activity increasing the level of suspended particles within it. For example, urban and agricultural run-off, catchment disturbance (from forestry, construction, and roads), removal or alteration of riparian vegetation, and alteration of hydrodynamic regimes (Dodds, 2002). All these activities contribute to the type and density of suspended particles present in water, which ultimately controls the amount of light

available for primary production by shading out algae, however, can also have negative effects on aquatic animals by interfering with reproductive patterns, oxygen transport through respiration, filter feeding, habitat availability, and predation (Dodds, 2002). All of which ultimately affecting rates of ecosystem metabolism within the water.

3.3.3. Water Velocity

Water velocity plays a significant role in the metabolic rate of a freshwater ecosystem. It does so through the reaeration of water by stirring or mixing layers of the water column and bringing them into contact with the oxygenated surface, thus providing the system with oxygen (Eckenfelder, Malina and Patterson, 2002). This process of aeration is discussed in further depth in the following section, however for now, the velocity of water contributes positively towards this process of reaeration, in turn abating the eutrophication process caused by excessive growth and reduced oxygen levels (Cooke et al., 2005). Furthermore, water velocity also acts as a disturbance mechanism for autotrophs, organic matter accumulation, and the dispersal and presence of invertebrate communities (Biggs et al., 1999). All of which, as discussed earlier, influence rates of freshwater metabolism.

What has been discussed in this chapter thus far has demonstrated the intertwined and complex nature of freshwater ecosystems. It is the contextual and multifaceted aspects that define such ecosystems and from the standpoint of freshwater metabolism, exhibit unique ways of using and dispersing energy, ultimately contributing to levels of dissolved oxygen present in the water. From the examples above, whilst representing different physical characteristics of freshwater ecosystems, they share parity in functional traits through what they provide to the system. When viewed through the lens of freshwater metabolism, they all contribute to net ecosystem production (NEP) by influencing the rate of growth through primary production (P), and rates of respiration (R).

When understood from this functional approach, it is possible to take a systems view of the inner workings of the ecosystem and understand just how intertwined and interdependent these influencing factors are. Further, one can turn thought towards how to improve the metabolism of freshwater ecosystems through controlling or intervening in the system by focusing on the variables discussed above. By *improving* metabolism, it is meant that the ecosystem in question has a better ability to use up and distribute receiving energy. This will be further built on in *Section 6.2* later in this thesis. However, for now, there are many natural and artificial methodologies for doing so that are widely documented and discussed within the literature. It is to these practices that the discussion now turns.

3.4. Methods for Improving Freshwater Metabolism

3.4.1. Riparian Management

Riparian regions can be defined as areas of direct interaction between land and water (McKergow et al., 2016), with management efforts focusing on the reduction of impacts on aquatic values including, but not limited to, providing habitat for aquatic animals, shade to shelter from incoming sunlight, and reduction of bank erosion. As briefly touched on above in the discussion on turbidity, bank erosion can play an influential role in the turbidity and overall rates of metabolism within freshwater ecosystems. One management practice that planners and landowners have implemented is the introduction of riparian regions to control rates of bank erosion.

Hughes (2016), provides dialogue on riparian management and stream bank erosion in New Zealand. Hughes compiled nine New Zealand studies that were investigating the effects of riparian interventions on bank erosion. Whilst Hughes highlights that such studies are seemingly rare, those that have been published suggest that riparian management can be effective in reducing bank erosion. They discuss that whilst direct management interventions through livestock exclusion were seen as the dominant method of riparian management, tree or plant-based riparian management needs further research due to effects only being observable over a long time-period.

What this means for freshwater metabolism is that whilst erosion and the subsequent input of sediment and nutrients occurs naturally, by implementing riparian management interventions such as stock exclusion or planting, the impacts of human generated erosion are mitigated, contributing positively towards ecosystem metabolic rates and ultimately, water quality.

In another New Zealand study, Collins et al. (2013), investigated the effectiveness of riparian restoration on water quality of lowland streams in Canterbury. They found that riparian restoration had a positive effect on water quality with regards to increased dissolved oxygen and decreased turbidity due to plant-water interactions and reduced light availability through canopy cover.

What becomes apparent from the above discussion is the crucial role of oxygen within freshwater systems, and its relation to water quality and overall health. From a management perspective, encouraging oxygen levels within a body of water is paramount to improving water quality. Whilst riparian planting and management is a natural way to encourage such levels, treatment initiatives concerning wastewater, stormwater, and other nutrient rich waters have taken a mechanical aspect, however, operate under the same underlying principle of aeration, or providing the system with

oxygen. It is the concept of aeration, which leads to the second method of improving freshwater metabolism, and in turn, water quality.

3.4.2. Aeration and Water Quality Engineering

As briefly mentioned in the section on water velocity, aeration is the process of introducing oxygen into a body of water. This introduction of oxygen can occur through the water coming in contact with the surface / atmosphere, known as surface aeration, or through the interaction of plants and animals within their freshwater environment (Eckenfelder et al., 2002) .

Oxygen within an ecosystem is imperative as it supports life through respiration. Aerobic bacteria use oxygen in order to survive and perform important ecosystem services such as the breakdown of organic matter and convert these into carbon dioxide. Fish rely on the same respiratory process, with both contributing to carbon dioxide levels within the system. This carbon dioxide is then taken up by phytoplankton and aquatic plants and used for photosynthesis. During the process of photosynthesis, these plants release oxygen back into the system and so the self-supporting cycle of respiration and production goes on.

The aquatic animals such as fish and invertebrates act as regulators of production through photosynthesis by feeding on the plants and thus ensuring that there is not excessive growth within the system that may cause such system to become anoxic or eutrophic through algal blooms and high nutrient levels. Furthermore, decomposing organic matter uses up a significant amount of oxygen within the system and so these animals eating the decomposing organic matter reduces oxygen consumption through the decomposition process.

This is the aeration process, and whilst the above demonstrates the process in a natural setting, from a management perspective, landowners and others who wish to improve oxygen levels within freshwater adopt strategies that encourage the aeration process. Natural strategies include riparian management and planting as discussed above, however the introduction of specific aquatic plants such as oxygen weed can be a natural way to encourage oxygen levels within the ecosystem.

However, whilst these act as natural solutions, there are mechanical methods implemented that involve the direct injection or addition of oxygen into freshwater. These can involve either stirring the water column with a paddle-like device that brings deeper water into contact with the surface to become oxygenated, or perhaps through more direct applications using fountains or fine and coarse bubble machines (Chin, 2006). Whilst these methods have been successfully introduced into natural

freshwater systems (Charpa, 2008; Cooke et al., 2005), they are widely used as a treatment of wastewater, stormwater, and the purification of drinking water (Chin, 2006).

This is where from a management perspective, understanding the oxygen processes and cycles within freshwater is of paramount importance. Whilst there are direct interventions in the regulation of dissolved oxygen levels within freshwater as demonstrated above, these mechanisms operate under the same underlying principles of aeration and the movement of oxygen within a system. Whether one decides to implement natural or mechanical mechanisms to encourage dissolved oxygen levels within freshwater, and ultimately improve metabolic rates and subsequent water quality, there is clearly time and labour required, and a cost to doing so – regardless of which method implemented.

From the perspective of the owners of the land and resources in question, it becomes desirable to provide a capital value to these aspects of their asset so as their management initiatives can be directed effectively, efficiently, and ensure they can add value to their asset. How one goes about this is highly contextual, and can yield different results, as discussed in the sections on the value theories and ecological economics above. It is at this point that a synthesis of the sections on value theory and freshwater metabolism will take place to understand how professionals, landowners, and public officials price and assign a capital value to freshwater ecosystems and services.

3.5. The Valuation of Freshwater

What has been offered in the previous chapter is a review of the relevant economic theories of value and their application to ecological economics and the valuation of ecosystem services. What will be offered in this section is a review of how scholars, businesses, and public sectors apply value theory to the valuation of freshwater ecosystems.

Within the existing literature on the valuation of freshwater, there is a heavy bias towards ecosystem services approaches – highlighting the dominance of marginal utility theory. Whilst efforts have been undertaken to transcend the marginal utility nomenclature by referring to *ecosystem services* as *human ecosystem benefits*, for the purposes of literature review, such language will be used to paraphrase the findings from relevant literature.

In a combined study, Chatterjee et al. (2017), investigated the Willingness to Pay (WTP) for safe drinking water in Jacksonville, Florida, in attempts to estimate the amount that could be added to the current water rates bill without public outcry. They found that the WTP for safe drinking water was

$6.22 per person, however highlighted that the WTP is affected by factors such as trust in authorities, health concerns, family structure, and education. Similarly, Kunwar, Bohara and Thacher (2020) sought to understand the public preference for river restoration in the Danda Basin, Nepal. By analysing the WTP for river improvement across 637 households, they found that the average household WTP was $1.63 per year, however further suggested that by incorporating respondents' preference uncertainty, the value of WTP was significantly more accurate. The authors concluded that by incorporating preference mechanisms, it was found that respondents believed that management of the river should be decentralised and managed by the local communities to enhance interest in conservation of common resources, such as freshwater ecosystems.

From a slightly different perspective, McDougall et al. (2020), investigated the WTP of the waterside of two freshwater lakes. The authors believed that often waterside values are lost in the discussion of freshwater health and management, and so begun to understand where societal values lie within the neglected aspect of freshwater ecosystems. Whilst engaging with 1056 respondents, the authors determined that the WTP of waterside regions was $12.06 at one lake, and $8.44 for another. The values of the watersides were based on recreation activities, cultural value of views and natural space to sit and eat. The authors conclude, somewhat controversially, that the value of water quality is less than that of space and views. These findings highlight that there are differences in individual preferences that ultimately influence the WTP and the subsequent value of freshwater ecosystems. What becomes important within such studies is the recognition of various preferences and the ability for the differences between them to influence overall WTP and corresponding value outputs.

In an attempt to capture the recreational fishing losses from an oil spill, Alvarez et al. (2014) implemented a WTP survey of recreational anglers to understand different compensation measures, whilst controlling for angler preferences such as shore fishing, private boat fishing, and for-hire anglers. The authors suggest that the WTP values varied based on angler preference, where private boaters have less adverse effects from the oil spill as opposed to shore-based anglers. This was attributed to travel costs on the shore-based angler having to travel further for their angling, whereas the private boat owners had more flexibility to move around to avoid the effects of the oil spill. Nonetheless, the authors found that compensation owing to anglers was in the vicinity of US$585 million.

The problems of accuracy and comparability of WTP methods, however, do not go unnoticed within the literature. This is one of the challenges of WTP and contingent valuation methods. The problems of inaccuracy and extrapolation have been discussed in *Section 2.2.6* prior, however, the notion of lack of comparability between different WTP studies has only been briefly discussed.

Roldán, Sarmiento and Roldán-Aráuz (2021), conducted a meta-analysis of WTP for freshwater improvement in developed and developing countries. Whilst highlighting that developing countries show a greater WTP than developed countries relative to their income, they conclude that there are problems of population size on the accuracy of WTP, and that comparison between these studies is difficult due to the population issues, as well as variances in cultural attitudes towards freshwater. These problems have led researchers to incorporate other measures and slight tweaks of methodology to allow for these inaccuracies and lack of comparability between studies.

Wilson et al. (1999) provides an analysis of the economic valuation of freshwater ecosystem services in the United States. Whilst the authors highlight the dominance of hedonic pricing methods such as WTP and contingent valuation, they highlight the usefulness of travel costs as an anthropocentric value method that is strictly relative to the value of the ecosystems to humans. The more one is willing to travel and thus spend more money on experiencing the freshwater system, the more valuable the ecosystem is to these individuals.

However, whilst the author highlights the usefulness of travel costs, they argue for new approaches due to the travel cost method being embedded in marginal utility theory, and thus subject to the limitations previously discussed on marginal utility. Nonetheless, the authors identified a value mechanism that had no reference to WTP or contingent valuation methods. A method that understands value as subjective and uses a *revealed preference* technique of travel costs to understand value.

It should be acknowledged here, however, there are flaws with these revealed preference measures, generally revolving around the inconsistence of choice between individuals. A classic example of this line of argument can be pulled from Amartya Sen's paper, 'Internal consistency of choice', in which Sen suggests that it is impossible to measure internal consistencies within individuals without referencing some form of external object, choice, or behaviour (Sen, 1993). Sen suggests that the robustness of the methods need to be questioned, highlighting that internal consistency and rational action need to be dropped.

Such a method would lend itself closer to praxeological praxis than marginal utility as it is what people have actually paid in the market, as opposed to hypothetical prices in a hypothetical market.

Similarly, Artell, Ahtiainen and Pouta, (2013) highlight the importance of subjective values in the valuation of water quality. The authors suggest that subjective perceptions vary significantly between respondents, and that individuals have differing ideas of what determines healthy or poor water quality. Factors such as water body type, how humans interact with the water, and again travel costs, all play a significant role in the overall perceived value of freshwater ecosystems and water quality.

This highlights a subjective undertone to the valuation of freshwater ecosystems and differing individual motivations that ultimately influence the value of such.

Cooper, Poe and Bateman (2004), provide dialogue on such matters by investigating the structure of motivation for contingent values. By interpreting WTP responses with attitudinal and motivational strength indicators such as social motivations, perceived personal responsibility for provision of the environmental good, ethical concerns for the environment, and altruism, all were found to influence the WTP for water quality improvement. The authors conclude that more research on the motivation structures that influence WTP need to be explored to contextualise the values and findings.

Of the studies reviewed above, one can gain an understanding of the overbearing presence of hedonic pricing methods within the valuation of freshwater ecosystems and services. However, as demonstrated by the literature above, there are methods to contextualise the values from WTP and contingent valuation studies such as controlling for responder preferences. This is a key process that needs to be encouraged for future researchers wishing to engage in contingent valuation studies, as whilst these methods are still subject to limitations such as extrapolation inaccuracies and the commensuration of various goods and services, the contextualisation and exploration of factors influencing WTP outputs is imperative to improving the explanatory power of such methods.

Motivation structures and subjective variances in value need to be understood to contextualise *how* and *why* an environmental good or service is valued the way it is. However, recognising such subjective and individualistic structures becomes a difficult task when behind the veil of marginal utility, purely due to its epistemological underpinnings of reductive empiricism and its corresponding methods. If one is to truly incorporate such values within the value structure, there needs to be a deviation away from the grounding ontological beliefs of hedonism to allow free thought to naturally evolve towards solving the valuation problem.

There is a need for other approaches to value theory that can provide context to such motivational structures that are otherwise left irrational and undefined by traditional marginal utility approaches. This is of paramount importance when applying value theory to the valuation of ecological goods and services as it is the contextual, highly nuanced aspects of ecological systems that define their value and niche. Within ecological academic literature and concepts, it is the concept of a niche that defines an ecosystem and the subsequent management and evaluation methodologies (Bowman et al., 2018). Ecological economics has been restricted to a singular framework and methodology for understanding through marginal utility. This is absurd for the development and practicality or representativeness of ecological economic methods and concepts. Ecological economics, after all, is a discipline defined by the *pluralism* of two separate academic fields. Too long has a situation or an observation been

moulded to fit understanding through a singular, rigid framework. It is time to inverse this logic and begin to mould and combine frameworks and paradigms to understand the observation.

Unfortunately, these questions have no easy solution and indeed are the product of the persistence of the dogma associated with schools of thought and paradigms. The value of an open-minded, interpretive approach has been argued in the sections above as an important binding mechanism for theoretical and economic pluralism. What will now be developed is a framework that embraces pluralism and subjectivism, harnessing the power of hermeneutics and interpretivism to enable such pluralism and contextuality that, as will be discussed, results in a holistic and accurate interpretation of the value one holds towards ecological goods and services. It is to this framework the discussion now turns.

Chapter Four: Development of value framework.

4.1. The need for pluralistic frameworks

The ecosystem services approach that grows from marginal utility theory is neither necessary nor sufficient for the valuation of environmental benefits. It is not necessary because there are alternative theories of value available with plausible accounts of valuation. It is not sufficient because marginal theory has theoretical and practical shortcomings. Therefore, despite the predominance of ecosystem service approaches, there is a need to innovate regarding the valuation of environmental benefits. This chapter sketches out an alternative framework for environmental valuation and, as will be argued below, it does this by working *with* the pluralism of economic thought, rather than working *against* pluralism through endorsing a single theory of value.

As discussed above, there exist shortcomings of marginal utility and its associated methods when approaching questions of value. What lies in these shortcomings are questions around the accuracy of the valuations derived from extrapolation and comparative modelling. Whilst convenient and scalable, to take the positive instances of a community sample and draw conclusions on a population is to suggest that all swans are white, or assume that respondents can actually afford to pay the amount indicated in their WTP responses. Furthermore, through a praxeological lens, WTP and contingent valuation methods construct synthetic prices that are arbitrary and meaningless because there is no private ownership of goods or physical exchange in which to make value judgements.

Another shortcoming of marginal utility discussed above are the misconceptions of human nature centred around hedonism and what is deemed rational behaviour. If hedonistic pricing models are correct, then pleasure seeking is the end goal of human experience, the driver of behaviour. To quote Nozick again, to become ‘an indeterministic blob of pleasure’ (p.43) is the desired end physical and emotional state. However crass this may seem, it is how current questions of value and associated political (and private) decisions are approached and addressed in marginalist analysis.

Value is more sophisticated and nuanced than current economic theory suggests. Value has a subjective element, and to generalise such individuality in decision-making and behavioural theory is to overlook important contextual information that drives such behaviour and associated actions. As shown above in the car exchange example in *Section 2.4.2*, both parties value the car either more or less than the other depending on what side of the trade they are on. Context needs to be provided for this exchange to fully understand where the value judgements lie, irrespective of price indications.

Furthermore, there exists an internal subjective evaluation of value hierarchies, or an ordinal ranking system of specific nuanced values that are wholly individualistic. From a praxeological perspective, it is these contextual factors that drive human behaviour and associated action - behaviours and context that marginal utility theory deems irrational and irrelevant. From the perspective gifted from *manahau*, it is the in-built, cultural mechanisms that drive and facilitate trade within the economy, and associated behaviours and actions. Such cultural and subjective mechanisms are often left misrepresented under a Western, marginal utility lens.

The question remains then, how can economic pluralism lend itself to the economic valuation of ecosystem services? To ensure there is no obfuscation in language, the term *ecosystem services* is closely aligned with the tenor of marginal utility and its resulting extrinsic conceptions of value. From here on, ecosystem services will be reframed as *human ecosystem benefits*. This will help detach the concept from broadly painting and generalising all ecosystem values as human values, and ensure that intrinsic qualities are left incommensurable and non-fungible. Further, it helps to step outside of the language of nature *serving* the needs and desires of humans. By doing so, it further assists in compartmentalising what aspects of ecosystem value that are of concern for humans, and highlights the notion that the ensuing ecosystem value is purely from an extrinsic human perspective. This line of thinking extends Burkett (2006) that was discussed in *Section 2.3.5* on Marx's labour theory of value and its application to ecological economics. There is a requirement to recognise at what point environmental values become commodified by the human capitalistic system in order to effectively compartmentalise the intrinsic and extrinsic values of nature.

However, unlike marginal utility, recognising ecosystem services as *human ecosystem benefits* creates a clear separation of intrinsic and extrinsic value, and does not attempt to bring a value to intrinsic qualities, as these are qualities outside of human understanding and perception and therefore should not come into questions of human exchange value. As a human, it is impossible to understand the intrinsic qualities of a tree or a possum because humans are neither, and do not share the same perception or lived-experience as the tree or the possum. To draw back to Routley's last man example – humans can postulate that the tree would want to live and so the man's cutting of the tree would be wrong. However, how do the postulators not know that the tree is not incredibly unhappy and suicidal? Humans do not have the receptors to communicate with trees like they communicate with each other and share knowledge (i.e. through pheromones and mycorrhiza soil fungi). To quote Ludwig Wittgenstein: 'If a lion could talk, we could not understand him' (Wittgenstein, 1968, p. 223). It is fruitless to follow this road as any ensuing interpretation of *intrinsic* qualities in nature is a shallow reflection of what humans think are valuable to the well-being of a tree, possum, forest, or ecosystem.

Ecosystems are incredibly complex and interrelated living environments that are defined by contextual relationships between the functioning organisms within such, and their wider environment. It seems a natural progression then, to ensure measures are taken to encapsulate and understand these complex, contextual relationships. Conceptual pluralism, in a wider sense, is implemented considerably in ecological research to explain phenomena and understand functioning natural systems. This is a non-trivial claim, to suggest that ecological research borrows concepts from various academic disciplines. So too does economics. And yet when approaching questions of value, pluralism is left unrepresented. There is a pressing need for pluralism to address methodology (Caldwell, 1988), particularly when it comes to the challenges present in ecological economics, in order to rectify issues in data quality assurance and control. Without such, the inaccurate and inappropriate data is used to inform models and decision-making at the public and private levels, and the resulting explanatory power of such models is left compromised, leading to misinformed decision-making and resource management (Warner, 2018).

There is a need for economic pluralism, a coexistence of theories, if value judgements and behaviours are to be understood and contextualised. To address and challenge the paradigms of the current system and associated schools of thought does not necessarily require a whole restructure or revolution as described by Thomas Kuhn (Meadows, 1999). However, it does require a questioning of the underlying structures and assumed truths that such paradigms are based upon. What follows, as Donella Meadows eloquently puts in her discussion on the hierarchy and effectiveness of leverage points within a system, is systems change that transcends the current paradigm of thought:

> ‘You could say paradigms are harder to change than anything else about a system, and therefore this item should be lowest on the list [of leverage points], not the second-to-highest. But there’s nothing physical or expensive or even slow in the process of paradigm change. In a single individual it can happen in a millisecond. All it takes is a click in the mind, a falling of scales from eyes, a new way of seeing. Whole societies are another matter – they resist challenges to their paradigm harder than they resist anything else.’ – (Meadows, 1999 p.17)

However difficult or challenging it may be to change paradigms at the societal level as described by Meadows, Kuhn would suggest that it is important to point to anomalies and failures within the old paradigm and system, push forth and focus on the open-minded change agents within society (Meadows, 1999).

Economics and other empirical sciences have been subjected to a repression of knowledge development due to the dogma associated with paradigmatic thought. Attempts to advance and challenge fundamental knowledge structures are often squashed due to the very nature of the challenge to the dogma. However, as A. F. Chalmers suggested in his seminal piece *What is this thing called science?* what follows a questioning of a dogma is the production of another, particularly when

constructed from the perspective of Kuhn's rigid and singular paradigms (Chalmers, 2013). This is where the decades long call for economic pluralism comes from (e.g. Caldwell, 1988; Gräbner, 2017; Warner, 2018; Marglin, 2023) as opposed to a siloed approach to complex questions. Economics and questions of value are no exception.

From this economic pluralism, there needs to be an accurate depiction of value contained within market goods and services, as opposed to a contingent value or price indication of a hypothetical reality. Further to these values, there needs to be context provided to ensure these values are understood wholly and accurately. This is a praxeological argument in that there lies a subjective element to value judgements, and to understand where these subjective values lie, one needs to understand the motivations behind historical action or behaviours. Approaching questions of value in this way will help address issues of accuracy and applicability in current hedonic valuation methodologies such as WTP. It will help embrace the praxeological rhetoric that price is merely an illusion or mask of real value. For if price and value were equal, there would be no observed market behaviour or transactions.

Economic pluralism requires subjectivity, interpretive historical analysis, and ordinality, for one to understand value in the sense of a commodity, or market pricing mechanisms. If praxeology holds that valuation is a subjective, individualistic process that is qualitative in nature, then there needs to be a reference point to which one can make value judgements on a particular market good or service. As discussed above in the *section 2* on the various value theories, it all comes down to the exchange value, and it has been this way for hundreds of years, even predating Adam Smith. If praxeological arguments are to be incorporated into economic pluralism, then there needs to be a balancing mechanism to provide a reference point or a universal equivalent. i.e., how many fish one should trade for a pair of shoes? To understand this exchange ratio, praxeology needs to combine with some form of positivist paradigm of thought to provide such a reference point for the individuals contained within the transaction or trade. This will provide the bones for a value framework that will aim to address these conceptual issues of value alluded to throughout this paper. It is to this framework the discussion now turns.

4.2. The Praxis of Labour: An alternative value theory framework

What follows in this section is an introduction to an alternative value theory framework entitled *The Praxis of Labour* (PoL). This framework follows the calls for economic pluralism in that it seeks to construct a framework that embraces the contextual and individualistic variances in value through recruiting interpretivist, qualitative methodology with praxeology, and combines this with a

quantitative approach of Marxian labour theory of value. Resonating across all aspects of this value framework is the necessary truth of *human action* that sits at the centre as it provides grounding and truth across all nodes of the framework.

It is at a point here that it should be noted that whilst manahau has been introduced in earlier chapters of this thesis, it will not be incorporated officially into the PoL. There is the opportunity for cultural value frameworks to be combined into the PoL as the openminded-interpretive approach allows for conceptual pluralism to bring in such frameworks and add to the understandings of contextual and subjective variances. However, this should be contributed to by an expert researcher for the process to be honoured and done correctly. I do not claim any expertise on the subject. Some examples will be given throughout the coming section to provoke thought as to how manahau and other cultural frameworks would add to the PoL, however deeper considerations will not be discussed for the above reasons.

4.2.1. Philosophical grounds for The Praxis of Labour

The philosophical grounds of the Praxis of Labour (PoL) bare its ontological roots of similar vein to that of praxeology. Conceptions of reality are based on the necessary truth of human action and calls upon interpretivism and hermeneutics to provide context and welcome an open-minded approach. However, due to the pluralistic nature of the PoL, this subjective and interpretive approach is combined with the positivist paradigm endorsed by Marxian labour theory to draw formal conclusions of value added and exchange value.

By considering humans as axiological agents that exhibit purposive action, one can draw formal conclusions about decisions to add human labour value as it is purposive human action. From an epistemological perspective, by employing interpretive or hermeneutical methodology, one gains the ability to step back and interpret what the appropriate combination of theories would be to understand and contextualise such purposive human action. It asks *how* and *why* such individuals decided to exhibit their human labour in such a way.

Hermeneutics, in that sense, allows one to step away from the dogma associated with each value perspective and holistically understand the narrative of the individuals making such judgements and ask why the value judgement appeared the way it did. By that token, hermeneutics is a binding mechanism to provide economic plurality and context across value judgements and associated valuation epistemologies. It allows one to interpret the situation and apply relative explanatory theory that is the most appropriate, as opposed to moulding the situation around a concrete, unwavering and

rigid value theory and epistemology. Afterall, the image of a cow is different to one, than it is to another.

4.2.2. Human Action and Value Judgements

At the centre of the framework is the praxeological notion of human action or *the action axiom*. It represents the centre of the framework due to its omnipresence across all nodes in the value framework. Human action takes the form of a historical transaction, it is the driver in value judgements as judging value is deliberate *actional behaviour*. What comes from that judgment is the conscious decision to invest human labour into such good, and there is clear human action to perceive the value of a good post hoc. Further, by rooting the PoL in the necessary truth of human action – there is confidence in the accuracy and legitimacy of the corresponding valuation. The framework can be seen in *Figure 7* below.

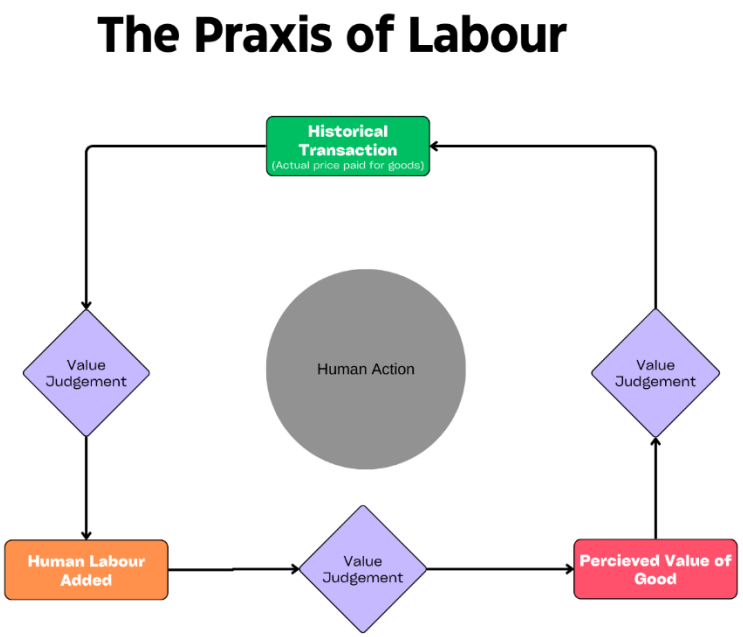

Figure 7: The Praxis of Labour (PoL)

Understanding the motivations throughout the PoL is a qualitative exercise, and calling upon interpretivism and hermeneutics as further reference will highlight why these behaviours are apparent, ultimately providing context on the value of goods and services, and the subjective variances across individuals.

Additionally, by combining Marxian labour theory with Praxeological subjective value and the necessary truth of human action, there is consideration of human labour as a necessary truth due to the purposeful, conscious decision by individuals to add their labour to something to add value. By that token, there is confidence that subjective variances in value can be understood through proxy of human labour as individuals will choose differently how to spend their labour and ultimately, add value.

This forms the foundation of the framework, to understand human labour as purposeful human action, and to root that purposeful human action as the necessary truth to which valuations and understandings of observed behaviour begin. However, the glue of the whole framework, what keeps it all together, are the evaluative *value judgements* before engaging in an exchange, judging whether to add value to such goods or services in the form of human labour, and the eventual exchange of offerings. This value judgement is again a subjective, process that is never identical both temporally and spatially. It harnesses experience, cultural norms, wider social climates, technology of the time, all these environmental factors that are mashed together to formulate, at least the external aspect of the value judgement. An interpretive approach again takes place here, by approaching these value judgements in an open-minded manner, one gains the ability to embrace pluralism and implement a combination of theories to further understand and contextualise why the observed behaviour or revealed preferences were constructed the way they appeared to be presented.

Further, there are considerable individual variances as to how one judges value, how long it takes, what considerations are factored in. Ultimately, there is a considerable amount of human labour that goes into the value judgements. Value which, under the PoL is incorporated into conceptions of value. There are entire industries such as business analysts whose vocation is to undertake value judgements quite literally. This is accounted for in the corporate and professional world – therefore it needs to be incorporated into individual subjective aspects of reality too.

4.2.3. Historical Transaction – actual price paid for goods

The Praxis of Labour (PoL) framework begins with praxeological arguments of revealed preference based on historical transactions as the foundation for observed market behaviour. This can be seen as the top green box in *Figure 7* above. It follows that human action is born from inequality, and so observed behaviour is the necessary truth one can draw conclusions from. This is a qualitative exercise and calls upon hermeneutics and interpretivism to bring in historical research and

information to contextualise and understand observed behaviour and subjective behavioural tendencies and nuances.

Further, by engaging in interpretive methodologies, one benefits by approaching from a pluralistic perspective that combines other value theories as doing so takes seriously the self-forming nature of value within the individual and the diversity of values that these theories express. This approach is in contrast to the positivism of marginal utility theory which results in explanatory theories based on the rigid assumptions of humans as rational, hedonic agents.

However, there remains a quantitative aspect to value, particularly exchange ratios, that highlight there need be a universal equivalent to base such exchange ratios off. To borrow from Marx, this universal equivalent has the capacity to take the form of human labour.

4.2.4. The Value of Human Labour Added

The PoL embraces a Marxian conception of exchange value in that value contained within a commodity is the value of the human labour added to such commodity. This can be referred to by the orange box in *Figure 7* above. When approaching questions of exchange value, and the question of exchange ratios, it is the amount of abstract labour contained within the good or service that determines its exchange value. What becomes important is the need to define a socially necessary reproductive wage rate for exchange ratios to be informed and value to be understood from a quantitative perspective.

Moreover, a socially necessary reproductive rate is needed for the creation of surplus value, and overall technological advancement. For there needs to be incentives to drive entrepreneurship and technological development to either cut labour costs or increase quantity and quality and gain competitive advantage. Without these incentives, the result will be a punitive approach where disenfranchisement weighs anchor to societal development and hinders proactive responses to wider challenges and problems – be that environmental or not.

Additionally, with human labour as the driver and reference point for exchange value, there is a metric to capture value added to larger assets and commodities that operate as part of a larger functioning system, such as environmental goods and services. There is confidence in this added value due to human labour being rooted in the necessary truth of human action.

To return to the farm restoration example, the farmer has paid a premium to plant kōtukutuku over exotic pine despite the obvious economic advantages of planting pine. Marginal utility theory would deem this irrational behaviour and incorrect assumptions would be drawn on. Perceiving such through a singular marginal utility lens, this irrationality would be explained by the existence of intrinsic values – i.e. the farmer holds that the kōtukutuku are more intrinsically valuable and so that is why they chose the way they did.

However, if understood through a praxeological lens, and correct investigation was undertaken, then the understanding of the observed behaviour would be stronger and better informed, ultimately achieving a greater depiction of value. Under the PoL, the farmer has engaged in a purposeful value judgement and chose to add their value to the farm in the form of human labour and restoration. The value of this restoration to the farmer is the historical transactions cost for materials, plus the added human labour at point of value judgement.

To bring in manahau to understand the revealed preference, it may be highlighted that the farmer prioritised kōtukutuku for its ability to provide kai for both humans and other animals, enhancing their *mana* and *hau* from a cultural perspective. These values take priority over pure economic gains through a manahau lens and thus provide further understanding for why the farmers' revealed preference was so, and providing context to the extrinsic motivations that otherwise would have been generalised down to intrinsic explanations. By incorporating various economic concepts and schools of thought, the PoL allows one to have a greater understanding of the values that underly the motivations and human action that are observed. Hermeneutics, in that sense, plays a pivotal role in this framework as it allows for this open-minded approach and provides the foundation for economic pluralism to wholly understand the narrative and corresponding *human actions*.

In the example above, Marxian labour theory has been used to understand the exchange value reference point for which one is willing to sell or exchange their goods at – the contained abstract human labour value within the offering. Praxeology has been used as the fundamental logic model for which observed behaviour is tied to the necessary truth of human action and keeps open the subjective variances in value. Manahau has further been combined to understand the human action and observed behaviour and provide context and value to the farmers decisions to plant kōtukutuku, or to the otherwise historical transactions that revealed preferences. This is the epitome of conceptual pluralism, and it is clear the variation and context that is endorsed when the singular, rigid framework is transcended. What was irrational behaviour has now been contextualised and included in rational value judgements that would have otherwise been generalised down to intrinsic values. Other cultural frameworks could be further combined in the PoL, and to do so would be welcomed by the

Praxeological notion of subjective value. Interpretivism and hermeneutics would be used to discern who the individuals were in such transaction and employ the appropriate cultural framework.

4.2.5. The Perceived Value of the Good

As discussed above, there is an element of a commodity that is dependent on the quantity of human labour embodied. This drives the exchange ratio or reference point for which exchange values are based off. As the seller of a good or service, the pure labour value of the offering is the amount of time that is required, multiplied by the socially necessary reproductive wage rate:

$$PV = (\text{labour hours} \times \text{social wage rate})$$

This social wage rate is industry specific and is governed by forces beyond the scope of this discussion. This wage rate is socially constructed and governed in part by industry and government, and in part by the socio-economic factors of the current times.

Being able to identify the aspects of value that are human labour helps identify and compartmentalise what the tangible and intangible dimensions of the commodity are. Further, human labour breaks down what aspects are extrinsic, and where individual differences lie within the use value aspect. If the dimensions of human labour are identified within the value judgement, then this is the core value of the commodity, the concrete labour. Surplus value is created when the concrete labour is less than the socially necessary reproductive labour costs. For example, if one owns technology that gives them a competitive advantage over the other, meaning the concrete labour costs are lower and therefore more surplus value is created. This is not new information as this was discussed in the labour theory section prior and follows the basic Marxian M-C-M formula for surplus value.

Furthermore, by incorporating a labour theory of value, there is a recognition of the shift in value that occurs when human labour become intertwined with nature. Essentially, at what point the raw natural value of nature was commodified by the human system. This follows the lines of thinking by Burkett (2006) as discussed in *Section 2.3.5* prior.

However, what has not been discussed is the capacity for human labour to capture value added to a commodity in the form of tangible, human value added. When put with reference to consumer goods this may seem like a trivial statement, however when put into the context of larger assets such as environmental goods and services, the applicability of such a claim becomes clearer. If one is to put

labour into the management and maintenance of their environmental goods or services, then this is value added to such good or service in the form of human labour. The quantity of added value comes in the form of human labour units, and the value of such units is determined by the socially necessary reproductive wage rate.

For example, a farmer is looking to regenerate his farm with native forest. They purchase the seedlings at ($X), to which this price reflects the human labour to get the seedlings to the point at which they were at purchase. The farmer plants the forest and uses a planting crew for ($Y) based on the amount of labour hours required to plant the forest and the socially necessary reproductive wage rate. At this point, the present value of the restoration project would be PV = X + Y. However, there are significant management costs involved in establishing a successful regenerative native forest, and so the farmer must do significant pest control, thinning and general maintenance to ensure the longevity of the forest ($Z). ($Z), however, is dynamic and is constantly being added to. Management and maintenance are constant tasks and always require consideration when ensuring successful regenerative projects. There are constant pest control labour hours, pruning and plant maintenance labour hours, all of which in a wage economy such as the current, mean capital expenses. But it is value added to the good in the form of human labour which ultimately determines the success and functionality of not only the restoration project, but the ecosystem as a whole. Therefore, the value of the restoration project is represented by:

$$PV = X + Y + (Z_1 + Z_2 + Z_{3...})$$

This provides a reference point for exchange value, and when approaching larger questions around the value of environmental goods and services, having a value framework with reference to human labour provides good data that is usable and applicable from a management and political perspective. Further, by rooting the value framework in the praxeological logic of human action as necessary truth, there is confidence in the accuracy of resulting pricing or representation of value, ultimately providing increased explanatory power to the data. There is no recognition of such a necessary truth in marginal utility theory, and so there is lesser explanatory power of the prevailing models under a marginal utility lens. What results from a lack of explanatory power of data is inaccuracies in models and decision-making when referenced and used at a resource management level. The repercussions of such a generalised approach can have detrimental effects to the fair and equitable distribution of resources and subsequent human wellbeing – ultimately impinging on the ability for societies and countries to meet international environmental and resource management goals and obligations such as the Sustainable Development Goals (SDGs) as set by the United Nations.

As the globe shifts towards an agenda around the SDGs, resource management and distribution are of the utmost importance. As alluded to above, it is imperative to have tools in place that capture the value of these resources effectively and efficiently right from the onset. The PoL in that sense, works towards overcoming some of these resource management challenges by providing a logical value framework that gives confidence and efficiency to capture these values within the context of environmental resources. After all, human behaviour and our relationship with our environment are an important cog in the wheel of resource management.

Chapter Five: The Praxis of Labour and the Value of Water Purification – a conceptual case study

As has been mentioned in sections prior, this thesis was an ambitious topic given the scope and resources. Because of this, it is necessary to first map out the conceptual space for the PoL framework with the intention to ground such framework in the real world as a future research direction. What will be offered in the following chapter is a conceptual demonstration of the PoL by use of a theoretical case study, and engage in applied ethics to reinforce the inclusiveness of the PoL. Further, how it can be applied to environmental goods and services and conceptually demonstrate how this value framework can be applied at a regional scale. The case study draws on all that has been discussed up until this point and will call on the PoL and apply it to the valuation of the human ecosystem benefit *water purification.* The location of the case study will be the Waimakariri catchment in North Canterbury and has been chosen based on the surrounding impacts and land uses. From intensive agriculture and small urban townships, to the sprawling urban growth of Christchurch City and its reliance on the Waimakariri river system for water supply.

Christchurch, and other urban centres nationally, are experiencing significant pressure around issues of water usage, treatment and ultimately, management. This can be witnessed apparently with the *Three Waters* national reform. Challenges and problems need to be addressed now before the time and cost become too far gone to remedy the situation with any sort of effectiveness with as little disturbance as possible. These are multi-faceted and complex problems that need rigour in their investigation, and collaboration in their solving. These problems need to embrace pluralism. The intention of this next section is to:

a. Use applied ethics to map out the conceptual space for the Praxis of Labour
b. Highlight the complexities when approaching such questions around restoration, land use, and ecosystem services.

5.1. The Waimakariri River and Catchment Context

The Waimakariri is a braided river north of Christchurch that runs from the Southern Alps on the Western coast of the South Island of New Zealand. As touched on above, it represents a freshwater system that provides benefits in which many humans are reliant upon. However, as with many of the freshwater ecosystems in New Zealand, the Waimakariri is under significant stress and pressure because of human land uses and extraction methods. Whether that extraction comes in the form of

agricultural bores for irrigation, domestic use as drinking water, or other public amenities such as pools, the water extracted needs to be of sufficient quality for it to be safely used.

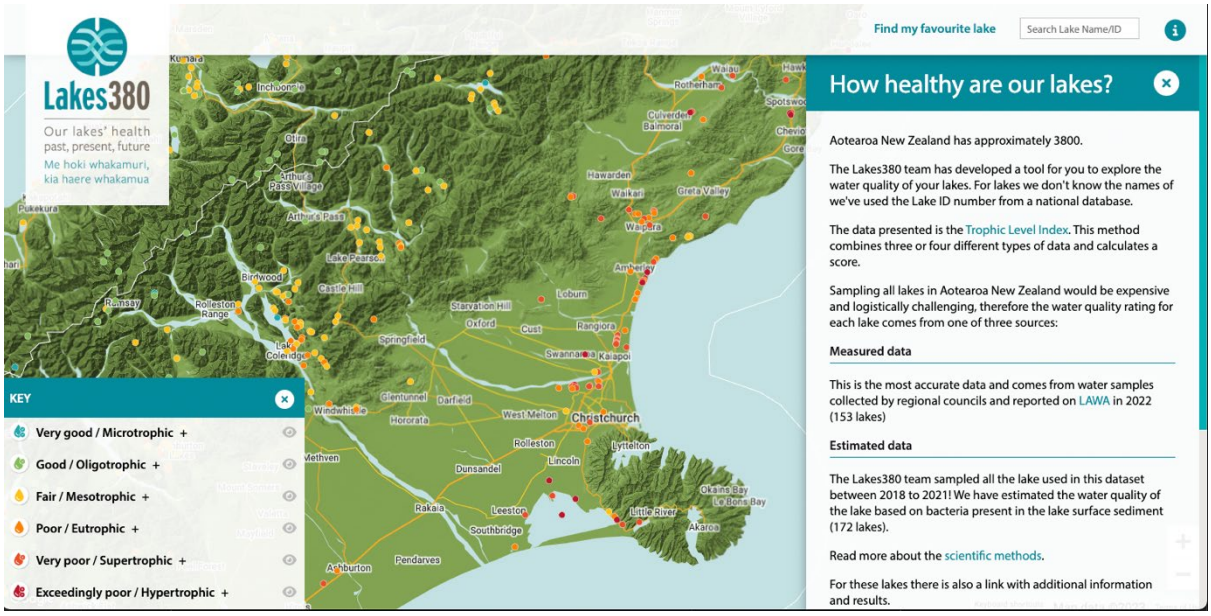

Figure 8: Lakes 380 project showing the Waimakariri catchment. Source (Lakes380, 2023)

The latest regional council and LAWA data show the journey of the Waimakariri from very good quality up in the forested mountains down the plains and as it meanders to the east coast through various intensities of human land use, it becomes apparent the quality drops significantly to exceedingly poor in some parts near Christchurch. There is clearly degradation of the ecosystem and as a result, water quality. In *Figure 9 below*, there is a map showing the water drinking supply points around the Christchurch/Waimakariri river area, highlighting the importance of the groundwater aquifers that are a part of the wider Waimakariri river system in supplying Christchurch with drinking water. When the two maps are compared next to each other, it is clear to see water quality issues within the region. When used for drinking water, treatment is required before consumption – often with the use of fluoride, chlorine, and direct injection of oxygen (as was discussed in *Section 3.4* above on freshwater management methods). These interventions to improve water quality cost time and money, as infrastructure needs improving, and physical treatment needs to be purchased.

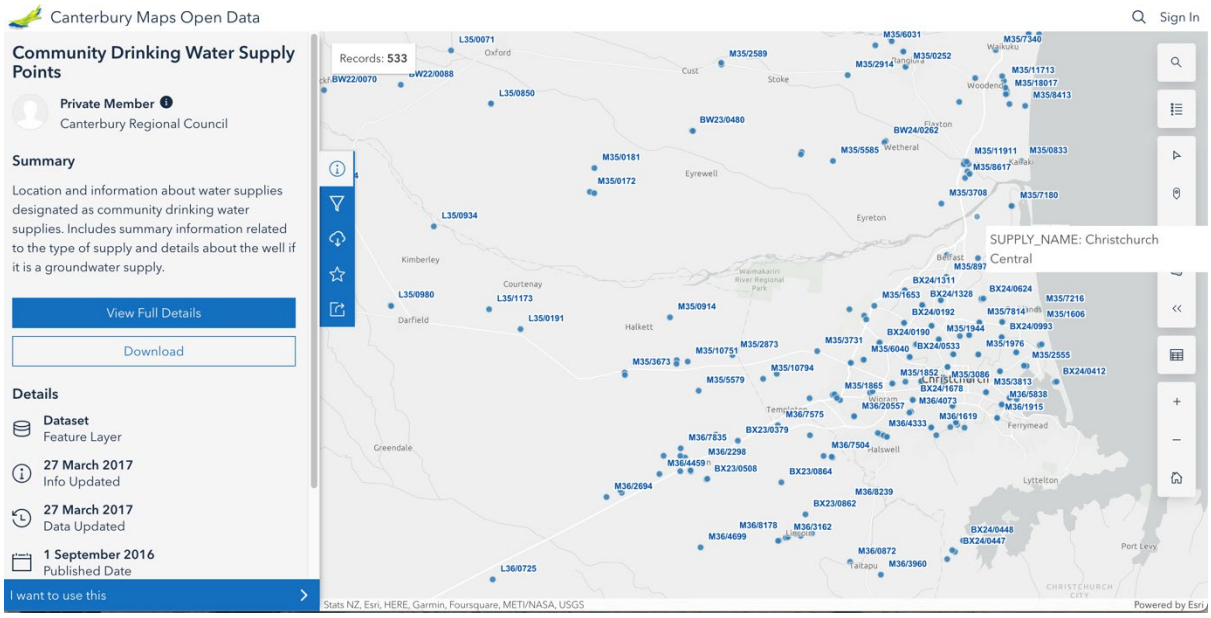

Figure 9: Canterbury maps showing community drinking water supply points. Source (Canterbury maps, 2023)

It is apparent that as the Waimakariri moves from source point in the Southern Alps through various human land uses, the water quality degrades, ultimately costing money for remediation which might otherwise have been put to more productive purposes. The question remains, how can the region address these issues of water quality in a proactive way to ensure water quality is improved and future costs are foregone? Simply treating water at point of extraction is reactive and does not address the underlying issue that land use is deteriorating the quality of the Waimakariri waters. Under a business-as-usual scenario, agricultural and urban intensification will degrade the quality further, and more treatment measures will have to be taken, costing more money into the future. The goal of such interventions should be to address issues of water quality in a way that ensures future quality is being improved, rather than treated. It comes down to a question of system resilience in the wake of changing environmental pressures.

Farmers fertilise and intensify stock on land as they can extract more value out of their land and earn more money by increasing the output per hectare – effectively increasing stock units. Urban cities expand and intensify to bring in more value for the region, earning the region more money but also ensuring fundamental human rights are still met. It is the prospect of increasing the bottom-line that drives land *use*, a function of human labour where land *use* is the means for human labour to create or extract value. This is what drove the historic New Zealand dairy boom, it is what has driven significant land *use* changes towards exotic pine plantations, it is what drives urbanisation. Approaching the issues of land *use* and, in turn, water quality, should then be done so with reference to the ability for human labour to *use* and create instrumental value. If water quality issues were framed as an opportunity for humans to add instrumental *use* value, then action would be taken to address this.

How then to incentivise and reward the right behaviour that is beneficial to water quality?

5.2. Farmer Barry and conceptually mapping the PoL

To map the conceptual space for the Praxis of Labour (PoL), the reader is welcomed to engage in theoretically applying the PoL into a place-based scenario following Barry, a hypothetical farmer who owns 300ha of predominantly dairy and grazing pastures. Barry's property borders the Waimakariri river, and as with many farmers nationally, Barry is under significant pressure from central government to manage his impact on fresh water as he looks to adhere to requirements that fell out of the National Policy Statement for Freshwater Management (Ministry for the Environment, 2020). As a part of this management, and as a response to the NPS-FM (2020) requirements, Barry must exclude stock from entering waterways, and manage effluent and nutrient run-off. Barry is a third-generation farmer of this property and has animosity towards these new regulations because land that he previously could graze and create value on he can no longer do so. Further from this, Barry must either pay a fencing contractor to fence off his stock from the Waimakariri or put his own labour and money on materials to fence it himself. The actual capital expenditure required to do this, plus the opportunity cost if Barry does this himself, and the loss of stock units on his property means Barry does not have much of an incentive to change his behaviour.

However, as with a significant portion of farmers nationwide, Barry believes that it is important to the functioning of his farm to have strong environmental performance. Below in *Figure 10* are the results from a 2021 Survey of Rural decision makers highlighting national environmental attitudes, controlled by land use.

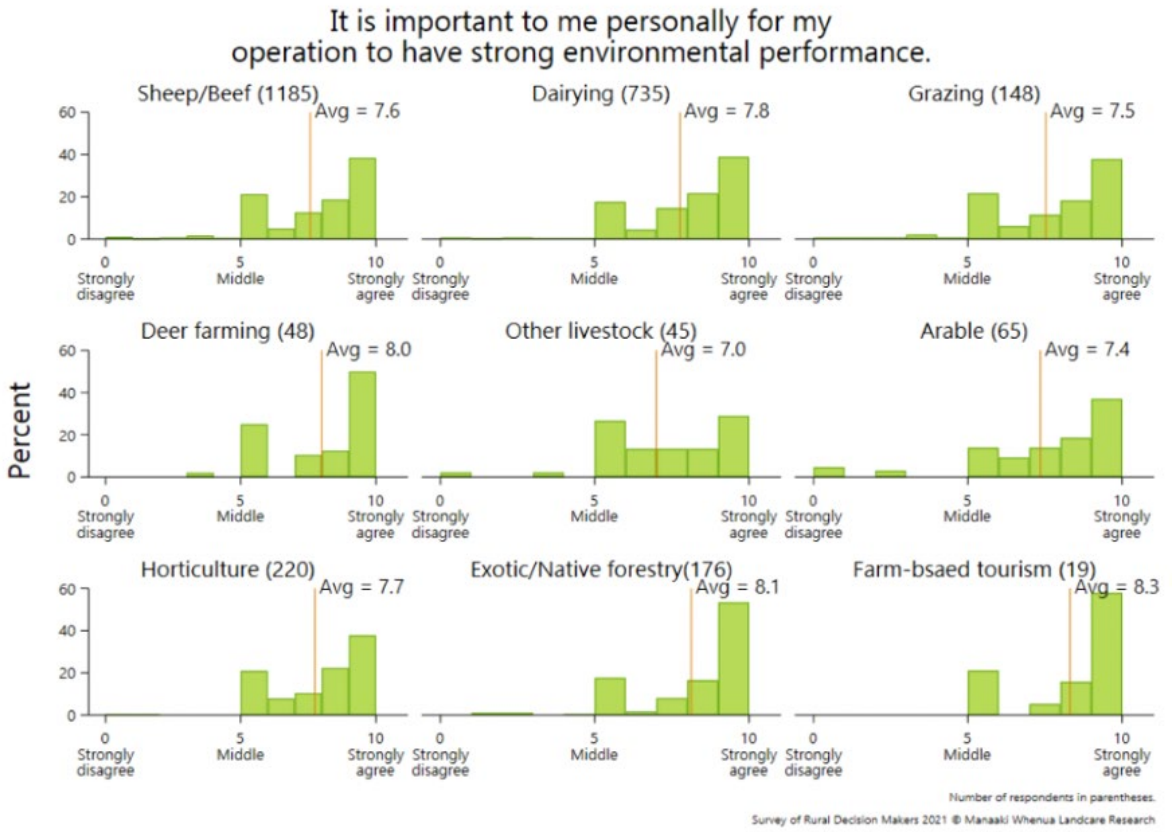

Figure 10: Maanaki whenua Landcare Research 2021 Rural decision makers survey. Source (Maanaki Whenua Landcare Research, 2021)

However, whilst he is environmentally conscious and believes he should do his part to ensure the longevity of these precious ecosystems, it is simply too costly.

1. Value judgement, historical transaction & human labour added.

In line with NPS-FM requirements, Barry decided to first exclude stock from the Waimakariri regions that pass through his property. Barry off-sets his stock by 10m from the water, even though the minimum requirement is 3m - Barry recognises that the further away the stock are from the water, the better chance the water has at receiving less nutrient run-off, less erosion susceptibility, and land use pressure. He also realises that he will be able to plant a riparian buffer region over this 10m zone, preventing further runoff, providing bank stability and erosion control, ultimately helping with dissolved oxygen levels, aiding the metabolic rate of the freshwater, and improving water quality and helping the purification process.

Barry makes a value judgement at this stage and weighs up the direct costs of his water purification project including fencing equipment and materials, and seedlings and planting equipment. He then purchases these at a price based upon the socially reproducible rate as his value judgement concluded

that he could *use* these goods to create more value. Barry then keeps record of his labour hours that he invests into the water purification project, including stock exclusion and fencing hours, planting hours, pest control hours, and any other on-going management activity that requires labour input.

Barry is adding value to his land in the form of human labour, and an externality of this human labour is water purification. How valuable this restoration project is to Barry, is a direct reflection of the human labour added to such at the various points in the process. $PV = X + Y + Z_1 + (Z_2 + Z_{3...})$. This is the value of the purification project to Barry, and Barry should thus be rewarded financially for the human ecosystem benefits, such as water purification, that he is positively promoting with his purification project. If another farmer were to regenerate their pastures so that they had greater stock units, then the value of their land would increase. This should be the same for Barry too.

Barry owns the land, he has purchased the materials and the labour units, there is a revealed preference in that Barry values the project more than his next best alternative. In this case, that may be the value generated from the ability to graze stock in the region or perhaps even a natural stock drinking water source. Because Barry has already purchased all these items and given his labour units, there is a necessary truth to which the valuations can be based off. There is also private ownership of the land, goods and labour units and so there is credibility given to his value judgement as the items are in his ownership and there is no hypothetical reality in which he is asked to provide a value judgement.

Further, to borrow from praxeological arguments, it is in Barry's best interests to manage, maintain and enhance his restoration project because he does not have the luxury of being able to levy taxes to supplement deterioration of his project and wants to ensure his asset appreciates in value as any business savvy individual would do. There is confidence that the management and impacts of the restoration project will be positive because of this private ownership.

2. Perceived value of Barry's restoration project

By considering the value contained within the good as amount of human labour that is contained within the restoration project, one has a strong reference point for the exchange value of such. There is a recognition of the initial capital expenditure of the project in the form of purchased materials, and a recognition of human labour added to take these raw materials and turn them into a functional use value and include these into the value judgement. This follows the same logical model as the standard Marxian M-C-M framework for surplus value. Money is spent - the commodity is transformed using human labour - and is now representative of a greater exchange value due to the increased human value added in the form of labour. Classifying value added as human labour further helps lubricate

value judgements as there is little abstraction of what values are within the project since the entity engaging in the value judgement owns the labour and considers the value to them as their added labour. They own this labour and are the best and most accurate valuers of such because of this ownership.

Further to this, human labour is the necessary truth to which one can reference value added to the project. This can be summarised in *Table 1* below. There was direct *human action* in the form of added human labour so at any point in time, one can understand value added and thus have an accurate representation of value and a strong reference point for exchange value and thus price over the defined timeline.

Table 1: Summary of perceived value of Barry's restoration project

Landowner ID	Materials cost (x)	Planting/site prep (y)	Maintenance ($Z_{t=0}$)	($Z_{t=1}$)	($Z_{t=2}$)	($Z_{t=3}$)	Total Labour Value $_{(t=3)}$
Year 1							
Barry	$100,000	$50,000	45 hours @ $25*	45 hours @ $25*	45 hours @ $25*	45 hours @ $25*	$154,500
Year 2							
Barry	$1,000	N/A	45 hours @ $25	30 hours @ $25*	20 hours @ $25*	25 hours @ $25*	$4,000

**Rate used as hypothetical socially necessary wage.*

That is not to say that the human labour contained within the project is the price to which extrapolations or market functions could be based off, however it provides a rooting mechanism to which baseline valuations begin. To understand this, the hermeneutical open-minded approach to welcome conceptual pluralism and understand who Barry is, why his observed behaviour was so, and why he decided to value and invest in his project the way he did – ultimately providing context to his chosen human labour decisions.

Manahau could be implemented to understand and value Barry's actions from a mātauranga Māori perspective. For example, further research may highlight that Barry planted a considerable number of

kōtukutuku along the bank surroundings, with a number of harakeke and toi toi as well. If approached from a manahau perspective, concepts of mahinga kai drive Barry's restoration efforts as he knows these indigenous species work well together and that all three species provide rich sources of food for both humans and other animals. Further, by restoring with these species, Barry is enhancing the mana of the land (whenua) and water (awa). By that token, there are many ways to which Barry's actions and purchase behaviour can be contextualised and understood.

3. The value of the human ecosystem benefit *water purification*

Above is a demonstration of the logic model for how value is constructed and understood within the pluralistic value framework *The Praxis of Labour*. It has shown that the present value of the purification project up until this point is the total amount of human labour required (including price paid for materials or contractors labour). However, this is only the value to Barry as he is the owner of the land, labour and materials that went into such. There are further downstream benefits or externalities that result from Barry's actions in the form of purer water. This is value that Barry doesn't necessarily receive tangibly – but rather is value in the form of downstream externalities. People or entities that use the clean water downstream from Barry are receiving value as a symptom of Barry's actions. This needs to be understood and incorporated into valuations when casting attention to human ecosystem benefits such as water purification.

Approaching this question is a complex one given there are many other human ecosystem benefits that result from Barry's restoration project including carbon sequestration, biodiversity enhancement, erosion control, and food and water supply. These benefits need to be compartmentalised and referenced to their direct realised benefits rather than stacked on top of each other. In the case of water purification and the Waimakariri river system, the downstream benefits are realised at point of water extraction for use. The value of the purification process is the value of human labour required to purify the water if the water was impure upon extraction. It is a cost saving, or opportunity cost of saving money in the future, or saving what money is already being spent on the treatment. From a water supply perspective, this represents the price paid for treatment chemicals such as fluoride and chlorine, treatment plants for dissolved oxygen purification, infrastructure, and ongoing human labour added in management.

In a 2022 report, Chambers and O'Brien estimated the health costs of increased nitrate levels within the Waimakariri system drinking water. They estimated that the health impacts alone on cancers and premature births to be in the range of NZD$21 - $47.8 million per year. To retrospectively treat water

to remove nitrates, they believed such a treatment initiative would cost NZD$610 million to install, and $24 million per year to operate (Chambers & O'Brien, 2022).

Within the Christchurch City Council 2021-2031 10-year water asset management plan budget below, one can see the allocation of the council's value of their water planning initiatives. There are considerable infrastructure and management costs associated with renovating and adding to the already existing water programme. Actual figures of the costs for water treatment to date were not able to be found on the publicly available data, however from the figures provided above, the reader can gain an idea of the types and quantity of resourcing required when dealing with water treatment initiatives.

Major Initiatives to address level of service gaps	Indicative $ over 30 years
Water Mains Renewal Program	$865.5M
Water Submains Renewal Program	$187.5M
City Water Supply Re-zoning & Demand Management	Over $20M
Fluoridation - if required	Over $20M (currently unfunded)
Water Supply Safety Improvements Programme	$14M
Modelling programme to support optimised improvements	$11M
Smart Water Network	Over $10M
Wrights Suction Tank and Pump Station Building	$4.7M
Land Purchase for Catchment Protection	$3.8M
Above ground well head conversions	$2.7M
Duvauchelle Membrane Filtration	$2.6M
Secure Groundwater / Age Dating	$2.3M
Hydrogeological Groundwater Model	$1.53M
Backflow Prevention Programme	$ 740k

Figure 11:Summary of Christchurch City Council water asset management plan 2021 – 2031 (Christchurch City Council, 2020)

Further, with future demand projections highlighting an estimated growth of 72,000 new residents over the next 30 years (p. 26) there is going to be increased pressure to renew and grow Christchurch's drinking water supply. Below is the demand projection year-by-year for the next 30 years.

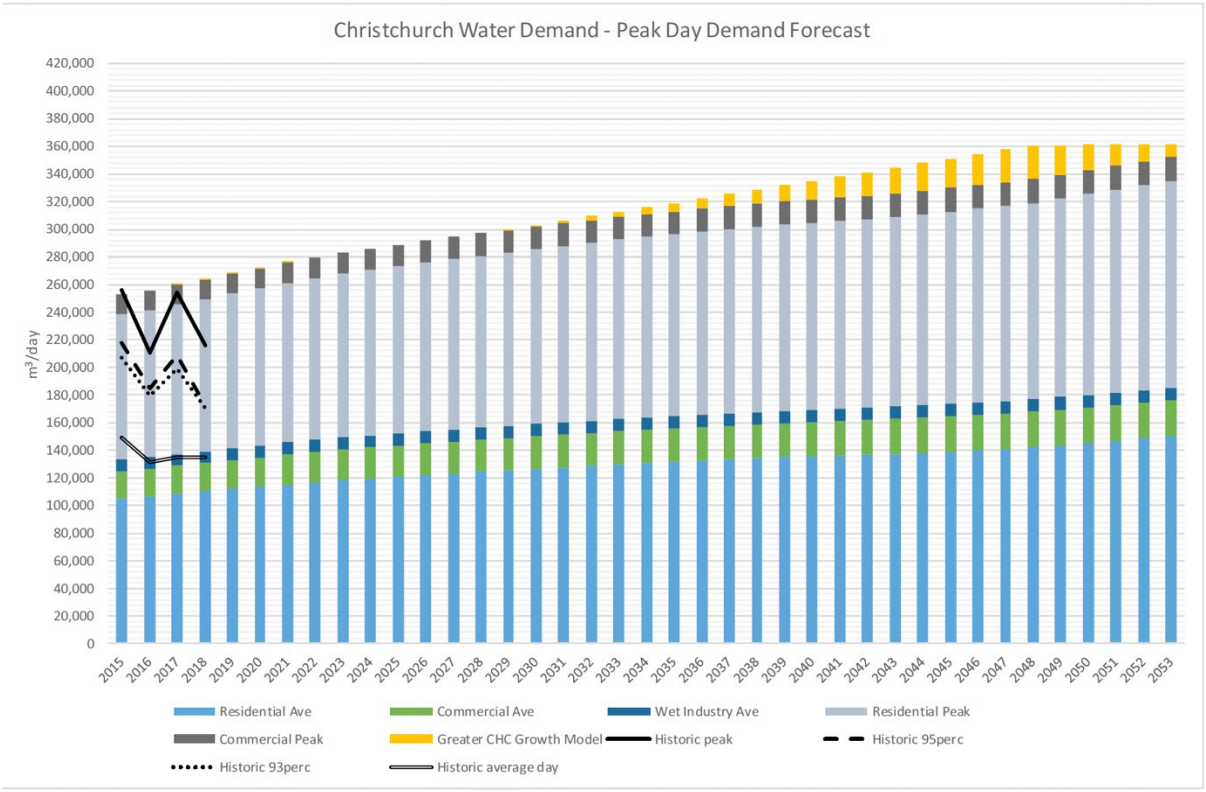

Figure 12: Christchurch City Council peak water demand (Christchurch City Council, 2020)

There is an incredible amount of maintenance and capital expenditure required to account for increased demand and increased requirement for water treatment. However, despite the indicated budget in *figure 12* above, of the c. $20m indicated for water fluoridation that is unfunded, the council earlier in 2023 has already had to begin chlorination due to poor water quality (Christchurch City Council, 2023). There are clearly water quality issues, however given that the necessary data required for valuing the water purification process of the Waimakariri is not easily available, external modelled figures will be drawn on to provide a proof of the logic that underlies the value framework.

Had the necessary data been available, one can directly plug in annual water treatment expenditure and simply add that to the overall value of the landowner's restoration projects. Let us hypothetically say that there are 100 landowners in total that border the Waimakariri river system over its 151 km length. A total per hectare or per km rate = the total annual water treatment expenditure / number of hectares or km. Total value of water purification process per km = annual treatment expenditure / 151km. The total value of the restoration project to Barry is:

PV = (total labour hours contained within restoration project) + (per km purification value) (number of km of river on Barry's farm).

If one were to use the figures indicated by (Chambers & O'Brien, 2022), without accounting for the $610 million initial capital expenditure in establishing a treatment plant for nitrates, $24 million p.a would be required for ongoing treatment for just nitrates alone. The per km value for the water purification process upstream would be $24,000,000 / 151 = $158,940.40 per km/year. Barry would then multiply this figure by the number of km his property borders and then add this to his total labour cost of the project up until this point. This would be the total value of Barry's restoration project with the human ecosystem benefit of water purification incorporated into this valuation. This is summarised in *Table 2* below.

Table 2: Summary of value of water purification human ecosystem benefit

Landowner ID	Bordering land (km)	Cost savings per km p.a*	Labour Value** (t=3)	Total Present Value (t=3)
Year 1				
Barry	1.5	$158,940.40	$154,500	$313,440.40
Year 2				
Barry	1.5	$158,940.40	$4,000	$162,940.40

**Figures taken from Chambers and O'Brien (2022).*

***Figures from Table 1.*

Chapter Six: Discussion

This thesis sketches out an alternative framework, the Praxis of Labour (PoL), for the valuation of human ecosystem benefits, specifically *water purification*. It is a framework that understands value as human labour contained within the good or service, which is the extrinsic, human value within such. It does not necessarily hold that intrinsic values do not exist, it merely holds that they are beyond the discussion of human value. Any attempt to generalise phenomena down to the presence of intrinsic value is to assign sufficient reasoning to something that is misunderstood through a singular, rigid framework. By incorporating hermeneutics and interpretive approaches, the PoL works *with* economic pluralism and enables contextual variances in value to be understood across cultural and social scales. This contrasts with traditional marginal utility theory which works *against* economic pluralism and understands these contextual differences as generalised intrinsic value variances.

By using human action as the foundation for understanding value, and human labour as the basis for human action, one can start to understand motivations behind behaviour and value judgements. By further incorporating hermeneutics into the valuation discussion, context is provided for what this value means and how it is constructed. Moreover, by understanding value through a human labour lens, there is the ability to encapsulate value added to goods and services under the M – C – M model, where C is human labour added and M is the action of purchasing and selling a good or service.

In the case study, all human action, including goods or services purchased, were conceptualised as value added as human labour. The value added was human labour units – the cost (or value) of the labour units was relative to the [hypothetical] socially reproductible wage rate (as determined by the socio-political factors of the time). This was value added to Barry's entire *water purification* project. The proportional value of the water purification ecosystem benefit was the downstream benefits of the process at point of extraction. This is conceptualised as cost savings the Christchurch City Council received from not having to treat water upon extraction. Within the PoL, this cost is the required human labour cost to treat the water from a capital expenditure perspective to build additional treatment plants, and annual management costs too in the form of human labour costs. These costs are embedded in the price paid for materials, as well as ongoing labour. This was summarised in *Table 1* and *Table 2.*

By combining human labour value added per year at four quarterly points with the downstream cost savings of value received in externality, there is the ability to capture both fixed costs/value and variable costs/value added to the project. This is necessary as Barry is constantly adding variable amounts of labour value each quarter, per year, indicating an increase in value added. Christchurch

receives downstream value that increases to the point of the critical threshold, where additional riparian stocking rate will not significantly increase water purification values. This value then effectively becomes a fixed value received into perpetuity. However, it is necessary to continually add the variable amounts of labour value added by Barry, as there is still significant management and maintenance costs to Barry in the form of human labour. It is still human labour value added to the project. Without Barry investing his labour, the ecosystem functionality will deteriorate, and the ecosystems' ability to purify the water will decrease, thus imprinting a cost to downstream extractors.

By using human labour as the metric for value, the value of existing ecological goods and benefits is better understood, and by using hermeneutics and human labour, value added to goods and services can be better understood, measured, and managed. Further, by having no reference to false realities and non-existent goods such as with marginal utility methods, there is grounded, tangible data that can be understood with confidence and represent action and behaviour within an actual, observed reality. There is confidence in the observation of the reality due to the praxeological notion of human action as necessary truth, and necessary human action being linked to human labour and value judgements. There is credibility provided to the data due to the framework being rooted in the necessary truth of human action throughout, and the tangible value added in the form of human labour.

6.1 Political and systemic implications

As has been alluded to throughout this research, the audience for this piece of work and subsequent value framework the PoL endorses is aligned with policy creators and decision makers. From the public sector in the case of central ministries such as the New Zealand Ministry for the Environment; Ministry of Business, Innovation and Employment; and the Ministry for Primary Industries, in terms of tracking labour values and valuing natural assets within their custodianship. From a private industry decision-makers perspective, there are implications for the banking industry; insurance industry; private equity firms; and general industrial reporting on corporate social responsibility initiatives. The PoL provides a logical framework to include human labour and environmental values into policy, decision-making, and regulatory obligations.

Further, whilst the Praxis of Labour framework has been applied to water purification as a specific human ecosystem benefit, it is potentially applicable to any ecological benefit that contains human labour within it or is being added to it. As was demonstrated with the case study above, the farmer, Barry, was adding value to his purification project through constant management, as well as the seedlings purchased, pest control initiatives etc. However, there are other ecosystem services that

Barry's project contributes to, such as erosion control, air purification, biodiversity, water regulation, and flood protection to name a few. If there is a defined metric and measurable impact on that metric, then there is a way in which human labour as value added can be tracked and ecological goods and services can be measured and valued.

For example, if labour values are tracked and measured against Barry's project, and *Biodiversity* is the desired ecosystem benefit, with species richness as the chosen metric and impacts measured. By putting his labour units into pest control and other management activities, Barry is adding value to the ecosystem benefit of *biodiversity*. The implications of such a logical valuation, particularly within the biodiversity sphere is very topical given the New Zealand government has recently sought advice and discussion on a biodiversity credit scheme (Ministry for the Environment, 2023c). A further example could be *erosion control*, all the interventions and management that Barry engages in like stock exclusion and riparian planting can have a positive effect on the ecosystem benefit *erosion control*. When suspended sediment (turbidity) is used as the metric and measured, the positive effects (or lack thereof) of Barry's restoration project can be witnessed.

Having valuation grounded in the necessary truth of the human action axiom means that there is credibility to the corresponding value and, ultimately, data. There is no necessary truth rooted in the marginal utility paradigm, and so there is lesser confidence that can be given to the valuations that follow. When there are better valuations there is better data, and when there is better data, there are better models and projections. When there are better models and projections, there is better policy and management. Better policy and management mean there is a fairer distribution of resources that ultimately improves sustainability, particularly when dealing with environmental goods and services.

Moreover, under the PoL, data collection is a form of labour (as seen with the discussions on value judgements within the framework) and when considered so for financial reporting like Environmental, Social and Governance (ESG) or Taskforce for Climate-Related Financial Disclosures (TCFD), data collection is a form of value added to an impact. This is an important point that previous thinkers have discussed as a necessary ingredient for a just society (Posner & Weyl, 2018). By reporting and indicating where an organisation stands with regards to their climate related positions – they are not only adding credibility and transparency to their business model and operations, but also adding value to their impact by way of incorporating environmental labour data into such reporting as value added.

Furthermore, when applied to environmental goods and services, there is a recognition of private ownership, so there can further be confidence in the valuation process. As suggested by Fox (1992), private ownership of goods means there will be better management of such goods and services because the owners must absorb the costs of loss or asset failure. Private ownership suggests that

owners will look to increase the value of their asset through input of labour and management. Having labour as the value-added metric means there is tangible data to which valuations are based off. Ownership also means accountability, which is drastically important when dealing with the management of environmental goods and services. If it is done right, the managers or owners need to be rewarded. If it is done poorly, then the owners need to be held accountable for their lack of management – highlighting the importance of transparency in reporting the PoL enables.

It should be noted here that a Payment for Ecosystem Services (PES) logic model would provide an alternative framework to the PoL in the sense that Barry could receive payments from the government for his water purification services. Downstream users and extractors could pay a utility fee that gets distributed to Barry and other up-stream landowners for the ecosystem services they provide to the downstream communities. However, how the PoL differs from the PES logic is that labour is embedded into the framework, meaning that it is not only the value received downstream in positive externality, but rather the labour entwined in the data collection, management, planning and other human action activities required to bring the downstream benefits to realisation, rather than simply the desired value received (in this case purified water).

However, that is not to dismiss PES as a logic framework, but recognise it as an alternative that, in true pluralistic form, can provide value and context to other questions of ecosystem valuation. The PoL, in that case, is welcoming of a pluralistic approach to combine with PES logic when appropriate to tease out nuances and context during the valuation process.

6.2. The requirement of impact measurement, monitoring, and evaluation.

As highlighted in the case study above, there is clearly an argument for a considerable amount of value associated with the water purification process. Even when Barry's restoration project was highlighted for water purification alone, the downstream benefits and potential for cost-savings is immense. If the water purification values laid across the total distance (151 km) of the Waimakariri river system before extraction were on a per km basis, for just nitrate removal, values could exceed $150,000 per km/annum. That is not including the initial capital expenditure of establishing a new treatment plant which would add another $600m to the equation. This is a considerable number of resources that will absolutely require transparency, monitoring and evaluation, and impact measurement to ensure those resources are shared fairly across landowners, and that those resources are having the desired impact.

Measuring these impacts will require significant resources too and, furthermore, landowners are often reluctant to let council or other public services onto their land. In an ideal world, landowners would have access to monitoring equipment such as YSI machines for dissolved oxygen and other important determining variables (like temperature, flow, pH) on the stretches of river that pass through their property, however these are costly machines – particularly when left in-situ. Working with freely available resources and tools is important initially before such technology is adopted and implemented due to technological costs and the socially necessary wage rate to construct such a device.

NIWA has such a tool called the Stream Health Monitoring Assessment Kit (SHMAK) (National Institute of Water and Atmosphere, 2020) which outlines key indicators of freshwater health that fell out of the NPS-FM (2020), and Standard Operating Procedures (SoP's) for citizens to be able to credibly monitor and report on freshwater health on their land. Such a tool kit is imperative for baseline monitoring and to analyse trends across time. The SHMAK procedures not only monitor dissolved oxygen levels, but macro-invertebrate index, submerged plant index, fish index, turbidity, conductivity, pH, so includes a significant number of explanatory variables for levels of dissolved oxygen present in the water, ultimately improving the understanding of freshwater ecosystem metabolism and water quality. Landowners have the capacity to carry out standard operating procedures for monitoring such freshwater health indicators and have agency in terms of what they would like to monitor given their individual circumstances, ensuring there is purposeful *human action* rooted in this process too. If the landowner engages in the monitoring of their freshwater, then they can include this in their management costs and be rewarded for such human action. It is, at the end of the day, human labour value added.

Moreover, implementing such a tool like NIWA's SHMAK helps address the need for increased environmental monitoring nation-wide. As New Zealand seeks to implement such national policy statements as the National Policy Statement for Freshwater Management (Ministry for the Environment, 2020) and the National Policy Statement for Indigenous Biodiversity (Ministry for the Environment, 2023a)to address environmental resource issues, incentivising landowners to carry out citizen science and feed into such monitoring programmes will address the looming problem of not enough boots on the ground to carry out such a monitoring programme. By that token, the PoL presents a framework to include the labour requirements for regulation, monitoring and evaluation within the discussions of asset management and valuation.

However, there is considerable expertise required to ensure a restoration and environmental plan will have the desired impacts. From species identification, plant maintenance advice and pest-control plans, landowners will require assistance initially. A qualified ecologist will be required to assist in the establishment of such to ensure resources are efficiently allocated and not put into a restoration

project that has no underlying ecological concepts referenced, ensuring the positive impacts of the restoration efforts. One aspect of marginal utility theory and its application to environmental resources can be referenced here.

As discussed in the marginal utility *Section 2.2.5.* above, Farber, Costanza and Wilson (2002) demonstrated the marginal utility of tree stocking on flood protection having a negative asymptotic relationship. The same argument and theory could be pulled into the discussion on water purification as shown in *Figure 13* below.

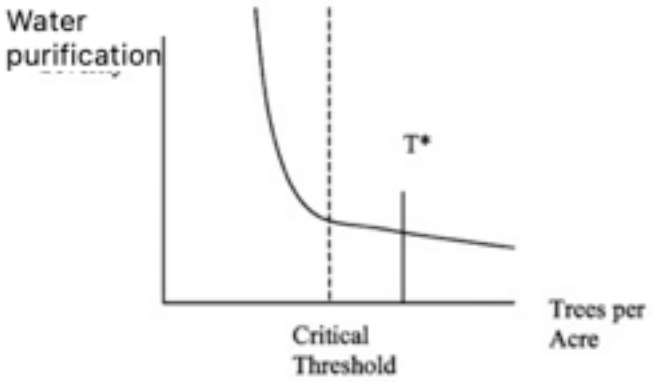

Figure 13: Water purification critical threshold graph. Modified from Farber et al., 2002.

There has been significant previous research done to understand the ideal level of stocking rate for flood protection, same too can be said for water purification and waterway restoration (these are however beyond the scope of this paper). This is *human action* that has resulted in the optimal restoration rates and so there is necessary truth embedded in the concept, so long as there was considerable research into species relationships and actual, physical monitoring and planning. This is the only way one can accurately and effectively plan and monitor environmental outcomes. No form of desktop analysis will suffice.

Clearly, there is a marginal utility of planting too many trees, where the received benefits plateau as there is less water purification benefit received per tree density per acre. What becomes important is ensuring the critical threshold is understood and held to ensure resources are effectively and efficiently allocated. By that token, the PoL is not completely devoid of marginal utility. Embracive of true economic pluralism, the PoL retains aspects of marginal theory that are useful as a decision-making tool, such as the critical threshold cost-benefit analysis to identify optimal marginal choice above in *Figure 13*. However, as has been demonstrated throughout this paper, marginalism has done

a poor job of valuation – particularly in environmental and ecological economics. This means that Willingness to Pay and other contingent valuation methods can be thrown away, without necessarily throwing away Cost-Benefit-Analysis.

6.3. Limitations

6.3.1. Choice of baselines

A general limitation to the PoL has to do with the arbitrariness of time and baselines considered within the framework. There is a consideration that the choice of baselines are somewhat theoretical in time and space in that to measure Barry's contribution to the ecosystem service *water purification*, there needs to be a reference point to which his (and others) contributions are measured. Too, it does not directly address the spatial representation of Barry's surrounding properties or neighbours. If Barry is to engage in his restoration or purification project, then his success is somewhat dependent on his surroundings and his neighbours making an effort to restore and purify their marginal land regions too. However, as suggested above, there are implements and measures that can be introduced to assess Barry's direct impact through use of the NIWA SHMAK guide and the expensive monitoring equipment such as YSI machines [2].

6.3.2. Anthropocentric

A specific and somewhat philosophical limitation to this value framework is that conceptualising value as human labour can be considered anthropocentric. If human labour is classified as added value, then value is instrumental in how much human labour (value) can be or has been added. This would be deemed an extrinsic conception of value. It does not recognise intrinsic values in the sense that there are values that exist outside of human use. This is a fundamental acknowledgement that needs to be held at the forefront of restoration and sustainable behaviours. Nature has value that is outside of human influence or control. Without doing so, value and the ecosystem benefits that provide it will be engineered as value extraction machines that is only relative to human needs and value structures.

[2] I give thanks to Reviewers 1 & 3 for their diligence in highlighting this general limitation to the Praxis of Labour framework.

However, as noted above, this value framework still has recognition of intrinsic values, they just do not play a part in the human valuation process as they exist with or without humans. The argument for the valuation of ecosystem benefits comes down to the value received by humans at point of realisation. This is the definition of human ecosystem benefits, so when looking at human ecosystem benefits, intrinsic values do not come into the equation. A tree or a forest has value in existing intrinsically with or without humans valuing it with whatever instrument seems convenient. But this is not surprising, for a value judgement or framework is another instrument. A conceptual instrument, however still an instrument that when applied, the results will be some form of reflection of human instrumental, extrinsic value. However, that does not mean intrinsic values are absent. They simply do not factor into the human value equation.

What results from the PoL conception of value is a reclassification of environmental goods and services that recognises the value shift that takes place when humans become intertwined with environmental values, and the extraction or promotion of such. To follow Burkett (2006), as discussed in *Section 2.3.5.* earlier, Marxian labour theory does not generalise intrinsic values down to extrinsic explanations or values, it simply leaves them out of the human valuation equation, however, recognises extrinsic value added as human labour. By doing so, there is direct divorcing from the commodification of nature arguments against ecological economics (see Castree, 2003) as the values that are being commodified are the human labour values, as opposed to natural values. Marxian thinkers would argue that there are a slew of ethical, psychological, and social dissonances that result from *Estranged Labour* such as alienation and disenfranchisement (Marx, 1844; Wolff & Leopold, 2021), however these arguments form the foundation of Marxian economics and theories of social revolution. They have been discussed at length for several decades, so there is little value added to this discussion if engaged with.

6.3.3. Resistance to Change of Ownership

The second limitation of the PoL has to do with the underlying structures of ownership of goods. The value framework suggests that if human labour is added to an ecological good or service, then that is value added to such good or service. Private ownership of ecological goods and services is currently against social and political agendas. Tracking value as human labour added insinuates private ownership of the goods and services the labour is being added to.

The private ownership of environmental goods and services is a praxeological argument, and holds as discussed above, that effective management of such resources requires some level of private ownership. This is because private owners must manage their assets effectively and efficiently

because they want to add value. They must absorb the costs of poor management as they cannot levy taxes like public ownership.

However, one advantage of private ownership of ecological goods and services is that it leads to accurate valuations as it references historic transactions and human labour as the necessary truth of *human action*. Being able to accurately measure and model value added is a desirable outcome for both public and private management purposes. If recognition of ecological goods and services as privately owned is all that it takes to get quality data and management, then why would there be resistance to such change?

What it comes down to is resistance to systemic change, and that is not to say that this framework is suggesting all ecological goods held in public and in common need to be sold for private ownership in the name of better management. What the framework is suggesting however, is that whomever the owner(s) of the land is/are (public, in common, or private) can add value to their ecological good or service by contributing human labour and increasing the value of their asset.

However, as identified in *Sections 2.2.3 – 2.3.4* on praxeology, it is not necessarily about whether the *impossibility theorem* is correct in that private ownership of goods is a necessary condition for accurate valuation – it is more that praxeological logic comes up against state powers to exclude. Yet, the state constantly requires private resources to fund public infrastructure and environmental projects. Take the case of historic financial bond structures to fund railway infrastructure for example. This is not new rhetoric. It is less about the mutual exclusivity of private or state ownership, but rather clarity and transparency around roles and responsibilities – ultimately, accountability.

6.3.4. There are simply no resources to fund a scheme like this.

The third limitation to the Praxis of Labour (PoL) is one that is raised frequently during conversations of valuing ecological goods and services. It is a dead-end valuing human ecosystem benefits if there is no funding or capital flow as a result. Relationships with funders are always a challenge when it comes to valuing ecological goods and services. The scale of change required to make a meaningful impact is huge and there is no one solution.

As discussed in the case study, there is value that lies in cost-savings through labour, however the timescale and therefore cost-savings will be drawn out and likely to provide too small a direct incentive or reward to stimulate the desired behaviour change or human action. As the ecosystem

matures it gets better at purifying the water, so it is more valuable downstream. However, the initial capital expenditure is what the landowners need help with.

One solution to this would be to think about the impacts in a time-value continuum, whereby the value of the human ecosystem benefit and labour cost savings over a 30-year period are discounted back to a present value today. This could be as simple as the net present value (NPV) formula:

$$NPV = \sum_{t=o}^{n} \frac{LV_t}{(1+r)^t}$$

Where the net present value would be the sum of the labour value (LV) each year (t), added together over (n) number of periods (in this case 30 years), hedged against the current market interest rates (r) to account for the value of the money if it was sitting in a bank account. This would provide an accurate representation of labour costs saved into the future and discount it back to a present value that would represent 30 years of labour cost savings and so would be greater value and thus fund the initial and ongoing cost of contributing to downstream value received by the human ecosystem benefit *water purification*. As has been referred to throughout the case study, Barry was engaging in a purification *project.* If such issues and restorations were framed as a *project,* then project feasibility and funding can be implemented. NPV for example is commonly used in project feasibility analysis.

Furthermore, there is a cost of doing nothing. Lake Ellesmere and the Selwyn River are prime examples of this. There is now significant clean-up cost from years of neglect of the health of the waterways. This cost is a direct labour cost in the form of restoration, management, and mandate, as well as abstract labour costs in goods and services purchased. If these labour cost savings can be brought to the present to provide incentive for behaviour change, then human action towards improving ecosystem health will follow.

However, this is not a novel limitation, but one that applies to all ecological goods and services. If anything, this limitation highlights the complexity of valuing ecosystem services and that there is much more involved than a simple household willingness to pay or contingent valuation survey. Whilst turning valuations into tangible cash is challenging, a good framework can help investors/funders to part with their money if the framework helps articulate the investment case. The PoL in that sense, approaches these questions in an openminded and pluralistic manner that creates a more persuasive investment case for prospective investors/funders than the case that is created under a WTP approach.

Chapter Seven: Conclusion

7.1. Overview

It has been demonstrated that by taking an interpretive approach that embraces economic pluralism, ecological economics benefits greatly from more accurate valuations that takes seriously the subjective and contextual variances that individuals hold. By having the PoL rooted in the necessary truth of *human action*, there is a reference point for individual behavioural differences in the form of chosen human labour added. When applied to the valuation of the freshwater human ecosystem benefit *water purification*, the Praxis of Labour (PoL) helped overcome valuation barriers by logically conceptualising the value as human labour units required to establish and maintain the purification project *plus* the added human labour cost saved by not having to purify the water at point of extraction.

When considering the limitations to the PoL, it is important to note that this framework is tentative and will require constructive criticism regularly to ensure a fair and accurate value framework is referenced. However, these limitations further highlight the complexity of the structures at play when valuing ecological goods and services, and their contribution to human well-being. There are many moving parts and contextual variables that factor into the equation when constructing a value judgement. Approaching such valuations with an open mind and in an interpretive manner will help demystify and recognise some of these contextual factors, but certainly not all. Some structures are simply too complex and deeply intrinsic to oneself that even the deepest interpretive analysis would not reveal.

Furthermore, these limitations raise questions of how accurate previous marginal utility theory valuation methods are. If approaching valuation from a tangible perspective (such as the PoL) yields such concerns of funding, then hypothetical values where one has no ownership or conception of time-value, cannot possibly be funded. When considering the valuation of ecological goods and services, there is considerable time and resources, ultimately labour cost, that is required to: a) provide accurate data that can be used in the valuation process; and b) fund the programme or essentially pay for the goods and services that are now the product of a capital value.

However, whilst these values may seem to be great, there is no frame of reference for the value of the human ecosystem benefit *water purification* that has embedded labour costs and value associated with it. Despite the figures used in the case study above being modelled externally from Christchurch City Council, the resulting values from the PoL help highlight the value of the common resources and

system processes that have been taken advantage of by society in externality. It is a simple realisation that pure and healthy water costs a lot.

7.2. Advancements and Ideology

This thesis sought to fill a gap in the ecological economics literature by going beyond marginal utility theory to deploy alternative theories of value. This ambitious project is necessarily tentative and incomplete. Consequently, this subject would benefit greatly from future research.

The scope of this research was to highlight shortcomings of current ecological economic approaches and introduce PoL as an alternative value framework to overcome some of these challenges. Research should build on what has been introduced here and seek to ground it in and establish a real-world case study to model actual labour costs currently paid for water treatment as water purification. Such research would then use the labour data to model future cost savings for water purification. This labour data would be embedded into a real-world purification project to understand actual costs per hectare to establish a functioning ecosystem that is contributing positively to water purification. Such research could begin as small or as large as resources allow, however would need to span over many years to analyse trends effectively and accurately across indicators, interventions and impacts, and ongoing labour costs too.

Future research should also look to expand on the PoL and see how cultural value frameworks can align and add to considerations of value within ecosystem services. There is a recognition of the cultural aspects and values that lie within ecosystems, it is one of the 4 categories of ecosystem services as defined by the Millennium Ecosystem Report (2005) introduced at the beginning of this paper. However, there needs to be value frameworks that are culturally specific to understand how each culture values the natural world independently. Manahau, in that sense, would represent an example of such a value framework. Combined with the PoL, it would provide a cultural lens on how Māori people value water purification differently, and what enduring *human action* and labour they would undertake to protect and enhance the health of the freshwater. To do so would further strengthen the understanding of contextual and subjective values that lie within environmental goods and services and add to the value of these. Such research would need collaboration with cultural experts to ensure such a process was done correctly and respectfully.

Finally, future research should look to extend the PoL to other ecological goods and human ecosystem benefits. There is significant labour cost associated with erosion control on state highways, on farm

gully's, on marine coastlines. There is also significant labour value associated with flood protection and even water purification in wetlands, estuaries and other marginal ecosystems. Whilst a consideration of these values in purely monetary terms is difficult, as has been demonstrated by the arguments in this paper, a good value framework helps articulate the investment case for the protection and enhancement of these precious ecosystems.

However, there is always going to be a generalisation of values when economic principles are used to understand and measure the complexities of the natural world. If Western developed society continues to be underpinned by the rigid capitalistic structure that defines the observed and natural world by stocks and flows of capital, then the sustainability of capital will be all that follows. *Biocentric sustainability* cannot be achieved by valuing the biosphere in terms of capital. This would indicate *capital-centric sustainability*. However, this is the nature of the power structures underlying Western developed countries – the dialectic of the time. The longer a dialectic is in place, the more entrenched and difficult it becomes to conceptualise and address realities outside of the dogma.

What becomes important is to have a frame of reference that seeks to understand all human values within natural systems – rather than singularly valuing utility and generalising the unexplained *irrational* behaviour as intrinsic values. In that sense, the Praxis of Labour (PoL) has helped unpack some of the subjective and human labour aspects credibly and logically and helps recognise the shift of value that takes place when nature becomes intertwined with the human capitalistic system, as opposed to conceptualising value as general utility.

However, when dealing with entire ecosystems and the values society gets from their services, the scale of change required to make an impact is huge and will require a whole social shift. To make this shift happen and fundable, there needs to be policy and mandate. Projects looking at ecological goods and human ecosystem benefits and the value and impacts on such require many moving parts at a large scale. To get that many individuals moving at once at a social level, there needs to be policy and mandates come from central governments at a national level. This is the only way to make an impactful change, and furthermore, the only way to fund such scale of change.

To get mandate and desired human action and impacts at the national level, there needs to be agreement at the international level that nationally defined metrics and impacts will be advantageous to achieving the international goals and vision. Monitoring and evaluation programmes need to be in place to determine positive or negative impacts on agreed upon metrics. Once this is done, incentives for desired behaviour can be implemented and human action as labour can be measured and rewarded. However, this thinking is not new.

With such agreement at the mandate level, there is a necessity for transparency through reporting and modelling of these critical natural resources. Transparency is a necessary ingredient in justice and liberty. To ensure fairness and change within a system, transparency is a sharp tool to wield. The Praxis of Labour (PoL), as discussed above, enables such transparency around where individual differences and values lie in the form of chosen *human action* and labour. It is through this reporting that helps reveal problems associated with the generalisation of environmental values.

However, it is important to note that despite its limitations, marginal utility theory has helped set the foundations for conceptualising the value of important natural assets and being transparent about them – regardless of whether they are generalised and hypothetical in some cases with Willingness to Pay and Contingent Valuation reporting. By quantifying and reporting natural resources, attention is directed towards the remaining stocks and flows of these resources.

As global efforts become increasingly concerned with sustainable development, transparency around where these values and resources lie becomes important for holding extractors accountable for the value they receive, or the deterioration caused. This is a generational shift and represents an important journey towards achieving the goal of sustainable development and ultimately, inspiring change within the political economic systems currently orchestrating reality.

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