2. THE DEVELOPMENT OF ECONOMIC THOUGHT ON THE NATURAL ENVIRONMENT

2.1 INTRODUCTION

The real-world policy-making process for sustainable development is influenced by many kinds of theories on the environment, on the economy, on socio-cultural interactions and on politics itself. Theories are sets of ideas *formulated to explain something* (Pollard & Liebeck 1994). These theories often do influence real-world decision-making processes. Many schools of thought have contributed to the theory on economics and the environment, amongst others, environmental economics, ecological economics, neo-institutional economics and (co)-evolutionary economics. In recent literature it was highlighted that these theories need to be integrated for enhancing decision making, but that such a process is limited if not impossible (Munda 1997; Hediger 1997; Bergstrom 1993; Norgaard 1992). Norgaard (1992) argues that there is no meta-model that could link individual theories into a coherent whole. The approach taken here is therefore necessarily cautious. Searching for a coherent policy-making framework is not attempted, at least not before more is known about the underlying opportunities and constraints of such an undertaking.

The objective of this chapter is to develop insight into the development of economic thought and the relationship between economic thought and the natural environment. The question to be answered here is therefore: under what circumstances did economic thought and its relationship to the natural environment develop? An answer to this question would possibly reveal key issues for developing an integrated policy framework or might reveal tensions that are impossible to bridge. In order to provide some structure in answering this question the following key research questions are identified:

- What is the character of reality?
- What are the implications (of the character of reality) for perceptions on the natural environment?
- What are the implications for economic thought?
- What are the modern economic thoughts on the natural environment?

The importance of these questions is that the choice between economic policy-making approaches, as supported and influenced by economic theories on the environment, is made more explicit through an emphasis on the circumstances wherein these theories have been developed. It opens the door to a critical appraisal of how we have come to shape our sets of ideas (i.e. theories) on reality.

A choice of circumstances within which economic thought has developed would always be arbitrary. In this chapter the focus is on philosophy, religion and science as key drivers in the development of economic thought and its implications on the natural environment. Support for this position comes from those who argue that philosophy, religion, science and economics are in continuous interaction with each other (Polkinghorne 1996; Moreland 1990; Hooykaas 1972; Raven 1943).

The structure of the chapter is as follows: In section 2.2 the focus is on the character of reality. This is a well-known philosophical question and one section will never do justice to the amount of philosophising on the subject. In this chapter the focus will be limited to the substance-process thought-framework. In sections 2.3 and 2.4 the implications of the interpretation of reality on the natural environment and on economic thought respectively, are discussed. In section 2.5 economic thinking on the natural environment is discussed, and this serves as a background to Chapter 3. In section 2.6 a few conclusions are provided.

2.2 THE CHARACTER OF REALITY

2.2.1 Philosophy

The question regarding the character of reality has been a persistent theme in Western philosophy. Following a period of animism, the **natural philosophers** rationalised the old myths by eliminating the magic (Matson 1987:7). Their focus was to identify the most basic substances the world was made of: earth, fire, water, and air (Matson 1987:48, 50). This focus on unchanging material atoms, as exemplified by Democritus (460-370 B.C.), was not unanimously shared. Heraclitus (born ca. 540 B.C.) argued that reality is not a constellation on unchanging things, but one of processes. This changeability is so part of reality that one cannot step twice in the same river (Rescher 1996:9). The main differences between this so-called substance philosophy and process philosophy are summarised in Table 2.1.

Table 2.1 Substance and process philosophy

Substance Philosophy	Process Philosophy
Discrete individuality	Interactive relatedness
Separateness	Wholeness
Condition (fixity of nature)	Activity (self-development)
Uniformity of nature	Innovation/novelty
Unity of being	Unity of law
Descriptive fixity	Productive energy, drive etc.
Classificatory stability	Fluidity and evanescence
Passivity (being acted upon)	Activity (agency)

Source: Rescher 1996:35

The key aspects of reality as promulgated in these philosophies are fixity versus change. The interpretation of these aspects of reality, namely substance and process, has set the stage for the further development of Western philosophy. This was true both for questions relating to epistemology (the nature of knowledge) and ontology (the nature of being). The latter provides a stronger version by interpreting the most pervasive, characteristic, and crucial feature of a substantivist or processional interpretation of reality (see Rescher 1996:29). Epistemology is a weaker version by interpreting substance or process as the most appropriate and effective conceptual instruments for understanding the world we live in (Rescher 1996:28-29).

The development of economic thought on the natural environment has been influenced by developments on both the epistemological and ontological levels. On the epistemological level the way of economic thinking about the natural environment has changed over time, and on an ontological level the relationship between metaphysical aspects and perceptions on the natural environment has been shaped. The important question therefore is on the relationship between substance and process on both the epistemological and ontological levels. This is necessary in order to understand the impacts on the development of economic thought on the natural environment.

As illustrated in Table 2.1 Rescher (1996) distinguishes between two broad lines of thinking: those that emphasise substance and those that emphasise process as the key determinants in explaining the character of reality. However, a third category is needed for those philosophies that argue that the nature of being cannot be explained in terms of substance and process alone, but are subject to the norms of an absolute God. For the purposes of this thesis this group is named normative philosophers. Although both substantialists and processionals have philosophised about the existence and the nature of God, this category distinguishes itself by emphasising that God is not within the sphere of human implication. God is both transcendent and immanent in reality (Ouweneel 1997:80)[6]. The main contributors to these three schools of philosophical thought are listed in Table 2.2. Note that these categories are only an early attempt to demonstrate the overarching tendency in the work of these philosophers with the purpose of providing a schematic framework for further discussion.

[6] Transcendent means that God is radically divided from creation. Immanent means that God "fills" creation with His presence.

Table 2.2 Philosophers on substance, process and norms

Time period	Process Philosophers	Substance Philosophers	Normative Philosophers
800 - 500 B.C.	Heraclitus (born ca. 540 B.C.)	Parmenidas (ca.515-450 B.C.)	
500 – 300 B.C.		Democritus (460-370 B.C.)	
	Plato(427-347 B.C.)	Plato (427-347 B.C.)	
	Aristotle (384-22 B.C.)	Aristotle (384-22 B.C.)	
300 B.C. – 0		Zeno (ca. 335-263 B.C.)	
0 – 1300			St Augustine (354-430)
			St Thomas von Aquinas (1225-74)
1300 – 1500		William of Ockham (ca. 1285 – ca. 1349)	
			Luther (1483-1546)
1500 – 1700			Calvin (1509-64)
		Descartes (1596 – 1650)	
1700 – 1900	Leibniz (1646-1714)	Locke (1632 – 1704)	
		Voltaire (1694 – 1778)	
		Rousseau (1712 – 78)	
		Kant (1724 – 1804)	
		Smith (1723 - 90)	
	Hegel (1770-1831)	Comte (1798 – 1857)	Kierkegaard (1813-55)
		Mill (1806 – 73)	
1900 – 2000	Peirce (1839-1914)		
	James (1842-1910)		
	Bergson (1859-1941)		
	Dewey (1859-1952)		
	Whitehead (1861-1947)	Russell (1872-1970)	
	Sheldon (1875-1981)	Moore (1873-1958)	Dooyeweerd (1894-1977)

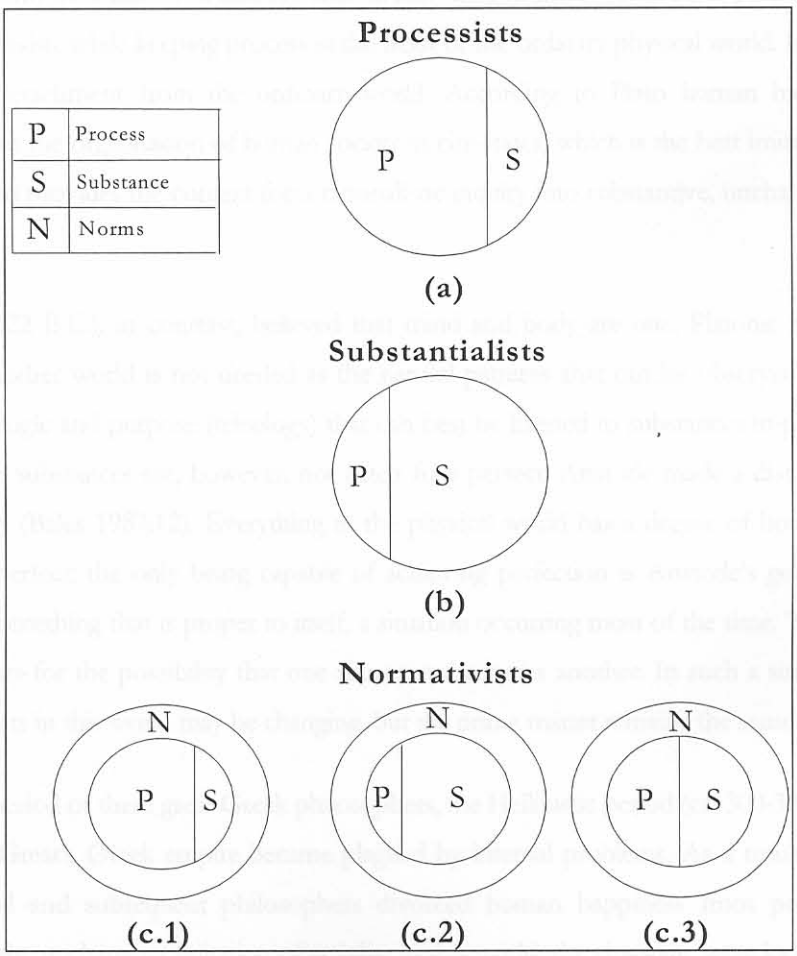
Source: Own analysis, process philosophers from Rescher (1996)

Despite many differences between philosophers within the respective categories, they do share features that are important for the purpose of this thesis. Process philosophers all agree in seeing time, process, change, and historicity as among the fundamental categories for understanding reality (Rescher 1996:24-25). Substance philosophers, the heart of most of the Western philosophy, agree that reality in essence consists of fundamentally, unchangeable **things**. Substances are treated as things that exist in their own right (Craig 1998:205). Normativists have in common that they regard reality as including the values of a transcendent and immanent God that is beyond human implication.

The differences between these three categories of philosophers are conceptually illustrated in Figure 2.1. If all of reality can be drawn in a circle, Figure 2.1(a) illustrates the processional view that the character of

reality is best explained through a focus on change. In Figure 2.1 (b) the substantialist view that a study of unchanging things would best explain the character of reality is depicted. Both these viewpoints, however, suggest human understanding or potential understanding of both epistemological and ontological aspects of reality. The third category, namely that there are aspects of reality that are not implicated by human perceptions of reality, is illustrated in Figure 2.1(c.1, c.2, c.3). Reality is larger than is being revealed to us by our reason or intuition. However, within the normative philosophy one would find changing emphasis on substance and process as explanations of reality[7].

Figure 2.1 Processists, substantialists and normativists



Source: Own analysis

As mentioned, the substance-process framework, as personalised through the philosophies of Heraclitus (born ca. 540 B.C.) and Democritus (460-370 B.C.), has set the stage for further developments in

[7] This model needs to be elaborated through a discussion of the contributions of different philosophers as listed in Table 2.2. A comprehensive deliberation of all the philosophers who contributed to mankind's understanding of the character of reality would be a far too ambitious task for the purpose of this thesis and one not attempted here.

Western philosophy. The subsequent Greek philosophers attempted to integrate an eternal life-stream from nature (i.e. process) and the fixed order (i.e. substance) of the Olympic culture (Dengerink 1979:28).

Plato (427-347 B.C.), for instance, attempted to integrate substance and process as explanatory metaphors for the character of reality into one framework by creating a distinction between mind and body. The world as experienced by our bodies is in process, while an unchanging reality existed behind this changing material world. Any substance in existing things is at best a shadow of stability in another world. This other-worldly unchanging reality (Plato's Form or Idea) is the source of existence of all other forms, and can only be understood through human reasoning (Bales 1987:9). Plato placed substance into a metaphysical realm, while keeping process at the heart of the ordinary physical world. However, he did not preach a detachment from the ordinary world. According to Plato human happiness closely corresponds with the organisation of human society in city-states, which is the best imitation of stability in this world and provides the context for a rationalistic inquiry into substantive, unchanging realities in the other world.

Aristotle (384-322 B.C.), in contrast, believed that mind and body are one. Platonic reasoning about substance in another world is not needed as the natural patterns that can be observed in the physical world reflect a logic and purpose (teleology) that can best be likened to substances-in-process (Rescher 1996:11). These substances are, however, not often fully perfect. Aristotle made a distinction between act and potency (Bales 1987:12). Everything in the physical world has a degree of both. An object in action is fully perfect; the only being capable of achieving perfection is Aristotle's god. An object in potency lacks something that is proper to itself, a situation occurring most of the time. This presence of potency accounts for the possibility that one substance becomes another. In such a situation the unity with other objects in this world may be changing, but the prime matter remains the same.

Following the period of these great Greek philosophers, the Hellinistic period (ca. 300-30 B.C.) emerged. Alexander the Great's Greek empire became plagued by internal problems. As a result, the city-states were threatened and subsequent philosophers divorced human happiness from political life. The perceptions of the unchanging imitation of stability in this world, the city-state, were loosened in favour of the realities of a changing physical world.

The Stoics, founded by Zeno (ca. 335-263 B.C.) placed reason in the broader context of logic, physics and ethics (Matson 1987:155-156). Their goal was not to employ reason for the Platonic ideal of finding timeless truths in other worlds, but to live well – an advocacy for a hedonistic life. Rationalistic and sensory inquiry into the character of reality was perceived to be important for realistic planning in order to achieve this good life. Reason and logic supported the pursuance of both ethics and physics – in order to change the world for the better. The Platonic dualism between mind and body, between substance

and process was discarded with the acceptance that the whole natural world was part of reality. The Stoic philosophy dominated the Greek and Roman world until Christianity became the official religion in ca. 380 A.D.

St. Augustine (354-430) is often called one of the fathers of the Christian church. He emphasised that belief is a prerequisite for reason (Matson 1987:196). One can reason about timeless truths, but it should always be embedded in a broader belief. He stated that human happiness could only be achieved through a belief in God (Copleston 1993:81). Drawing on the Platonic concept of city-states as an organisational means to happiness, Augustine believed that the church was the 'city of God' on earth. The Christian church, therefore, has a mission to act as the leaven of earth (Copleston 1993:89). This philosophy provided the roots for the later scholastic of the Roman Catholic Church.

The Arab influence in Europe at the end of the 12th century and Latin translations of the works of Aristotle brought a revived interest in an inquiry into the physical character of reality. The question was whether religion and this new knowledge were compatible. St. Thomas of Aquinas (1225-1274), the most influential of the Schoolmen who were pre-occupied with this question, attempted to create a synthesis between faith and knowledge: *he christianised Aristotle* (Gaarder 1997:151). He stated that natural theological truths and a theology of faith both are from God. The natural law is in the nature of man and is perfectly rational and unchangeable. The divine law is the concept in which the natural law is grounded, namely in the Scripture and the tradition of the church (Bales 1987:37). Reason tells us about the natural world, and revelation adds to the knowledge of the supernatural world (Matson 1987:232). Aquinas kept the hierarchy clear: Whatever is done by nature must be traced back to God as its first cause (Matson 1987:235).

By placing faith and knowledge in two separate, albeit interconnected realms, Thomistic philosophy proved to be a watershed between medieval thought and the Renaissance (ca. 1300-1600). In post-Thomistic scholastic philosophy, especially in the work of William of Ockham (ca. 1285 - ca. 1349), theology and philosophy became separated again (Matson 1987:243). After William of Ockham, reason and revelation became more and more separated. Philosophers during the subsequent period of the Renaissance reacted to this dualism by emphasising not only mankind's ability to reason, but also a new sense of humanism where a free and autonomous individual controls the natural and societal realities. God's revelation was pushed into the background, and through this fundamental humanistic motive a new vision on history and change became crucial (Dengerink 1979:28). The resulting philosophies were driven by an anthropocentric, optimistic and cosmocentric view on life (Klapwijk 1986:11).

Not only the Renaissance, but also the Reformation brought a revolt in Catholic Christianity. In contrast to the anthropocentric character of the Renaissance, the Reformation was christocentric in character and demanded a return to Scripture as the sole authority. Reformationists, such as Maarten Luther (1483-

1546) and John Calvin (1509-64), emphasised that the ecclesiocentrism of the Roman Catholic Church and humanistic rationality as promulgated through the Renaissance, should be exchanged for a personal belief in God. The implications were that the character of reality includes both substance and process, but cannot be explained by those alone. The complete character of reality is subject to God's norms, something that cannot be fully understood or experienced in this world.

Descartes (1596-1650) attempted to reconcile reason and christocentrism. Nevertheless, he only accepted what was self-evident or deducible from it. The natural world was something to be maintained by a God from moment to moment, but the character of reality is primarily a function of man's ability to reason. This early rationalism has been widely influential, and has led to disparagement of observation and the natural world (Attfield 1994:85). The French Enlightenment philosophers of the 18th century (e.g. Voltaire (1694-1778) and Rousseau (1712-78)) strongly supported rationalism. The French Enlightenment can even be called the Age of Reason (Gaarder 1997:261).

However, rationalism was not the only philosophy attempting to understand the character of reality. Influenced by Aristotle's observation of nature, 17th century British empiricism brought back the **philosophers of experience** (e.g. Hume (1711-76) and Locke (1632-1704)). The reality of nature was perceived through observation, experimentation and controls.

Referring to the distinction between substance and process, Descartes and the Enlightenment philosophers of reason and the British philosophers of experience have in common that they are both substantivists. The Platonic ideal of finding a constant, timeless and unchanging truth has been pursued through both reason and experience in the physical world. The result was that the initial focus of philosophy on the ontological question of the nature of being has changed to the epistemological question on the nature of knowledge. This set the stage for the further development of Western philosophy.

Kant (1724-1804) attempted to reconcile British empiricism, rationalism and moral certainty, but was interpreted by his followers as dropping reference to the natural world (Attfield 1994:82). This produced a century of Romanticism focusing on mysticism, cosmic consciousness, history and change. Kant's philosophy was also the last real philosophical attempt to integrate substance and process in one framework by placing each in its own terrain. In this framework substances has started to take the form of scientific ideals (whether pursued through reason or experience), while process have been interpreted as the ideals of autonomous individual beings. Kant confounded the operational sphere of the substantivist scientific ideal to that of nature and that of the processional personality ideal to religion and morality (see Dengerink 1979:29).

Post-Kantian philosophy did not follow such an integrated approach, but developed broadly into two schools of thought: substantivist positivistic rationalism and processional historical dynamics (see Gide

& Rist 1915). **Positivist rationalism** has been developed by philosophers such as Comte (1798-1857), Smith (1723-90) and Mill (1806-73), while **historical dynamics** have been developed by philosophers such as Hegel (1770-1831). Hegel was the first philosopher who tried to free philosophy from its post-Kantian romantic, spiritual orientation. He was also the first philosopher who discarded eternal criteria (i.e. timeless truths, unchanging substance) for mankind's knowledge about this world. He believed that the basis of human cognition changes from one generation to the next (Gaarder 1997:301) – the character of reality can best be explained as a process. Hegel stated that everything that is reasonable is reality and everything that is real is reasonable (Dengerink 1979:54).

After the split between positivist rationalism and historical dynamics, these different schools of philosophy continued to work within their own interpretations of reality. On the one hand those with the Democritian search for the character of reality in the fixity of substance (things): the search for universality, condition, and stability, and on the other hand the Heraclitian search for the character of reality in processes: novelty, activity and fluidity. The first group are the modern substance philosophers: the logical positivists such as Moore (1873-1958) and Russell (1872-1970) (Craig 1998). The second group are the modern process philosophers: Peirce (1839-1914), James (1842-1910), Bergson (1859-1952), Dewey (1859-1952), Whitehead (1861-1947) and Sheldon (1875-1981) (Rescher 1996). Each school of thought has its disciples in the applied sciences such as economics.

A third group, the normative philosophers, argued in line with the philosophy of the Reformators. Kierkegaard (1813-1855) argued that faith is something given by the grace of God and outside the sphere of human implication. Neither reason nor observation would be able to prove the existence of God; it is a matter of faith beyond human understanding. Dooyeweerd (1894-1977) also falls in this category. He argued that there are fundamental, inherent tensions in the philosophy of humanism (Dooyeweerd 1953, 1968). Neither the substance philosophers nor the process philosophers have succeeded in breaking through to a true **philosophy of everything**. The tensions in humanistic philosophy emerge from the religious roots of the humanistic thinking, whether it is a belief in understanding the character of reality of an unchanging physical world or a belief in understanding the character of reality of a dynamic physical world. Plato searched an understanding of reality (or truth) in reasoning about another world and its imitation of the city-state, the Stoics emphasised truth-values in the hedonism of the real world, Kant looked for truth-values in the individual, the state and the nation, while Hegel looked for these values in the state-organised nation (see Dengerink 1979:60 for references to Kant and Hegel). The tension between the scientific ideal of control, at least as old as the Greek philosophers and the Platonic city-state, and the ideal of personal freedom, is eminent in both broad streams of humanistic philosophical thought. Roszack (1974:18), a defender of humanism sketched the current situation vividly: *In the modern West, we have, during the past three centuries, run a dark, downhill course from an early morning humanism to a midnight humanism; from a humanism of celebration to a humanism of resignation.*

It can be concluded that different philosophical schools of thought have emphasised different aspects of reality. Although attempts have been made to integrate substance and process philosophy the yields are meagre. Normative philosophers exposed the fundamental tensions between these interpretations of reality and doubt whether an integrative philosophy on the character of reality will ever be achieved without reference to the will of a God beyond full human implication. This is an issue further discussed in the next driver of Western thought, namely religion.

2.2.2 Religion

Religion can be defined as belief in and worship of a superhuman controlling power, especially a God or gods (Pollard & Liebeck 1994:676). In distinguishing it from philosophy the character of reality is always perceived to be subject to belief and worship. Reality in itself is not the most important, but the norms that guide human implication of reality. Ancient animistic religions were dominated by myths that attempted to maintain the delicate balance between good and evil. As evident from many different gods representing the earth and its virtues, physical nature was perceived to be sacred (see Shelldrake 1994:3-24).

The Jewish religion, based on Mosaic laws, continued to exist in parallel to animism. The focus was throughout on serving and glorifying their God Yahweh. Everything, including the natural world, is subject to His will. The principles of Jewish religion did not become submerged in the new Greek philosophy, but served as the basis for the new religion of Christianity. Christianity spread quickly throughout the Greek world. Despite opposition it kept growing even to the point where Constantine the Great (ca. 274-337) declared it an official religion in his empire (Matson 1987:191). In medieval times Christianity was dominant through the Roman Catholic Church. This situation prevailed until the Reformation.

As discussed in section 2.2.1, the early church fathers were influenced by substantivist Platonic philosophy, and this eventually resulted in the formation of the Roman Catholic Church. According to Rescher (1996:154) in this religion it is characteristic that God is perceived as a being, or a substance of some sort. He is entirely external to the realm of change and process.

As opposed to the substantivist scholastic Christian theology, process theologists accord *God an active role also within the natural world's spatiotemporal frame* (Rescher 1996:155). In this view God is influencing, but never imposing, the world's process.

The Reformationists do not support these singular substantivist or processional interpretations of God. In the Reformation it was questioned whether the Roman Catholic Church really acted as a leaven on earth. The Reformation demanded a return to the Scripture as the sole authority. This christocentrism can still be found in current Protestant churches throughout the world. Through the Renaissance and

the Reformation the powerful, unchanging city of God of the Roman Catholic Church was gradually making room for accountability to God by the individual and the church in the first place.

Current Christianity counts many different church denominations. Although the emphasis on the character of reality as unchangeable things, structures and laws or changing processes, structures and laws differ considerably between these churches, it can be stated that most accept the existence of a God that is beyond full human implication. Any eternal absoluteness is outside the character of reality and humans cannot fully reason about it or observe it. Neither a substantivist nor processional theology alone would be able to describe the nature of God.

2.2.3 Science

The scientific interpretation of the character of reality differs considerably from the religious interpretation thereof, and has far-reaching impacts on how reality is understood and managed. Although there are references to scientific activities in earlier times, the real impact of science on Western thought came with the scientific revolution starting with the Renaissance. The discussion focuses on the following points:

- atomistic, reductionist and universal ways of thinking
- a belief in progress
- evolution and relativity theory
- systems and chaos theory

Firstly, atomism emerged at least as early as the early Greek philosopher Democritus (460-370 B.C.). He discarded animism and believed that the world consisted of atoms (Matson 1987). These changes in thinking vindicated the possibility of scientific inquiry. However, this atomistic approach to science was dormant in Western Europe during Medieval times and only restarted in the time of the Renaissance. It was argued that the earth moves around the sun (Copernicus (1473-1543)), and some laws of motion were developed (Galilei (1564-1642)); these laws of motion were applied to planetary movements (Kepler (1571-1630)) and also applied in the development of the universal law of gravity (Newton (1642-1727)). In short, this is called the Newtonian or first scientific revolution. It was thought that the world is governed through unbreakable laws or mechanisms and that every natural change could be calculated with mathematical precision (Gaarder 1997:192). It was a small step to the belief that human reasoning and general laws were able to explain the nature of physical reality – or the mechanistic world-view. In this world-view a very substantivist interpretation of reality is promulgated.

Secondly, the growth of science cannot be understood adequately without understanding the role of progress (Merton 1970:232). The developments in the religious sphere had a profound impact on the

idea of progress. The Renaissance did not only lead to a distinction between philosophy and theology, but also between philosophy and science. According to Petulla (1987:339), *…science came to be equated with the earlier philosophical understanding of reason in the project of controlling nature and the natural world for the benefit of humankind, but without a transcendent power.* The religious idea of progress was replaced by a horisontalistic interpretation of progress: no place for God and an absolute interpretation of what progress means (Klapwijk 1986). A belief in God was replaced by a belief in progress (Nijkamp & Douma 1974:88-89). The result was that reason and the idea of progress were not subjected to higher norms and values, but were left to the whim of individuals, nationalistic states and economic powers.

Thirdly, the second scientific revolution came when Darwin (1809-1982) developed his key ideas – struggle for existence, survival of the fittest, natural selection based on individual differences, and the evolution of species – based on the Malthusian (after Malthus (1766-1834)) thesis on population. Darwin's theory brought the processional interpretation of reality back into scientific thinking. After the Newtonian and Darwinistic scientific revolutions, Einstein's (1879-1955) general theory of relativity triggered a third revolution in scientific thought. His theory of relativity states that what is true for an observer in one system may not be true for an observer in another system if the two systems are in motion relative to one another (Oser 1970:441). In this case the universality of laws have been changed for contextual approaches.

Fourthly, recent scientific advances in physics, the *physics of the living systems, …describe processes that dynamics and the mechanistic causality principle cannot tackle adequately* (Dopfer 1988:675). Physics has experienced a long-standing conflict between classic dynamics and thermodynamics. The reversibility of physical properties is axiomatic to classic dynamics, while thermodynamics insists on energy changing states irreversibly through time (Prigogine & Stengers 1984). This critical questioning of scientific determinism can be loosely bounded together under the term **dynamical systems theory** (Capra 1997). Chaos theory is an important branch of dynamical systems theory (Stewart 1990). In chaos theory scientific thinking is swung around from reductionism to macroscopic, real-time phenomena (Atkinson 1991:145). This enabled a new thinking on the questions of time and space and reopened the debate between science and philosophy (Atkinson 1991:147). The emphasis is away from the mechanistic, Newtonian approach to one where the world is perceived as an integrated, organistic, open system. Some developments in systems theory, however, only take account of increased complexity and not necessarily of the changing realities of the world. Cybernetics, for example, is an extension rather than a substitution of the mechanistic theory (Germain 1981; Schuurman 1996:26-27). These developments in science do not have that much impact to justify referring to a paradigm shift, but neither of an insignificant growth at the edge of our intellectual culture (Atkinson 1991:148). The important implication of this scientific revolution is that the search for unchangeable substances is virtually impossible – **the world is changing, even at the most fundamental realities**.

In a philosophical investigation of systems thinking and its implications for culture in the normative tradition of Calvin and Kierkegaard, Strijbos (1988) emphasised that systems thinking is also subject to a norm beyond human implication. Systems thinkers do recognise the complexities in the real world and either place these more complex problems within a substantivist or within a processional framework. Cybernetics is an example of the former and general dynamic systems theory an example of the latter (Germain 1981). However, the humanism of systems thinking is often cosmocentric as opposed to an anthropocentric humanism of more mechanistic approaches (Strijbos 1988:127). Although vastly different in approach, both cosmocentric and anthropocentric humanism have in common that a God beyond human implication, as argued by normative philosophers, is not accepted.

2.3 IMPLICATIONS FOR PRESERVATION

The following question relevant for this thesis is what the implications of the philosophical, religious and scientific interpretations of reality are for the preservation of the natural environment. The word preservation is, however, ambiguous. It is defined as keeping something in an unchanged condition (Pollard & Liebeck 1994:630). This definition reflects a substantivist interpretation of reality. For the purpose of this thesis the term preservation is used, but with a caveat, namely that preservation could also include processional elements. Another point is that conditions are not just left unchanged for the sake of it. There must be some appeal to a normative value as to why things (or processes) should be kept the way they are. The key to understanding the attitude of philosophy, religion and science to preservation is: which values underlie the reason(s) why the natural environment should be preserved.

Early animists considered nature to be sacred, but not in the sense of preserving it. The purpose was not to disturb the cosmic balance. Nevertheless, this natural sacredness did not prevent earlier civilisations falling prey to acts of environmental exploitation and deforestation (Nijkamp & Douma 1974:12-13).

In some philosophical works it is argued that Western philosophy, influenced by a Greek rationalistic philosophy, discouraged the emergence of preservationist attitudes, thereby necessitating a new environmental ethic which ought to profoundly change Western philosophy (Hargrove 1989). As pointed out by Hargrove, first, the Greek emphasis on reason brought tension with an inquiry into the natural world that requires observation and experimentation. Second, an aesthetic appreciation of the natural world was discouraged and third, Greek philosophers promoted a conception of reality that made natural preservation difficult or even impossible. The implied linear causation between Greek philosophy and modern Western philosophy is simplistic and therefore it is worthwhile to evaluate the thoughts of Greek philosophers on the environment in more detail.

Plato's dualism (427-347 B.C.) discouraged an inquiry into the world of aesthetics and experience. The natural world was simply shadows of eternal forms and could not be preserved or protected, primarily

because it is not timelessly true. Plato's perception of reality did not leave room for the preservation of nature, because substance in another world – only to be perceived by reason – is the timeless truth. Aristotle (384-322 B.C.), however, did recognise the need for observation in biology and geology, but he had no particular interest in the protection of nature. He believed that in nature all animals were made for the sake of man, but that natural entities have an in-built purpose, a **teleology**, which needs no specific human concern (Attfield 1994:79; Glacken 1967:43).

Although these Greek philosophers' attitude is a stance of neutrality to or even ignorance regarding the natural world, Attfield (1994:77-87) pointed out that Hargrove's viewpoint placed too much emphasis on the legacies of Greek philosophers that focused on the fixed premises of rationality and thought. Other viewpoints, such as the early process philosophers, accepted the changing realities of the created world. The Stoic mindset was manifested in an appreciation of natural beauty (Attfield 1994:80) and emphasised the idea that human beings are caretakers of this world (Petulla 1987:338). However, to them the reason for preservation was ultimately hedonistic.

Process philosophers regard nature's micro-processes as part of a broader macro-process which encompasses creative innovation, productive dynamism, and an emergent development of richer, more complex and sophisticated forms of natural existence (Rescher 1996:101). In such a philosophy it would be difficult to defend the preservation of **things**; it would rather preserve a process that leads to such higher states of nature. The point is that change is given and interpreted as the norm against which any preservation should be measured. The reason for preservation is ultimately one of sustaining the teleological process, which in practice leads to a pragmatic approach to the preservation of nature[8].

Since the Stoics had already discarded the Platonic philosophy by accepting the reality of the natural world, Christian dogma continued to frame it around an ethical framework of enhancing beauty for the sake of God's glory. The application of Christian stewardship has attracted numerous contributions (Nijkamp & Douma 1974; Goudswaard 1997, 1982; Badke 1984; Wilkinson 1980). Wilkinson (1980:233) attempted an interpretation of stewardship: *If God is owner over all and human dominion is clearly delegated, then it is also clear that the steward is both a servant and a manager. Thus God's steward over nature is to be a manager over of the earth's household: rock, water, air, tree, bird, and beast, in the infinite complexity of their interrelationships. This human management or stewardship must be directed to benefit the household of the earth and the creatures who depend on it for life, health, and fulfilment. Thus the manager of the earth…is often called upon to balance conflicting needs. The stewards of nature…establish priorities, smooth out conflict. In short, they must manage for the welfare of the creation and the glory of God.* This definition makes clear that despite being critical to the philosophical tools at his/her disposal, a steward is not exempted from taking a fatalistic attitude to an issue such as the preservation of nature.

However, it is often argued that Christianity is responsible, or partly responsible, for our present day ecological crisis (White 1967; Toynbee & Ikeda 1976). The critique usually focuses on the presumed Christian axiom that nature has no reason for existence except to serve man. It is then argued that the development of science and technology, to a considerable degree an offshoot of Christian beliefs and attitudes, was in line with the Christian belief in the dominion of humanity over nature. Yet, some environmental philosophers and historians point out that it is a mistake to trace despotic attitudes to the Biblical book of Genesis (Clark 1994; Passmore 1980). God's command was to tend the garden, not to exploit it and God never gave humans absolute power to do as they please. Another point is that modern science was born out of a rejection of Christian values and that societies with no Judeo-Christian traditions are also abusing nature (Badke 1991:29). As pointed out by Attfield (1994:16), the metaphor of dominion would have conveyed the idea of still being answerable to God, rather than the absence of moral constraints. This point was re-emphasised during the Reformation: Stewardship (of nature) is an act of faith and an obligation to God (Nijkamp & Douma 1974).

What does the Christian interpretation of stewardship mean in practice? Christians greatly influenced the development of science and technology on the basis of the belief to exercise dominion over God's works to God's glory (Attfield 1994:14). However, by the very nature of Christianity, this does not encourage a despotic attitude to nature. A consequent application of stewardship might lead to a wiser deployment of science and technology, and to a more sustainable relationship with nature (Badke 1991; Attfield 1994:18). Therefore, to blame Christian dominion as a root of present ecological crisis is a misunderstanding of the meaning of Christian stewardship. Post-Reformation Christianity played a major role in work ethics to glorify God's works and an acceptance of trade and interest. Although exploitation is often the practical result of ambiguous Christian behaviour (Santmire 1985), this is not the deeper message brought forward through the Scripture or the Reformation.

Science did not provide a preservationist attitude either. Although the reality of the physical world is accepted, it is perceived as a source of analysis rather than as an object for preservation. The scientific ideal of control, coupled with the ability of technological advancement and the economic incentive of more production and consumption, often leads to exploitative behaviour. The scientific belief in progress has led to a partial interpretation of reality. This secular interpretation of reality drove natural and social sciences to the possible abyss of exploitation of natural and environmental resources.

In summary, neither Western philosophy, nor science embodies a preservationist attitude to the natural environment by definition. Ambiguous Christian behaviour could also be exploitative in character, but the deeper message of stewardship of God's earth embodies the concept of a prudent management of nature.

[8] The reader is referred to Rescher (1996) for a discussion of pragmatism in process philosophy.

2.4 SUBSTANCE, PROCESS AND ECONOMIC THOUGHT

The perception of the character of reality and therefore of nature has had a profound impact in the development of economic thought. The substance philosophers' search for timeless truths in the physical world was key to the development of science and most of modern philosophy. Scholastic philosophy, as a part of substance philosophy, brought Roman Catholic religion into economic thinking. However, despite the dominance of substance philosophy in the development of economic thought, both process philosophers and normative philosophers have influenced certain strands of economic thinking.

The influence of religion on the development of economic thought declined since the times of the Roman Catholic Church. The Schoolmen in the thirteenth and fourteenth century played a major role with their insights and also later through reinterpretation by some thinkers in the Renaissance period (Pribram 1983:3). Economic views in the early Middle Ages were more theological than economic in its own right. As discussed in the previous section, the most influential of the Schoolmen was St. Thomas of Aquinas. The dualism of Thomistic reasoning led to an acceptance of the natural truths, but also their subordinance to moral standards. Religion was seen as the first cause of all natural activities. Economic activities have to be tested against their justness; the concept of a just price comes from Thomistic economics. Values were embedded in a set of higher ethical standards. The real controversy was whether the cost of the producer or the utility for the consumer was the true source of value (Hobson 1931:12). Labour as a factor of production was good in itself; Jesus and his Apostles spoke of toil with pride. Value was only embedded in labour if labour was just. Early Christians and also the Schoolmen condemned the taking of interest. The outcome was that the Roman Catholic Church regulated economic life, claiming a mandate to see to the principle of **justum pretium**, or fair dealing. However, in retrospect, the Roman Catholic Church failed in this mission: *It did little to curb the greed and rapacity of the strong* (Hobson 1931:20).

The individualism accompanying both the Renaissance and the Reformation brought a more favourable environment for the rise of market economies (Fellner 1960:29). The Renaissance emphasised the absolute freedom of the individual while the Reformation taught an individual freedom from the Catholic Church, but with a personal responsibility to God. The reformers taught that one can trade and claim interest, but within Biblical norms. Tawney (1926:105) claimed that the Protestant faith is perhaps the first systematic body of religious teaching, which can be said to recognise and applaud the economic virtues. To paraphrase Galbraith (1991:38): *even merchants were not denied access to heaven.*

With the rise of the nation states this individualism became largely submerged in nationalism, an important cornerstone of mercantilist economies (Oser 1970:10). This rise of mercantilism saw a gradual break with the ethical attitudes of Thomistic economics (Galbraith 1991:37) and in its later stages with the ethical foundations of Protestantism – against the intentions of the reformers. In fact, to paraphrase

Hobson (1931:29): *Mammon…was taken into the service of God as a junior partner.* The further development of capitalism, mainly influenced by the philosophy of positivism, was not necessarily the offspring of Puritanism (Tawney 1926:226), but it did gain new momentum through the Renaissance and the Reformation.

The influence of religion on economic thought declined with the rise of science as well. The atomistic, reductionistic approach to scientific inquiry led to the formulation of basic axioms. In economic science the individual is referred to as the smallest unit of enquiry (Dow 1996:88). The scientific emphasis on the universality of laws governing reality also influenced economic thinking. The Physiocrats believed in the natural order. Quesnay (1694-1774), one of the founding fathers of the Physiocrats, compared the laws of geometry to the laws governing human associations (Gide & Rist 1915:53).

This Physiocratic perception of reality did not go unchallenged. Although Sismondi (1773-1842) agreed that physical reality should be the starting point of economics, he stated that this should be tested against experience, history and observation. He opened the door for including processional elements of reality in economic thought.

This is broadly in line with the development of post-Kantian philosophy in two schools of thought: substantialist positivistic rationalism and processional historical dynamics. Economic thought developed roughly according to these two schools of thought as well.

Although the belief in the permanence and universality of natural laws was challenged within the substantialist school (see the works of Mill (1806-1874)), a rational positivist revival in the twentieth century interwar years prohibited any further major influence. Positivistic rationalism became the basis of modern mainstream economic thinking. The early twentieth century revival in economic positivism through the works of Walras (1834-1910), Jevons (1835 - 1882) and Menger (1840-1921), were all based on a mechanistic and reductionistic world-view governed by economic laws (Pribram 1983:277-291). The work of the rational positivist Vienna Circle was classic-scientific and anti-metaphysical in thought, and yielded the verification principle. This means that all statements are either analytic or synthetic – either true by virtue of the definition of their own terms, or true, if true at all, by virtue of practical experience – and then the Vienna Circle pronounced that all synthetic statements are meaningful if and only if they are capable, at least in principle, of being empirically verified (Blaug 1992:12). Reason and, by preference, experience became the only valid norms to search for truth in reality. This school developed into various branches of modern conventional economics, among them the neoclassical school, marginalism, mathematical economics, monetarism, Keynesian economics and welfare economics. The key ideas of these different schools are well documented in the literature on economic history and economic systems (Oser 1970; Pribram 1983).

The rational positivist approach to economic thought relies on a methodology that is derived from classical Newtonian physics. This positivistic approach to economics left little incentive for philosophical and methodological inquiry (Boland 1982). Currently, the subject methodology is often seen as a luxury science or specialist topic (Dow 1996:xiii; Boland 1982). However, there are important differences between social and physical sciences that raise the possibility of diverse methods for these different disciplines. The differences between economics and the physical sciences are elucidated in Table 2.3.

Table 2.3 Methodological differences between economic and physical sciences

	Economic sciences	Physical sciences
Sources of observation	No isolated experimental work. The real world hampers/rules out the development of basic axioms.	Isolated experiments conducive to the formulation of general laws.
Significance of historical context	Subject matter changes. Historical context in which theories are tested changes. Examples are changing economic institutions and behaviour.	Subject matter does not change historically. The laws of physics are in a better position to resist the *test of time.*
Human will and purposefulness (teleology)	Complex purposeful human behaviour makes it very difficult/impossible to define a universal *rational economic man*	Physical objects do not have an own free will and are passive.
The *verstehen* principle	The economist has the capacity to have knowledge of human behaviour through introspection. This would enhance knowledge on individual behaviour, but is not universally applicable due to the uniqueness of every individual.	Physical scientist could not have an innate understanding of subject-matter in any comparable way. This situation is known as *the problem of induction.*

Source: Based on Dow (1996:38-40)

It is apparent that economic sciences do not have the luxury of fixed basic axioms and can only be exercised within the realities of changing institutions and individual human behaviour. However, the different schools of thought in economics are almost always judged by their adherence to the standards of the positivistic methodology. Boland (1982:190) sums up the situation very clearly: *...if anyone wishes to be 'scientific', he or she must imitate the methods of physics or some other 'hard' science. It is as if physicists had a monopoly in clear thinking.* With reference to Table 2.3, the results of economic experiments are applied as if conducted in an isolated environment; the historical context in which they are conducted is ignored and human behaviour is reduced to rationality.

In contrast, the historical dynamic approach interprets reality first and foremost as a process. The processional historical dynamic school developed in parallel to substantivist positivistic rationalism. The most important contribution came from Hegel whose dialectics was also applied to economic theorising. The **historical school** argued that fixed universal laws are not possible. The reasons are: first, positivistic economic laws are no absolute revelation. Secondly, self-interest and gain are narrow and insufficient motives to build economic theory on. The motives are varied: a sense of beauty, vanity, pity et cetera. Thirdly, the reliance on the deductive method in a world driven by a multiplicity of motives would result in a mere caricature of reality (Gide & Rist 1915:895). Modern old institutional economists and evolutionary economists are influenced by this historical dynamic approach to economics and emphasise the changing realities of the real world.

This historical, deductive method influenced the naturalistic current that took shape in the middle of the 19th century. Marx (1818-83), Darwin (1809-82), and Freud (1856-1939) all accepted no other reality than nature and the sensory world for the development of their theories. According to Oser (1970), two strands of economic thought could be related to the naturalistic current and more specifically the Darwinian revolution: the evolutionary approach to economics and social Darwinism – the latter virtually ended by the time of World War I. The evolutionary approach was incorporated in the thinking of Marxism, the German historical school and the old institutional school.

It was argued in section 2.2 above that the distinction between substance and process has been inherent in the history of philosophy, religion and science. Following on the distinction between rational positivism and historical dynamics one can also make such a distinction in economics. Substance economics is building on the rational positivist mode of thought and process economics on the historical dynamic mode of thought (see Atkinson 1991:43). Dow (1996:13-19) provides a useful breakdown of the terms contained in these two approaches to economics, describing substance economics as the Cartesian/Euclidian mode of thinking, and process economics as the Stoic/Roman mode of thinking (see Table 2.4 for a distinction between substance and process economics).

Table 2.4 Substance and process economics

Substance economics	Process economics
Closed Systems – A closed system is one whose bounds are known and whose variables and relations are known, or can be known. Reality is captured in natural laws. Relations are determined, lending itself to formalism. Positivistic economic theory, such as manifested in general equilibrium theory, is a good example of a closed theoretical system.	Open Systems – An open system is one where the boundaries of the system are not known or able to be known. Not all variables and relationships are known or can be known. Reality leaves scope for an indeterminate evolution of behaviour and institutions. Regularities, rather than laws, are used as a starting point for knowledge. For the purpose of analysis, an open system can be fragmented into partial subsystems, each treated as a closed system, but always in relation to influences from other parts of the overall system. Segmentation according to disciplinary lines is possible, but requires openness towards other disciplines.
Atomism – In earlier physics atoms were perceived to be the smallest physical units to be identified. In positivistic economics this reductionist mode of thought led to the formulation of basic axioms, referring to the smallest unit of enquiry: the individual.	Organicism – The rejection of universal axioms, exchanged for complex interdependencies not amendable to formalisation, is known as organicism. A chosen analysis is not universally applicable. It depends on the environment in which this analysis is done. Different theories are different perceptions of how the system works. The binding factor in this holistic mode of thought is a perception about how the system as a whole works. Absolute causal relationships in economic theory are impossible; the probability can only be increased by a persistence of events in a changing economic structure.
Dualism – Dualism means to classify concepts, statements or events according to all-encompassing, mutually exclusive categories with fixed meanings. The elimination of error is central to this mode of thinking. The trade-off principle in positivistic economics is an exponent of dualism.	Non-dualism – A non-dualistic way of thinking presupposes that any chain of reasoning has its shortcomings when applied to reality. This approach does not concentrate on the elimination of error, but on dealing with error that is the result of uncertain knowledge. Central is the ability to deal with a wide range of practical problems.
Certainty – Uncertainty is regarded as something quantifiable by means of probability distributions. Probabilities and expectations are granted a present value. More information will reduce uncertainty. All knowledge is certain, or at least certainty-equivalent.	Uncertainty – Reality is too complex to yield much certain knowledge. Uncertainty exists in different degrees that are unquantifiable. In order to make judgements under uncertainty, conventions are needed to choose between theory and action. The influence of expectations implies a move outside the formally exact realm. Knowledge is uncertain; the challenge is to make the best of it.

Source: Based on Dow (1996:13-19)

In Table 2.4 it is clear that substance economics emphasises that truth in reality lies in fixed theories and models achieved through reason and observation. Errors should be eliminated as far as possible. Reality is inherently certain – the challenge is to discover those certainties. Process economists emphasise that the best approximation of the truth lies in accepting the indeterminate changing of the real world, but may also be achieved through reason and observation. Errors are part of reality, but should be dealt with in the best way possible. Reality is inherently uncertain, the challenge is to make the best of it within this uncertainty.

It was shown that both substance philosophy and process philosophy have had an impact on economic thought, with the former playing a dominant role. The question that remains is whether (and how) normative philosophy has influenced economic thought. Economics as based on normative philosophy is not included in Table 2.4, but the qualification that neither substance nor process economics have a monopoly on timeless or unchanging truths is maintained. Given the normative philosophy that reality includes a God that cannot be implicated by either human reasoning or observation, it is not surprising that such thinking had little impact on the further development of economic thought, since reason and observation are the cornerstones for both substance and process philosophies. However, the thinking of 15th and 16th century Reformationists and the modern movement in Reformational philosophy have laid the basis for an economic thinking that includes this broader interpretation of reality. Goudzwaard (1997:6) puts it vividly (freely translated from Afrikaans): *The world-view that economists have created for themselves became stronger than the argument with which to appeal to reality. The existing economic model closes the world, independent of any external value-judgements. This offers the (economic) scientist a security that he will find in no other world-view.* According to Goudzwaard, this has led to an absolute, non-contextual interpretation of progress and economic happiness and has brought economic exploitation to the abyss of potential global unsustainability. The perceptions of reality led to materialism and exploitation, unguided by ethical foundations such as stewardship. A more comprehensive exposition of this work is beyond the scope of this thesis. The important point is that any further discussion on substance or process philosophy and its implications for economic thought is subject to an interpretation of normative philosophy on economics.

2.5 CHANGING ECONOMIC THINKING AND PRESERVATION

In this section a few key points are raised on economic science and its relation to the natural environment. One can observe a tendency away from purely substance economics, to aspects of process economics also being included in questions related to the natural environment.

An emphasis on process has been embodied in various schools of thought such as institutional economics, post-Keynesian economics, Marxist economics, the Austrian school of economics and evolutionary economics. The theory of open systems has started to impact on economic thought

recently. The Santa Fe Institute in the US are applying systems concepts to economic problems (Arthur, Durlauf & Lane 1997). Systems thinking have already entered the fray on economic analysis in various applications (Arthur 1989; Ormerod 1994; Baumol & Benhabib 1989; Yanagihara & Sambommatsu 1997). The emphasis on an open systems approach in the natural sciences poses many opportunities for the use of systems approaches to the linking of economic analysis and the natural environment.

Positivistic economics, the most influential school of economic thought that can be classified under substance economics, accepts the scientific objectivity – or the ethical neutrality – of economics (Bromley 1991:207). Positivistic economics was seen as being synonymous with scientific objectivity (what is or what might be) and normative economics as connoting value-laden arguments (what ought to be). According to Blaug (1992:112), one can best think of this as a distinction between *scientific* economics and practical advice on economic policy. Inspired by the philosopher David Hume (1711-76), the perception that there is a watertight distinction between the realm of facts and the realm of values was born and further developed within positivistic economics.

Blaug (1992, 1980) and Caldwell (1982) come to the conclusion that economics cannot claim to be scientifically objective and ethically neutral. Ward (1972) argues *that economics is basically a normative science adorning itself with the fig leaf of hard-headed positivism* (as quoted in Blaug 1992:238). Positivistic economics became divorced from value-judgements and too many values were treated as basic or were simply ignored (Sen 1970). There is no real value-free social science. Economy is partly ideology, and a separation of the positive from the normative in developing economic theory is impossible.

The policy implications of such a methodological statement are significant (Bromley 1991:212). The positivistic policy research programme in economics has concentrated on an apparently value-free way of participating in the policy debate. The resulting new welfare economics, with efficiency as evidence of scientific objectivity, however, is controversial. Blaug (1980:147-8) concluded that *the concept of Pareto optimality … should not be confused with theorems of positive economics…immense confusion has been sown on matters of "efficiency" without committing ourselves to any value judgements.* The search in welfare economics for a fixed order for the collective choice process is frustrated by the complexity of policy making. Bromley (1991:217) describes this search for a fixed order as reductionistic decision rules. According to Bromley (1991:217), the persistent debate on the appropriate welfare criterion and on the Boadway paradox, in which the ability of the gainers to compensate the losers does not lead to an unambiguous improvement in social welfare (Boadway 1974), is testimony to this complexity[9]. Efficiency on the policy level is a value-laden concept in itself. This change in economic thinking, especially on the level of policy making, forces a recognition of the complexities in the collective choice process.

[9] Kaldor (1939), Hicks (1939), Scitovsky (1941) and Mishan (1971) contributed to the discussion of appropriate welfare criteria.

One can also observe a change in economic thinking on the natural environment. The environmental crises brought on the one hand a search to absorb the natural environment into substance economics, and on the other to think about new ways of doing economics. Five aspects of this change in economic thinking can be distinguished:

- A transformation of conventional economics from within, which Allison (1991) describes as the replacing of narrow utilitarianism with a broad utilitarianism[10]. In the latter case not only economic values have to be weighted in the decision-making process. In the 1960s this mode of thinking led to the development of environmental economics. The central idea was to monetarise non-economic values (i.e. internalise externalities) in a more comprehensive decision-making framework. In the 1980s and early 1990s ecological economics came to the fore, accepting the notion that biophysical constraints are an essential part of economic enquiry. In this mode of thought the character of reality is still perceived to be primarily substantative, but it was extended to include the natural environment. However, it must be noted that the field of ecological economics is developing rapidly into several directions, many of them including more dynamic aspects of reality (Faber, Manstetten & Proops 1996). In this thesis, however, these aspects of ecological economics will be discussed under the evolutionary approaches to economics, as noted in the next point.
- The appreciation of change through evolutionary approaches to economics. The environment is perceived as being part of a dynamic world. The internalisation of the environment has only recently started to take place in the subject field of evolutionary economics.
- A christocentric moral/ethical critique on the anthropocentric belief in progress and the accompanying exploitative nature of economic society. An internalisation of both processional and substantive elements in an economic model might enhance decision making, but would still be lacking an embedment in higher norms and values of christocentric stewardship (Nijkamp & Douma 1974; Goudzwaard 1997).
- A cosmocentric moral/ethical critique on the anthropocentric belief in progress and the exploitative nature of economic society, with an emphasis on a cosmocentric care for a mother nature (Capra 1984; Lovelock 1979).
- A radical break with the conventional way of thought, including economics, is associated with leftist green and political movements (Atkinson 1991).

This thesis is limited to an evaluation of economic theories on policy making for sustainable development. Both elements from substance and process economics will be elaborated upon, as it is

[10] Utilitarianism is defined as the doctrine that actions are right if they benefit or are useful to most people (Pollard & Liebeck 1994:884).

argued that the character of reality includes at least aspects of both. The moral/ethical critiques and a radical break with economics are issues not considered in this thesis.

There are strong reasons to keep the neoclassical economic tradition in place (Galbraith 1991:284-287). However, this does not mean that it is not worth exploring beyond the traditional boundaries of economic theory. In contrast, when reality is asking for solutions outside the realm of neoclassical thinking, there might be no other option. To paraphrase Galbraith (1991:286-87): *In assessing the future of economics, no one will wisely discount the service and therewith the durability of the classical-neoclassical tradition. Its influence is not, however, plenary nor will it be in the future. Reality also has its claims on thought, a persisting, obtrusive presence that commends itself by its practical relevance and, to some, by its very inconvenience.*

2.6 CONCLUSIONS

Modern economic thought and its relationship to the environment are most influenced by substance philosophy and the methods of classical science. It has been pointed out that substance is only one aspect of reality. Normative philosophy, process philosophy, and new revolutions in physics, such as relativity theory, quantum theory and chaos theory, are pointing towards normative and processional aspects of reality that have received little attention in the development of mainstream economic thought. Therefore, the atomistic and mechanistic approach of classical science, and its application to economic methodology, are lacking. Reality does not only consist of substance, but also of processes. However, the question whether either substance or process, or some kind of integrated approach would lead to better science, better economics or better ways to come up with solutions to issues such as policy making for sustainable development, cannot be answered. The approach that will be followed here is to include both these aspects of reality in an evaluation of economic theories on the environment.

Neither substance nor process philosophy has a clear preservationist attitude to nature. Substance philosophy often has a neutral or even ignorant attitude to nature. Although the reality of change in nature is accepted in process philosophy, it cannot be said that it is necessarily preservationist. Normative philosophy highlights the importance of stewardship, an issue often compromised in practice. Science does not have a preservationist attitude to nature either, as nature is primarily seen as a source of analysis.

The historical development of economic thought does not point to an adequate framework for policy making on sustainable development. Policy making for sustainable development should at least include various interpretations of reality, values and norms external to economic science, and the realisation that neither philosophy nor science embodies a preservationist attitude to the natural environment per definition. Due to fundamental tensions between the philosophies underlying economic theories on the environment, a unified approach to policy making is likely to encounter many difficulties.