Performativity and pluralities of biodiversity offsetting experiments: Towards a synthesis of economy as instituted process and economy as performativity

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Acronyms

ANT	Actor-network Theory
BAP	Biodiversity Action Plan
BBOP	Business and Biodiversity Offsetting Programme
BFAD	Bundersverband der Flächenagenturen fordert Qualitätsstandards für Flächenpools – (Federation of Area-Agencies for Quality Standards in Surface Pools)
CWA	Clean Water Act
DDM	Dialectic Double Movement
DEFRA	Department for Environment, Food and Rural Affairs
EC	European Commission
EIA	Environmental Impact Assessment
EM	Ecosystems Marketplace
EMTF	Ecosystem Markets Task Force
EPA	Environmental Protection Agency
ESA	Endangered Species Act
EU	European Union
EU-ETS	European Union's European Trading Scheme
GIS	Geographic Information Systems
ICMM	International Council on Mining and Metals
IEP	Instituted Economic Process
IEEP	Institute for European Environmental Policy
IMR	Impact Mitigation Regulation
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
ITQ	Individual Transferable Quotas
MEA	Millennium Ecosystem Assessment
NGO	Non-Governmental Organisation
NMBA	National Mitigation Bankers Association
NNL	No Net Loss of Biodiversity
PES	Payments for Ecosystem Services
SSF	Social Studies of Finance
STS	Science and Technology Studies
TEEB	The Economics of Ecosystems and Biodiversity
TNC	Transnational corporation
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNEP-FI	United Nations Environmental Programme – Finance Initiative
UNEP-WCMC	United Nations Environmental Programme – World Conservation Monitoring Programme
USA	United States of America
US-ACE	United States - Army Corps of Engineers
US-FWS	United States - Fish and Wildlife Service
WTA	Willingness to accept
WTP	Willingness to pay
WWF	World Wildlife Fund

Abstract

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Development and land use change diminish the quantity of natural habitat, impacting negatively on the number of animal and plant species – biodiversity. Concern about the consequences of these losses has led to calls for mechanisms which allow development to proceed only when *no net loss of biodiversity* can be assured, such as biodiversity offsets. Markets for biodiversity offsets are being tried as mechanisms for achieving this societal objective in the most efficient manner possible.

Theoretically, this thesis develops a framework connecting the Polanyi-inspired notion of the economy as an instituted process, and concepts developed by Callon and colleagues in the Social Studies of Finance literature. This framework is used to analyse the emergence, development and expansion of markets for biodiversity offsets. Using qualitative methodologies, the research examines in detail three existent biodiversity offset markets: Species Banking (United States), Impact Mitigation Regulations (Germany) and Biodiversity Offsets (England).

The emergence of markets for biodiversity offsets is shown to be the result of performativity of economics. Changing representations of biodiversity, anchored on economic sciences, lead to policies which create economic experiments, such as markets for biodiversity offsets. Because these markets are historical and geographically contingent, the economic experiments emerge in the context of pre-existing regulations and traditions, resulting in variety of forms of organising biodiversity offset markets. To bring biodiversity to the market involves measuring and quantifying externalities. This requires the creation and development of market *agencements* – assemblages of agents and market devices – to commodify biodiversity. These *agencements* constitute the technical infrastructures upon which the markets are built, but they too are contingent of pre-market practice. This creates tensions between the role of agents and the role of devices inside the market infrastructure. Biodiversity offsets are shown to not maintain their commodity status beyond certain geographical and geopolitical boundaries. The result is the creation of mutually exclusive market nodes, between which no trade takes place. Despite common origins and infrastructures, the local markets do not exchange between themselves.

This thesis contributes a framework for the analysis of market emergence, in which two literatures are used to complement each other's limitations. As a result, the thesis is able to conceptualise how a common generative mechanism results in variety of economic organisation. It also demonstrates that it is possible for markets to share a regulatory and technical infrastructure, but not exchange between themselves and expand.

Declaration

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Dedication

For my mother, father and sister, without whom this thesis would not have been possible; and for Jenny, without whom it would not have been worth it.

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1. Introduction

1.1. A new form, or forms, of governing nature?

In January 2012, the Business and Biodiversity Offsets Programme (BBOP)[1] released its Standard on Biodiversity Offsets (BBOP, 2012c). Designated "The Standard" in the group's own parlance, it is the result of almost eight years of work by the Programme, including several pilot biodiversity[2] offsetting schemes in different locations all over the world. Biodiversity offsets are defined as "…measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development" (BBOP, 2012c, p. 14). In other words, they are mechanisms to provide compensation for impacts over biodiversity which result from land use change, such as building projects. Biodiversity offsets are currently in widespread use around the world. The Standard suggests a set of principles for biodiversity offsetting, designed to guide all biodiversity offsets worldwide.

Very little of The Standard is new; certainly the concept of compensating for losses to biodiversity resulting from land development and land use change has a long history. In many ways, biodiversity offsetting is a feature of modern environmentalism, with the earliest experiments (in Germany and Brazil, and later in the United States) dating from the 1970s. All over the world, the advent of planning regulations has made land development conditional of impact mitigation measures and, in some cases, of actual compensation being provided. In other words, biodiversity offsets are historical and geographical contingent; they have been developing in different places and at different times. The key feature added by the BBOP in its early proposals (ICMM, 2005a, 2005b; ten Kate, Bishop, & Bayon, 2004; ten Kate & Inbar, 2008), and reinforced in The Standard, is the idea that biodiversity offsets should always result in demonstrable *no net loss of biodiversity* from development. This apparently simple requirement encapsulates a set of normative, technical and representational principles, the strength of which is to provide a clear objective for offsetting, and ultimately serve as guidance for action in the field of environmental conservation. Through the principle of *no net loss of biodiversity*, biodiversity offsets institute and make coherent a clear view about the place of biodiversity in the context of the economy and society. In particular, they raise the prospect that it may be possible to have continued development, and the associated economic gains, without losing parts of nature as a consequence. Furthermore, markets for biodiversity offsets are now in operation in a number of

[1] The BBOP are the most important transnational network of academics and corporations, working to promote the concept of biodiversity offsetting. The role and the work of the BBOP is discussed at several points in this thesis, especially in chapters 3, 5 and 6.

[2] A clear discussion of what biodiversity consists of is beyond the scope of this introduction. The topic is reprised in chapter 3.

countries[3], in which those companies responsible for impacts over biodiversity can acquire certified biodiversity offsets from third parties. These markets promise to add economic efficiency to the conservation gains from biodiversity offsetting, raising the prospect that *no net loss of biodiversity* may be achieved more quickly and at a lower cost than otherwise possible.

This thesis analyses the emergence, development and expansion of markets for biodiversity offsets. It identifies a mechanism behind the creation of these markets, which explains why the number of markets for biodiversity offsets has been increasing for some time now. At the same time, it takes into account the observation that existing markets for biodiversity offsets are varied in their organisation and functioning (Madsen, Carroll, & Moore Brands, 2010), and explains how a single generative mechanism can result in such variety. In exploring this issue, this thesis also demonstrates the importance of the mechanisms for measuring and commodifying biodiversity. Scientific and technical developments produce a market infrastructure which underpins the development of these markets. However, a number of tensions within this scientific and technical infrastructure are also identified, which impact how the markets organise and operate. And finally, the thesis examines the potential for expansion of markets for biodiversity offsets, and identifies some of the sources of resistance against that expansion. In doing so, it makes the point that many of the problems faced by biodiversity offset markets are not economic, but representational and political. Four research questions are posed: What is the background to the emergence of markets for biodiversity offsetting? How are the exchanges being organised? What are the mechanisms by which biodiversity is being brought to the market? What are the limits to expansion of markets for biodiversity offsets?

1.2. Theoretical framework

In order to address these questions, the thesis presents a research framework which contemplates both the role of agents and technologies, and the institutional, historical and geographical aspects of the processes involved. This thesis is based on two distinctive literatures, both of which seek to research economic processes from a substantive position; their objective is to analyse the economy as it is, and not to describe it as a formal model. These two literatures are the Science and Technology Studies-derived Social Studies of Finance (STS-SSF), a field of economic sociology; and the Instituted Economic Process (IEP) approach, which is inspired by the work of Karl Polanyi. The literature on STS-SSF focuses on the actions of agents and on the materiality – the devices and calculative agencies – which are involved in the emergence of markets (D. MacKenzie, 2009b). Following the research of Michel

[3] These are detailed in chapter 3.

Callon, it starts from the insight that the *homo economicus* of neoclassical economic theory can exist in reality, but that he is a constructed agent (Callon, 1998b). In Callon's opinion, economics is not only a descriptive science, but it is performative (Callon, 1998b, 2007; D. MacKenzie, Muniesa, & Siu, 2007; Muniesa & Callon, 2007). Agents act to create the calculative spaces on which they can operate as rational utility maximisers: markets. Markets are thus social constructions, the result of performativity of economics and normative beliefs about the benefits that can be reaped from their operation (Garcia-Perpet, 2007); for example, there are now examples of market mechanisms designed to civilise the market, responding to societal worries about the worst impacts of capitalism forms of economic organisation (Callon, 2009). As a research framework, STS-SSF has the distinctive advantage of suggesting a clear generative mechanism, a causal path for the emergence of markets. The STS-SSF framework also provides a lens to study the technical infrastructure of markets. Specifically, the work of Muniesa, Millo and Callon in identifying the market *agencements* – technical devices and calculative agencies combined – which underpin the exchange and allow agents to calculate outcomes and make options in terms of the states of the world they prefer (Muniesa, Millo, & Callon, 2007). These socio-technical parts of the market infrastructure are fundamental, particularly when applied to the problem of bringing economic externalities to be governed by the market (Callon, 1998a; Holm & Nielsen, 2007; Muniesa et al., 2007). While rich in explanatory value, the STS-SSF literature lacks a description of the dynamics of emergence, and does not have a concept of variety in forms of markets. This thesis complements the STS-SSF literature with the Instituted Economic Process (IEP) framework, derived from the work of Karl Polanyi on political economy (Polanyi, 1944, 1957c). IEP provides a descriptive model of markets, which are conceptualised as instituted parts of the economic system. IEP conceptualises markets as historically and geographically-embedded institutions of exchange, which acquire their characteristics through the dynamic interaction between existing institutions and pressures for change (M. Harvey, 2007; Randles & Harvey, 2002; Randles & Ramlogan, 2007; Randles, 2003, 2007). While not providing a generative mechanism of markets or a model of agency, IEP provides this thesis with a mechanism for analysing change in economic models, as well as to conceptualise the variety in forms of economic organisation.

Through the analysis of three case studies of biodiversity offset markets[4], it is demonstrated how a generative mechanism (performativity of economics) results in the institutional variety observed, through a succession of dialectic double movements

[4] Species Banking (United States of America), Impact Mitigation Regulations (Germany) and Biodiversity Offsets (England). The reasons for selecting these specific programmes are detailed in section 4.3.

(Randles & Ramlogan, 2007). The process dimension is fundamental to understand how agents and technologies contribute to instituting markets for the governance of biodiversity. This thesis also reveals tensions within the market *agencements* involved in the production of the commodity exchanged, and the mechanisms by which biodiversity offsetting programmes develop specific market structures.

1.3. Structure of this thesis

The remainder in this thesis is organised in seven chapters. Chapter 2 presents the theoretical foundation on which the research is based. It reviews the basics of the neoclassical economics theory on the origins and nature of markets, which is presented as a formal perspective, and contrasts this with the need to produce a substantive perspective of the same topics. Among these substantive perspectives of markets, this chapter reviews Polanyi's work on the political economy of markets, and the Polanyi-inspired Instituted Economic Process (IEP) approach. This is followed by a review of the Science and Technology Studies (STS) and Social Studies of Finance (SSF) perspective on the emergence of markets, focusing on the agents and technologies involved in the process, and on the concept of performativity of economics. The chapter finishes with a framework for the research of the emergence of markets for biodiversity offsets, which brings together IEP and STS-SSF, and will be used throughout this thesis.

Chapter 3 reviews the state of the art with regards to biodiversity offset markets. The chapter is divided in two sections: the first details what is meant by biodiversity offsetting, the history of the concept of offsetting biodiversity losses, and the worldwide prevalence of the usage of these mechanisms worldwide. This section finishes by highlighting how varied the existing biodiversity offset mechanisms are. The second section of the chapter reviews the published research on biodiversity offsets, from both a biological and an economics and business perspective. The chapter finishes with the enunciation of the research questions which this thesis will address.

Chapter 4 details the research approach taken in this thesis. The ontological and epistemological commitments are detailed, with reference to STS-SSF and IEP perspectives on ontology – particularly important considering that the research framework tries to bring together the two perspectives. The case is made for a case study approach, and the three case studies chosen for this research are presented and justified in terms of their contribution to the research. Following this, the specifics of the data collection are detailed, discussing the methodologies employed to collect both secondary and primary data. Considerations with regards to the challenges posed by

the necessity of interviewing elite individuals are also made. The chapter finishes with a presentation of the data analysis procedures which the research followed.

Chapter 5 discusses the emergence of markets for biodiversity offsets, thus addressing research questions 1[5] and 2[6]. It discusses the changing representations about biodiversity, its role and its place with regards to the economy, and the new agents and scales gaining traction in terms of biodiversity conservation. The chapter then discusses the actions taken by agents which result in the institution of markets for biodiversity offsets. This is done by approaching each of the three case studies in turn. The chapter concludes by identifying the key function played by markets for biodiversity offsets, and how the necessity to accomplish this function relates to the emergent representations of biodiversity and the increasingly distributed governance arrangements to result in the emergence of markets for biodiversity offsets, via performativity of economics.

Chapter 6 analyses the role played by technologies in markets for biodiversity offsets, thus addressing research question number 3[7]. For buyers and sellers to agree on what is being exchanged, besides quantities and prices of the commodities, biodiversity loss and compensation need to be measured. This requires the development of a socio-technical infrastructure of measurement and calculation, a market infrastructure, which allows market agents to calculate the outcomes of their decisions. The chapter describes the working and components of this socio-technical infrastructure in each of the three case studies, and how they achieve both quantitative and qualitative equivalence between biodiversity loss and the offset, and presents evidence of tensions at the core of those socio-technical components. The chapter also describes some of the technologies being developed as components of the market infrastructure, such as databases, applications and electronic exchange platforms.

Chapter 7 follows from this, analysing the difficulties in producing a fungible commodity for exchange, which allows the geographical reach of the market to increase. The analysis in this chapter addresses research question number 4[8]. The chapter demonstrates that there is significant resistance to this, because of both biological and political reasons. The analysis highlights how the representation of what biodiversity offsets are and what their result might be is not entire in control of the proponents of biodiversity offsetting. Controversies over the socio-technical infrastructure which is

[5] Research question 1 is “What is the background to the emergence of markets for biodiversity offsetting?”
[6] Research question 2 is “How are the exchanges being organised?”
[7] Research question 3 is “What are the mechanisms by which biodiversity is being brought to the market?”
[8] Research question 4 is “What are the limits to expansion of markets for biodiversity offsets?”

used to commodify nature are also prevalent, with agents operating at a local scale maintaining preference for historically-grounded practice over new techniques and technologies. The result is resistance to adoption of technical standards at local scale, which in turn implies that commodities are not fungible between local markets. The overall result is a nodal structure to national programmes of biodiversity offsetting, which share some market components but remain separate.

Chapter 8 concludes, pointing out the theoretical and empirical contributions of this thesis. The chapter then makes a number of considerations in terms of the methodology, and suggests future directions of research.

2. Understanding the market: formal and substantive views of the economy

2.1 Introduction

The market is a central construct to the discussion and research on the economy. Sometimes represented as the natural setting in which economic activity takes place, its properties and the possibilities which it raises as a mechanism for governing human societies and increase human welfare have been the topic of many discussions and policy-making. Having come under scrutiny from many perspectives (Mazzoleni & Nelson, 2013), the nature of markets remains a disputed field today. An important part of the dispute centres on the origins of markets: from being taken as phenomena that naturally evolve from other forms of exchange to being seen as vehicles for class struggle and capital accumulation, researchers from different fields have so far been unable to agree as to where markets come from. In a similar fashion, what happens to markets after they emerge – their evolution, the shaping of their architecture and their potential expansion, all remain contested fields of research. These different understandings are compounded where public goods are involved, such as environment-related products and services, because of the difficulties in bringing public goods and externalities to the fold of the market.

This chapter aims to review research on the emergence, shaping and expansion of markets, comparing and contrasting two different understandings: the "formal" (section 2.2) and the "substantive" (section 2.3). The chapter is organised as follows. Sub-section 2.2.1 reviews the research in neoclassical economics (Besanko & Braeutigam, 2005; Dobson & Palfreman, 1999; Mankiw, 2001), which presents the market as the natural form of organising resource allocation in society. It posits that, if a number of conditions are observed, to bring all activity in society under the governance of the market will result in the highest possible welfare for all members of society. In situations where this does not happen, designated market failure (Bator, 1958), the proposed remedy is to create and implement functioning, efficient markets (Bromley, 1989; Chichilnisky & Heal, 2000a, 2000b; Devlin & Grafton, 1994).

Section 2.2.2 discusses an evolution of the neoclassical paradigm, the theory of new institutional economics (Coase, 1937, 1960; Hess & Ostrom, 2003; North, 1990; Ostrom, 1990; Williamson, 1973, 1983, 1991). While new institutionalism is based on the same model of agency and individualism as neoclassical economics, it acknowledges that the institutional setting in which the exchange takes place influences the efficiency a market can achieve. As a result, the authors working in this perspective acknowledge that, in many situations, alternative forms of exchange may

be preferred to the market as mechanisms for governance. The analysis extends to the problem of governance of public and common goods.

Section 2.3 critiques this group of perspectives, focusing in particular on the controversy over the distinction between the formal and substantive views of the economy. In sub-section 2.3.1, Karl Polanyi's work identifies the premise of the market as a form of governance (the formal understanding of the economy), a historical and geographically contingent phenomenon (Polanyi, 1944), and highlights how the principle of choice under conditions of scarcity does not describe the totality of the exchanges human are involved in; for him, this is the substantive view of the economy (Polanyi, 1957c). The emergence of what Polanyi calls a "market society" – the expansion of the market as a form of governance – is seen by the extension of market governance to fictitious commodities (labour, land and money), which are not produced for exchange, but which need to be freely bought and sold if price-making markets are to organise (Polanyi, 1944). Convinced that this unhindered expansion of the market can have negative consequences, Polanyi warns about impending challenges to human freedom in the context of market expansion and apparently unchallenged technological development (Polanyi, 1957a, 1957b, 1957d).

Section 2.3.2 reviews a Polanyi-inspired literature applied to the research of economic processes, the Instituted Economic Process (IEP) approach (M. Harvey, Quilley, & Beynon, 2002). Like Polanyi himself, authors in this field start from a perspective of markets as one in a multiplicity of possible forms of exchange, operating in historical and geographically contingent institutional backgrounds. The objective is to research specifically economic processes of production, consumption, distribution and exchange, and how these economic processes organise (M. Harvey, 2007; Randles & Harvey, 2002; Randles & Ramlogan, 2007). These processes are subject to simultaneous currents of process (change, innovation) and stabilisation (institution and standardisation), which resolve differently in different settings; the result is variety in configuration of economic processes, including forms of exchange. From this emerges a research agenda centred on the organisation of the exchange (Randles, 2003, 2007), which seeks to describe the dynamics of economic processes.

These frameworks for the analysis of markets do not offer a generative mechanism which may explain the emergence of markets. One attempt to conceptualise such a mechanism is offered by the field of New Economic Sociology (sub-section 2.4.1), which conceptualises markets as embedded in social networks (Granovetter, 1985). In this context, markets are formed by producers observing each others' behaviours, and selecting niches and production schedules which minimise their risk (White, 1981).

A different mechanism of market emergence is suggested by the role played by science and technology in the changes operated on the governance landscape (sub-section 2.4.2). Science and Technology Studies (STS) have spawned the discipline of Social Studies of Finance (SSF), which develops and applies an STS framework to the study of the economy and, especially, markets (Callon, 1998b; D. MacKenzie, 2009b). In this case, markets are conceptualised as the result of the performing of economics in public policy (Callon, 1998b, 2007; D. MacKenzie et al., 2007).

It is in this context that economic experiments (Muniesa & Callon, 2007), including but not limited to the creation of new markets, are being tested as a way to control said risks and answer to societal concerns (sub-section 2.4.3). Faced with the risks of acid rain, markets for sulphur emissions were created in the United States (Ellerman, Joskow, Schmalensee, Montero, & Bailey, 2000; Joskow & Schmalensee, 1998; Schmalensee, Joskow, Ellerman, Montero, & Bailey, 1998); faced with climate change, markets for carbon emissions have been created in several locales, from the sub-national scale (the case of the American state of California), to the national scale (Australia and Korea), and the supra-national scale (the European Union's European Trading Scheme – EU-ETS) (Kristiansen, Kaineg, Arsiwala, & Chinn, 2008; Tucker, 2001; Wara, 2007); faced with the risk of water pollution, markets for water quality have been implemented in various guises (Huang & LeBlanc, 1994; Shabman & Stephenson, 2007; Woodward & Kaiser, 2002); faced with the risk of depletion of its fish stocks, Norwegian fisheries created a market for Individual Transferable Quotas (ITQs) for landings (Holm & Nielsen, 2007).

One particular example of performativity of economic is the discipline of ecological modernisation (sub-section 2.4.4), which argues that economic growth will benefit from measures to protect environmental capital (Christoff, 1996; D. R. Fisher & Freudenburg, 2001; A. P. J. Mol, 2000; Murphy & Gouldson, 2000) in the context of a changing understanding of modernity (Spaargaren & Mol, 1992) and expansion of the stakeholders involved (A. P. J. Mol & Spaargaren, 2002; Spaargaren, Mol, & Buttel, 2006). Associated to ecological modernity is the current of market environmentalism (Bailey, 2007). This field proposes that environmental loss and degradation has its roots in a specific political-economic organisation of society. Late modernity societies, as they are strongly dependent of markets as mechanisms for governance, find it difficult to appropriately value the environment; the absence of a translation of the value of nature into a language that can be interpreted in markets (economic value), in turn, means difficult, often poor decision-making (TEEB, 2008, 2010). The concept of ecosystem services has been developed and put into widespread use in order to help translate and clarify the benefit humans derived from biodiversity (Boyd & Banzhaf,

2007; B. Fisher et al., 2008), and raises the potential that better decisions are made in terms of land development or conservation, by either implementing safe minimum standards (R. Bishop, 1993), estimating non-market values (Garrod & Willis, 1999; Hanley & Barbier, 2009; Nunes & van den Bergh, 2001), or creating markets for ecosystem services (Kroeger & Casey, 2007; Landell-Mills & Porras, 2002). In parallel, the number of groups of stakeholders involved in these new governance mechanisms has increased over time (Jessop, 1998). Consumers, in particular, appear to be increasingly motivated to prefer acquiring goods and services from companies who are seen to reduce the negative impacts of their activities over the environment. In this consumers are often supported by environmental NGOs, who strive to denounce activities which damage nature and promote best practice. All this means that businesses, in particular those whose activities might have a negative impact on biodiversity conservation, have the appropriate incentives to change their practices to comply with responsible, green forms of capitalism (Spaargaren & Mol, 2008).

Markets serve as collective spaces in which agents agree on the price, quantity and quality of goods transacted (Callon & Muniesa, 2005). This is made possible by the development of market devices, through which the necessary calculations for the process of economising to take place are made (Muniesa et al., 2007): technical, and sometimes human, mechanisms, equations and assessments which serve to create a common language and understanding through which agents can choose in the context of a market. These devices constitute socio-technical and political innovations (Holm & Nielsen, 2007; D. MacKenzie, 2009a, 2009b), following their particular, partly path-dependent, journeys in each case (Callon, Meadel, & Rabeharisoa, 2002; Muniesa et al., 2007); this raises the question of potential devices co-existing in divergent markets. The role of technology in the process of market emergence is discussed in sub-section 2.4.5.

Section 2.5 distils these contributions into a framework for researching the emergence of markets in environmental goods and services. The STS-SSF and the IEP perspectives are compared in terms of their similarities and fundamental differences, and the role of each as component of the research framework is detailed. This framework is composed of four themes: the new governance actors; the changing role of States; the importance and development of market *agencements*; and the discourses and representations of biodiversity and marketisation.

2.2 A formal understanding: the market in economics

Different approaches within the discipline of economics have provided a number of conceptualisations of the topics of emergence, shaping and evolution of markets. The

main strand, neoclassical economics, provides the basis for much of current economic thinking. An alternative strand, new institutional economics, attempts to deal with some of the limitations of the strict neoclassical framework, developing it in specific points but accepting many of its basic tenets.

2.2.1. Neoclassical Economics

The study of markets is one the cornerstones of neoclassical economics. Taking the allocation of scarce resources as its object of research (Dobson & Palfreman, 1999), neoclassical economics assumes that the market is the most efficient way of allocating resources and, in a broader sense, organising economic activity in society (Mankiw, 2001). For neoclassical economists, the market is the natural form of organising and governing socio-economic activity, in a tradition which dates as far back as the first classical economic theorists - in effect Adam Smith himself put the existence of trade down to a natural tendency in humans to truck and barter (A. Smith, 1776) – that is, to exchange. The market itself is understood simply as the group of buyers and sellers for a particular good, commodity or service (Dunnett, 1992; Mankiw, 2001). As a result, it is assumed to exist naturally every time agents engage in exchange; the market is seen, at least implicitly, as a normal occurrence – almost a “natural” form of governing society (Lawson, 2013).

Neoclassical economics provides an account of the role of the market as a governance mechanism tasked with the allocation of resources in society, regulating the production and consumption of goods and services. This model focuses on the roles of three groups of economic agents: consumers, producers and the state (Dunnett, 1992). Consumers are seen to attempt to maximise their wellbeing (utility), subject to income constraints, while producers attempt to maximise their profits, subject to input cost and production technology constraints. The market would work by aggregating consumers’ preferences, reflected in the price consumers are willing to pay for goods: increased consumer demand would lead to price increases, and reduced consumer demand would lead to price falls. The social value of the products in the market would consequently be reflected on the aggregate price they sell for. The information on consumer preference implied in those price rises and drops would then be used by producers to make decisions – allocating more resources for the production of goods and services with higher demand, and fewer resources to the production of goods and services with lower demand. Through the pricing mechanism, resources could be allocated in such a way that the quantities of a product (good or service) supplied and demanded are equated – via the “invisible hand” of the market, supply and demand would equal at a certain price, and the scarce resources society has at its disposal would be used to produce the maximum possible amount of welfare – a point at which

the market is said to have reached equilibrium. Neoclassical economics postulates a tendency for the market to stabilise at a market-clearing price equilibrium over time – a phenomenon described as the law of supply and demand (Mankiw, 2001). This equilibrium has been postulated to exist for most market situations, and acceptance of the existence of a law of supply and demand has been based on economic modelling, even under weakening assumptions – which appears to corroborate its applicability to describing normal economic behaviour (Arrow & Debreu, 1954; McKenzie, 1959, 1981)[9].

As a mechanism for resource allocation[10], markets have a significant impact on the welfare of the members of a given society: the neoclassical model of the functioning of an economy assumes that freely functioning, non-distorted and competitive markets will result in an optimal allocation of resources, a situation designated as a Pareto optimal equilibrium. A Pareto optimal equilibrium refers to a hypothetical situation where resources are distributed so that no member of society can be made better off without making some other member of society worse off – in other words, no member of society can see his or her situation improved without redistribution of wealth (Besanko & Braeutigam, 2005).

However, for this description of the operation of markets to apply to economic reality, a number of conditions need to be observed. The first assumption refers to the economic agents involved: all participants in the market are assumed to act as rational utility maximisers[11], displaying complete, transitive and strongly monotonic preferences. Not only are these agents trying to maximise their welfare, they can always choose between two alternatives in the market based on their preferences, they can extend those preferences to other sets of goods in the market, and they always prefer more of the goods to less. In other words, the economic agent is capable of calculating his or her total welfare, motivated to increase that welfare, and ready to extend exchangeability to every possible good in his or her pursuit to achieve a state of maximum possible welfare.

[9] It should be highlighted that there is evidence that some markets are characterised by price cycles and the inability to converge on a clearing price; causes for this apparent violation of the law of supply and demand include lack of competition on the supply side and uninformed, slow or response (that is deemed "irrational" to market signals) on the part of producers (Dunnett, 1992).

[10] The description of how the price information is used by producers to make resource allocation decisions is a configuration of the market as a mechanism for governance of society's production and consumption, among other activities. The expression "mechanism for resource allocation" is, in the context of this thesis, equated to the expression "mechanism for governing economic life".

[11] This includes companies acting as rational profit maximisers.

A second assumption is that all economic agents possess perfect information about both the qualities and the prices of the commodities in the market. This would give the agent the capacity to increase his utility by acquiring the basket of commodities he or she wishes at a lower cost, or a larger basket at the same cost.

A third assumption is that all agents are price-takers. This concerns the numbers of agents operating in a market (the market size), but also the share of the market that each agent has – their market power. The assumption holds that if the number of participants is large enough, no single player can gain the ability to set prices because of competitive pressure. The price-taking assumption concerns both buyers and sellers; situations where it does not hold include monopolies, monopsonies and cartels.

The fourth main assumption is that the market must be open, with no barriers to entry or exit for any potential participants. This is important in maintaining the competitive dynamics on the market, assuring that the third assumption holds. It has important consequences in terms of regulation – especially regulation that impacts the conditions for admittance in a sector of activity, or the long-term responsibility of market agents. It is from this principle that derives neoclassical economists' preference for as little trade barriers and trade-encumbering regulation as possible; the market should be allowed to extend to ever more agents and any incentives against this expansion should be eliminated, if the result is to be maximum social welfare.

Other conditions are also recognised. These include accepting the assumption that there are no transaction costs associated with the exchange process[12]; that the goods and services for exchange are homogeneous in quality and perfectly measurable; that markets are complete, with all goods and services freely priced and traded in the market; and that all property must be privately held, with no public goods or externalities, and property rights perfectly enforced and not contested (Besanko & Braeutigam, 2005). The last two conditions complement each other: all goods and services should be owned by private individuals, who will freely trade them in markets.

In practice, it is difficult to identify any situation where all of these conditions are simultaneously observed; some – often all – of these conditions are routinely violated in existing markets (Crespo, 2013). Agents behave in a way which is apparently inconsistent with maximum utility maximisation; there are information asymmetries in markets, and the costs of acquiring such information may not compensate agents'

[12] This condition is very important in terms of mathematical modelling of agents' behaviour in the market. The idea that no transaction costs can, however, have very significant welfare and distributional impacts, as will be discussed in the context of Coasian Bargaining (sub-section 2.2.2).

effort[13]; distortions caused by market power are frequent and difficult to detect even by the authorities tasked with doing so; and barriers to entry, of many types, are pervasive. As a result, the outcomes of markets routinely diverge from the estimated Pareto optimal. Situations where this takes place are described as market failure (Bator, 1958). The role of the pricing mechanism means that the market is an information system; market failure refers to situations where that information is less than perfect (Dobson & Palfreman, 1999).

The main causes of market failure are the prevalence of externalities and public goods (Besanko & Braeutigam, 2005). An externality consists of "...the effect that an action of any decision maker has on the well-being of other consumers or producers, beyond the effects transmitted by changes in prices" (Besanko & Braeutigam, 2005, p. 637); as a result of its existence, "…the market price does not fully reflect all the information about the costs and benefits of the market transaction" (Dobson & Palfreman, 1999, p. 138). There will be an under-supply of the good or services which produce benefits for humans but which are not paid for (positive externalities), and an excess supply of those products which result in negative impacts, but whose producers are not forced to compensate other agents for (negative externalities). Public goods are another source of market failure. In neoclassical economics, public goods are characterised by difficulties in terms of excludability and rivalry: where non-excludability applies, it is impossible to prevent non-payers from benefiting from the goods or services involved, while a non-rival product is one whose consumption by one individual does not diminish the potential benefit of others. The economic discussion of public goods follows that of externalities; the benefits provided by a public good are similar to positive externalities, the difference being that they don't necessarily result from the economic agents actions (Besanko & Braeutigam, 2005).

The classical economic analysis of externalities separates the private benefits and costs of agents involved in the market from the social benefits and costs; the difference between the two sets of impacts, labelled the marginal external benefit (or cost), consists of the effect of the externality (Pigou, 1932). It proposes that in the case of a negative externality a tax is applied to the transaction at such a level that the private cost equals the social cost[14], ensuring efficiency in the market. The market is assumed to pre-exist the measures to internalise the externality, and the objective of the policy is to bring those flows that occur outside of the market into the market fold.

[13] In fact, the cost of information gathering is often a significant transaction cost in the context of markets (Geertz, 1978).

[14] Conversely, in the case of a positive externality, a subsidy should go to the private benefits until they equal the public benefits.

However in some cases the market may not exist at all; one specific case of market failure is the situation where the markets are not complete, that is, not all goods and services are priced and traded in markets. Referred to as situations of missing markets, these are especially prevalent when externalities resulting from public goods and/or inter-temporality[15] are involved (Bromley, 1989). The neoclassical prescription for these cases of market failure is that policies are put in place such that minimise the market failure, including the creation of functioning markets (de Janvry, Fafchamps, & Sadoulet, 1991). It is assumed that markets can be designed and created where none exist, attempting to approximate the market as much as possible to the ideal, Pareto optimal functioning. This approach, the intellectual tradition of which dates at least from the work of Ronald Coase in the so-called Coasian Bargaining (Coase, 1960), postulates that in a situation with missing markets for externalities, economic efficiency can be restored simple by attributing property rights[16]. This eliminates the externality, allowing economic agents to bargain the level of compensation required to internalise any negative impacts. Further, to implement such policy would have no distributive effects regardless of who receives the property rights (and, conversely, who is left with the liability) (Hanley, Shogren, & White, 2007); the core of the policy lies simply in the attribution of property rights to the public good, so that a market for compensation develops when buyers and sellers come together to bargain. This concept has inspired the creation of numerous markets for externalities, in some cases through the creation of a commodity which represents that externality, in the expectation not only would there be a behaviour-change effect, but also a (second order) technology innovation impact (Devlin & Grafton, 1994).

Overall, the formal models of neoclassical economics do not provide a comprehensive theory of the origins of markets. Markets are seen as naturally existing situations where buyers and sellers come together, each looking to maximise their utility, thus delivering the most welfare possible to all. This is understood to only be possible when all the assumptions related to market efficiency are observed (a tall order), but that does not impede much of the prevalent discourse to “read” this idea of markets into societal problems and policies[17]. The creation of markets in situations where they are missing is seen as a question of attributing property rights and providing the conditions which approach as closely as possible to the assumptions in the models – a technical issue, with no distribution consequences. The result is a simplistic distinction between the

[15] Inter-temporality refers to situations where market efficiency must be calculated across generations. Examples include situation where the choices of one generation impact the utility of posterior generations. It is difficult to imagine a situation where one generation can compensate others for the externalities relating to their activity – a situation of missing markets.
[16] Assuming no transaction costs occur and that all agents involved possess perfect information.
[17] A closer analysis of this “reading” – and the imprinting – of neoclassical economics thinking into societal issues is the theme of section 2.4.

market and non-market forms of governance, with a strong normative position that the former trumps the latter. From this derives one of the most frequent critiques levelled at neoclassical economics: its excess reliance on the formality of its models, often at the expense of the understanding and explaining of the "real" economy. Neoclassical economics does not engage with the alternatives forms of exchange which exist alongside markets - and which are a feature of economic life - save for recommending that barriers to marketisation are lifted, and distortions to the pricing mechanism avoided or minimised (Besanko & Braeutigam, 2005).

For all these failings, neoclassical economics serves as a useful baseline for understanding the role of markets as forms of governance in society, and it provides the bases and vocabulary for much of the discussion. But the field of economics is not solely composed of orthodox, neoclassical economics; variations on the theme have been devised to produce extensions to the analysis. One such extension, new institutional economics, engages both the issue of managing social and private costs and benefits, and the variety of forms of exchange which can be used for governing social and economic life.

2.2.2. New Institutional Economics

As discussed in the previous section, neoclassical economics describes the economy as a self-organising system, coordinated by the pricing mechanism alone. It does not ignore the fact that individual economic agents plan, exercise foresight and pick alternatives, but still the theory assumes that the allocation of resources ultimately depends on the pricing mechanism. This is an incomplete description of the economic system, insofar as it largely ignores other forms of exchange. The literature on new institutional economics, on the other hand, attempts to explore the importance that institutions have in governance processes, providing a theory of the role that socio-economic and political institutions have in governing human life. However, despite these differences new institutional economics follows the neoclassical methodological focus on strict individualism, providing explanations in terms of the actions and objectives of individuals, even where it assumes there are social phenomena present, such as social norms and culture. Its main value consists of insisting that the focus of research be on comparative institutional analysis, instead of comparisons between real world outcomes and theoretical models (Klein, 2000): the results of different forms of governing economic life are to be compared for their outcomes.

One important example of alternative forms of organising and governing economic activity is provided by the existence of firms. Instead of extremely decentralised system mechanisms of governance, such as markets, where economics agents interact at

arms-length, firms aggregate agents who cooperate and coordinate their actions. As a result, while outside firms the movement of prices might direct production, within firms the decisions regarding production are directed by the entrepreneur. The firm and the market are clearly different forms of organising production. Overall, on the subject of forms of governing resource allocation, it is clear that "…nothing could be more diverse than the actual transactions which take place in our modern world" (Coase, 1937, p. 396). The reason for this relates to the prevalence of transaction costs: where neoclassical economic analysis assumes away transaction costs in the context of markets (Coase, 1998), and posits that the result of market exchange is increased specialisation and increased productivity: the lower the transaction costs, the higher the specialisation would be (Coase, 1937). Consequently, high transaction costs have the potential to impact what gains are made from trade. Firms are one possible response to this: for a firm to succeed, the entrepreneur needs to accomplish the resource allocation function at a lower cost than the market could. The same could be true for alternative forms of governance.

Transaction costs depend on the wider institutions within which the transaction takes place, for example at national level. Institutions are, in effect, the fundamental determinants of the performance of an economy, and constitute the most important factors in understanding economic life and its evolution:

> Institutions are the rules of the game in society or, more formally, are the humanly devised constraints that shape human interaction. In consequence they structure incentives in human exchange, whether political, social or economic. Institutional change shapes the way societies evolve through time. (North, 1990, p. 3)

Considering that the main purpose and effect of institutions is to save on transaction costs (Williamson, 1985), the designation "institutions" includes aspects such as the legal system, the social system and culture (Coase, 1998). Institutions should not be confused with organisations; while both provide a framework for human interactions, the latter emerge and act in the framework created by the former. If the institutions constitute the rules of the game, then organisations are some of the players of that same game (Williamson, 1998). The role of the institutions is to define and constrain the economic agents' operation. Institutions can be distinguished in terms of the institutional environment (laws, polity), which constitute the "rules of the game", and the institutions of governance (markets, hierarchies, hybrids, bureaus and others), which operate at the level of individual transactions (Williamson, 1996).

The pervasiveness of transaction costs in most economic transactions, and agents' objectives to minimise them, means that "...economic agents purportedly align transactions with governance structures to effect economising outcomes" (Williamson, 1996, p. 5): economic agents make choices in terms of what governance structure best suits their objectives. For this reason, a research agenda in new institutional economics focuses on the institutional features of the economy, and involves determining and comparing the factors behind the relative costs of coordination between alternative forms of governance. Instead of only researching how the relationship between supply and demand determine prices in a market, new institutional economists prefer to inquire into "…the factors that determine what goods and services are traded on markets and therefore are priced." (Coase, 1998, p. 72). Extending the analysis beyond the discussion of transaction costs, new institutional economists have succeeded in identifying a number of institutional conditions affecting markets. A number of these are attributed to human characteristics, including bounded rationality, individual opportunism and the general atmosphere in the specific context of the exchange. Adding to these, a number of transactional factors, consisting of uncertainty, insufficient numbers of market participants (with the related problems in terms of acquisition of market power), and the costs of information asymmetry (Williamson, 1973).

Owing a lot to neoclassical economics for its underpinnings, new institutional economics attempts to extend the understanding of the economy by specifically aiming at describing social and legal norms involved in economic life. One of the results of this strand of analysis has been a multiplicity of typologies of forms governance[18]. The corollary of this acknowledgement is that no single form of exchange can be expected to emerge and be readily adopted in all situations, but that instead institutional and functional variety will be the norm. This variety raises a number of possibilities, from a continued co-existence of different forms of organising the exchange (in which case the different exchanges remain isolated), to the development of one specific organisation of exchange in preference over the alternatives (such as a market being preferred to firms or other mechanisms of coordination of economic activity). Despite going beyond the market in its analysis, new institutional economics remains close to the paradigm of the rational decision-making agent inherited from neoclassical economics. As a result, it conceptualises the origins and selection of different mechanisms of governance in terms of the comparative economic efficiency of the different alternatives. The market

[18] There are many examples of such typologies, often depending of the objectives of the author (for example: Adler, 2001; Fehr, Kirchler, Weichbold, & Gächter, 1998; Ménard, 2004; Williamson, 1973). Actual typologies of variety of forms of governance are not in the remit of this thesis; the reasons for this are discussed in sub-section 2.3.2.

remains the main form of organising economic relationships, and alternatives only emerge when the market is imperfect:

> It is generally acknowledged that a *prima facie* case for the development of nonmarket (or quasi-market) forms of economic organization can be said to exist whenever the market, if used to complete a set of transactions, experiences 'frictions' (Williamson, 1973, p. 316)

Despite this ongoing assumption that the market is the preferred mechanism of governance of economic life, the acknowledgement of the limitations of markets in conditions other than perfect competition and that a range of alternative governance mechanisms is possible, is felt in the developments that the work in new institutionalism offers on the provision of public goods. Two of the most prominent example of this strand of research comes from the works of Elinor Ostrom (Hess & Ostrom, 2003; Ostrom, 1990, 1999, 2000, 2009) and Ronald Coase (Coase, 1937, 1960, 1988, 1992, 1998), who both illustrate the importance of considering the institutional background to the problem of governing externalities. Commenting on policy prescriptions of neoclassical economists, Ostrom (1990) refers to the habit within that discipline of promoting policy prescriptions that consist of metaphors. In particular, the practice of recommending single prescriptions for governance of common goods and services – attribution of property rights and marketisation – has meant that the diversity of institutional arrangements, and how they operate in practice, is ignored:

> Many policy prescriptions are themselves no more than metaphors. Both the centralizers and the privatizers frequently advocate oversimplified, idealized institutions – paradoxically, almost 'institution-free' institutions. (Ostrom, 1990, p. 22).

New institutionalist policy prescriptions to the case of market failure caused by externalities and public goods is that while markets can be created, in those cases where the "frictions" resulting from these institutional arrangements exceed the benefits obtained from marketisation, then other forms of governance can and should be considered.

A particular criticism that should be levelled at the intellectual edifice of neoclassical economics is the piecemeal appropriation of ideas which fit its formal models, while discarding the basic assumptions on which those ideas are based, as evident with the concept of Coasian Bargaining[19]. In the original paper the mechanism of Coasian Bargaining is presented not as a possible solution to the problem of social cost arising

[19] Coasian Bargaining was discussed in detail in sub-section 2.2.2.

from externalities (Coase, 1960), but as an illustration of the results that could be achieved in an ideal situation. On expanding the analysis to a non-ideal world, where the formal conditions of neoclassical economics do not apply, Coase's paper demonstrates that what became known as Coasian Bargaining is of limited use:

> In these [*realistic*] conditions the initial delimitation of legal rights does have an effect on the efficiency with which the economic system operates. One arrangement of rights may bring about a greater value of production than any other. But unless this is the arrangement of rights established by the legal system, the costs of reaching the same result by altering and combining rights through the market may be so great that this optimal arrangement of rights, and the greater value of production which it would bring, may never be achieved. (Coase, 1960, p. 16)

Coase used this line of argument to criticise the prevalent, neoclassical analysis of the problem of social cost for its excessive simplicity in defining the problem and proposed solutions. While in that tradition the main thrust of analysis is the difference between social and private products (that is, the value of the externality), Coase focuses on the fact that the problem is reciprocal: whenever an externality is produced, at least two agents are involved – those responsible for producing the externality, and those who are affected by it. When taking action on the externality, the same two agents are impacted. With missing markets, to create a market where the different agents could compensate each other would require the distribution of property rights – the liability or benefit for the externality. Only if these markets were devoid of transaction costs – an unrealistic assumption, as seen - would the attribution of these property rights would be without consequence, and make everyone better off:

> The economic problem in all cases of harmful effects is how to maximise the value of production (…) It is always possible to modify by transactions on the market the initial legal delimitation of rights. And, of course, if such market transactions are costless, such a rearrangement of rights will always take place if it would lead to an increase in the value of production. (Coase, 1960, p. 15)

Comparative policy analysis of the potential responses to internalise an externality should note the changes in welfare in both groups of agents:

> What answer should be given is, of course, not clear unless we know the value of what is obtained as well as the value of what is sacrificed to

> obtain it (…) this problem has to be looked at in total and at the margin. (Coase, 1960, p. 2)

In other words, there cannot be a single policy prescription to the problem of externalities. The perspective thus highlights how institutional arrangements are important for governance purposes, and how the outcomes depend on the particular structures of the institutions:

> In the most general sense, all institutional arrangements can be thought of as games in extensive form. As such, the particular options available, the sequencing of those options, the information provided, and the relative rewards and punishments assigned to difference sequences of moves can all change the pattern of outcomes involved. (Ostrom, 1990, p. 23)

In conclusion, the market is not the only possible form of governance – nor is it always the preferred one. Even assuming that agents operate as rational utility maximisers, issues such as bounded rationality, imperfect information, lack of predictability and trust, high levels of complexity and transactional difficulties (Ostrom, 1990), all impact the ability of the market to operate as predicted by neoclassical models, and deliver the efficient, utility-maximising results. Other institutional arrangements should be considered.

New institutional economics provides a useful development from the neoclassical framework, widening the understanding of the economy, its functioning and the role of markets as mechanisms for governance. The recognition that institutional factors serve as a background and impact the functioning of markets, as do individual cognitive and organisational factors, means that markets no longer appear as disembodies entities operating in a vacuum; markets become contextualised. Likewise, the contribution in terms of the study of transaction costs means that markets can now be compared to other forms of exchange that might plausibly organise economic activity: the market becomes one among several mechanisms for organising economic life. Extending the analysis to the problem of provision of public goods, an important point is made that the market need not be seen as the only – or even the best – form of governance. However, the perspective maintains important limitations. The continued focus on the individual, rational agent (even when she suffers from bounded rationality) precludes the study of other *loci* of economic agency, such as social groups; the interpretation of the social (as norms) is thin.

New institutional economics suffers from many of the same normative issues that neoclassical economics does. The market, while seen in a context of multiple forms of

governance, remains the preferred mechanism of exchange[20], only to be superseded when it is demonstrably inferior to the alternatives in terms of economic efficiency. The understanding remains formal, based as it is in neoclassical economics, even where it takes steps to approximate the "real" economy. But other perspectives, working from outside the economics framework, have made greater strides in the attempt to study the substantive – as opposed to the formal – economy. Two of these perspectives are pursued in the next section.

2.3. A substantive understanding: the place of markets in the real economy

This section reviews a different set of approaches to the economy, the work of Karl Polanyi, and the Polanyi-inspired work on Institute Economic Processes. This set of frameworks is substantially different from the two economic models presented in section 2.2: the focus here is on the real, existing – Polanyi himself called it the *substantive* – economy (Polanyi, 1957c). These studies are not concerned with trying to fit the workings of a component of the economic process – the market – into a formal model; instead the methodological focus is "…both comparative-historical and comparative-spatial, and traces change in the nature and over-riding governing logics of various forms of instituted exchange (…) a rich multi-method institutionalist oriented substantive research programme (…) which reveals, in any particular contingent case, how the economic potentially constructs (normalises) the structured and relational meaning of social worlds" (Randles, 2007, pp. 151–153). Overall, these perspectives provide a much wider remit than the extensions to the neoclassical model by new institutional economics.

2.3.1. The economy as instituted process: the work of Karl Polanyi

As highlighted above, one of the main criticisms levelled at neoclassical economics is the confusion between the models developed in the realm of formal economic analysis and the phenomena observed in the economy. A part of this confusion is related to different understandings of the economy: the formal and the substantive (Polanyi, 1957c). A formal understanding of the economy, as described above, is related to the logical character of economising situations, and postulates that agents operate economically by choosing between preferred outcomes under conditions of scarcity; thus are scarce resources allocated according to preferences inferred from the pricing mechanism – the essence of neoclassical economics. The substantive perspective, in turn, refers to the fact that human agents depend on social and natural environments, which they are a part of, for the satisfaction of their needs:

[20] Albeit not across the board. Some authors maintain a greater distance from the market than others, Elinor Ostrom in particular.

> The substantive meaning implies neither choice nor insufficiency of means; man's livelihood may or may not involve the necessity of choice and, if choice there be, it need not be induced by the limiting effect a "scarcity" of the means (Polanyi, 1957c, p. 31)

Instead of taking motives and institutions as mere sources of "friction" in markets, as neoclassical economists do, Polanyi favoured institutional analysis to understand economic processes, and was particularly critical of the tendency in economic analysis to apply market analysis in the context of non-market economies (Lie, 1991). Formal economic thinking, in Polanyi's opinion, confuses the problems of subsistence and scarcity by placing them under the same frame of analysis (Polanyi, 1957c). This confusion between the two "meanings" of economics is historically contingent, owing to the fact that in the years since the development of formal economic theory, human livelihood in the Western world has been such that it is well described by constrained choice in the context of price-making markets. Neoclassical economics is the result of applying formal economics to a specific type of economy, the market system. The market system consists of a situation where the economy is embedded in institutions – markets – in such a way that any individual's choices impact the entire economic process; this happens because of the generalisation of price-making markets, which become the principal form of governance of the economy (Polanyi, 1944). It is through the introduction of a means of exchange – money – that subsistence is turned into a formal problem of choosing between alternative allocations of scarce goods. Only then are the conditions of choice quantifiable as prices. But this formal economic system results of how the economy is instituted; the substantive economy is, conversely, "…an instituted process of interaction between man and his environment, which results in a continuous supply of want satisfying material means" (Polanyi, 1957c, p. 34).

As a result of these historical differences and changing forms of instituting the economy in different contexts, a significant variety of ways in which societies might organise the satisfaction of their needs can be observed in practice. Polanyi designates these as forms of integration, and distinguishes three types: reciprocity, whereby symmetrical groups in society exchange in a mutually satisfying way; redistribution, where a central authority collects and distributes the society's product; and exchange, where markets (at either fixed rate or price-making) serve as a way of integrating economic activity (Polanyi, 1957c). But these constitute only main patterns; the different forms of integration co-occur side-by-side and at different levels in society. Polanyi's framework of forms of economic integration suggests that non-market mechanisms should not be considered non-economic; non-market forms of exchange are to be conceptualised as components of the substantive economy. Non-market forms of integration possess

their own regulation, allocate resources and produce prices (in a non-market form), both opposing and complementing the market economy (Barthélemy & Nieddu, 2007).

With specific reference to the market mechanism as a form of integration of the economy in society, Polanyi's work focuses on explaining the conditions under which the market results in price creation – in other words, how can it become a form of governance (Polanyi, 1944). The market exchange can only produce prices if individual transactions occur under a specific institutional setup – a system of price-making markets. It is the institution of price-making markets, connected to each other and interdependent, that gives the exchange its role in integrating economic life (Polanyi, 1944). Further, price-making markets are not the only possible form of market; market exchange can also occur at set rates, for example. It is the behaviour of agents – competitive, attempting to make gains from trade, economising – that gives the market price-making mechanism its specific characteristics, and allows it to constitute a specific form of economic integration (Polanyi, 1957c). An expanding, self-regulating market demands the institutional separation of society into an economic and political sphere. A market economy needs society to subordinate to its requirements, and leave all elements of industry, including labour, land and money to its control. In the context of a market economy, it falls to the market to take control of all externalities (Polanyi, 1944).

Three structural elements should be considered when determining what a price-making market is: separation of supply and demand; establishment of equivalence; and competition. The first element, the separation of supply and demand "crowds", refers to the fact that supply and demand are often conflated as the price-making mechanism[21]. In fact, the two different groups ("crowds"), of sellers and buyers, can exist separately. Existence of only one of them identifies a market-type institution, but both need be present to identify a market. The second element, equivalence, concerns the mechanism by which the rate of exchange between one good and the other is agreed; markets can be price-making (where the price fluctuates and is determined in each act of exchange) or set-price (where the rate of equivalence is pre-determined). The third element, competition, is specific to price-making market institutions (Polanyi, 1957c). The method by which the market mechanism is enabled to control and direct the actual elements of industrial life consists of defining commodities empirically as objects produced for sale on the market. Every element of industry is regarded as having been produced for sale; consequently, there need to be markets for every element of industry, organised by supply and demand, interacting and interconnected via prices. However, labour, land and money are not commodities – defined as anything that is

[21] The Law of Supply and Demand, referred to in sub-section 2.2.1.

bought and sold which must have been produced for sale. When land, money or labour are subject to market governance, Polanyi warns, the consequences are mostly negative; speaking of land – shorthand for the natural environment – in particular, he remarks that:

> ...land is only another name for nature, which is not produced by man (…) To allow the market mechanism to be sole director of the fate of human beings and their natural environment indeed, even of the amount and use of purchasing power, would result in the demolition of society (…) Nature would be reduced to its elements, neighbourhoods and landscapes defiled, military safety jeopardised, the power to produce food and raw materials destroyed. (Polanyi, 1944, pp. 75–76)

In his exploration of the nineteenth century British economy, Polanyi (1944) demonstrates how the negative consequences of this unhindered marketisation led to social unrest and meant that regulation was eventually put in place to try and limit the scope of the market mechanism. Regulation and marketisation become, therefore, opposed tendencies, or movements:

> Social history in the nineteenth century was thus the result of a double movement: the extension of the market organisation in respect to genuine commodities was accompanied by its restriction in respect to fictitious ones. While on the one hand markets spread all over the face of the globe and the amount of goods involved grew to unbelievable dimensions, on the other hand a network of measures and policies was integrated into powerful institutions designed to check the action of the market relative to labour, land, and money (1944, p. 79)

The concept of double movement does not imply that a movement for protection will automatically follow the move towards marketisation. The two movements are chronologically sequential, but they co-occur:

> This suggests synchronic analysis in which the double movement market/protection has to be viewed not as sequential but rather as simultaneous. Each class or group takes an interest in the market (the trading class of course, but working or peasant classes also in virtue of labor division and of separation of production and consumption) as well as in protection (tradesmen have families and need their future to be protected) (Barthélemy & Nieddu, 2007, p. 523)

The synchronic approach recognises that the same people, at the same moment in time, can be involved in both market relationships and protective non-market economic relationships. Market and non-market are linked, co-existent.

Polanyi's interest was not limited to the relationship between the economy and society. Later in life he eventually sketched (but did not publish) three articles about the importance of technology in instituting economic processes, and shaping society (Polanyi, 1957a, 1957b, 1957d). These unpublished essays shift the author's focus to a concern about the effects of the expansion and growing importance of technology, and the constitution of a technological society – the result of society's immersion in the affective powers of mass technology and a mass-desensitisation to its effects (Randles, forthcoming). In these essays technology is presented by Polanyi as both a source and a consequence of changes that go beyond the strictly economic realm; the author manifests concern about his perception of a creeping averagism, conformity, and uniformity – the consequence of the rate of development of technology is a serious challenge to the freedom of the individuals living in society (Polanyi, 1957a, 1957b, 1957d).

Karl Polanyi's work inspired and continues to inspire research. Some of the enquiry follows closely from his framework, but there is also evidence of significant theoretical production which is Polanyi-inspired[22] (M. Harvey, Randles, & Ramlogan, 2007). Among the Polanyian-given research, much of the focus is on applying Polanyi's critique of the consequences of nineteenth-century liberalism to the contemporary political economy (Dale, 2010), characterised as neoliberal (Boas & Gans-Morse, 2009; D. Harvey, 2005, 2007; Kingfisher & Maskovsky, 2008; Navarro, 2007; Springer, 2008). The most important insights in Polanyi's work that serve these researchers are his insistence that liberalisation is the result of a struggle to disembed the economy from social control, which brings devastating consequences to society; the result is a countermovement to re-embed economy in society, re-establishing social control through the use of regulation to limit the reach of the market (Dale, 2010). The appeal of this approach is its capacity to describe how the modern capitalist society, in many ways similar to the *market society* which Polanyi described, "…is represented as a specific mode of organisation, of 'integration of the economy (…) the market constitutes the 'institutional arrangement' of this kind of society" (Cangiani, 2007, p. 27). The perception is that, in modern neoliberal societies as in the nineteenth-century society which Polanyi describes, the prominent role of the market as the preferred mechanism for decision-making means that the economy may be in control of social life. This is

[22] The next sub-section, 2.3.2, describes a particular Polanyi-inspired framework, the Instituted Economic Process approach.

seen in the social turn towards *governance* over government (Kazancigil, 1998), with the shift in the role of governments. The result is that governance has become a multi-level system, in which different actors exercise differing levels of authority, power and capacity to act (Reed & Bruyneel, 2010). Some of these pressures occur at the (various) boundaries between the economic and the extra-economic regimes, re-articulating the relationship between the market, the state and civil society. The state accumulates functions that concern not only its statute as top-down (hierarchical) government, but also as an agent to the expansion of the commodity, market based form of exchange, as part of a move from government towards governance – understood as "...any form of coordination of interdependent social relations – ranging from simple dyadic relations to complex social divisions of labour" (Jessop, 2002, p. 52). Three types of governance can be distinguished: anarchy of exchange (which includes the market); organisational hierarchy of command (such as state intervention), and self-organising heterarchy (Jessop, 1998, 1999, 2002). This later form of governance is based on self-organisation of different parts of socio-economic systems, from interpersonal networks to inter-organisational coordination and decentred, inter-systemic steering (Jessop, 1998). More specifically, this involves processes of meta-steering, both within the three types of governance described (anarchic market exchange, hierarchical organisation and heterarchical self-organisation), and to guide the relationship between the three forms of organisation (Jessop, 2002). As the interdependencies between the mechanisms for governance increase and the number of groups of agents involved grows, so does the variety forms of governance take. This does not mean that government rule is being decisively replaced by decentred forms of governance; it merely highlights how political decision-making is no longer confined to the formal structures of government, from formulation to implementation (Sørensen & Torfing, 2005).

One area in which Polanyi-given frameworks are very frequently used is in the analysis of changes to the governance of the environment (Castree, 2003, 2008a, 2008b, 2011). These analyses often focus on the processes and consequences of changes to forms of environmental governance, especially in terms of the privatisation and financialisation of nature (Corson, 2010; Heynen & Robbins, 2005; Humphreys, 2009; Igoe & Brockington, 2007; McAfee, 1999). Following Polanyi's (1944, 1957c) designation, the term fictitious commodity has been applied to a vast array of Payment for Ecosystem Services schemes, including biodiversity conservation (Robertson, 2000, 2007; Sullivan, 2010a, 2010b; Vatn, 2000), water (Bakker, 2005, 2010; Prudham, 2004; Roberts, 2008) and carbon dioxide (Lohmann, forthcoming, 2010).

These usages of Polanyi's work to understand and illustrate the mechanisms of advancing marketisation of non-market goods and services fail to make distinctions between the different existing types of economic organisation, place or scale. This is a surprising observation, considering that many such researches emanate from the field of geography. Geography, and especially economic geography, consists of employing an approach which "…is about understanding patterns and processes in space and the particularities of places (…) a contrast to the abstract and generalising tendencies of economists" (Coe, Kelly, & Yeung, 2007, p. 6). Even while accepting the premise that neoliberalism can be identified as a tendency, current geographic thinking points to the variegated nature of neoliberalisation, operating through different geographies and pathways (Barnett, 2005; Brenner, Peck, & Theodore, 2010). Current thinking involves attempting to devise research frameworks which "…adequately balance national specificity and path-dependency on the one hand with common underlying tendencies in capitalist restructuring on the other" (Peck & Theodore, 2007, p. 731), which can conceptualise the continued existence of localised logics of variegated capitalisms in the context of globalising pressures and markets. Polanyi's legacy is contributing to this, opening a path for the comparative and relational analysis of and between variegated economies (Rankin, 2013). It provides an entry point to a view of the economy, which is historical and geographically placed in real, variegated contexts, and involves theorising differences within regional formations (Peck, 2013). Space and scale cannot be dissociated from understanding of the substantive economy.

Polanyi's insights on existing exchanges, the role of markets and non-markets in the context of the wider economic activity, and the different "crowds" operating in markets speak to concerns about the confusion between the formal and the substantive economy. Markets are posited to exist in a geographical and historically contingent manner (Polanyi, 1944), one of the possible forms of responding to society's requirement to institute forms of providing for its needs and wants. Markets are thus seen in context, and as one among several possible alternatives for providing for society. These alternatives are not mutually exclusive; markets and other forms of exchange co-exist, and it is certain that the continued existence of markets is in part dependent on non-market exchanges (M. Harvey et al., 2002; Randles & Harvey, 2002). At the same time, Polanyi's analysis brings two dimensions to the fold that are ignored by economic analysis: the political and the social. Marketisation and the expansion of the markets are framed as a political project, in which specific agents are engaged, with the involvement of the polity. Also, marketisation is a process with social, as well as environmental, consequences; the disruption caused by the expansion of markets into hitherto-unmarketable commodities is negative for society and tends to result in some form of resistance, which in turn spreads to the political

field as well. And despite this, Polanyi is careful to highlight the necessity for an analysis of the specifically economic. To this, he adds the realisation that technology, society and the economy are all related, and influence each other. This chapter will now turn to a contribution which expands this Polanyian analysis: the Instituted Economic Process approach.

2.3.2. Neo-Polanyian perspectives: the Instituted Economic Process framework

Rather than presenting a specific model of the functioning of the market, the neo-Polanyian Instituted Economic Process (IEP) approach focuses on the organisation of economic exchanges. This presents two advantages (Randles & Harvey, 2002): first, it avoids making normative assumptions about whether markets are "better" or "worse" than alternative forms of exchange; markets are conceptualised as a subset of the number of possible forms of economic exchange, operating simultaneously and with multiple mutual dependencies. Second, it allows for the analysis of non-market forms of exchange, and the role they play in economic processes, to be done not by comparison to the market, but in relation to the whole economic process. The concept of "organisation of economic exchange" allows for both market and non-market forms of exchange to be placed in a common analytical space; the result is that the relationships between the market and the non-market, as well as possible hybridisations, can be studied (Randles & Harvey, 2002). The agenda for research focuses on the origins, empirical saliency and roles of the institutions of exchange in the emergence, reproduction and change operated in systems of exchange. This agenda highlights the historical and geographical contingencies involved in the production of complex and interdependent systems of market and non-market exchange (Randles, 2003).

The IEP approach maintains that the analysis of any economic process must be based on specifically economic processes, and their historically-contingent configurations: production, distribution, exchange and consumption. These four economic processes are not necessarily separate, but a set of activities instituted in different configurations. The analysis focuses not on the processes *per se*, but on their relational dimension: production, distribution, exchange and consumption form a relational complex, and varieties are explained by changes in the relations between the processes and the way they are manifest in historically instituted configurations (M. Harvey et al., 2002)

Two of the extensions the IEP approach offers to the work of Polanyi are the topics of competition and innovation. Neither was approached by Polanyi in his original work, which is probably a function of the historical moment in which the author produced his best-known research (Randles, 2003, 2007). To conceptualise the dynamics of competition and innovation, the IEP approach requires a mechanism of both change

and stability. Polanyi's (1944) analysis theorised a double movement of marketisation and resistance, but the extensions to the IEP model, and the insistence that the focus should be on the dynamics of economics processes instead of the underlying political economy, mean that this framework is not satisfactory, and cannot be imported wholesale. Instead, the IEP approach highlights the interdependent nature of the various economic processes. The restructuring of market and non-market exchanges occurs within the context of a complex, multi-linked and interdependent set of interactions, dynamic and uncertain in terms of outcomes (Randles, 2002). The notions of flux and stability, as suggested by Polanyi (1944, 1957c) himself, constitute entry points into these issues: the expression "instituted economic process" derives from Polanyi's (1957c) description of the economy as an instituted process, where change and stability co-exist in the economy. The change aspect relates to the "process" term; to refer to economic exchange as a "process" involves looking at exchange activities over time, to trace the changes in the nature and governance logics presiding over the exchange, and finally to see the instituted economic process as historical and geographically-contingent. How society organises process is not pre-determined: in a market economy it is assumed there are a series is acts of economising; when social activities form part of the process, they become economic (Polanyi, 1957c). The sources of variability in socio-economic systems have been identified as either being internal to the same system (the innovation driven from within, in autocatalytic processes), or external to it (adaptation to changing environmental conditions). The resulting change might be quantitative (the proportion of the available resources that are appropriated by agents, a marginal change, as seen by neoclassical economics) or qualitative (different nature of the resources captured) (Mina, 2003).

Conversely, the stability in the process refers to the "instituted" dimension of the economic process. It involves the norms that emerge from within the system to allow for the stabilisation of imbalances, and the achievement and reproduction of ordered patterns (Randles, 2007). The economy is enmeshed in institutions, the source of unity and stability in exchange, providing continuity over time (Polanyi, 1957c). The act of instituting adds significance to the processes, providing them with a place and structure in society. However, the notion of "instituted" is also permeated by the dynamic view of economic phenomena. There is a permanent tension for change, whereby stability is ultimately under strain. The economic processes are not instituted on a definite basis, but instead institutions can evolve alongside parts of the system they are supposed to control. In periods of institutional uncertainty the notion of institution is better described by the concept of instituting:

> …instituting can be seen as a process of historically changing pre-existing instituted processes, whereby instituted processes are those that may endure over longer or shorter periods and involve dynamic processes of reproduction, and for economic processes specifically reproduction. (M. Harvey, 2007, p. 175)

Economic processes are variously institutable and de-institutable. The outcome of the process of instituting is the normalisation of objects of exchange and of the practices presiding over economic transactions: a form of standardisation. The institution of a (shared) standard has been shown to reconcile different interests and strategies, if accompanied by a specific regulatory framework and the emergence of new patterns of consumption (Mina, 2003, 2007). The same logic of the role of standards applies to the topic of market expansion in general. In his historical analysis of development of trade, North (1990) describes how in antiquity local trade would have typically expanded over distance, on the back of increased specialisation, the development of trading centres and economies of scale. In the process, the number of agents and trading locations would increase significantly, in turn leading to increased transaction costs, associated with problems of agency and contract fulfilment and enforcement. The economic problems of costs and uncertainty associated with expansion were dealt with by innovations in the institutional context, such as political and legal structures, the emergence of institutions devoted specifically to information gathering and distributing, and the development of standardised weights, measures and units of account – standards that allowed the exchange to take place. Standards can also reduce transaction costs by allowing parties to agree on what is being traded easily:

> "Some goods today are incapable of being described in a standard designation because of the unevenness of nature or man-made uniqueness (…) [w]here possible, however, transaction costs on commodities are reduced by standardizing quality by grades" (Kindleberger, 1983, p. 378)

With this complexity in mind, Polanyi's description of the mechanism of economic change proves insufficient to describe the substantive economy. Instead of a double movement of market expansion and market resistance, economic processes suffer tensions, between and within the economic sphere, the wider society and technology. The result is a series of successive iterations between marketisation and resistance, characterised as dialectic double movements (DDMs), which have an impact on how the economic processes are ultimately instituted (Randles & Ramlogan, 2007). The result of this dialectics between the drive to expand the market and the geographic and historical contingencies in each case is a wide variety in how exchanges are eventually

instituted. From this conceptualisation of change and stability in the institution of economic processes follows that the research object becomes the ways in which boundaries (and interdependencies) change and become re-thought between different, co-occurring forms of instituting. This involves exploring the boundaries between the market and non-market forms of provision, consumption and exchange; between production, distribution and consumption; between economic and non-economic competition; and between private-public and private-corporate forms of provision.

Any instituted process of exchange depends on market and non-market exchanges on either side. Market exchanges may depend on other markets, and they may depend on non-market exchanges for their continued operation. No economic exchange can self-sustain, and will typically depend on myriad exchange relations with other agents. Overall, "…a complex nexus of innovation – and transformed exchange processes – across several classes of economic agent is necessary for new market formation" (Randles & Harvey, 2002, p. 19). The changes to the boundaries between market and non-market might come about for different reasons, such as deliberate projects and strategies by given groups of agents defending specific interests, or wider and unrelated societal transformation (Randles, 2003). As processes of innovation and competition are, themselves, differently instituted in different geopolitical and historical settings (M. Harvey, 2007), the result is variety in forms of exchange, the diversity originating from the structural change operated to instituted economic processes: "variety and contingency characterise market institutions" (Mina, 2003, p. 436).

The study of variety does not imply that IEP research has the objective of producing typologies of exchange[23]; instead, it is the dynamics of the change that provide the fundamental insight:

> The perspective that all such processes are fundamentally 'instituted' and therefore the result of processes of institutionalization and de-institutionalization, underpins a central theoretical perspective of comparative and historical variability. Indeed, the focus of theoretical interest becomes one of dynamics of variation – how processes are formed differently, rather than a taxonomic interest in resultant 'types' of capitalism (Ramlogan & Harvey, 2003, p. 321).

With this in mind, Randles and Harvey (2002) present a framework for analysis of the different exchange processes, consisting of two dimensions, with three aspects each. The first dimension, conceptual analysis, refers to the steps in the understanding of the institution of exchange, regardless of what specific exchange is being analysed. The

[23] As was the case in New Institutional Economics (sub-section 2.2.2)

three aspects of the exchange processes consist of (1) separating and distinguishing the different classes of economic agents between which the exchange occurs, where "class" is taken to signify a group of economic agents sharing broadly similar economic functions, and contrasting with the remaining classes; (2) organising the relationship between the two classes of economic agents, without which exchange cannot take place; and (3) the exchange process proper. As noted above, these exchanges are not necessarily market exchanges, and frequently there is strong interdependence between market and non-market forms of exchange. These are the universal instituted characteristics of the exchange.

The second dimension refers to the specifics of each exchange, highlighting the instituted specificities of exchange processes. These consist of (1) the nature of parties to the exchange – more than simply consumers and producers, or even the distinguishing between supply and demand crowds that Polanyi highlights, specific groups are involved, such as private and public organisations, non-governmental bodies, consumers, citizens, or workers and their representatives; (2) the nature of the entities that are traded – which can be good and services, but also labour, capital, property rights or others; and (3) the modalities of the exchange in a specific space and time.

Unlike most economics analysis, IEP does not assume that certain external conditions (such as perfect competition) are enough to balance the power of the agents involved in the exchange. On the one hand, the dynamics of the exchange process results in a functional dependency between the classes of agents – one class of agents may not be capable of continued existence without the other. On the other hand, there is the potential for asymmetry of power in the relationships between classes, despite the mutual dependency. Potentially, power asymmetries may cause continuous tensions in the exchange. At the same time, in some instituted economic processes it is possible there might be interactions between different classes of economic agents across the exchange relationship, shaping and conditioning the exchange. These interactions are, again, not theorised in economics thinking, but they may have a crucial role in the coordination of the market. Examples of such coordinating interactions include co-design and specification of the product exchanged between sellers and buyers, agreements on the nature and terms of contracts, quality specification and accounting procedures, among others.

The picture suggested by the neo-Polanyian, IEP approach suggests that innovation within and outside the socio-economic system – driven by technology, competition and regulation – results in changes to the four fundamental economic processes of

exchange, production, distribution and consumption. The result is a variety of instituted forms of exchange and governance of social processes. Further, besides the flux there should be evidence of attempts to normalise the exchange, through processes of standardisation. By focusing on the specifically economic dimension, it presents a clear-cut model of how markets fit within the wider exchange, and how innovations at the level of each of the fundamental economic processes disrupt, create and destroy exchanges, including markets. It reaches beyond the simplistic analysis of institutional economics, in particular, by not assuming the existence of markets as an *a priori* to firms, instead identifying them as co-existent forms of exchange, which can be instituted (and de-instituted) in different ways in different contexts; this continued use of Polanyi's insight of the historical contingency of forms of exchange is one of its most important contributions. However, three distinct criticisms can be levelled at the perspective: first, that it is somewhat vague in its analysis; being a systemic approach, it steers clear of determinism to the point of losing any significant capacity to make predictions. Second, that it describes high level processes of economic organisation, but overlooks the actual structures and architectures on which the market is built and shaped; and third, that by focussing on the specifically economic it overlooks some of the non-economic aspects of the exchange (such as the political, legal, cultural or social). In an attempt to analyse these same issues, this thesis will now turn to the field of economic sociology.

2.4. In search of a generative mechanism: the contribution of economic sociology

2.4.1. The embedded economy and networks: new economic sociology

New Economic Sociology (NES) is another approach that has produced a critical appraisal of the excessive formality resulting from neoclassic economics. NES analysis is derived from the observation that institutions, governments and firms operate, in the context of markets, in a fashion that produces more social structure than economics analysis can make a sense of. At the same time, these agents operate against a background of common understandings, rules and laws. The emergence and operation of markets depend of the involvement of many groups of social actors, such as entrepreneurs and managers, but also workers, firms and governments: "In order to make new products to make new markets, extensive social organisation has to come into existence" (Fligstein, 2001, p. 4).

The argument posed by New Economic Sociology is that such radical separation between the social and the economic is not valid (Swedberg & Granovetter, 2001). Economic behaviour is theorised as embedded in social relations, and consequently

constrained by ongoing social relations; it is not so much that economic life is submerged by these relations, but rather that they become a key aspect of the market (Granovetter, 1985). Individuals always operate against a background of social structures, which predate them and have their own evolution history. An economic agent is never isolated, but instead he or she remains in contact with others. Individuals operate in networks of personal relationships, regular sets of contacts and social connections between individuals or groups. As a result, their actions are expressed in interaction with others. Interpersonal relations and social factors can impact both technical and regulatory decisions, and impact the eventual outcome of development processes, and may contribute to locking in technical and shaping whole industries – and, consequently, markets (Garud & Karnoe, 2001; Garud, Kumaraswamy, & Karnoe, 2010; Granovetter & McGuire, 1998; Stack & Gartland, 2003). This concept helps avoid not only over-simplified views of the economic actor, but also the conceptual flaws of theories which presume one single explanation for economic action.

The market is thus characterised as a type of social structure, where the term social structure refers to "…some kind of recurrent and patterned interactions between agents that are maintained through sanctions" (Swedberg, 2005, p. 255), a social institution which facilitates exchange. A description of the empirical market can be produced from these two ideas:

> …I suggest that the core of the market phenomenon does not consist of one element – exchange – but of two elements: exchange in combination with competition. More precisely, the social structure of a market is characterised by a special type of interaction that begins as competition between a number of actors (buyers and/or sellers) and that ends as an exchange for a few of the actors. (Swedberg, 2005, p. 271)

Where the research in NES takes a significant step forward with regards to the models referred to above is in providing a potential mechanism which can explicate the emergence of producer markets (White, 1981). Producer markets are markets which coordinate the producer firms into producing downstream flows, into which upstream procurements have been incorporated; as a result, "…streams of differentiated goods and services from the market get split among diverse buyers as equally good options: the market discipline centres on product quality" (White, 2002, p. 1). The markets are seen as being composed by two separate sides: consumers and producers. Both the consumer and producer groups are aggregated, and jointly they monitor each other via a joint social construction – the terms of trade. Producers, acting on self-interest, base

their productions decisions (of how much to produce) on the production decisions of other producers, not on a speculation on the reactions of buyers (demand). The market, in this case, emerges as a structure of roles out of the mutual observation of producers:

> Markets are not defined by a set of buyers, as some of our habits of speech suggest, nor are the producers obsessed with speculations on an amorphous demand. I insist that what a firm does in a market is to watch the competition in terms of observables.
>
> In my proposal, markets are social structures in which producers reproduce their own set of actions; the set confirms as correct each firm's expectations of what it hoped was an optimal volume." (White, 1981, p. 518)

Price, in this context, is quantity-dependent. Because each producer firm in the market has its own cost structure (and appreciation of products by the buyers), each producer needs to decide on what specific niche of the schedule to take on:

> …firms seek niches in a market in much the same way as organisms seek niches in an ecology. Because each firm is distinctive, they are engaged not in pure competition but in finding and sustaining roles with respect to one another given an environment of discerning buyers. (White, 1981, p. 518)

Confronted with uncertainty, producers in the market (firms) act to minimise the gap between the procurement costs they face (in their upstream interface) and the revenue from sales downstream. By this mechanism of strategic placement, "each market reproduces itself as a social construction by virtue of some form of signalling within a shared frame of perception within its firms". (White, 2002, p. 2).

2.4.2 The performativity of economics and the technologies of markets

Modern societies are living through a general re-configuration of governance relationships. Part of this has to do with what Beck (1992) designates as the modernity issue of producing, and living in, a "risk society" – a society where the successes of modernisation and industrialisation are also the root cause of problems. The benefits of development and increased wealth (which itself entails consumption) have increasingly resulted in unpredicted, uncertain risks. The process of modernisation has systematically and demonstrably had negative consequences (Beck, 1992). Paradoxically, much of the instituted risk discourse is confined to what can be measured and controlled. Risk is something to be discovered and taken care of; there is a claim to control, which ascertains that all significant future consequences of risk

can be identified and controlled. Ignorance and future consequences beyond the realm of scientific knowledge are not acknowledged and deleted from discourse: risk and technology are related and constitute the main issue of modernity (Wynne, 2002).

Research in the field of Social Studies of Finance (SSF) offers an alternative perspective on the role of perceptions of risk and consequent changes to governance mechanisms. In doing so it allows for a critical understanding of marketisation, as well as some of the other processes prescribed by ecological modernity. Markets are progressively presented as artefacts, to be constructed and experimented with; but at the same time this "real life" dimension makes markets subject to dispute, and become political objects, not just economic entities (Muniesa & Callon, 2007). Capitalism, all these examples show, does not possess fixed characteristics, but is the result of the networks the actor is made up and forms part of. The market is not simply expanding, but rather continuously emerging and re-emerging; the framing necessary to contain externalities is costly and overflows are the inevitable corollary of the requisite links with the surrounding environment. The expansion of markets often results in other, new externalities being, if not produced, detected (Callon, 1998a). It is for this reason that the concept of performativity becomes a good possible explanation for the evolution of exchange mechanisms. Economists, as social scientists, participate both in the description of the economy, and its constitution, by innovations in markets and in institutions in general (Callon, 2007). But by describing the existing forms of exchange as either market (seen as *good* and *efficient*) and non-market (represented as *bad, inefficient* or *lacking*), the discipline of neoclassical economics displays an (unacknowledged) normative dimension, dispensing only one type of advice and remedy to existing problems, with one theme in common: to deploy markets (Mitchell, 2007). It should be clear at this point that the emergence of markets is the enactment (the performativity) of a certain, different and specific, way of doing things. It consists of a set of processes whereby a set of non-economic ways of operating, are transformed into, or substituted by, economic ways of doing things: a process of economising (Callon, 1998b).

2.4.3. From staging to performativity: science and economic experiments

In Beck's (2007) assessment, risks do not constitute actual catastrophes, but neither are these risks imagined or otherwise manufactured. Risks consist of the anticipation of said catastrophe. In not being actualised, they are no less real, as they refer to events that may occur in the future. By consisting of perceived threats, they have the capacity to shape expectations and guide actions. Beck (2007) describes the working of this process using the concept of staging, through which the distinction between the actual catastrophe and the anticipated catastrophe are blurred. Eventually, risks become so

important that they require preventative action at the political level. It is what form this political action takes that makes the issue paradoxical: there seems to be an ingrained tendency in decry political action as flawed and potentially biased, and instead call for solutions based on scientific advances, perceived as unbiased and superior to politics. Especially given the expansion of the number of agents involved in governance, scientific knowledge and expertise have become very prominent in political discourse; science (and the knowledge it produces) have become a mechanism for the legitimisation of governance (Kazancigil, 1998). Economics, as a science purporting to study how to allocate society's resources so as to achieve maximum welfare[24], plays an important role in these matters.

The starting point for the analysis in this perspective is the dichotomy between the formal construct prevalent in economics – the markets – and the empirical observation of an existing space for exchange in the economy – the marketplace. The research agenda defined by SSF is based around understanding this dichotomy between the market as seen in economics and the existing marketplace, how they relate, and how they influence each other:

> …to construct a social history of economics which would show how abstract notions such as those of supply and demand, or those of interconnected markets (à la Walras), imperfect competition (as proposed by Chamberlain) or incentives, have been formulated in constant relation to practical questions which, in turn, they help reformulate. (Callon, 1998b, p. 2)

From the very outset, the perspective aims to understand the two way transit between the empirical reality of the market and economic theory. Looking at how economic theory describes the market, three dimensions are clear: the first is a specific model of agency, what is described as “calculative agencies”; the second is an organisation, or multiplicity or possible organisations, within which economic action occurs, that takes into account the variety of calculative agencies and their distribution; and the third is a process dimension, in which said calculative agencies come together, oppose each other, and eventually reach a compromise. This process results in the construction of the markets and in the stabilisation of the competitive processes for a given space and time (Callon, 1998b).

The emergence of the market thus fosters the emergence of calculative agents, changing individuals and society itself, leading to the hypothesis that economics is a performative science (Callon, 1999, 2007; D. MacKenzie et al., 2007). Economics,

[24] As postulated by neoclassical economic – see section 2.1.1.

more than merely describing the functioning of the economy, instead "...performs, shapes and formats the economy..." (Callon, 1998b, p. 2), and can thus be seen as "... a set of instruments and practices that contribute to the construction of economic settings, actors and institutions" (D. MacKenzie et al., 2007, p. 4). Herein is the research agenda for SSF with respect to market emergence:

> The issue that needs to be tackled in relation to economies and economics is not just about "knowing" the world, accurately or not. It is also about producing it. (…) Economics swings between representation and action, between science and policy, between academic inquiry and political interventions (D. MacKenzie et al., 2007, p. 2)

Such insight explains, in part, the proliferation of market-based mechanisms in the discourse and public policy practice on externalities. The notion of internalising externalities derives from neoclassical and new institutional economics theory, with the assumption that externalities can (ultimately, should) be internalised – that is, that non-market forms of exchange should be brought under the control of the market. However, it is also clear that internalisation of externalities inevitably results in the production of other externalities – a phenomenon designated overspilling. Ultimately, it is impossible to internalise all externalities (Callon, 1998a, 1998b, 1999). However, the economic and public policy practice continuously devises economic experiments in which markets are created to internalise externalities:

> These experimental activities are research activities in the sense that they aim at observing and representing economic objects, but also – and quite explicitly – in the sense that they seek to intervene on these economic objects: to seize them, to modify and then stabilise them, to produce them in some specific manner. (…) Economic experiments perform economic objects, in a quite general sense. What economists describe is indeed produced by them in the experimental setting. They account for what they provoke. (Muniesa & Callon, 2007, p. 163)

It is in this context that the emergence of economic experiments is seen: situations where a specific model of what it is to economise are both tested, and at the same time performed (Muniesa & Callon, 2007). Much of this is due to the performative character of economics – the fact that economic sciences are not just a form of descriptive knowledge, but a set of prescriptions, instruments and practices which contribute to creating economic actors and settings (Callon, 1998b; D. MacKenzie et al., 2007). The environment is one of the areas where the deployment of these economic experiments has been notorious, to the point that it has been asserted that "markets in

environmental services are becoming the dominant approach to managing and protecting the environment in the twenty-first century" (Liverman, 2004, p. 735).

And, as this chapter will discuss below, faced with the risk of losing biodiversity and ecosystem services, several governments are experimenting with markets for biodiversity offsets. These market experiments derive from self-organising governance networks, but they are embedded in the precepts of economic theory (Garcia-Perpet, 2007). This is demonstrated by their pursuit of mechanisms to economise, that is, to circumscribe the actors and their networks to a space where calculation around the commodity and exchange alone can take place, and the overflowing (non-economic) externalities can be framed, economised – that is, internalised (Callon, 1998a).

While these experiments can take place in the relatively limited setting of the laboratory, increasingly the setting of some of these is the whole of a national economy. The concept of creating a perfect market, one where the theoretical conditions for competition are in place and allow for a perfect allocation of resources (prices are given; products exchanged are homogeneous; actors can enter and exit the market freely; and there is perfect information in terms of quality, quantity and price of products on offer) is prevalent in the discourse and in policy-related discussions; little wonder, then, that policy often consists of attempts at producing this ideal market. One such example is the construction of an ideal market for strawberries on the French region of Fontaines-en-Sologne (Garcia-Perpet, 2007). The participants in this (political) project set about creating a market structure that would counter the networks which controlled the exchange beforehand, where producers were dependent on direct bargaining with brokers, shippers or agents. Those producers obtained the cooperation of a regulator with strong neoclassical economics training to design, construct and implemented a perfectly competitive market, and applied the principles of commodification and standardisation to the product. The market was successful; in the end, the knowledge capital of the proponents of the market gained ascendency over the economic capital of brokers and traders, increasing earnings for the producers. The author's observation points to the creation of the market as a social innovation:

> ...the creation of the new auction-based trading mechanism (…) should be seen as a social innovation resulting from the work of a number of individuals interested, for different reasons, in changing the balance of power between the growers and the buyers (…) it should not be seen as the spontaneous appearance of a mechanism for liberating economic energies which come into being because of the rationality and efficiency of its procedures. (…) It is not, therefore, a simple development of pre-existing

> trading relations – the outcome of a mechanism which would have perfected itself as interactions between those involved in exchange developed and unfolded. The practices which constitute the market are not market practices. (Garcia-Perpet, 2007, p. 37)

The author goes on to remark how, even in a purpose-built set like this, both buyers and sellers had to be constantly watched to ensure that the arms-length, competitive relationships did not develop into personal relationships; and how, later, that interaction was becoming ever more common, as new market actors with both knowledge power and capital (supermarkets) became important players in the market. So, in a way, the non-market aspect remained prevalent; unsurprisingly, Callon has remarked that the framing that brings externalities into the market creates, by its very existence, new externalities – so it is impossible to eliminate externalities altogether (Callon, 1998a).

Another example of the performative creation and evolution of perfect markets can be found in emissions trading schemes. By attempting to price companies' emissions (of carbon, sulphur, nitrogen or other pollutants), “[a] carbon market is thus an attempt to change the construction of capitalism's central economic metric: profit and loss” (D. MacKenzie, 2009a, p. 441). The focus, again, is on changing the economic organisation to follow a specific model – the efficient market. In the different cases of construction of emissions markets worldwide, the result so far can probably be described more as the result of the deployment of socio-technical systems of measurement, on the one hand, and on the political pressure and bargaining that agents engaged in; again, like in the strawberry auctions example, the process was eminently political (D. MacKenzie, 2009b). The design of these socio-technical systems of measurement is essential in the process of economising.

2.4.4. Economics and biodiversity loss: the promise of ecological modernisation

One example of the application of a neoclassical economics rational to the problem of biodiversity loss comes from the field of ecological modernisation (Christoff, 1996; D. R. Fisher & Freudenburg, 2001; Murphy & Gouldson, 2000; Spaargaren & Mol, 1992). This literature applies the neoclassical model to the relationship between biodiversity and the economy, identifying causes for biodiversity loss and proposing mechanisms for addressing those losses. It provides an example of how specific policies are promoted, creating a basis for the performativity of economics in the context of biodiversity losses. This section reviews the rationale presented by ecological economics in this context.

The relationship between society, the economy and the environment is characterised by a strong inter-dependence: society and the economy require environmental goods

and services – ecosystem services – provided to function; social and economic activities, in turn, impact the environment. When referring to the environment as producer and source of goods and services, it is important to specify which part(s) of nature are at stake. At the core of ecosystem services is biodiversity – the quantity and diversity of living organisms and their relationships with the environment they inhabit (TEEB, 2008). Biodiversity is a complex construct: it refers to a number of dimensions of organisms, from the genetic level – the variations of DNA within a species, for example, to the number and variations of individuals of a certain species, and through to the numbers and variability of species in an ecosystem (Chakraborty, Wu, & Hazen, 2012). Because of this complexity, different aspects of biodiversity may be highlighted in specific contexts. Ultimately, biodiversity is responsible for the continued and timely production of ecosystem services: through their normal activity, the relationships established by organisms and their environment result in goods and services which not only sustain life on Earth, but also serve as a basis for human economy and human enjoyment (Balmford et al., 2002; Constanza et al., 1997), constituting the infrastructure of human activity (Biller, 2007).

Human activities are having a negative impact on the flow of ecosystem services, and have the potential to alter all of the Earth's ecosystems (Daily et al., 1997). The main causes of biodiversity loss are rooted in human activity: the clearance of natural habitat, especially for agricultural or building of infrastructure – in other words, land development (Foley et al., 2005). Biodiversity loss is frequently correlated with economic development and activity, which makes it a particularly difficult problem to tackle since both biodiversity conservation/ecosystem services and land development have the potential to result in human welfare increases:

> The ecosystem services supplied annually are worth many trillions of dollars. Economic development that destroys habitats and impairs services can create costs to humanity over the long term that may greatly exceed the short-term economic benefits of the development. These costs are generally hidden from traditional economic accounting, but are nonetheless real and are usually borne by society at large. Tragically, a short-term focus in land-use decisions often sets in motion potentially great costs to be borne by future generations. This suggests a need for policies that achieve a balance between sustaining ecosystem services and pursuing the worthy short-term goals of economic development (Daily et al., 1997, p. 13).

Consequently, biodiversity losses are a serious environmental problem, one which requires urgent action in order to be stopped or mitigated, thus maintaining the

potential for continued and appropriate ecosystem services production (Balmford et al., 2002; TEEB, 2008, 2010).

This view of nature, biodiversity and their role in human livelihoods and activities has its apex in growing concern with the possibility of maintaining the pace of economic development (and the consequent increase in consumption and improvement of material conditions for a growing human population), while observing the necessity of preserving Earth's resources and potential for future production. This interest culminated in the influential United Nations-sponsored report Our Common Future[25], which introduced the concept of sustainable development as "...development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987, p. 16).

The translation of this apparently simple definition into political action has been fraught with difficulty. Applied to the environment, this definition of sustainable development recognises that the economy necessitates goods and services provided by nature for its continued functioning, while at the same time enshrining the rights to development of their own to future generations. This latter point resulted in much increased uncertainty around the topic of development, since it forces intergenerational considerations to the fore: on the one hand, present-day humans have a clear ethical responsibility towards their descendants (however far in the future), to conserve and preserve nature's resources for future use. But on the other hand, it is assumed that the continued rate of scientific and economic development will result in future generations enjoying higher living standards and greater utility from built capital; that being the case, it is equally inefficient and unethical for current humans to reduce their consumption excessively and conserve "too much". In the face of these problems, the search for tools[26] which can help bring about sustainable development has developed, with some of the answers coming from the emerging field of market environmentalism.

As discussed above, much of the conservation policy in the context of sustainable development is related to the problem of choosing between conservation of land for biodiversity and ecosystem services production, or development of that same land for economic gain. Ideally, the choice should be between directly competing uses of a certain area, with the use that results in the biggest utility over time preferred over the other.

[25] The report became known as the Bruntland Report.
[26] The term "tools" is used here to signify a myriad of different (and sometimes opposing) governance, technical, legal and other mechanisms and initiatives.

However, a number of facts about biodiversity and ecosystem services result in a reduced capacity to make rational choices about land uses. A significant number of ecosystem services are not priced in markets. They are externalities in two senses: on the one hand, it is not possible to stop non-paying agents from benefiting from the services produced – the benefits of biodiversity are usually non-excludable. On the other hand, these services are also usually non-consumable – that is, one agent's enjoyment of some ecosystem services does not necessarily reduce others' utility from the same service (Baumol & Oates, 1988; Hanley et al., 2007; Perman, Ma, McGilvray, & Common, 2003). The status of ecosystem services as externalities means that it has so far been difficult to bring many of these benefits to markets, where societal preferences for conservation or development can be manifest through willingness to pay for either. Often this means that land development, the benefits of which can be predicted with a degree of certainty through income and profit expectations, tend to be pitted against diffuse conservation benefits, about which there is little information in terms of preferences, and much less an estimation of the economic value (Garrod & Willis, 1999). The lack of a system through which individuals can manifest their preference for more or less biodiversity conservation or land development could result in a tendency to benefit the alternative which has clear monetary benefits.

A second important issue related to biodiversity loss is its geographical dependence. It makes relatively little sense to speak of aggregate, global biodiversity losses when taking an anthropocentric view of nature, since most of the benefits are strongly locale-specific. Individuals often need to be in specific places in order to benefit from ecosystem services, either in their "pure" form, or when paired with built capital (B. Fisher et al., 2008). This makes the task of determining the value of biodiversity conservation all the more difficult: as a general rule, the benefits enjoyed by agents tend to diminish with the distance they find themselves from the location where said benefits can be enjoyed[27] (Bateman, Day, Georgiou, & Lake, 2006; Concu, 2006; Hanley, Schlapfer, & Spurgeon, 2003).

Because of these two problems – the externality status of ecosystem services, and the distance-decay of the benefits provided – biodiversity has been largely kept from marketisation. Some attempts have been made to provide payments for conservation, such as the biodiversity conservation schemes related to agricultural programmes in

[27] The fact that distance has a negative impact on value led to the development of an environmental valuation technique, travel-cost, which presumes that the value of an area (presumed to include goods and services) is at least as great as the total cost that all visitors to it incurred travelling there (Garrod & Willis, 1999; Hanley & Barbier, 2009); the value is often larger than the travel cost, but the numbers can be disputed. It could also be argued that in the case of growing conservation and tourism partnerships (Brockington, Duffy, & Igoe, 2008), the value increases thanks to the fact that the land and ecosystem services visited are perceived as far away and exotic.

the United States and the European Union, or Payments for Ecosystem Services (PES), taking place between countries[28]. In other situations, institutions such as NGOs have bought land areas devoted to conservation, in what could be seen as a use of the market in land to provide conservation. However, and apart from these specific schemes and attempts, in general it remains difficult to reach decisions about the preferred allocation of a society's resources when it is necessary to choose between biodiversity and development. This situation can be characterised as market failure – or, as the TEEB (The Economics of Ecosystems and Biodiversity) study put it, evidence that society's economic compass is defective (TEEB, 2008, 2010).

This situation of market failure does not preclude that valuation of the economic benefits of ecosystem services is undertaken. In fact, environmental valuation has been an emerging field since the 1980s. Environmental valuation can be employed as a mechanism to correct the consequences of market failure (Garrod & Willis, 1999; Hanley & Barbier, 2009). At the most generalist, it consists of a suite of techniques for determining how much "people" - assumed to be the pool of potentially paying agents, hopefully those benefiting from the good or service being valued – would be willing to pay[29] for continuing to benefit from such good or service. The resulting values constitute a mechanism for aiding decision in settings other than the market: legal matters, such as the value of compensation for environmental disasters[30], or planning decisions. In planning situations, in particular, it is proposed that estimates of the economic value of an environmental feature can help establish whether it is more advantageous for society (if it results in higher welfare) to conserve a given area than to develop it. In this sense, environmental valuation is a (partial) substitute for a functioning market, providing an estimate of what the outcome of a potential (but not actually existing) market would be, and thus enforcing policy. Valuation does not imply marketisation; if anything, valuation is an obstacle to marketisation: in producing a set of value estimates, it constitutes a potential substitute for the main task of the market – to settle on a set of prices, and consequentially coordinate resource allocation. It

[28] For a comprehensive review of the rationale and consequences of PES schemes, see Landell-Mills and Porras (2002).

[29] One of the (many, significant) criticisms of environmental valuation is the fact that the results produced change with the structure of the proposals made to agents: estimates of willingness to pay (WTP) for conservation and willingness to accept (WTA) compensation for loss of utility should be in theory be similar, but in practice tend to differ significantly, the latter being much higher than the former. Authors in the area suggest adopting WTP as the "real" measure, and consistently employ in in environmental valuation studies (Hanley, Shogren, & White, 2007).

[30] Historically the use of environmental valuation became mainstream in the aftermath of the Exxon Valdez accident, when an oil tanker ran aground and created an oil spill which reached and damaged areas of Alaska. At the time, the American judiciary made the decision of including results from environmental valuation in the calculation of the compensation to be paid by the companies responsible.

produces information and “signals” which can guide the action of policy makers in the absence of markets.

Environmental valuation is not the only such market-substituting mechanism; other tools have been devised. One important alternative to marketisation is the deployment of safe minimum standards. Safe minimum standards are defined as “a restriction (…) which limits the use of resources to levels that are thought to be safe, e.g. conservation of a sufficient area of habitat to ensure the continued provision of ecological functions and services, at the ecosystem level” (European Environmental Agency, 2013). They constitute reasonable minimum quantities of a given environmental good, which should be preserved in order to assure continuous future availability (Crowards, 1998; Fromm, 2000). In the case of ecosystem services, to designate a safe minimum standard would imply defining minimum safe quantities of biodiversity for a given area, bearing in mind dependencies between components of an ecosystem; when well designed and implemented, these safe minimum standards of biodiversity conservation would result in significant ecosystem resilience (the capacity to withstand shocks and continue functioning and reproducing), and would ultimately assure that the necessary ecosystem services would go on being produced, even in the face of external shocks (R. Bishop, 1993). In practice, safe minimum standards of biodiversity conservation require that strict limits to loss of habitat are put in place, consequently impacting how much total are can be built on. As before, these minimum standards would be more efficient when applied on a localised basis, such as determining and enforcing a minimum “conservation acreage” in a given ecological area.

However, the safe minimum standards approach suffers from a number of problems. The first is uncertainty: the stochastic nature of ecosystem relations means it is very difficult to determine with precision what constitutes a reasonable quantity of conservation of biodiversity in order to assure continued ecosystem services provision. As a result, too much acreage may be devoted to conservation, resulting in the equally inefficient outcome that not enough development occurs. This problem is especially glaring in the face of growing population and rising consumption. To add to this information failure, there is the fact that the well-known reluctance to accept losses could lead to excessively high standards being imposed, damaging the possibilities of development. Landowners could be negatively impacted by such standards, seeing their potential economic gains cut short by regulation curtailing their potential earnings (Latimer & Hill, 2007). The result of this would be another type of new market failure, whereby the minority of landowners would be forced to produce externalities to benefit the rest of society for little or no personal gain. In short, this imposition of safe minimum standards, while potentially efficacious, is potentially economically inefficient.

Besides economic efficiency, there is also the problem of value capture. Using environmental valuation methods it is possible to obtain estimates of the value of biodiversity conservation. But valuation estimates do not produce actual economic value, such as would be realised under the guise of payments being passed on to those responsible for producing ecosystem services. The answer to the difficulty of capturing economic value from the estimated produced by environmental valuation is assumed to lie with the opening of decision-making to citizens: given a number of options with regards to their preferred balance between development and conservation, citizens would be able to communicate their preference for more or less development and conservation. In short, a mechanism should be devised which aggregates the preferences of all members of society in terms of the balance between land development and biodiversity conservation. Such mechanism, it is suggested, is the market. Market environmentalism proposals suggest that individuals are sensitive to losses of ecosystem services, and would thus react to these losses by manifesting their preference for less development (and destruction of habitat) and increased conservation. Higher-valued ecosystems and lower-valued land development would result in society's resources being channelled to conservation instead of land development.

On the basis of this theoretical perspective, all citizens in society would be involved in the market. However, it is not clear that a market can be designed to accommodate the preferences of all the citizens in a society. Neither should it be expected; not many individuals are directly involved in land development, and it is not clear why they should be involved in this side of the market. The two sides of the conservation-versus-development problem involve primarily on the one hand landowners, and on the other hand companies interested in land developments. In practice, a working market system needs to be put in place which raises the cost of development and increases the rewards to conservation. This follows the experiences in other applications of market environmentalism: markets for pollution rights, such as the markets for sulphur emissions (in the United States) or the markets for carbon emissions (in the European Union). In each of those markets, actors (such a private companies) producing externalities (such as sulphur or carbon dioxide) that impact on a public good (the atmosphere) are forced to acquire emission licenses equivalent to the total of their emissions for a given period of time. The aggregate level of impact for a given period of time can be decided *a priori* and capped by the regulator – potentially obeying an estimate of a safe minimum standard –, with the emitters being allowed to exchange

emission licenses among themselves[31]. The assumption is that, given a high enough emissions cost, agents will prefer to invest in technologies which reduce their production of externalities rather than buy new emissions credits. Over time, emissions will then be reduced – this is described as the dynamic effect of the market mechanism (Hanley et al., 2007).

For these benefits to be possible, an existing market needs to be designed and implemented. Among the most challenging aspects of doing this is devising a clear definition of what is being traded. This has proved challenging, especially considering the multi-tiered definition of biodiversity, and the fact that the parts of the system tend to need the conservation of the rest of the system to exist. Crucial to this has been the concept of ecosystem services.

It is a tenet of market environmentalism that the necessary concepts, techniques and technologies for the measurement of biodiversity and its benefits have already been developed, field-tested, and are ready for deployment in the service of the creation of markets for biodiversity conservation. Much of this rests on the understanding of what biodiversity is, and how it relates to the key concept of ecosystem services. From a measurement point of view, biodiversity is considered a stock variable (Perman et al., 2003), measured for example by counting the actual number of members of a species in a given location[32]. Likewise, it may be important to consider the entire ecosystem, or at least the food chain on which a species depends; in that case, the population size of several relevant species can be measured. However, the population size of one or several species is not enough in terms of marketisation. As discussed above, human enjoyment of biodiversity is characterised in terms of benefits accrued from ecosystem services. Ecosystem services are the key dimension of measurement, as they are of valuation. However, because they consist of flow variables, which are transient by their very nature, they raise many measurement problems. The solution to this problem is often to establish the relationships between stocks of biodiversity and the flows of ecosystem services: the amount of a given service provided per unit of time can be estimated, using models which translate how the stock of biodiversity results in flow.

[31] This mechanism, combining a "hard limit" of externality production and an exchange of credits between actors is appropriately described as "cap-and-trade", especially in the United States.

[32] Measurement of biodiversity is affected by many issues. Most surveys of a population are based on counts of individuals over a sampling period (Link, Barker, Sauer, & Droege, 1994). That a species is declared present or absent on a landscape may be a descriptor of the methodology and individual surveyor's ability to find the species, not its presence or position at the time of measurement (D. I. MacKenzie, 2005). Attempts to reduce errors by having several surveyors work together and consult in the field to minimise errors (Klimeš, Dančak, Hájek, Jongepierová, & Kučera, 2001) are subject to confusion and disagreement between observers (Robertson, 2007).

This can be done through production functions, for example, using reasonably standard econometric tools[33].

Measurement of both biodiversity and ecosystem services has been facilitated by the development of technologies. The most important of these are Geographic Information Systems (GIS) (Chen, Li, & Wang, 2009; Foody, 2008; Guralnick & Neufeld, 2005; Salem, 2003), which allow for relatively precise determination of existing stocks of biodiversity and flows of ecosystem services at increasingly small scales. Information gathered in such conditions can be fed into ecological and valuation models, increasing the potential for measurement, while diminishing the associated costs. Increasingly, there are attempts to devise models that are capable of value transfer, allowing for estimates of value in one location to be applied elsewhere (Garrod & Willis, 1999; Hanley & Barbier, 2009), subject to strict conditions of analysis. Here too, the use of GIS is proving important (Troy & Wilson, 2006).

While the theoretical options behind bringing biodiversity to the market and the technical issues of how to measure the benefits accrued by humans have all been developed, there remains the issue of the acceptance of these issues by the companies which will be forced to increase their expenditure (in compensating for their impacts). In democratic societies, the issue of why companies should "do the right thing", as opposed to short-term profit maximisation, remains questionable as it appears to contradict the very basis of capitalism.

The progressive retreat from the State from the role of single governance agent for environmental issues has been mirrored by the increased role played by a number of other agents. Alongside the national state, there are now a myriad of organisations and civil society agents operating at different scales: at the transnational level, supranational institutions and international arrangements have become increasingly more important, putting pressure for agreements to be committed to, establishing objectives which nation states are compelled to enforce. Simultaneously, there is increasing assertiveness from the side of local governments, challenging nationwide decisions which they feel might impact the local well-being (Liverman, 2004). But the pressure does not come exclusively form the political side; environmental governance has expanded to the realm of civil society, with an increasing number of agents asserting their right to having a say. Today the nation state must share much of its governance responsibilities with other agents: transnational organisations (some of

[33] However, the errors and biases involved in these estimates are very significant. Frequently the production of ecosystem services depends not only on biodiversity, but also on physical and biological processes operating at various scales, which makes the relationship between stocks of biodiversity and flows of ecosystem services complex and variable for each case (Vira & Adams, 2009).

which non-governmental), businesses and international agreements bind the state to acknowledge powers and influence beyond its borders, while at the same time dealing with increased assertiveness from regional and local governments, as well as groups of individual citizens (Spaargaren & Mol, 2008). All of these pressures and changes have led to significant changes to the politics of governance, especially when it refers to the environment, "...where new actors, scales, and metrics are transforming environmental decisions" (Liverman, 2004, p. 734), especially in terms of "...the commodification of nature and the reworking of environmental governance to include consumers, corporations, environmental groups, and transnational institutions" (Liverman, 2004, p. 734). Not only is there a growing debate as to who should take decisions, that debate has been framed around the pricing and governing of the environment, on the face of globalisation and the widespread impacts of global environmental change. Both of these factors are part of a significant change in the relationship between humans and nature.

Much of this activity to regulate risks would have a direct activity on business concerns. Transnational Corporations (TNCs), in particular, face the possibility of regulation interfering with their activities and profits in at least three settings: in their home country of activities, in one or more host countries, and internationally, thanks to potential agreements. The result has been a significant trend towards industry self-regulation, whereby private businesses come together to devise and approve standards, often expressed on codes of conduct or companies' systems (Haufler, 2001). This diverges from the evolutionary model of standard-setting, prevalent in economic literature, which refers to agreements on necessary standards for technical development or market promotion, often in the context of "standards wars" (Quark, 2012; Shapiro & Varian, 1999; Stango, 2004). Instead, these self-regulations are based on political and social demands emanating from outside the business community, related to the corporate accountability of firms, pressuring that companies act upon the risks they create (Haufler, 2001). The TNCs most likely to adopt high standards are those operating with high levels of assets specificity, in which they are tied to specific assets (such as natural resources, people, locales or production processes), especially if these involve high, long term capital investments – extraction industries constitute a good example of this.

Two other factors (besides the threat of regulation) weigh on businesses' decisions to adopt self-regulating standards: reputation threats and learning processes. Reputation threats are especially acute among companies which sell directly to consumers and wish to benefit from strong brand image. Adopting high standards may benefit their image and reputation, but might also in the long term increase scrutiny and make the

companies more accountable, thus forcing more action. Operating in parallel to this is the learning which occurs within the business community itself, as corporate leaders spread information and knowledge about the standards they employ, and proceed to both lobby and put pressure on partners and supply networks to operate to the same standards (Haufler, 2001).

Consumers are also emerging as important agents of environmental policy. While individual consumer actions are limited in scope, collective action by groups of consumers is possible, especially when it consists of changing purchasing behaviours to benefit companies with better environmental and social standards – the concept of "shopping to save the planet" (Liverman, 2004).

Another class of emergent agent which is gaining importance in the context of environmental governance are transnational non-governmental organisations (NGO). Their role is both to help coordinate consumers' decisions and actions (Liverman, 2004), as well as to pressure companies to improve their performance and increase their reporting. In specific situations, they will come together with companies to help devise better standards and verify how standards are employed in practice (Haufler, 2001).

Ecological modernisation presents an internally consistent set of ideas, including an understanding of the relationship between the economy and nature, an interpretation of the benefits of biodiversity conservation, an explanation of the root causes for biodiversity loss, and a diverse set of tools to help stem it. Within this realm, and despite the consistency of the set of ideas, there is a broad enough perspective to allow for mechanisms such as the environmental valuation, the setting of safe minimum standards or marketisation to co-exist, and at times be combined. Ultimately optimistic of the possibility that society, the environment and the economy can co-exist, there is nevertheless an assumption that the ways societies cater for and govern nature – needs to be changed to follow a more economic logic. At all stages, it is presumed that science and technology can (and should) be deployed in such a way that the logic of economics, which has served mankind well and helped produce progress for over a century, can now be applied to nature. A sense of a changing political conditions, and expansion of the number and types of agents involved in governance of nature, helps justify the belief that a green, responsible capitalism could be a better mechanism for governing nature than what the previous regime (centred on the State and its effects) could do.

Ecological modernisation is a heavily technical discipline, bringing together in (apparently) seamless ways the idea that technology and economics, deployed

irrespective of place and situation, are the solution to loss of nature. Therein lies one of its greatest contradictions: that it recognises, on the one hand, that individuals and local groups, operating at increasingly small scales, can become important governance agents, their opinions and preferences over local matter prevailing, while at the same time assuming (even if only implicitly) that individuals are all rational agents, motivated by the same mechanisms, and pushing for standardised mechanisms to be applied at much larger scales. This clear contradiction raises the question of what role, and what motivations, are behind this apparently blind deployment of technical devices and economic models.

2.4.5. Economising: the creation of economic agencements

At the core of the explanation for the emergence of the market lies the emergence of a specific economic agent, who follows the ideal *Homo economicus* of economic theory: a calculative agency. This economic agent is not a fictional agent produced by economics, nor is it a simplification of a "real person"; it exists, it is capable of ranking its preferences with regards to possible states of the world, and it is capable of taking action based on those preferences. It is thanks to this capacity of calculative agencies to exist that the market can function as a form of coordination in society (Callon, 1999). Consequently, to understand the emergence of the market is to understand the emergence of the agencies created specifically to function within the laws of the market. Naturally, humans exist in a context of social relations, and the calculative agencies are no different. These agencies emerge in the context of a network – they are embedded[34].

According to this literature, which is built on the foundation of actor-network theory (ANT), agents and commodities are in principle entangled with each other in all social situations. This makes it difficult for the agents to alienate the commodities. The emergence of a market must involve the disentangling of the actor and the network, and the framing of boundaries wherein rational calculations can occur and actors can engage in exchange in such way as to increase their returns (Callon, 1999), anonymously and independently of the surrounding context. Framing can, in this sense, be seen as a process of relative disembedding of the economic exchange. It allows agents, armed with a complete rank of their preferences with regards to states of the world (and the utility attached to them) and the actions necessary to achieve

[34] It is important to highlight that this is neither the embeddedness proposed by Polanyian (Polanyi, 1957c) and neo-Polanyian approaches (Randles, 2003) – which focus on the institutional background to economic action – nor a network which configures agents in social structures, as presumed in the New Economic Sociological approach (Granovetter, 1985). In SSF the network is not a context for action, but rather a part of the calculative agencies; as elsewhere in Actor-Network Theory, the actor and the network are indistinguishable (Callon, 1999).

those same states, to come together and trade, internalising externalities (Callon, 1998b). These calculative agencies are detached, socially disembedded, anonymous and acting independently of the "outside world", allocating goods and services in society in an efficient manner.

As mentioned above, the process of market emergence cannot be considered without reference to the calculative agencies involved in the process; but these agencies are not only single agents: the encounter between economic counter-parties – designated an economic *agencement* (Muniesa et al., 2007) – needs a set of devices that render things, behaviours and processes economic. If indeed there is a drive in every system towards extending exchangeability to as many items as the exchange technology will accept (Kopytoff, 1986), reframing society's relationship with something that is pre-existent to the market must involve the measurement of its stocks or flows in a way that renders it economic (Muniesa et al., 2007). Herein lies the importance of scientific and technological mechanisms to the development of markets: the very possibility of the existence of stable markets is linked to the institution of a shared agreement between agents about the commodity. Technical and scientific agencies are deployed to construct, measure and re-interpret the existence and intensity of the externalities involved (Callon, 1998a). These processes, be it through individuals (Beunza & Garud, 2007), sets of economic equations (Holm & Nielsen, 2007; D. MacKenzie, 2009b) or complex constructions such as index-based derivatives (Millo, 2007), "make things" real, creating a shared understanding, paving the way for marketisation. They operate at quantitative level – calculation, with its technical and scientific dimensions, rooted on calculative agencies with a cognitive and material dimension (D. MacKenzie, 2009a). At the same time the object (individual and hence not easily exchangeable) must be symbolically disentangled from the social setting it is attached to (Callon, 1998a, 1999) – a qualitative change, by which processes of framing and reframing the object, attaching or detaching if from social realities (Muniesa et al., 2007). The processes through which objects acquire qualities that make them exchangeable – their qualification process – is fundamental to the evolution and stability of markets (Beunza & Garud, 2007; Millo, 2007; Sjogren, Helgesson, Callon, Millo, & Muniesa, 2007).

Viewed from this perspective, markets are spaces where compromises are reached, both in terms the quantities of goods produced and on the value attributed to those same goods. Their effectiveness is associated with making these calculations possible, which they achieve by distributing the agency to do so; markets are collective calculative devices (Callon & Muniesa, 2005). But quantity and price are not the only operations necessary to determine the market's schedule; when buyers and sellers come together, one of the results is the emergence of a common language of quality

(Favereau, Biencourt, & Eymard-Duvernay, 2002). Calculation and qualification both emerge through similar, distributed cognition processes. And they are neither in the remit of agents only or of market devices (the material and discursive components involved in the market construction and operation) alone. Instead, calculative agency is distributed by both the human agents and the market devices in compound market *agencements*:

> An economic *agencement* is, in a broadest sense, one that renders things, behaviours and processes economic. (…) The meaning of what it is to be 'economic' is precisely the outcome of a process of 'economisation', a process that is historical, contingent and disputable. (…) in so-called advanced liberal societies, 'economic' often refers to the establishing of valuation networks, that is, to pricing and to the construction of circuits of commerce that render things economically commensurable and exchangeable. (Muniesa et al., 2007, p. 3)

Human agents and market devices come together when applied to externalities, measuring and valuing them – translating them into a "language" of value which can be interpreted by buyers and sellers in a market. With agency distributed through agents and devices, market *agencements* are the socio-technical infrastructure upon which markets are built; it is thanks to them that "externalities" become "commodities", subject to trade, economising, and governance by the market.

The development of (calculative) market devices, in particular, is crucial for the effectiveness of the market. It may seem at first that the problems associated with marketising externalities are metrological, and that all that is required is the development of techno-scientific systems of calculation, by deploying the knowledge of techno-sciences to the problem of measuring and quantifying externalities. However, it is clear that the measurement issues are dependent of political processes, as demonstrated by MacKenzie's studies on the EU-ETS (2009a, 2009b), and Holm and Nielsen's research on the Norwegian market for fish ITQs (2007). Market devices do not emerge from technical and scientific consensus alone, but rather they are socio-technical innovations.

The development and implementation of these innovations is therefore not a simple, univocal process. Innovations take specific paths; they tend to proceed in "journeys" through the technical, economic and institutional landscapes in which they occur (Callon et al., 2002). This partly path-dependent nature of market *agencements* (Muniesa et al., 2007) raises the prospect that, instead of market expansion through the agreement on common standards, there could be failures to achieve the

"crystallisation" necessary to result in common product standards, and thus in a common market (Delemarle & Larédo, 2006). Instead of development along a common path, diverse, privately owned, standards would remain in use within limited circles. Other possibilities are also observed: a distributed innovation model, such as what is prevalent in the development of free software. In this regime, instead of different agents developing their preferred technologies along competing paths (of which they become dependent), there is a process of collective experimentation and open innovation at the technical level. Standards are, in this case, open property, and the communities involved take an interest in their development (Joly, Rip, & Callon, 2010). This is another form of conducting the economic experiments, one where the innovation process has inputs from a wider constituency.

2.5. A dialogue of perspectives? A research framework for market emergence as economic experiment

This section develops a research framework, based on the theoretical perspectives on the origins of markets developed above. This framework is designed to research the emergence and development of markets, understood as mechanisms of governance. It brings together contributions from the Polanyi-inspired IEP approach, and the perspective from Science and Technology/Social Studies of Finance, following work of Callon and colleagues. These two perspectives differ in a number of important aspects, as detailed in Table 2.1.

Table 2.1 – A comparison of the IEP and SSF approaches

	IEP	**SSF**
Focus of the research	The dynamics of economic change. Process dimension.	Agency. Logics of actions. The role of technology.
Generative process	None made explicit. The research approach is descriptive.	Performativity of economics as a mechanism of market emergence.
Explanation of variety	Historical and geographic focus. Dialectic Double Movement.	None is made explicit.
Importance of technology	Innovations create dynamics, which reverberate throughout the economic system.	Socio-technical structures allow calculation. Market devices and *agencements*.

Source: author.

It should be referred that there have been previous attempts to bring together Polanyian scholarship and STS. A notable example is found on the work of Muellerleile (2013), which brings together Polanyi's concept of embeddedness and disembeddedness of markets in society (Polanyi, 1944) and the idea of performativity of economics (Callon, 1998b, 2007; D. MacKenzie et al., 2007). Like this thesis, Muellerleile's analysis attempts to complement the STS-SSF analysis, which tends to decontextualize markets, with Polanyi's institutionalist method, and the notion that markets are embedded in society. However, this leads the resulting framework into what Randles (2007) calls "the problematic notion of embeddedness":

> [*embeddedness hints*] at a benign humanist phenomenology, and one which almost invariably leads us blindly towards sociological determinism. It further suggests one domain 'the social' encircling and materially 'producing' the other: the 'economic' […] whereas, the rich anthropological and ethnographic record suggests that, in any particular historical/spatial context, a richly interdependent mixture of social and economic inter-play exists. (Randles, 2007, p. 148)

The suggestion is that the shift between an embedded and a disembedded economy is exaggerated, and that the concept of a disembedded economy is overplayed in some of the Polanyian-given analysis. In fact, even in Western market societies, the economy is strongly based in social networks and structures (Randles, 2003). Far from simply acknowledging that social and institutional dimensions are important in economic processes, this thesis seeks to understand the organisation of the economic system as a whole (Cangiani, 2007). This is achieved by analysing interdependencies and boundaries between market and non-market forms of governance; the dynamics of economic and non-economic competition; and public and private forms of provision (Randles, 2007). For this reason, instead of focusing on embeddedness, this thesis uses the Polanyian-inspired Instituted Economic Process approach (M. Harvey et al., 2002, 2007; M. Harvey, 2007; Randles & Harvey, 2002).

The Institute Economic Approach focuses on describing changes and dynamics in economic processes. The analysis identifies historical and geographical contingencies of each case. Variety of economic organisation is attributed to a series of dialectic double movements (Randles & Ramlogan, 2007), resulting from said contingencies. Technology is considered a source of dynamics in economic processes, as specific innovations lead to changes throughout the economics system.

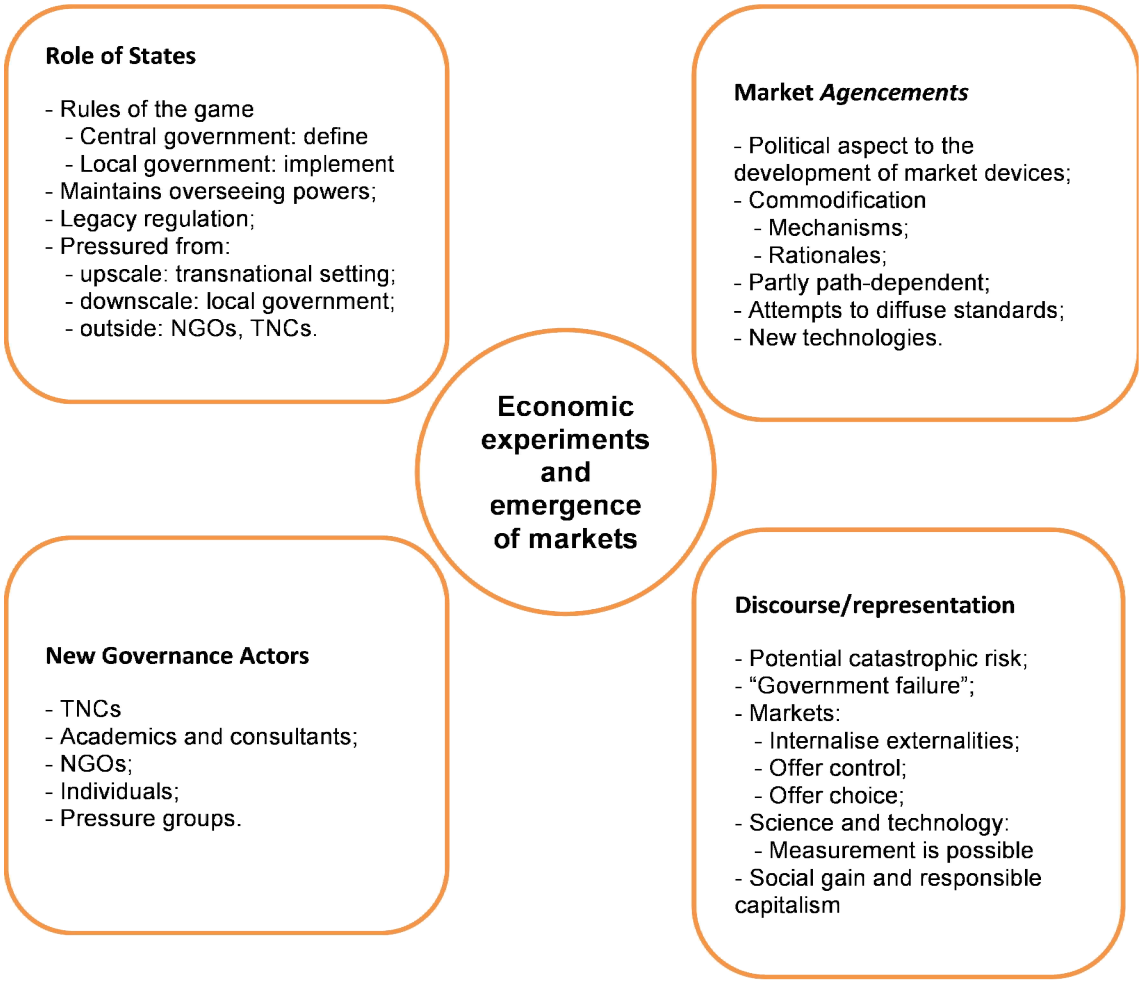
The SSF approach, on the contrary, provides a specific generative mechanism for markets, the performativity of economics. As a result, the focus of the research is on

the logics of action displayed by relevant agents, and also on the impact of socio-technical devices. SSF does not, however, provide a model or cause for variety of markets: the mechanism of performativity is, at first, incompatible with the idea of variety of forms of exchange, as agents attempt to design a model of the market which fits as closely as possible with the perfect market of neoclassical economic theory. Technology, especially the role of socio-technical devices in constructing a market infrastructure which allows agents to calculate and exchange, is a core element of this theory.

Based on the perspectives above, it is possible to devise a research framework to guide the emergence of markets for biodiversity. The contribution of the two theoretical perspectives to this framework is felt both in terms of the topics of the analysis, and the general direction that same analysis takes. The resulting framework is not a hybridisation of the two perspectives, but complementarities and parallels between the two are important – in particular, because both constitute substantive understandings of the economy. Nevertheless, their contributions to the framework are different. The IEP approach highlights the instituted nature of economic processes, for which the role of the state in defining and implementing the *rules of the game* – institutions – is key. The impact of legacy regulation and the necessity that states have to maintain continued overseeing powers are important components of the movements towards stability in forms of exchange. Simultaneously, the pressures towards change – including changing discourses and representations, scientific and technological innovations and the emergence of new groups of agents – all constitute components of the movement of de-instituting and re-instituting. While the IEP approach contributed this perception of dynamics in the system, the SSF approach contributes specific aspects of the analysis. In particular, it points the focus of the research towards on the logics of action of economic agents, as well as the role played by technologies.

Four general points are relevant: the role of states in this process; the newly emergent governance actors involved in the process; the development of market *agencements*; and the discourse and representations involved in these experiments (Figure 2.1).

Figure 2.1 – A framework for the research of market emergence



Source: author.

It falls to the state to define and implement the "rules of the game", including regulations covering the affected area of activity, in particular those regulations which prescribed how the given activities were governed. The role of defining the rules belongs to central government, while often it falls to local governments to implement them. It is possible that these legacy regulations have competing, even conflicting, objectives and prescriptions to those of the experiments. It is not expected that the State will nullify said regulations for the sake of the experiments alone, and there could potentially be disagreement in terms of the necessity, or desirability, of proceeding with the experiments; how these tensions are negotiated could help determine important outcomes "on the ground". Equally important are the pressures the State finds itself under: from the transnational scale there is the necessity to comply with international agreements and conventions, while from the regional and local scales there are increased demands for devolution of power, decision-making capabilities and respect for local preferences. Individual citizens likewise demand a say in governance issues,

while from outside the state NGOs, academics and other expert groups are recognised and established as legitimate stakeholders. In this context, the State may be sharing a significant portion of its authority, but it maintains the power to regulate, to change regulation, and to oversee the implementation of experiments. How this power is distributed is an important issue.

With regards to new governance actors, a significant number of groups can be seen gaining importance. Local governments can increase calls for more powers, as it frequently falls to them to implement experiments. Businesses, some of which can operate in a transnational context, are also seen as legitimate stakeholders, as are NGOs and organised pressure groups. Individual citizens are also increasingly involved in governance matters. Finally, academics, scientists and other technical experts are also involved. What coalitions are negotiated between these different powers, and how they relate to the nation State, becomes an important factor in the outcome of these experiments.

The development of market *agencements* is also crucial. The rationales behind commodification mechanisms influence the design of market experiments. Simultaneously, it bears remembering that, despite the evolution of the technical devices, there is a path-dependent component to market *agencements*, potentially leading to conflicting rationales and devices being carried forward. It is clear that the development of these new technologies has an important political aspect.

It should be also borne in mind that there are discursive and representational aspects to the emergence of markets as economic experiments. From a potentially catastrophic risk, the need for political action must emerge. The problem must be identified with the pre-market governance situation, presumably related to the (in-)actions of government. This problem identification needs to be paired with a consistent solution, namely the deployment of markets – seen as a mechanism to internalise externalities, offering choice and control over the potential risk, and therefore making everyone better off. At the same time, science and technology need to be presented as established, in agreement over the solutions presented, and capable of delivering the necessary techniques with a level of precision that leaves no doubt. Part of this has to do with societal gains. It includes the vision that, by deploying such mechanisms, society will be made better. Markets and the empowerment of consumers are seen as components of a reformation of the social order, and bearing the potential to bring about a more responsible capitalism, both on a social and in an environmental way. All agents are assumed to be ready and willing to “do the right thing”, but were previously constrained by the governance conditions, which provided them with the incorrect signals and

incentives. The change in governance mechanisms should be enough to stop this state of affairs.

This thesis now turns to the issue to which this framework will be applied: the case of markets for biodiversity offsets.

3. Really existing biodiversity offsets

3.1. Introduction

This chapter aims to contextualise the emergence, continued operation and expansion of market-derived mechanisms for conservation, designated biodiversity offsets.

Section 3.2 defines what this thesis understands as biodiversity offsets, exploring the many relevant dimensions of the concept. In particular, it makes the point that the idea of *no net loss of biodiversity* is a defining feature of this group of mechanisms, driving an understanding of biodiversity offsets which is rooted in both economic and technical-scientific understandings.

Section 3.3 looks at the origins and evolution of biodiversity offsetting. The section highlights in particular how biodiversity offsets have emerged in different locations and at different times. Distinguishing between voluntary biodiversity offsets and biodiversity offsetting programmes, sub-section 3.3.1 compiles available information about the biodiversity offsetting programmes in operation as of the first half of 2013.

Section 3.4 looks at the variety of forms of biodiversity offsetting. Based on a typology used by the biodiversity offsetting industry (Madsen et al., 2010), this section explores how similar understandings of the need to compensate for biodiversity loss have been implemented differently, in different places and at different times. Section 3.4.1 builds on this, suggesting there is scope for some evolution of the different forms of biodiversity offsetting, and that some of the programmes may be evolving from in order to conform more closely to what is expected of a “true” market.

Section 3.5 provides an overview of existing academic research on biodiversity offsetting, and section 3.6 summarises the findings of the chapter. Section 3.7 presents the research questions which guide this thesis.

3.2. Multiple dimensions: biodiversity offsets defined

Biodiversity offsets consist of “...conservation actions intended to compensate for the residual, unavoidable harm to biodiversity caused by development projects, so as to ensure no net loss of biodiversity. Before developers contemplate offsets, they should have first sought to avoid and minimise harm to biodiversity” (ten Kate et al., 2004, p. 13). Further developing the concept, they are better seen as “...measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from development plans or projects after appropriate prevention and mitigation measures have been taken”, the goal of which is “...to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to composition, structure, function and people’s use and cultural values

associated with biodiversity" (Treweek et al., 2009, pp. 13–14). It is proposed that "biodiversity offsets not only rehabilitate sites but also address the company's full impact on biodiversity at landscape level, thus assisting companies to manage their risks, liabilities and costs", as well as "...support sustainable livelihoods, addressing some of the underlying causes of biodiversity loss incurred by human use of natural resources" (ten Kate & Inbar, 2008, p. 189).

In common, the various different interpretations of the biodiversity offsetting concept include a set of rules which aim to provide compensation for losses to biodiversity resulting from development. A structure of characteristics defines these mechanisms, around which the most important dimensions of how biodiversity offset programmes are being shaped. Among these characteristics, four are highlighted here: *no net loss of biodiversity*; the mitigation hierarchy; equivalence; and the accepted compensation activities (eftec & IEEP, 2010). Overall, there are many different mechanisms through which this can be achieved; in common, all have the stated objective of producing compensation for unavoidable damages to biodiversity from development, which result in a net loss of biodiversity (BBOP, 2009a; ICMM, 2005b; ten Kate et al., 2004; ten Kate & Inbar, 2008).

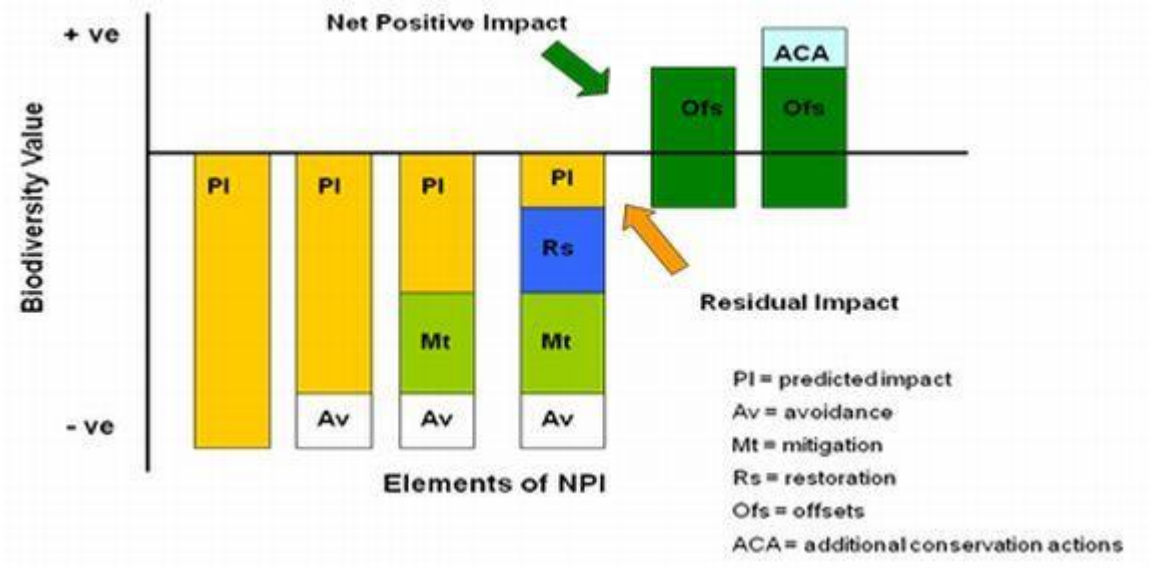
In a situation where development activity results in loss of biodiversity, a compensation measure – the biodiversity offset – is provided in order to assure that the net amount of biodiversity suffers no reduction; the development is then said to result in *no net loss of biodiversity*. Because biodiversity and the associated benefits are mostly local, a maximum distance between the impact area and the proposed offset needs to be agreed on, as "...there is emerging consensus that offsets are actions that lead to measurable *in situ* conservation outcomes" (ten Kate & Inbar, 2008, p. 190). Usually this is achieved by previously defining a service area, "the area within which habitat or species loss can be offset by a credit from a specific location" (eftec & IEEP, 2010, p. 13). The service area is a fundamental consideration in determining compensation for impacts: because both habitats and species have a definite geographical dependence, and their loss impacts that specific area, it makes little sense to compensate for losses out of the service area. The offsetting measures are said to result in *no net loss of biodiversity* when, within the geographical expanse defined as the service area, biodiversity loss and compensation are found to be equal.

This strict definition of biodiversity offsetting in terms of no net loss implies that the amount of compensation is to be directly related to the amount of development The core innovation which biodiversity offsetting offers over previous forms of governing compensation for damages to biodiversity is the attempt to establish a direct link

between losses and compensation; *no net loss of biodiversity* requires that a strict equivalence is established. This strict equivalence means that the development and large-scale deployment of a governance mechanism for offsetting damages to biodiversity is predicated on the development of a system that measures and quantifies biodiversity losses and proposed compensations, thus allowing for no net loss to be demonstrably achieved. As a result, quantification is a core step of the emergence and development of biodiversity offsetting markets: to decide what constitutes an appropriate compensation measure requires the measurement and calculation of the amount of damage resulting from development, and how much compensation is appropriate. This requires the quantification of both the biodiversity losses and the resulting compensation. Achieving no net loss in the context of a mitigation hierarchy means establishing equivalence between two alternative land uses, “a state whereby the expected benefit (credit) generated approximately equals the damage (debit), both quantified in terms of the same metric” (eftec & IEEP, 2010, p. 13). The idea of equivalence is firmly rooted on a system of metrics that is able to determine the credits and debits, and involves the creation and development of standards which encompass techniques, systems and technologies of measurement.

The mitigation hierarchy refers to a set of concepts taken in part from the field of environmental management. The classical mitigation hierarchy requires that proposed development should avoid, minimise and mitigate – in that order – damages to biodiversity (ten Kate et al., 2004). In this context, developers are to reduce their impact over biodiversity by as much as possible, designing and adapting projects where appropriate, in such a way as to reduce harm and alleviate any residual and avoidable damages. Only after this is achieved, should developers provide compensation for whatever residual impacts there remain – that is, to provide or acquire biodiversity offsets (ICMM, 2005a, 2005b). Figure 3.1 illustrates the mitigation hierarchy.

Figure 3.1 – The mitigation hierarchy



Source: Forest Trends (2013), adapted from Rio Tinto and Government of Australia.

The concept behind the development of a mitigation hierarchy is that, through damage avoidance, impact mitigation, restoration measures and offsetting of residual impacts, it should be possible to achieve a biodiversity break-even point (ICMM, 2005b; Kiesecker, Copeland, Pocewicz, & McKenney, 2010). Strict application of the mitigation hierarchy should result in the damage caused by development being balanced out and outweighed by measures designed to achieve avoidance, mitigation and compensation – in other words, *no net loss of biodiversity*. The concept of no net loss has received ample endorsement as a basis for policy in the context of conservation and development, so long as an appropriate mitigation hierarchy is respected and the necessary safeguards are in place against allowing for development in otherwise off-limits areas (ICMM, 2005a; ten Kate et al., 2004; ten Kate & Inbar, 2008; Treweek et al., 2009). The application of a strict mitigation hierarchy and the demonstrability of claims to *no net loss of biodiversity* are fundamental to the environmental sustainability claims being made by proponents of biodiversity offsetting.

The question of what constitutes an acceptable compensation for biodiversity losses varies in practice. Often, biodiversity offsetting programmes require like-for-like compensation, that is, “the no-net-loss principle dictates that where mitigation is obtained by means of credits (…) these credits should have parity with the losses due to development, both in keeping with the scale of loss and the nature of the loss. The financial analogy would be that the credits are of the appropriate currency and monetary value” (Latimer & Hill, 2007, p. 9). The equivalence is, in this case, direct.

However, in some cases, a range of other compensation activities may be allowed. Examples of these out-of-kind offsets include investments in biodiversity funds, general investments in nature areas and funding of nature organisations (CREM, 2005), support for environmental research, capacity building, environmental education, training and awareness raising (ten Kate et al., 2004). Another possibility consists of *trading up*, a process through which compensation delivers biodiversity of a different type, judged as having greater value than that which is lost – for example, by substituting the loss of a certain species by members of a species with a higher conservation threat status (Treweek et al., 2009). Obviously, this necessitates the previous categorisation of the conservation status of biodiversity resources in the affected area, and a rationale to consider the equivalence calculations. The opposite case, where species with a lower value are substituted for those damaged is also possible, and is known as *trading down*. An associated requirement being brought into the legal frameworks presiding to these programmes is that a *multiplier* is applied when calculating the appropriate compensation. Also known as an *offset ratio* (which represents the area occupied by the offset divided by the area affected by a given impact), a *multiplier* represents a decision made by the regulator to increase the area of the offset, in order to increase the probability of achieving no net loss in the face of uncertainty (Crowe & ten Kate, 2010). The use of multipliers is a relevant issue in practice: because of concerns about permissible service areas and uncertainty as to the outcomes of compensation measures, multipliers serve as an insurance against potential losses. Often, the calculation of multipliers involves decisions taken by the courts of law (Christensen, 2008). This raises questions of potential excessive burdening of developers, and non-efficient outcomes from the use of multipliers. All of these issues surrounding what constitutes appropriate compensation point out to another important problem: how to ensure qualitative equivalence – that is, how to ensure that two different states of nature, the biodiversity lost and the proposed compensation – represent the same, as far as nature and society are concerned.

Two further considerations – beyond the four points above – deserve mentioning, as they also have an important impact in the design of biodiversity offsets, because of the requirements that they raise. The first concerns the temporal aspect of compensation: some programmes require that there are no interim losses – that is, losses of biodiversity, goods and services that takes place between the moment when environmental damage occurs and the time when the offset is fully in place, returning the habitats and species to their baseline condition (eftec & IEEP, 2010). The second consideration is the requirement that compensation demonstrates additionality – that is, that "the conservation outcomes it delivers are demonstrably new and additional and would not have resulted without the offset (or the action)" (eftec & IEEP, 2010, p. 5).

Additionality is particularly difficult to demonstrate in situations where the proposed offsets comply with pre-defined conservation objectives and purposes (Madsen et al., 2010), in which case there is no additionality.

Overall these vectors of characterisation of biodiversity offsets can be distilled into three objectives underpinning the development of biodiversity offset markets. Two of these are obvious: first, to correct for the undesirable effects of development and the associated consumption – an objective which is encapsulated in the *no net loss* formula – and second, to improve companies' "social license to operate", managing reputation and assuring stakeholders (PriceWaterhouseCooper LLC, 2010; ten Kate et al., 2004). The third objective, which is both further away from immediate reality and more pervading, is to re-organise the way society provides for nature conservation, and ultimately the relationship between society, the economy and nature.

This section has identified the main dimensions of biodiversity offsets, thus proposing the main vectors of analysis, and contributing to objectively separate these mechanisms from other alternatives in finance for biodiversity conservation. The following section contextualises the creation of these schemes historically, and provides an overview of the current extent of usage of biodiversity offsetting worldwide.

3.3. The origins and history of biodiversity offsetting

The concept of requiring developers to offset any damages to natural values caused by their activities – such as species, biodiversity, habitats or others – has been in operation for a number of decades[35]. In fact, since the emergence of Environmental Impact Assessment (EIA) as a key step in the context of planning, many governments have taken the opportunity to make the requirement for compensation a possibility. This is the case of early experiments in Brazil, and particularly in Germany: in both cases, regulations required that the total 'natural' (undeveloped) area in a given administrative division (at State level or below) should not drop below a given quantity. Individuals or companies wishing to develop natural areas above and beyond that development ceiling were required to pay into compensation funds, administered by government, which would provide compensation (Darbi et al., 2009; eftec & IEEP, 2010). This approach is similar to the 'safe minimum standard' requirements discussed elsewhere in this thesis[36].

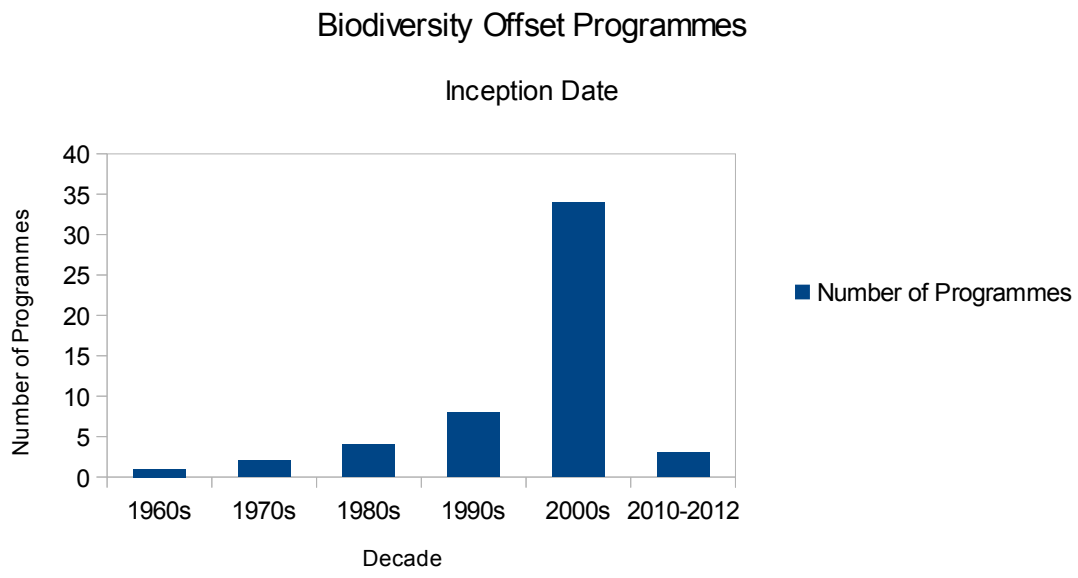
A crucial development in turning these mechanisms into markets derived from the experience in the United States of America, with the creation of the Wetland Mitigation

[35] The inception dates for the varied schemes currently in operation are listed in Table 3.1 (sub-section 3.3.1).
[36] Safe minimum standards were discussed in sub-section 2.4.4.

Banking programme: the emergence of the possibility of acquiring the required compensation (the offset) from a third party. It was the advent of legislation, specifically the Federal Water Pollution Control Act of 1972 (better known as the Clean Water Act, CWA), that created the requirement for mitigation of impacts on wetlands. Mitigation of impacts was, initially at least, on a case-by-case basis, undertaken physically close to the impact area. While providing a workable system, it was felt that this arrangement resulted in fragmentation, by creating numerous small mitigation sites. A solution found was the approval of wetland mitigation banks: entrepreneurial individuals and companies managing one or several locations, from which wetland 'credits' could be sold to developers to compensate for their wetlands impacts (Gardner, 2011). The same logic has been applied to biodiversity, but focusing on endangered species: when a development project results in the loss of individuals of listed species, planning approval is contingent to the developer presenting evidence of appropriate offsetting – by preserving a comparable number of individuals of said species. This can be done, in some US states, by acquiring the appropriate number of credits from a third party, a species bank. By doing so, the developer discharges the legal obligation to provide the offsetting (Gardner, 2008; Mead, 2008).

The interest in the possibilities offered by biodiversity offsetting increased during the 1990s and especially the 2000s, resulting in a pronounced expansion of the number of programmes in operation. Figure 3.2 illustrates the progression of this trend.

Figure 3.2 – Biodiversity offset programmes worldwide, by date of creation



Source: author

The global annual market size and the total size of land area dedicated to biodiversity offsetting worldwide has also been rising. Hard data on this topic are very scarce; one influential report claims that "...80% of existing programs are not transparent enough to estimate their market size" (Madsen et al., 2010, p. iv). The same report estimates that by the end of 2009 the total market value would be, at minimum, between USD $1.8-$2.9 billion (and likely considerably more), and that over 86,000 hectares of land would be dedicated to offsetting worldwide, including (but not limited to) over 600 offset banks (Madsen et al., 2010). An update to this report, published in March 2011, suggests a minimum market size between USD $2.4-4.0 billion and over 187,000 hectares of land reserved for offsetting (Madsen, Carroll, Kandy, & Bennett, 2011).

The culmination of the increasing worldwide interest in the topic of biodiversity offsetting was the creation of a network of advocates, practitioners, academics and private companies, dedicated to forwarding good practice in the field, the Business and Biodiversity Offsetting Programme (BBOP). This network first came into existence in 2004. Formally a non-governmental organisation and part of the Forest Trends cluster of NGOs, BBOP aggregated many of the individuals and groups interested in the topic of biodiversity offsetting and its development. Following a series of pilot projects (BBOP, 2009b), where the rationale and methodologies proposed in initial documents were tested in practice[37], the BBOP published a Standard for Biodiversity Offsetting in 2012 (BBOP, 2012c), intended for application in projects at different locations. The BBOP's Standard in not a market primer; instead, it set out what a biodiversity offset is and how it should be used. In this sense, it is designed to impact the discourses, methods and technologies which must provide the basis the market, in terms of defining what appropriate compensation is. While not being officially adopted wholesale anywhere, the BBOP Standard is designed to inform all activity in biodiversity offsetting worldwide.

3.3.1. Worldwide prevalence

Following on from the discussion above, at their most simple a biodiversity offset consists of a set of compensation measures put in place to compensate for losses of biodiversity resulting from development, resulting in *no net loss of biodiversity*, according to a given set of metrics. But as has been mentioned, there is no single definition of what biodiversity offsets consist of. This has led to a variety of interpretations of the concept, and consequently a variety of implementations.

[37] Individual reports of the findings in each pilot case were published in 2009, and are publicly available (Anglo Platinum, 2009; Berner, Dickinson, & Andrianarimisa, 2009; City of Bainbridge Island, 2009; Newmont Golden Ridge Limited, 2009; Solid Energy New Zealand Limited, 2009).

In some cases, developers undertake activities to offset their impacts in the absence of requirements to do so. These schemes – designated voluntary biodiversity offsets – are not regulated, but instead consist of projects that attempt to demonstrate the possibilities of cooperation between the companies involved and the local communities in the interest of compensating for biodiversity losses (Doswald, Barcellos Harris, Jones, Pilla, & Mulder, 2012). Some of the projects include local governments acting as stakeholders, and so (at least theoretically) the authorisation for development depends on formal environmental impact assessment (EIA) in addition to proposed offsets. Despite the existence of these voluntary projects, they tend to consist of local affairs with little or no follow up.

The situation which this thesis will focus on consists of developers being legally required to provide compensation for their damage to biodiversity. The existence of this legal requirement to offset means that the conditions are created for different groups of agents to take an interest in the situation, and devise strategies to participate in and influence the mechanisms by which the offset is delivered. It also means that there are incentives for attempting to innovate and devise more economically efficient ways to produce the offsets, and that dynamics of competition between different forms of offsetting might come into play. More importantly, regulatory requirement for offsetting implies that there will be a repeated demand for biodiversity offsets for as long as the regulation is in place, as there is the potential for repeated exchanges to take place over time. A socio-technical and economic infrastructure can thus develop to support the instituting exchange.

This happens when the area where the damage to biodiversity occurs is contemplated by a biodiversity offsetting programme. A biodiversity offsetting programme consists of "...any law or policy established, enhanced and/or preserved for the purpose of generating certified credits that may be sold for compensatory mitigation for impacts to biodiversity" (Ecosystem Marketplace, 2013a). The existence of a law or policy – that is, some regulatory requirement imposed by the state or competent authorities – and the complementary assertion that there is a degree of certification of whether or not a given offset results in no net loss, implies that these are rules-based mechanisms[38]. In turn, the concept of generating certified biodiversity credits allows for a distinction between the agent causing damage to biodiversity (the developer) and the agent providing the compensation required (the offset provider) to emerge: the definition assumes *ex-ante* the possibility that the developer will not choose to provide the required compensation, but instead contract a third party to do so. This creates the

[38] Programmes are designated in this thesis as "rules-based" mechanisms because their operations are guided by have an official framework and controlled by a regulatory agency, even in the cases where these arrangements are not enshrined in law.

opportunity for a commercial transaction to take place: the developer can acquire the compensation credits necessary to discharge his or her obligation from an offset provider. The possibility that a market in biodiversity credits could emerge results from this distinction. Economic value, translated in the price of a given offset, is injected into the calculations of those involved.

Table 3.1 is a compilation of available information about the programmes currently in existence: legal designation, geopolitical location (country), the date in which the programme was established and operational status as of 2013, as listed on the Species Banking website (Ecosystem Marketplace, 2013a). In common, these schemes share two characteristics: first, all the programmes presuppose that compensation is provided by a third party – i.e. that the developer will acquire a biodiversity offset (credit) from an offset provider. This, as mentioned above, is a clear indication that a market exists, or is in the process of emerging. Second, all these programmes have a degree of government backing, even where they are designated as "voluntary". Where credit acquisition by developers is voluntary (not legally required), central or local governments retain responsibility for emitting general guidelines and verifying that compensation takes place[39].

Table 3.1 – Biodiversity offset programmes worldwide

Name of programme	Country	Established	Status (2011)
Forest Code Offsets	Brazil	1965	Active
Impact Mitigation Regulations	Germany	1976	Active
EU Habitats and Birds Directives	EU-wide	1979	Active
Aquatic Compensatory Mitigation	USA	1983	Active
Fish Habitat Compensation	Canada	1986	Active
Conservation Banking	USA	1988	Active
Program for Environmental Restoration and Compensation	Mexico	1989	Active
Forest Conservation Act	USA	1991	Active
Environmental Action Plan	Madagascar	1992	Active

[39] The importance of states and regulation in the emergence of markets for biodiversity offsets is discussed in section 5.4.

EIA Law and Environmental Compensation Fund	Argentina	1994	Active
Environmental Licensing	Colombia	1994	Active
Environmental Offsets	Sweden	1995	Active
Saipan's Upland Mitigation Bank	USA	1998	Active
Environmental Impact Assessment Law	Costa Rica	1998	Active
Vegetation Management Offsets	Australia	1999	Active
Industrial Impact Compensation	Brazil	2000	Active
Forest Vegetation Restoration Fee	China	2002	Active
Marine Fish Habitat Offsets	Australia	2002	Active
Wetlands Conservation Policy	Canada	2002	Active
Property Vegetation Plan Offsets	Australia	2003	Active
Native Vegetation and Scattered Tree Offsets	Australia	2003	Active
Wetland Conservation Policy for Prince Edward Island	Canada	2003	Active
Environmental Liability Directive	EU-wide	2004	Active
Wetland Restoration and Compensation Guide	Canada	2005	Active
WalMart's Acres for America	USA	2005	Active
Koala Offsets	Australia	2006	Active
BushBroker	Australia	2006	Active
Environmental Offsets	Australia	2006	Active
Kingborough Council Offsets	Tasmania	2006	Active
Environmental Services Certificates	Paraguay	2006	Active
Environmental Offsets Policy	Australia	2007	Under Study
Biodiversity Offsets	Tasmania	2007	Active

Wetland Conservation Policy	Canada	2007	Active
Wetland Compensation Agreement (Manitoba)	Canada	2007	Active
Willamette Multi-Credit Watershed Market	USA	2007	Under Study
Malua BioBank	Malaysia	2008	Active
Conservation Trust	Paraguay	2008	Active
US Bureau of Land Management Mitigation Policy	USA	2008	Active
Recovery Credit System	USA	2008	Active
Biodiversity Law Covering Compensation for Damage to Biodiversity	Vietnam	2009	Under Study
Regional Planning Offsets	Australia	2009	Under Study
Darwin Harbour Offsets	Australia	2009	Under Study
BioBanking	Australia	2009	Active
Pilot Biodiversity Bank	France	2009	Active
Wetland Mitigation and Compensation Strategy	Canada	2009	Inactive
Riparian Buffer Mitigation Program	USA	2009	Active
Habitat Credit Trading System	USA	2009	Active
Bay Bank Multi-Credit Watershed Market	USA	2009	Under Study
Biodiversity Offsets	UK	2012	Under Study
Biodiversity Offsets Study Group	Japan	2010	Under Study
Draft National Offsets Framework	South Africa	2012	Under Study
Draft Biodiversity Offset Policy	Uganda	--	Under Study
Multiple developments regarding biodiversity offsets in Indonesia	Indonesia	--	Under Study
Third-party mitigation system	Malaysia	--	Under Study
Biodiversity Offsets	Australia	--	Under Study

TNC's Development by Design Pilot	Colombia	--	Under Study
TNC's Development by Design Pilot	Mongolia	--	Under Study
Waikato Region Biodiversity Offsets	New Zealand	--	Under Study
INE Biodiversity Banking Initiative for SEMARNAT	Mexico	--	Under Study

Source: author, compiled from the speciesbanking.com website (Ecosystem Marketplace, 2013a)

The research identified 59 different biodiversity offsetting programmes in 23 different countries worldwide (plus two EU-wide programmes, and one in the USA-controlled territory of the Marianas Islands). 40 of those programmes are listed as currently active, 17 as in development (a term that may encompass different stages of planning and approval, meaning that, while not currently producing credits, there is the expectation that they will in the future), and two are inactive[40].

Only three programmes listed are taking place in African nations, and among these only one is currently in operation: the Malagasy Environmental Action Plan. Despite several voluntary offsets initiatives by companies operating in extracting industries (mainly oil and mining), expansion of biodiversity offsetting initiatives in Africa has been hindered by "...financial barriers, political instability and disagreements within the conservation community on how and if biodiversity markets should be structured" (Ecosystem Marketplace, 2013b).

With three programmes active and five programmes in development, the panorama for Asian biodiversity offset markets remains limited. Although there is some interest on the topic, and EIA requirements are widespread, penetration of these mechanisms has so far been low (Ecosystem Marketplace, 2013d).

Australia and New Zealand sport a large number of biodiversity offsetting programmes, with 11 schemes currently in operation and a further five under development. The high number of co-existing programmes is related to relatively high level of political independence of state governments within the countries: different states enact their

[40] About this last observation, it is difficult to determine why is it that these programmes are listed as inactive; in the EU, both the habitats directive (European Commission, 2011b) and the birds directive (European Commission, 2011a) are, active; the former, especially, has been the cornerstone of Europe's, since it is the legal framework for Natura 2000. There is also no indication of why this is the case with regards to the Canadian Wetland mitigation and compensation strategy. It may simply be the case that, while the programmes exist, no compensation measures are being considered or accepted at this stage (never mind credit production or sale).

own policies, even if the central Australian government has a national policy under study. The programmes are therefore related to EIA and planning (Ecosystem Marketplace, 2013e). The Australian programmes, especially the experiment taking place in the state of New South Wales, are often referred to as some of the most advanced and carefully designed anywhere (Shields, 2008).

With two programmes under development and a further eight in operation, the region of Central and South America has displayed a significant interest in biodiversity offsetting programmes. Further, most of these programmes now have a long legacy of operation – the very first such mechanism considered, Brazil's *Forest Code*, dates from 1965, and many of the other initiatives date from the 1990s. It should be noted, however, that most programmes in this region are based on EIA, and that in most cases the mechanisms consist of programmes in which the developers pay into funds administered by governments, which then provides compensation measures[41]. The programmes currently under study seem poised to extend the range of potential offset providers (Ecosystem Marketplace, 2013c).

The experience with biodiversity offsets markets in Europe is more limited than in some other regions. Six programmes are currently active, but two of those (in France and the UK) consist of “pilot schemes”, which governments and groups of proponents are using to experiment with the idea of offsetting (Treweek et al., 2009). It should also be mentioned that the two EU-wide programmes suffer from unequal application in different States, and limited reach in terms of the activities they cover (Ecosystem Marketplace, 2013f). Despite this, the European Commission has shown interest in the potential of biodiversity offsetting mechanisms, and commissioned studies on the topic (eftec & IEEP, 2010).

The experience in North America contrasts with this: there are a high number of mechanisms in operation (16 in total, 14 of which are listed as active). This is partly due to the politico-geographical spread of the programmes (with many Canadian and US states having their own individual policies), and to the spread of environmental values covered in different schemes (wetlands, river streams and species) (Ecosystem Marketplace, 2013g). This last point deserves highlighting: instead of biodiversity, or even just habitat, many of these policies are directed at individual locations and species, on a logic of species offsets (Bonnie & Wilcove, 2008; Mead, 2008).

[41] The types of programmes in existence and the relevance of their distinctions are considered in section 3.4.

3.4. One idea, many executions: the variety of forms of biodiversity offsetting

The wide geographical dispersion of biodiversity offsetting initiatives is corresponded by a high degree of specificity of implementation. Contrary to the idea that there would be a superior, more efficient design shared by all market instances, significant variety in forms of biodiversity offsets can be observed. The biodiversity offsets industry[42] is aware of this fact, to the point that it has attempted to rationalise variety and produced its own typology of offsetting mechanisms. This typology analyses the existing programmes along a number of criteria: driver for demand, potential complexity of the implementations, amount of infrastructure required for an appropriate functioning of the market, the level of strategic integration of the offsets policy with conservation further afield, the potential ecological effectiveness of the type of offset and the openness and transparency in terms of information provided. This typology is reproduced in Table 3.2:

Table 3.2 – Typology of forms of biodiversity offset mechanisms

	Compensation Funds	**One-Off Offsets**	**Mitigation Banking**
Driver	Compliance	Compliance or Voluntary	Compliance
Implementation Complexity	Low	Medium	High
Required Market Infrastructure	Low	Low to medium	High
Broad-Scale or Strategic Conservation	Dependent on program design	Less likely	More likely
Ecological Effectiveness	Dependent on design and enforcement	Dependent on design and enforcement	Dependent on design and enforcement
Who supplies the compensation?	Government	The developer	Third-party, government, or the developer
Transparency	Moderately likely	Less likely	More likely
Policy Examples	China's Forest Revegetation Fee; Brazil's Industrial impact compensation	Offsets under various Environmental Impact Assessment laws	US Compensatory Mitigation (aka wetland mitigation); BioBanking in New South Wales,

[42] The term "industry" is used loosely in this context, since there is no unified industry body. In effect, this is a reference to an emerging, increasingly organised network of stakeholders, coalescing as the process of market emergence picks up pace.

	(‘developer’s offsets’)	Australia

Source: Madsen et al. (2010, p. iv)

The first type of mechanisms, Compensation Funds, consist of situations where developers are required to pay into a fund, administered by government, from which offsetting will be paid for. The offsets themselves are provided by governments, and in many situations consist of investment in nature reserves and parks, meaning that the offsets are often not directly related to the losses – the equivalence is limited, and in most cases the principle of additionality cannot be respected. This type of scheme is easy to implement and requires very little infrastructure in place to function appropriately – all of which translates into potentially lower transaction costs (Bayon, 2004; eftec & IEEP, 2010; Treweek et al., 2009). These schemes are also potentially quite transparent, although that will obviously depend on local specificities. There is also the potential that the schemes will deliver broad-scale, strategic conservation beyond the locale of the impact – again, depending on the specifics of design and implementation.

The second type of mechanism, one-off offsets, is the most common, and there are examples of both compliance-driven and voluntary one-off offset schemes. These are usually more complex to implement and require a heavier dedicated market infrastructure than compensation funds, partly because there can be a myriad of suppliers of compensation – ultimately, because to provide offsets is the developers' responsibility, it is possible to have one offset provider per project.

Finally, the third type of mechanism – mitigation banking – consists of a set of compliance-based mechanisms, whereby a biodiversity offsets bank – essentially an area specifically dedicated to producing conservation – sells the resulting biodiversity offset credits. These mechanisms are considered more difficult to implement than compensation and one-off offsets, and require a more complex market infrastructure. The offsetting itself can be provided by any party – the developer, government or third parties, such as entrepreneurial biodiversity offset bankers. Because of the complex market infrastructure, which requires certification and larger numbers of agents, mitigation banking is considered more likely than compensation funds and one-off offsets to provide transparency.

The apparent inconsistency in suggesting that the various programmes are all independent and unique in their implementation, while at the same time producing a typology of forms of offsetting can potentially be explained by the underlying technological structures necessary for the functioning of these markets. The

characteristics 'implementation complexity', 'required market infrastructure' and 'transparency' all relate to this, in different ways. Specifically in terms of market infrastructure, compensation funds require very little to implement, functioning more as a tax on developers. Not much attention is given to the problem of equivalence: developers pay into the fund, and from then on the responsibility of deciding how to compensate for damages lies with the government agents. On the contrary, in the cases of one-off offsets and mitigation banking the problem of deciding what consists an appropriate compensation action is much more prevalent, as developers or the third parties providing the offsets must demonstrate equivalence between the losses and compensation, thus ensuring *no net loss of biodiversity*. This necessitates the development of technologies of calculation, all of which must be implemented before any exchanges can take place. For this reason as well, the implementation of one-off offset and mitigation banking-type mechanisms is more complex. Particularly in the case of mitigation banking, the proliferation of agents involved – developers, offsets banks, regulators, technicians and consultants – requires the development of procedures and increased bureaucracy. This, of course, may result in an increase in transaction costs for these mechanisms. But on the other hand the increased amount of formal register of activities has at least the potential to result in a more transparent system, where all decisions are registered and open to scrutiny by third parties.

3.4.1. Towards the market? Evidence of evolution in forms of offsetting

In their review of markets for forest biodiversity services and their impact on the poor, Landell-Mills and Porras (2002) identify three types of mechanisms involved in biodiversity finance: markets, cooperation (based on trust) and regulatory (hierarchical). Assuming that these markets are situations where buyers and sellers come together voluntarily, the authors' argue that markets are by no means the only (or even the most desirable) mechanism to allocate resources for biodiversity conservation. Instead, they make the point that the potential efficiency and distributional effects of markets for conservation depend on the other two types of institutional arrangements providing support – the cooperative systems and the hierarchies effectively support the functioning markets.

In contrast, the overall picture in biodiversity offsetting appears to be less one of cooperation and support between different mechanisms than one of diverging evolution, followed by competition. The approach taken in different programmes has been diverse, but it would seem that the establishment of fully-fledged biodiversity offset markets is the result not of a momentous decision, but of evolutionary trajectories and changes to institutions, technologies and processes. Regulation is, as identified in Table 3.2, an important driver of demand for offsets; but it is also a driver of the

evolution of forms of offsetting. The concept of compensation for damages resulting from development has existed in many countries' and areas' rules and regulations for a long time, and is a feature of the numerous requirements imposed on development, in the context of Planning regulations and Environmental Impact Assessment (EIA). As discussed in section 3.2, two changes open the door to marketisation of these efforts: the requirement that all damages are offset so as to assure no net loss of biodiversity, and the possibility that developers might discharge their legal responsibility by acquiring compensation from a third party.

The distinction between biodiversity offsets and mitigation banking, in particular, is telling: while the idea behind biodiversity offset refers to concepts of *no net loss of biodiversity*, the concept of mitigation banking, on the other hand, is only possible in the context of a process of market emergence. This is a fundamental point: offsetting biodiversity losses does not need to involve a market for biodiversity offsets, such as mitigation banking; but, on the contrary, a market for biodiversity offsets can only emerge if preceded by a rationale of compensation and offsetting biodiversity losses. There is an evolution from the logic of offsetting to the logic of offsetting via the market.

The importance of the evolution of the schemes, and in particular of the technologies that make markets function is well reflected in the crucial issue of value. On a one-off offset situation, the economic value of the offset is intrinsically linked to the “nature on the ground” - that is, the assessment of the cost of producing the adequate compensatory measures. Only one dimension needs to be assessed: the losses and gains to biodiversity, in their bio-geo-physical aspect. Pricing of compensation is incidental – covering the costs of the offset, opportunity costs of land and whatever level of profit the provider might require. But when the developer has the possibility of acquiring a biodiversity offset credit in an open market, valuation becomes a two part process: first the buyer agrees with the regulator about the bio-geo-physical losses that need to be compensated, and afterwards he or she is left free to explore the dynamics of competition between sellers that can vouch to provide the required compensation. The second type of value, the economic value (that is, the price the buyer pays the biodiversity offsets bank for a given compensation agreed with the regulator) can be determined in a market exchange. The main change occurs in the transition from compensation funds and one-off offsets to mitigation banking, concerning the way by which the economic value of the commodity is determined. In the latter two cases, it is determined not by a third party (the regulator), but by bargaining in the exchange. The exchange is progressively being taken from the control of society (through either negotiation with the regulator or with the communities) and left to the control of the market – and this is being achieved through the precisely economic dimension.

The distinction points to an evolution in the exchange mechanisms involved; if the specific economics of offsetting when deployed on a one-off, case-by-case basis could conceivably be agreed in a process of barter, involving negotiation, trust and eventual agreement (regardless of the actual biological reality being affected or not), biodiversity banking necessarily involves the introduction of monetary values in the exchange, and would consist – when and if the necessary techno-scientific measurement and commodification processes (algorithms) are in place – of an arms-length, impersonal exchange, where supply and demand determine the price of the commodity being exchanged.

3.5. State of the art: current research in biodiversity offsets

The size – and growth – of the use of biodiversity offsetting worldwide, as demonstrated in the previous sections, is not paralleled by the amount of research published on the topic. The concept is frequently referred to in discussions of marketisation from a political ecology perspective[43], where it is compared (and, at times, conflated) with other experiments in commodification and marketisation of nature, at least as far as the processes and drivers involved are concerned. This thesis will not review this literature in depth, as it does not specifically analyse the phenomena involved in biodiversity offsetting. Instead, two strands of research are presented: the commentary provided by the biological, ecological and ecosystem restoration sciences about the claims of proponents of biodiversity offsetting, and the (more scarce) work done so far in terms of the biodiversity offsets as forms of governance, and the governance of biodiversity offsetting.

Biological sciences have produced a number of assessments of the proposals and practices of biodiversity offsetting. In general, the results are critical of the capacity of offsetting to deliver *no net loss of biodiversity*, with a number of problems being identified repeatedly. In many ways, biodiversity offsetting has started off in spite of biological sciences, not thanks to them. Biodiversity offsets owe their expansion and popularity to the premise that, through their usage, it would be possible to simultaneously achieve conservation objectives and maintain economic development (Bekessy et al., 2010; Bull, Suttle, Gordon, Singh, & Milner-Gulland, 2013). However, because the methodologies and frameworks for offsetting biodiversity remain under development, current application of these mechanisms means that their use involves accepting biodiversity losses in return for gains which are not guaranteed (Bull et al., 2013). Some of the greatest challenges to biodiversity offsets lie with their governance,

[43] As referred in sub-section 2.3.1. This field of research has been exceptionally well summarised by Noel Castree (2003, 2008a, 2008b, 2011) in a series of papers on neoliberalisation and nature.

including poor monitoring and poorly defined liabilities, but also a lack of formal methods for designing and quantifying offsets. The approaches used on measuring and determining what and how to offset vary widely between different countries (Quétier & Lavorel, 2011), as do the policy frameworks on which the markets are based (McKenney & Kiesecker, 2009).

In her review of the concept of biodiversity offsets, Burgin (2008) identifies a number of weaknesses, including a narrow definition of the concept of biodiversity, and potential problems at the level of implementation, management, monitoring and long-term compliance. Overall, biodiversity offsetting is contrasted with carbon offsetting, in the sense that technical challenges in terms of measurement are rife: "…the concepts are based on a flawed logic and immature, imprecise and complex science which results in difficulties in determining biodiversity values" (Burgin, 2008, p. 807). The science on which biodiversity offsetting depends is "immature and inexact" (Wotherspoon & Burgin, 2009, p. 68).

One of the greatest limitations of biodiversity offsets found by the research was in how to account for the time lags between the time when the damage to biodiversity takes place, and the time when the offset develops to a point where it can deliver the same values (Bull et al., 2013; Burgin, 2008; Gibbons & Lindenmayer, 2007; Norton, 2009; Overton, Stephens, & Ferrier, 2012). In at least one case it was found that most of the offset designs would result in continued loss of biodiversity for 100 years. To counter these losses and deliver *no net loss of biodiversity*, the scheme in question would have to protect other aspects of biodiversity also at risk – which would in turn increase the amount of land necessary to secure *no net loss of biodiversity* (Maron, Dunn, McAlpine, & Apan, 2010).

One potential solution to the problem of time lags between losses and offset is the development of biodiversity offset banks, in which biodiversity gains would be developed and certified for offsetting. In order to avoid losses, a biodiversity offsets bank would need to serve as a savings bank, that is, to demonstrate the gains in biodiversity before the losses to be offset can occur (Bekessy et al., 2010). Of course, biodiversity banks may in turn displace biodiversity in order to compensate for time lags, thus creating other problems. Another suggestion to improve the capacity of existing forms of calculation to consider the impact of time lags on biodiversity offsets is presented by Overton *et al.* (2012). This proposal involved the introduction of a commonly used aspect of environmental valuation to offsetting calculation – net present value (NPV). Time discount rates are applied to measures of utility and economic value of biodiversity and translated into area size; as a result, a biodiversity

offset which requires longer time to be provided will require a larger area to assure *no net loss of biodiversity* is achieved (Overton et al., 2012). Similarly, Moilanen *et al.* (2009) suggest that both NPV and compensation for the uncertainty related to the success of the offset may be required to assure no net loss of biodiversity; the caveat in this case is that very large areas of compensation may be necessary (Moilanen et al., 2009).

Other mechanisms and technologies for calculating appropriate compensation have also been considered. One particular study compares the potential results of offset proposals, using Geographic Information Systems (GIS). The research concludes that to assess the benefit score on a scheme alone could hide losses sustained by elements of biodiversity (Bedward, Ellis, & Simpson, 2009). GIS itself is not enough in the decision-making process, and some judgement from decision-makers remains necessary.

The potential for compensating biodiversity losses through out-of-kind offsetting has also been the object of research. For example, Jonlan and Wilcove (2007) suggest that to undertake invasive mammal eradication from islands could be an economically efficient mechanism to offset losses of sea turtles and seabirds lost to fisheries by-catch, and could also result in novel alliances between fisheries management and inland conservation. The actual actions necessary to provide a biodiversity offset have also been questioned. Despite positive comments from some proponents (Hill & Arnold, 2012), the limits to the science of environmental restoration have been openly discussed in the literature (Elliot, 1982, 1997; Hilderbrand, Watts, & Randle, 2005), concluding that is not possible to entirely restore lost ecosystems. Proponents of biodiversity offsetting place high expectations on environmental restoration science, but these expectations are not founded on evidence about the domain in which restoration can deliver *no net loss of biodiversity* (NNL) is small (Maron et al., 2012).

With all these limitations in mind, attempts have been made to consider the conditions in which biodiversity offsetting could deliver *no net loss of biodiversity*. In an attempt to establish a framework for the acceptance of biodiversity offsets, Norton (2009) presents six principles for offsetting: first, biodiversity offsets must only be used in the context of a mitigation hierarchy, which seeks to reduce impacts; second, there must be a legal guarantee that the proposed biodiversity offset will occur; third, biodiversity offsets are inappropriate for rare ecosystems and habitats, especially those which contain endangered species; fourth, biodiversity offsets will usually involve creating new habitat, and may include protection for currently unprotected existing habitat; fifth, biodiversity offsetting requires a clear currency to allow transparent quantification of

values to be lost and gained and ensure ecological equivalence; and sixth, offsets must account for the uncertainty involved in obtaining the desired results and the time lag involved in the process (Norton, 2009). Overall, these are limits to offsetting, designed to favour the environmental consequences over the economic and market functioning necessities. They establish limits to exchange, and to what can be done overall.

Other authors highlight how biodiversity offsetting can have a positive impact over biodiversity, not by itself but combined with other conservation measures. Underwood (2010) analyses the potential of offsets to engage with landscape-level conservation planning. In an analysis of the impact of the two forms of organising conservation on populations of endangered species, the study concludes that to combine biodiversity offsetting with landscape-level conservation is more effective than landscape-level conservation planning alone (Underwood, 2010). This result seems to point out that there is potential for synergy between biodiversity offsetting and other planning policies, such that it could become part of the conservation estate. The economic cost of conservation should be blended with landscape conservation planning, thus helping steer the mitigation hierarchy according to development priorities (Doherty, Naugle, & Evans, 2010). This exploration of the synergies between biodiversity offsetting and other forms of nature conservation is also discussed by Brownlie and Botha (2009), who present the case of the biodiversity offsetting in the Western Cape of South Africa. In this case, the policy focuses on securing and managing priority conservation areas over the long term. Instead of *no net loss of biodiversity*, the political, socio-economic and institutional all contribute to emphasise to adding priority habitats to the conservation estate. Overall, Brownlie and Botha conclude, this has significant advantages over using biodiversity offsetting alone:

> In the absence of an overarching biodiversity conservation plan with clear priorities and targets, it could be argued that repeated biodiversity offsets, for which developers would be responsible for at most the life of a proposed development, could result in a game of 'offset dominoes': the cumulative risks and uncertainties associated with repeated undertakings to restore, create or enhance habitat resulting not only in insidious loss and fragmentation of biodiversity over time, but also in foregone opportunities to secure priority habitat as part of the conservation estate in perpetuity. (Brownlie & Botha, 2009, p. 231)

Overall, despite the many limitations discussed, the research does not entirely object to the principle of offsetting biodiversity. Biodiversity offsets have untapped potential as a mechanism for the governance of conservation. Specifically, there is a need for clear

guidelines for the participation of private actors, government and stakeholders, as well as the use of robust scientific practice, especially interdisciplinary approaches (Kumaraswamy & Udayakumar, 2011). Both measurement and ethical issues remain unresolved (Reid, 2012), and the need remains to question the calculations involved (Jones & Solomon, 2013), and the very role of biodiversity offsets as mechanisms for nature governance (Tregidga, 2013).

3.6. Summary

This chapter has reviewed the rationale behind biodiversity offsets, in order to provide a context for the thesis. It found that the concept is proposed as capable of not only addressing problems related to land use and biodiversity loss, but also support sustainable development and help companies present themselves as responsible corporate citizens. Despite this wide range of objectives, a wide variety of interpretations of the concept exist. In this sense, biodiversity offset markets are closer in their concept to the American experience with markets for wetland mitigation credits, where the compensation is subject to respect for a service area, than to carbon offsetting markets, where it has been possible to exchange carbon emissions for emissions saved anywhere in the world.

This fact raises the importance of quantification and qualification mechanisms in this context: in order to achieve *no net loss of biodiversity*, it is necessary to measure losses and compensation, in order to ensure equivalence in the exchange; but because biodiversity is often seen as unique and difficult to offset, the need for mechanisms to make different species, ecosystems, *values* comparable and substitutable is more prominent. This raises the need for the development of quantification technologies – without which the markets for biodiversity offsets cannot operate efficiently. These three pillars of biodiversity offsetting markets – no net loss of biodiversity, quantitative measurement (resulting in equivalence) and qualitative equalisation (resulting from the limits imposed on the range of acceptable compensation activities) seek to cement the concept of offsetting as the best possible mechanisms to assure that developers' environmental responsibilities are put in practice. Reducing the variety of mechanisms to three “types” may not serve much in terms of analysis, since the actual schemes within each type still differ markedly, but it highlights that there may be a tendency in operation for the harmonisation of the various programmes in the direction of a more markedly “market” approach. The mechanisms through which this may be achieved will be explored further in this thesis.

3.7. Research questions

Following from the review above, this section outlines the specific questions which guide this research. The overarching research objective is to consider the social, economic and technological processes involved in the emergence, development and expansion of markets for biodiversity offsets.

Four main questions guide this thesis. These questions were arrived at following the author's review of the development of markets for biodiversity offsets, detailed in the previous sections of Chapter 3. While informed by the literature on the substantive understanding of markets[44], these research questions were driven by the observation and description of really existing biodiversity offset markets.

1. What is the background to the emergence of markets for biodiversity offsetting?

This question is addressed by identifying the socio-political background to the creation of the markets for biodiversity offsets. The normative values that biodiversity carries, and how these change, are analysed. Following from these, the generative mechanism of markets for biodiversity offsets is identified.

In terms of the research framework (Figure 3.1), it refers to the role of states and the growing importance of new governance actors, as well as to the changes in representations. This research question is addressed in Chapter 5.

2. How are the exchanges in biodiversity offsets being organised?

This question relates to the variety of markets for biodiversity offsets. The analysis explains how it is that, despite a common generative mechanism, the existing markets for biodiversity offsets display such diverse forms of organisation. The focus is on the geographic and historical contingencies in each market.

In terms of the research framework (Figure 3.1), it refers to the ongoing role of central and local governments. This research question is addressed in Chapter 5.

3. What are the mechanisms by which biodiversity is being brought to the market?

The market devices and calculative agencies involved in producing exchangeable commodities from biodiversity are analysed. The drivers of said innovations, and the roles of agents involved in these innovations, are specified.

In terms of the research framework (Figure 3.1), it refers to the development of market *agencements*, as technologies, rationales and mechanisms are created to assist

[44] As detailed in sections 2.3 to 2.5.

agents' calculating. The political aspect of market *agencements* is noticeable by the fact that, while the development of these socio-technical devices rests with technical specialists (such as academics and consultants), it is influenced by others (such as central and local governments, NGOs). Legacy regulation also comes into play, setting boundaries to how the new *agencements* can develop. This research question is addressed in Chapter 6.

4. What are the limits to the expansion of markets for biodiversity offsets?

This question is addressed by analysing the tension between the drive for expansion of the markets, and resistance to it. Resistance is related to both biological and ecological aspects of biodiversity, and to political reasons. The circulation of biodiversity offsets is geographically limited, although some components of the market infrastructure appear to circulate.

In terms of the research framework (Figure 3.1), this refers to the impacts of existing pre-market regulations and institutions over new markets for biodiversity offsets, and the development of new market *agencements*. All the groups involved in governance – governments and the new governance actors – attempt to influence the outcome, against a background of normative representations about what responsible governance of biodiversity is. This research question is addressed in Chapter 7.

This thesis now turns to the research approach used to address these questions.

4. Research Approach

4.1. Introduction

This chapter describes the research approach taken by this thesis, including the ontological and epistemological influences and the methods employed.

The problem of analysing the emergence, development and expansion of markets for biodiversity offsets requires that the ontological and epistemological considerations of the framework for research[45] are made explicit. Bearing in mind that this framework is an attempt to bring together two different theoretical perspectives – the neo-Polanyian Instituted Economic Process (IEP) approach and the Actor-Network Theory-derived Social Studies of Finance – the discussion of the ontological and epistemological commitments of this thesis become even more important. These issues are discussed in section 4.2.

Sections 4.3 and 4.4 discuss the methodological approach taken. Specifically, the case for a qualitative research approach is made (4.3), taking into account both the research questions and the ontological and epistemological considerations made. This section also justifies the case studies chosen for analysis. Subsequently, the thesis details the approach taken in terms of secondary (4.4.1) and primary data collection (4.4.2); considerations about the issues involved in interviewing elites are highlighted (4.4.3); and the steps undertaken to analyse the data are specified (4.4.4). Section 4.5 summarises.

4.2. Grounding the research: ontological and epistemological considerations

To undertake research, and especially to do so in the area of social sciences, requires that the researcher clarifies his position with regards to the conception of science s/he is taking, which is done by clarifying the epistemological stance taken. It is also necessary to discuss the researcher's position with regards to the nature of the reality under study – which involves identifying the ontological position taken (Bryman & Bell, 2007). These philosophical assumptions have an influence in the process of social inquiry, as well as the confidence that can be placed in its results (R. C. Bishop, 2007).

With regards to the theorisation of the nature of science, researchers can take a wide variety of positions. The positions taken vary widely, encompassing positivism (Popper, 1970), social constructivism (Barab, Dodge, Thomas, Jackson, & Tuzun, 2007; Vygotsky, 1978), post-structuralism (Derrida, 1984; Foucault, 1982), Marxism (Peet & Thrift, 1989), post-modernism (Dear, 1988; Soja, 1989) and critical realism (Archer,

[45] The research framework is presented in section 2.5.

1995; Bhaskar & Lawson, 1998; Bhaskar, 1998a, 1998b, 2008; Sayer, 2000, 2004, 2010)[46]. This thesis utilises a critical realist-inspired approach, which in turn influences the methodology selected. It rejects the positivist approaches, common in neoclassical economics[47] and other formal attempts to describe the market and the economy (R. C. Bishop, 2007). While accepting that reality is pre-existent to individuals, and constitutes a necessary condition for people's activities – an intransitive component (Bhaskar, 1998b) – its actualisation depends, on the individuals' cognition, knowledge and perception (Sayer, 2010) – a transitive dimension. Reality is thus the result of a process of continuously construction and structuration, which involves existing structures and the agency of relevant actors. A critical realist perspective thus assumes that actors transform and reproduce social structures, over a world where events can be observed and are independent on human social construction (Denzin & Lincoln, 2011). The critical realist perspective then sees reality as a set of levels, the domains of reality (Bhaskar, 1998a, 1998b; Denzin & Lincoln, 2011): the real, the actual and the empirical.

This ontological perspective informs this research, especially the framework for research presented in section 3.4. As detailed in that section, this framework brings together contributions from Polanyi's theory of political economy (the economy as instituted process) and of the Science and Technologies/Social Studies of Science perspective. While Karl Polanyi never discusses the ontology of his theory in his writings, Randles (2004), based on a detailed study of Polanyi's *oeuvre*, published and unpublished, concludes that through his dialectic method of analysis Polanyi shares many of the critical realists' substantive interest in the process of socio-historical change. Specifically, Polanyi struggles to disentangle phenomena from the social context, which he ultimately believes are inseparable (Polanyi, 1957c). Ultimately, his solution to this paradox is to disentangle society and the economy methodologically only as an approximation which render it analysable; however, in practice the different components of the social system have a bearing on the form and organisation of the economy.

The ontological position of Science and Technology Studies (STS) is more complex and disputed. The field has been the stage of long-running debates about whether it espouses a realist or a constructivist position (van Heur, Leydesdorff, & Wyatt, 2012). As a discipline concerned with "…the way power is produced and reproduced in the technoscientific performance of realities" (Landström, 2000, p. 477), it is natural that some confusion exists as to the nature of reality under study. Authors such and

[46] The description and analysis of these perspectives in detail is beyond the remit of this thesis.
[47] See section 2.2.

Sismondo (1993) and Mol (1999) (through the development of the idea of *ontology politics*) espouse a perspective closer to the realists':

> The word 'ontological politics' suggests a link between the real, the conditions of possibility we live in, and the political (A. Mol, 1999, p. 86)

Other authors, notably Knorr Cetina (1993), espouse a much more strongly constructivist position, suggesting that the world is constructed through scientific practice and enactment. Likewise, Law warns that a core concern of STS is

> …how methods represent and enact the real (…) sociology would be understood as a discipline composed of (theoretically freighted) methodological practices for producing descriptions of reality and the realities that correspond with those descriptions. Sociology would be understood, in other words, as a set of devices for doing reality (Law, 2008, p. 639)

The debate between realism and constructivism is not settled within STS, although there is a suggestion that objects are real and constructed at the same time (Powell, 2001; van Heur et al., 2012).

While some questions remain about the exact ontological commitments of Polanyi's political economy and the STS perspective (the latter, in particular, still displaying important question marks on its "ontological turn"), both perspectives can at least be framed as having components of a realist approach to social sciences research.

In order to answer the research questions posed in section 3.7, an approach which allowed for a degree of comparison and contrast between different programmes would be the preferred route. The resulting research design would have to follow on from the epistemological and ontological considerations mentioned above. Sayer (2010) suggests two types of research design which can be chosen – extensive and intensive. The two types of research design differ in a number of ways: the types of research questions posed. the techniques and methods employed, and the definition of the objects and boundaries of research. The research in this thesis is based on an intensive research design: it is interested in how causal processes work in a limited number of cases (how have markets for biodiversity offsets emerged and developed in specific geographical and historical settings?) and the actions of individual agents within those causal contexts. This was done by employing qualitative methods (described below), and by exploring in detail those causal processes in a limited number of cases, regardless of the fact that the results are not necessarily generalizable (Sayer, 2010). Intensive research designs emphasise the causal

explanation of how phenomena are produced, which has led to their use being common in the study of innovation and technology processes (Wong, 2005). The use of intensive methodologies, guided by a critical realist approach, means that the research seeks to uncover the nature of causal mechanisms behind empirically-observed phenomena, not regularities or generalisations (Wright, 2010).

4.3. The case for a case study approach

This section outlines the research approach taken in this thesis. The methods discussed here were chosen for their appropriateness, bearing in mind the research questions mentioned above[48].

The decision to utilise an intensive research approach involved making specific methodological choices, such as the use of case studies (Barnes, Peck, Sheppard, & Tickell, 2007). Case studies tend to emphasise intensive examinations of the settings under study, usually (but not exclusively) associated with a given location (Bryman & Bell, 2007). The choice of a case study approach for this research was informed by the ontological considerations referred to above, but also by theoretical frameworks chosen: the Instituted Economic Process approach favours, after Polanyi's own work, holistic methodological approaches, with a strong sense of historical background, as provided by case studies (Randles, 2003, 2007). Likewise Science and Technology Studies, the practitioners of which "predominantly think through materials", use case studies as the main stimulus for research, their opening into theory (Law, 2008). On attempting to synthesise the two approaches, this thesis opted for a case study approach.

In his review, Yin defines a case study as "…an empirical enquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (…) The case study enquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis" (Yin, 2009, p. 18). In the context of a case study, the case itself becomes an object of interest, and it is the researchers' objective to treat it as such, gaining an in-depth understanding of the processes involved, their complexity and the particular nature of the case (Bryman & Bell, 2007). Sarantakos (2005) suggests eight basic criteria of case study, which help distinguish this approach from others: 1, that the research is conducted in natural settings; 2, that it is suitable to pursuing in-depth

[48] See section 3.7.

analysis; 3, that it studies whole units, and not just aspects of those units; 4, that the sample size is limited to either one or a few cases only; 5, that it studies typical cases; 6, that respondents are perceived as experts, and not just sources of data; 7, that it employs diverse methods; and 8, that it employs several sources of information. In common with other authors, Sarantakos does not prescribe a specific methodology, not even if this should be of the quantitative or qualitative type; the focus in on a holistic, in-depth approach, employing several methods and sources simultaneously, and synthesising them into a detailed understanding of the phenomenon in question (Sarantakos, 2005). A case study is more often a multi-method approach to research, through which different types of evidence are collected (Gillham, 2000). Overall, a case study is not a technique, or even a number of techniques; it is a mechanism for analysing social data, such that it preserves the unitary aspect of the social object under study, keeping together the characteristics which are important for the problem being researched (Blaikie, 2000). More than specific methods, the case study is a research strategy (Yin, 2009).

The consequence of this definition is the fact that case studies can use a variety of methods of data collection and analysis. Qualitative methods, and an inductive approach to the relationship between theory and research are, however, more frequently chosen (Bryman & Bell, 2007; Sarantakos, 2005), quantitative methodologies are also possible, depending on the problem being researched (Blaikie, 2000; Yin, 2009). With regards to this thesis in particular, the choice was made to use qualitative methodologies of data collection. Markets for biodiversity offsets are emergent institutions, very often in the initial stages of the processes of instituting. The markets are neither strongly regulated nor clearly implemented; this has an impact on the types and quality of the data that can be collected. As discussed in sections 4.3 and 4.4, quantitative data about the actual existing markets for biodiversity offsets in operation is scarce. Apart from anecdotal information about the price of a hectare of a given species habitat in a certain area for a given year, very little is known about the market price of biodiversity offsets. This observation applies to all markets, and makes it very difficult to calculate simple estimates of demand and supply, let alone estimate price movements or a market schedule. This fact first emerged during the preliminary research, and was later pointed out by several agents during the data collection. Due to this fact, and the nature of the research questions developed, it was decided that the best approach to the research was to employ a qualitative methods approach, combining secondary data from published materials (such as reports, proposition papers and legal documents, when available) and semi-structured interviews with stakeholders in the field. As previously discussed in section 3.3, there are 59 biodiversity offset programmes currently in operation worldwide. The ways in which

these programmes are instituted are very varied; the variety of forms of biodiversity offsetting is a feature of the sector, as demonstrated in Chapter 3.4.

Case studies can be distinguished in terms of their relationship with theory. Babbie (2004) suggests that a first type of case study is aimed at verifying, modifying or refining existing theories – to test and enhance understanding – while the second type is aimed at developing new theories and concepts. Theory-building cases (the second type) can be seen as the basis of development of new ideas and concepts (Babbie, 2004; Gillham, 2000; Stake, 1995, 2000)[49]. However, for a case study approach to be considered a valid form of theory-building, some issues and limitations must be analysed, especially those involving the generalisability of the results produced (Bryman & Bell, 2007). Often the results obtained through case study research are seen as constituting the preliminary phase of larger research projects, because of their apparent difficulty in producing generalisable results (R. C. Bishop, 2007). Some authors, however, dispute the idea that those criteria are the best by which to assess the quality of a case study research. Stake (1978) suggests that, because case studies are more easily in tune with readers' epistemological experience, they can be become a more natural basis for generalisation: the form in which case studies are conducted and how they are reported is closer to readers' experiences and knowledge gained from that experience. Bassey (1981) makes the same point, that case studies provide readers with relatability and merit in terms of its intended purpose. Adding to this, Flyvbjerg (2006) argues that experts, as a rule,

> "…operate on the basis of intimate knowledge of several thousand concrete cases in their areas of expertise. Context-dependent knowledge and experience are at the very heart of expert activity. Such knowledge and expertise also lie at the center of the case study as a research and teaching method or to put it more generally still, as a method of learning" (Flyvbjerg, 2006, p. 222).

All of these authors point to case studies as a method of particularisation, not generalisation (Bell, 2005; Miller & Brewer, 2003; Stake, 1978, 1995). However, particularisation is not the only possible outcome of case study research, and under certain circumstances case studies can result in generalisation. Stake, in particular, argues that generalisation is possible when multiple comparative studies are undertaken (Stake, 2000). Punch proposed a similar idea, arguing that generalisation were possible where abstract theorisation is undertaken, and where phenomena are

[49] Other typologies of case study research are present elsewhere in the literature, such as those suggested by Stake (1995, 2000) and Yin (1984, 2003, 2009).

identified which can be transferable to other cases (Punch, 1998); This has been termed analytical generalisation (Miller & Brewer, 2003).

These considerations inform the choices made in terms of number of cases chosen for analysis in this thesis. Case studies are usually conceived as detailed examinations of given examples from a class of phenomena (Bryman & Bell, 2007). The researcher has the choice of having a single case study, or more than one case, for purposes of comparison and contrast, but also for theoretical considerations. In the context of this thesis it was felt that a multi-case approach was the best approach, as it would allow for theoretical development. While this thesis sets out to analyse the emergence of markets for biodiversity offsets, it also theorises about processes which may be common to other situations where markets are deployed to govern environmental and public goods.

This led to the question of which programmes to select from the list presented in sub-section 3.3.1. The choice of cases obeyed important criteria. Yin (2003) suggests that the selection of cases should be informed by the theory, while Kuzel (1992) defends that sampling should be purposive – that is, based on the researcher's opinion of which cases better serve the objectives of the study. Sarantakos (2005) suggests that, as a general rule, when undertaking qualitative research the first case chosen should be a typical one among the category under study; additional cases are then chosen by means of snowball sampling or other theoretical sampling – in which case the selection of the cases follows the development of the theory. However, as seen in section 3.3, it is difficult to define what a typical biodiversity offsetting market is, such is the variety of these mechanisms. Instead, a number of considerations emerged from the theory and initial assessment of biodiversity offsetting, and were taken into account in the process of case selection.

Three programme cases were selected for in-depth analysis: the Species Banking programme, in the United States; the Impact Mitigation Regulation (IMR) programme, in Germany; and the Biodiversity Offsets pilot programme, in England. These three programmes share one important characteristic: they are all circumscribed to Western, developed nations. This lends them a greater approximation in terms of polity and institutional frameworks than would be the case if the cases selected included, for example, both Western and developing nations[50]. But besides these similarities, the

[50] It has been pointed out by many authors that the institutional frameworks between these countries can be very different. In particular, the literature on Varieties of Capitalism clearly distinguishes between the German and the American/British model (Boyer, 2004, 2005; Hall & Soskice, 2001; Hollingsworth, 2002).

three programmes present important contrasting points, which justify their choice for analysis.

With regards to the biodiversity offsets industry's standard typology of biodiversity offsetting programmes[51] (Madsen et al., 2010), each case represents a specific type of programme. The German IMR programme is listed as an example of a compensation-type mechanism, where offsetting takes place by developers paying a fee to a government body, which subsequently delivers the offset itself. In contrast, the English Biodiversity Offsets programme represents a one-off offsets case, a situation in which each offset is calculated individually, on a case-by-case basis; biodiversity offsets can be acquired from public or private sellers, but there is no provision for offset banking so far. Finally, the US Mitigation Banking programme represents an entrepreneurial banking-type programme, in which developers acquire biodiversity offsets from privately owned and operated biodiversity offset banks.

A second difference which led to these three programmes being chosen is the historical background associated with the programme. Mitigation Banking and IMR are some of the longest-running biodiversity offsetting programmes currently in operation. Both can trace their existence to environmental regulation first put in practice in the 1970s: the Endangered Species Act of 1973 in the case of the Species Banking programme, and the original Impact Mitigation Regulations, in the case of the German programme. In contrast, English Biodiversity Offsets programme is one of the newest programmes in operation, at the time of writing consisting of only a number of pilot programmes, created to test alternative ideas and inform the future direction of a potential national programme. As this research acknowledges that the institution of markets is grounded on specific historical dimensions, these differences are significant.

A third important difference between the programmes chosen relates to the role of formal regulation in each. The German IMR programme is based on clear laws – the Impact Mitigation Regulations mentioned – which require offsetting in case biodiversity is impacted by development. This set of laws has been changed through time, prescribing new objectives and forms of functioning to the biodiversity offsetting mechanisms in place. In contrast, in the United States there is no single formal regulation requiring that impacts over biodiversity are offset; the Endangered Species Act is a federal rule, in place to protect listed species, but it does not make provisions for offsetting. Instead, each State has different regulations for the issue (some forbid the practice altogether), and the US Fish and Wildlife Service has published a number

[51] This typology was presented in section 3.4.

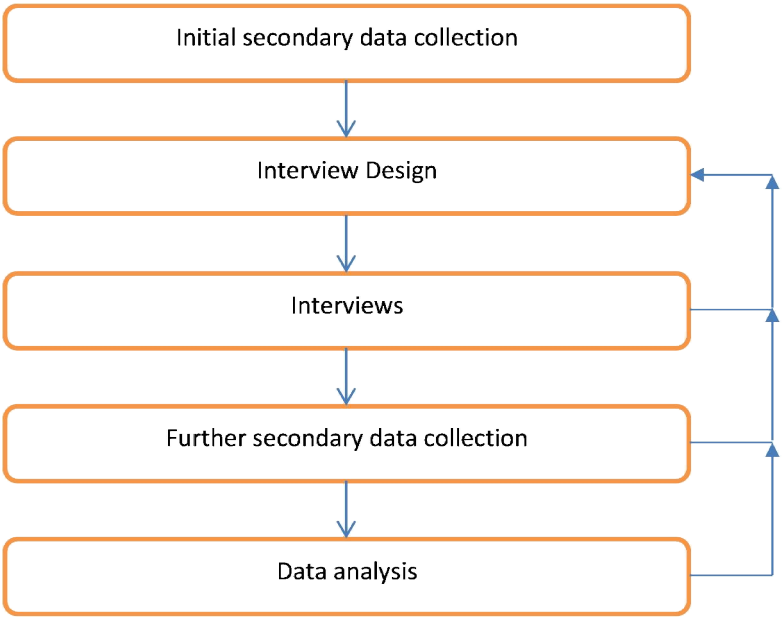
of guidelines to assist decision-making where it is allowed. Finally, the English Biodiversity Offsets programme is, at this time, entirely voluntary.

Overall, it is not only the problems associated with generalisation which have been used to criticise case study approaches. Despite the advantages of this in-depth and comprehensive strategy, case studies have been criticised for not being objective or rigorous enough (Bryman & Bell, 2007; Miller & Brewer, 2003). As Blaikie puts it, "[t]he first and greatest concern is the possibility of sloppy research and biased findings being presented (…) Part of this prejudice is that qualitative research, unlike quantitative research, cannot be replicated because there is too much scope for the researcher to influence the results" (Blaikie, 2000, p. 218). However, case study research needn't limit itself to qualitative methodologies; criticisms directed at the qualitative component of the case study can be addressed through a process of triangulation (Stake, 2000). Triangulation is one of the main principles of case study research referred to by Yin (2009), who argues that the possibility of using multiple sources of evidence is one of the major strengths of case study research, as it "…allows an investigation to address a broader range of historical and behavioral issues" (Yin, 2009, p. 115) and allows the development of converging lines of inquiry. This allows for multiple perceptions to be collected in order to clarify meanings and verify observations (Stake, 2000), through triangulation and corroboration. Findings, analyses and conclusions are likely to be more accurate when a triangulation approach is used (Bryman & Bell, 2007; Yin, 2009). Triangulation was employed extensively during this research, by comparing information from secondary data, published reports and grey literature with the primary data gathered from semi-structured interviews.

4.4. Researching biodiversity offset markets

This section describes the process of data collection and analysis in the research on markets for biodiversity offsets (Figure 4.1).

Figure 4.1 – The research project



Source: author

4.4.1. Secondary data: evidence from documental analysis

Secondary data, under the form of online information, reports and grey literature on the topic of biodiversity offsetting, played a key role in the research, as part of the process of triangulation (Stake, 2000; Yin, 2009). It allowed the identification of key stakeholders, concepts and narratives involved in the creation of biodiversity offset markets, which in turn pointed the way for the primary data collection that followed. It also allowed for decisions to be made in terms of which biodiversity offsetting programmes were to be selected for case study research[52]. Throughout the research process (Figure 4.1) the secondary data was consistently referred to as a source of triangulation, helping develop and reconfigure the interview guide.

The main source of secondary data on biodiversity offsetting programmes worldwide is the speciesbanking.com website (Ecosystem Marketplace, 2011), which is compiled by Ecosystem Marketplace (one of group of NGOs under the Forest Trends banner). The results of Ecosystem Marketplace's research have eventually resulted in two reports summarising what was known of the then-current state of the art in the biodiversity offsets markets (Madsen et al., 2011, 2010). To this were added a number of other reports about biodiversity offsetting, looking both at international and national scales. The majority of these reports were compiled and published by consultancies, NGOs

[52] The three case studies and the rationale for their choice were elaborated in section 4.3.

and national governments. The information gathered from these reports is used as a form of triangulation of the interview data in this thesis.

4.4.2. Primary data: semi-structured interviews, participant observation

The primary data collected consisted of two types: semi-structured interviews and participant observation in relevant forums and meetings on relevant topics.

Following from the secondary data collection, it was necessary to gain an understanding of the ways in which the agents involved in the creation of markets for biodiversity offsets construct the processes which lead to the emergence of the markets, and what meanings they attach to those processes. In order to achieve this, it was decided to undertake a number of semi-structured interviews with the appropriate agents, as identified partly thanks to the documents analysis. The method of semi-structured interview was chosen as it allows the understanding of interviewee's perceptions, how they define situations how they construct reality, and which meanings they attribute to events (Punch, 1998). Semi-structured interviews are construction sites of knowledge, where the researcher seeks to "…obtain descriptions of the interviewee's lived world with respect to interpretation of the meaning of the described phenomena" (Kvale, 2007, p. 11).

The degree to which a semi-structured interview is structured depends on a number of considerations, such as the research topic, the type of information which the researcher wishes to obtain and, necessarily, the objectives of the research (Sarantakos, 2005). It may come close to an everyday conversation, but it is imbued with a purpose and a technique (Kvale, 2007). Methodologically, the semi-structured interview consists of a conversation between interviewer and interviewee, in which the interviewer has a list of reasonably specific topic to cover – the interview guide[53]. The interview guide is not, however, a strict instrument; the interviewee can respond to the interviewer's prompts in many different ways (Bryman & Bell, 2007).

Despite the preparation of an interview guide, the process of semi-structured interviews is by nature flexible. To gain the required understanding of the topic, the interviewer is not interested only in collecting information, but also in understanding in which terms the interviewee frames and understands events and issues (Bryman & Bell, 2007). This allows for the emergence and explorations which the interviewer, for whatever reason, was either not aware of, or had not previously attached importance to (Gerson & Horowitz, 2002). This was the approach taken in this research, which led to a development of the interview guide, and the gradual emergence of topics as the data collection happened.

[53] See Annex A for an example of a sample of the interview guide used in this research.

The intensive research design selected as the most appropriate for answering the research questions posed in this thesis required that causal groups, which could account for the effects observed, be identified (Sayer, 2010). As mentioned above, this meant that groups of agents operating at both the transnational and the local scale should be approached, but it creates a methodological issue: as the impact of some transnational actors is felt in different national biodiversity offsetting programmes, the different case studies share common causal agencies. In other words, by taking a holistic approach, which allowed for both transnational and local scale agents to be included in the data, the research design involved a significant degree of porosity in terms of which agents belong within the boundaries of the different programmes; as will be seen, this reflects the actual structure of the markets for biodiversity offsets.

Potential interview participants were identified in news, newsletters, reports and lists of participants in conferences on the topic of biodiversity offsetting. These agents were temporarily classified with regards to what roles they seem to be involved in. However, these initial classifications began to evolve as the interviews took place and more information was known about the participants. Eventually a new classification emerged, which classifies the agent in terms of their role in the markets for biodiversity offsets and the scale at which they operate (Table 4.1). From the analysis of Table 4.1 it becomes clear that many agents accumulate different roles, or have in the past been involved in a different role. As the interviews progressed and new information emerged the initial interview schedules were updated accordingly. Simultaneously, the interviewees were asked to suggest new potential informants, which were then contacted to take part in the research. This sampling strategy, usually designated snow-balling (Bryman & Bell, 2007) did not prove successful, as most respondents quoted informants already in the initial sample. In fact, more than one participant commented on how small the networks of agents involved in biodiversity offsetting were. A total of 16 semi-structured interviews took place (Interviewees I1 to I16, Table 4.1).

Table 4.1 – Respondents

Respondent	Class of Economic Agent	Type of Organisation	Programmes Involved	Interview Date
I1	Intermediary/ Regulator	Private provider/ Government agency	Biodiversity Offsets (England)	2012/01/13
I2	Consultant	Policy consultancy	Biodiversity Offsets (England)	2012/01/06

I3	Information Provider/ Promoter	Ecosystem markets promoter (NGO)	Species Banking (USA)	2012/01/05
I4	Information Provider/ Promoter	Ecosystem markets promoter (NGO)	Transnational	2012/01/04
I5	Academic/Consultant	Policy consultancy	Transnational	2012/02/02
I6	Regulator	Central government	Biodiversity Offsets (England)	2012/04/24
I7	Regulator	Central government	Biodiversity Offsets (England)	2012/05/21
I8	Seller/ (Former) Regulator	Consultancy. Species bank. State government	Species Banking (USA)	2012/04/04
I9	Seller	Species banks operator	Species Banking (USA)	2012/04/24
I10	NGO	Environmental NGO	Biodiversity Offsets (England). Transnational	2012/05/18
I11	Local Government	Local authority	Biodiversity Offsets (England)	2012/05/24
I12	(Potential) Buyer	Transnational corporation	Transnational	2011/10/20
I13	Regulator	Central government	Biodiversity Offsets (England)	2012/05/28
I14	Local Government	Local authority	Biodiversity Offsets (England)	2012/06/06
I15	Local Government	Local authority	Biodiversity Offsets (England)	2012/06/08
I16	NGO	Environmental NGO	Transnational (Europe-wide)	2012/12/05
B1	Academic	University. Academic network	Biodiversity Offsets (England)	17/05/2011

B2	Transnational Promoter	Biodiversity offsets promoter (NGO)	Transnational	14/06/2012
B3	NGO	Environmental NGO	Transnational (Europe-wide)	13/03/2012
B4	Government Body	Park Authority Association	Biodiversity Offsets (England)	13/03/2012
B5	NGO	Environmental NGO	Biodiversity Offsets (England)	13/03/2012
B6	(Potential) Buyer	Transnational Corporation	Transnational	13/03/2012
B7	(Potential) Buyer	Transnational Corporation	Transnational	13/03/2012
B8	Transnational Promoter	Business and academic network (NGO)	Transnational	14/06/2012

Source: author

Bearing in mind these difficulties of recruiting interviewees, other approaches were attempted. One successful strategy employed to reach potential participants was to take part in workshops and meetings in the area of biodiversity and business and environmental valuation. Two criteria presided over the choice of these forums as relevant opportunities for participant observation: first, they were judged to have direct relevance for the topic of biodiversity offsetting; and second, that important actors involved in biodiversity offsetting, which had been impossible to contact otherwise, would taking part and, in some cases, speaking at these meetings. The meetings in question included: the Valuing Nature Network Scoping Workshop (17th May 2011); the Natural Capital and Ecosystem Services for Business: New Collaboration Opportunities meeting (13th March 2012); and the Summit of Experts on Bio-Footprint Project (14th June 2012). These three summits provided insights into what is being done in the field of biodiversity offsets and environmental valuation, besides allowing informal access to potential participants that had previously decline requests for formal interviews. Further, they provided glimpses to the views and interests of large multinational corporations who are not directly involved in offsetting, but are frequently quoted by participants as being potential buyers.

Ethnographic participant observation is often a component of mixed-methods case studies, used alongside interviews and complementing the information collected

(Kvale, 2007). In fact, interviews are often a component of ethnographic research; the two methods are broadly complementary (Hammersley, 2006). Yin (2009) considers participant observation as one among the six sources of evidence in the context of case studies[54]. It has the advantages of covering events in real time and in context, providing an insight into interpersonal behaviour and motives. However, participant observation may also present a number of weaknesses, namely that it is time consuming, selective in the scope of activities covered, costly, and may result in reflexivity and bias caused by the observer's presence (Yin, 2009). The use of ethnographic participant observation in business management and organisational contexts has been established since the late 1950s (Bryman & Bell, 2007), when Dalton published his research on behaviour of company managers (Dalton, 1959).

The problem of the roles the researcher plays in the context of participant observation is relevant in terms of the validity of the data collected. In ethnographic observation, the researcher is an active participant of the research process, and his behaviour and attitudes often play a role in shaping the research context (Hammersley & Atkinson, 1995). Gold (1958) suggests four roles that observers can take, along a continuum of degrees of involvement. At one end, the researched is a *complete participant* when he or she is a member of the social setting in which the research takes place, and his or her status as a researcher is not known to other members. In these situations, the researcher is a covert observer, which has the advantage of introducing less bias (Bryman & Bell, 2007). At the other end, the researcher can be entirely detached from the situation, acting as a *complete observer*. In these situations, the researcher does not interact with people, and the participants don't need to take him or her into account. In between these two extremes, it is possible to distinguish two intermediate levels of involvement, the *participant-as-observer*, and the *observer-as-participant* (Gold, 1958): the latter acts mainly as an interviewer, with some observation, while in the former role the researcher is, like the complete participant, a fully functional member of the social group, but the members of the setting being studied are aware of his or her status as a researcher. The observations in this research were all conducted with the researcher in the role of participant-as-observer: in order to obtain access into these workshops and meetings, the researcher had to sign up as an interested party, and participate actively in the debates and contribute to the discussions taking place. At the same time, the researcher always presented himself to subjects by signalling his status and the remit of his project. This created issues in terms of the role the researcher played; Gold (1958) suggests that situations where the researcher takes a *participant-as-observer* role, such as this study, raise the possibility of going native – a situation where the

[54] Documentation and interviews are also among the six sources of evidence.

researcher loses their sense of being a researcher and become too involve in the world-view of the research subjects. This is a potential problem, as the researcher might then find it difficult to appropriately collect and analyse the data (Bryman & Bell, 2007). In this research on the creation of markets for biodiversity offsets, this was accounted for by limiting the range of activities in which the researcher took part, and interacted with the participants exclusively in the context of the meetings. For example, as work groups were constituted to develop research projects, the researcher declined to participate in the design to the proposals. The participation of the observer was appropriate for him to create a status as a group member, but it remained limited to the activities social settings in the context of the meetings and forums.

Observation notes of these meetings and the conversations had with participants were made as soon as possible – often during the procedures themselves, and when this was impossible immediately afterwards. It was decided to treat each of the informal conversations with agents and notes from speeches as data points similar to interviews, and code them according to the same framework in development from the interview data, hence the attribution of internal codes (Interviewees B1 to B8 in Table 4.1).

4.4.3. Interviewing specialists and elites

As detailed above, this research involved interviewing and interacting in social settings with individuals which are specialists in their field. Their socio-economic and institutional positions in the corporate, NGO and government sectors (and in some cases, in more than one of those sectors simultaneously) is an important factor to take into account. The nature of the organisations involved and the business-led aspect of the research project itself mean that these subjects should be considered elites (K. Smith, 2006).

The designation ‘elite’ is used to refer to individuals who are judged to be in positions of power and privilege *vis-à-vis* the other members of society (Woods, 1998). The individuals interviewed and interacted within the context of this research included, among others, several company CEOs, current and past central government agents and marketing directors in transnational corporations, all with high levels of responsibility, but also commanding power from their positions, which certainly classifies them as such. They would also frequently accumulate high status, considerable industry experience, broad relationship networks, and in some cases enjoyed extensive international exposure – all criteria which define an elite, according to Welch *et al.* (2002). All of these issues have an impacts in terms of issues such as access (of the researcher to the informants) and differences in power between

researcher and participant (Rice, 2010; K. Smith, 2006), and present important methodological and ethical issues (Cormode & Hughes, 1999).

Individuals belonging to groups designated as elite are used to being in a position of power, control and authority, and can translate this into the interview setting. Particularly, they may use the interview scenario to follow their own interests, not the researcher's (Schoenberger, 1991). It falls to the research to understand this dynamic, and try to negotiate and manipulate the gap between him or herself and the interviewee (Moss, 1995). One of the strategies suggested to try and ensure some degree of control by the researcher is to only undertake the interviews after completing a thorough examination of published materials, thus becoming familiar with the terminology and the most pressing issues considered relevant by the experts (Schoenberger, 1991). In the case of this research on the emergence of markets for biodiversity offsets, this was done by completing an extensive analysis of published data (Figure 5.1). In practice, it was felt that to do so was very relevant for this review to be done and the main points emerging from it internalised before approaching the informants. More than one of the respondents, upon first contact, pointed to reports and published information which they felt should give their broad opinion on issues; only once assured these had been covered by the researcher did they acquiesce to being interviewed.

Finally, while the issue of nationality and culture was not part of the research project brief, it was still kept in mind, as research has demonstrated that national culture can have an impact on managerial styles and opinions expressed (Hofstede, 1984; Ralston, Holt, Terpstra, & Yu, 1997; Schneider, 1988). Ultimately, this led to important observations in terms of the *porosity* between the different case studies chosen, as a significant portion of the actors was or had been involved in more than one biodiversity programme at the same time, or otherwise worked principally from a transnational perspective[55].

4.4.4. Data analysis

All interview materials were transcribed in full, as soon as possible after the interviews were made. Often this meant that the transcriptions would take place the day after the interview, although in some cases it took more than a week before the transcriptions were finished. Likewise, the data from the ethnographic observation was transcribed as soon as possible after the meetings and conferences took place. As mentioned in section 4.4.2, the data from the participant observation sessions was treated the same

[55] The consequences of this circulation of agents are discussed in Chapter 7.

way as interview data for transcription purposes, the researcher having gone through the greatest care possible to note informants' words as accurately as possible.

The advantage of transcribing the data as it was collected is that it allowed the researcher to develop his understanding of the processes involved in the emergence of markets for biodiversity offsets as the data collection occurred; it also allowed him to update his interview guide, as mentioned elsewhere, and to pose new, different questions to subsequent informants. This process of iteration is designated as explanation building (Yin, 2009), and in represented in Figure 4.1 by the arrows pointing from the data analysis box and back into the interview process. Overall, the approach was to consider that data collection and data analysis were not mutually exclusive (Sarantakos, 2005), but complementary.

The data was coded in order to simplify and aggregate the amount of information gathered, following the methodology suggested by the Grounded Theory literature (Glaser & Strauss, 1967). Grounded theory is "…by far the most widely used framework for analysing qualitative data" (Bryman & Bell, 2007, p. 584) – not a mean feat, especially considering that the authors of the 1967 book subsequently diverged in their development of the methodology (Charmaz, 2000). As defined by Strauss and Corbin, a grounded theory is one which is derived from the data; the process is iterative and recursive, the data collection and analysis taking place in parallel, and evolving in tandem (Strauss & Corbin, 1998). In its pure form, grounded theory approach required that the researcher come to the research without previously outlining his theory; the theory must emerge out of the data. However, this is seldom the case, and often the usage of the moniker to define the technique is simply meant to indicate that the theory espoused emerged from the data (Bryman & Bell, 2007). This was the case in this research, as the process of data collection was preceded by an extensive review of secondary data and by an elaboration of the research framework discussed in section 2.5.

Using a grounded theory-derived methodology the data analysis process produced, among other things, a number of components of the representations about biodiversity and markets shared by the informants. When undertaking qualitative data analysis it is often suggested that discourse analysis is employed when the objective is to extract representations: "[d]iscourse analysis deals with discourses. These are socially constructed frameworks of meanings that act upon people like rules, norms or conventions. Discourse analysis deals primarily with language, but especially with its constructive and action-oriented nature" (Sarantakos, 2005, p. 309). However, for this research it was felt that a discourse analysis approach to the data would be

excessively constructivist in its epistemological outlook and consequences. The grounded-theory approach was selected instead for its capacity to emphasise the perspective of the respondents on the processes taking place: "…Strauss' paradigm is familiar (…) as a way of relating structure to process for the phenomenon [*under study*]. Processes can be complex and fluid, constantly varying in response to changes in structural conditions, including the differing perspectives of different actors" (Bazeley, 2013, pp. 355–356). This focus on *process* over the construction of *meaning* mirrors the methodological recommendations of the IEP approach (Randles, 2003, 2007), and ultimately led to the decision to select a grounded theory-derived data analysis in this thesis.

Following the technical advice dispensed in the literature (Grams, 2001; Strauss & Corbin, 1990), the interview and observation data were coded in three steps. The first step is designated open coding, where the data is reduced to simple codes. These are not pre-existent, standardised codes, but codes which emerge from the data itself (Charmaz, 2000), often employing the respondents' own language. The process yields concepts, the "building blocks of the theory" (Strauss & Corbin, 1998, p. 101), and they represent the highest level of abstraction in the theory (Grams, 2001). Concepts are then elaborated and grouped, so they represent real world phenomena (Bryman & Bell, 2007). They are, therefore, less abstract than concepts (Grams, 2001).

The second step in the analysis is designated axial coding (Grams, 2001; Strauss & Corbin, 1990), and consists of a process of making connections between categories. This is achieved in part by connecting categories to each other, and in part by attributing properties to them – the attributes and aspects of the categories, based on specific contexts and situations.

Finally, the third step consists of the process of *selective coding*, by which core categories are selected and systematically connected to the remaining categories (Bryman & Bell, 2007; Grams, 2001; Strauss & Corbin, 1990). The theory, which allows the researcher to answer the research questions, is thus allowed to emerge from these relationships and connections between categories. To aid with this process, the data was entered and coded in RQDA, a qualitative data analysis software (Ronggui, 2012). This three-step process was undertaken as the data emerged from the interviews and observations, throughout several iterations.

4.5. Summary

This chapter has described the methodological strategy used in this thesis to research the emergence, development and expansion of markets for biodiversity offsets. It started by making explicit the thesis ontological commitments, which are critical realist-

inspired: that there is an objective world outside the subject which can be studied, and that there is a degree of social construction involved in the ways in which said world is actualised. Both Polanyi's political economy and the Social and Technology Studies (STS) frameworks have strong realist components: Polanyi's model of the substantive economy is opposes the positivist approach of neoclassical economics, while the work in STS attempts to balance out the assumption that objects and reality are pre-existent *and simultaneously* constructed by the performing of technosciences. The realist approach led to the selection of an intensive methodology of research, which involved selecting three case studies: the programmes of biodiversity offsetting in England, the United States and Germany. These programmes were chosen for being typical of the variety of biodiversity offset markets identified in section 3.4, but also because they provide a degree of contrast, which should allow the research to theorise about the causes for any similarities and differences.

The following three chapters use the results of the data analysis to address the research questions posed in section 3.7. The chapters do not follow a case-by-case structure, but instead look at specific issues: chapter 5 analyses the background to the emergence of markets for biodiversity offsets, and to the process of emergence proper. The role of regulation and changing representations of biodiversity are analysed, with reference to the changes in agents and scales involved in the process; in doing so, chapter 5 addresses research questions 1 and 2. Chapter 6 describes the role of technology and standards in the creation of a market infrastructure capable of sustaining trade in biodiversity offsets; this addresses research question number 3. Finally, chapter 7 analyses the difficulties faced by markets for biodiversity offsets as they attempt to expand the area within which the exchange is accepted, and what consequences this tension between fungibility and localisation may have; this analysis addressed research question number 4.

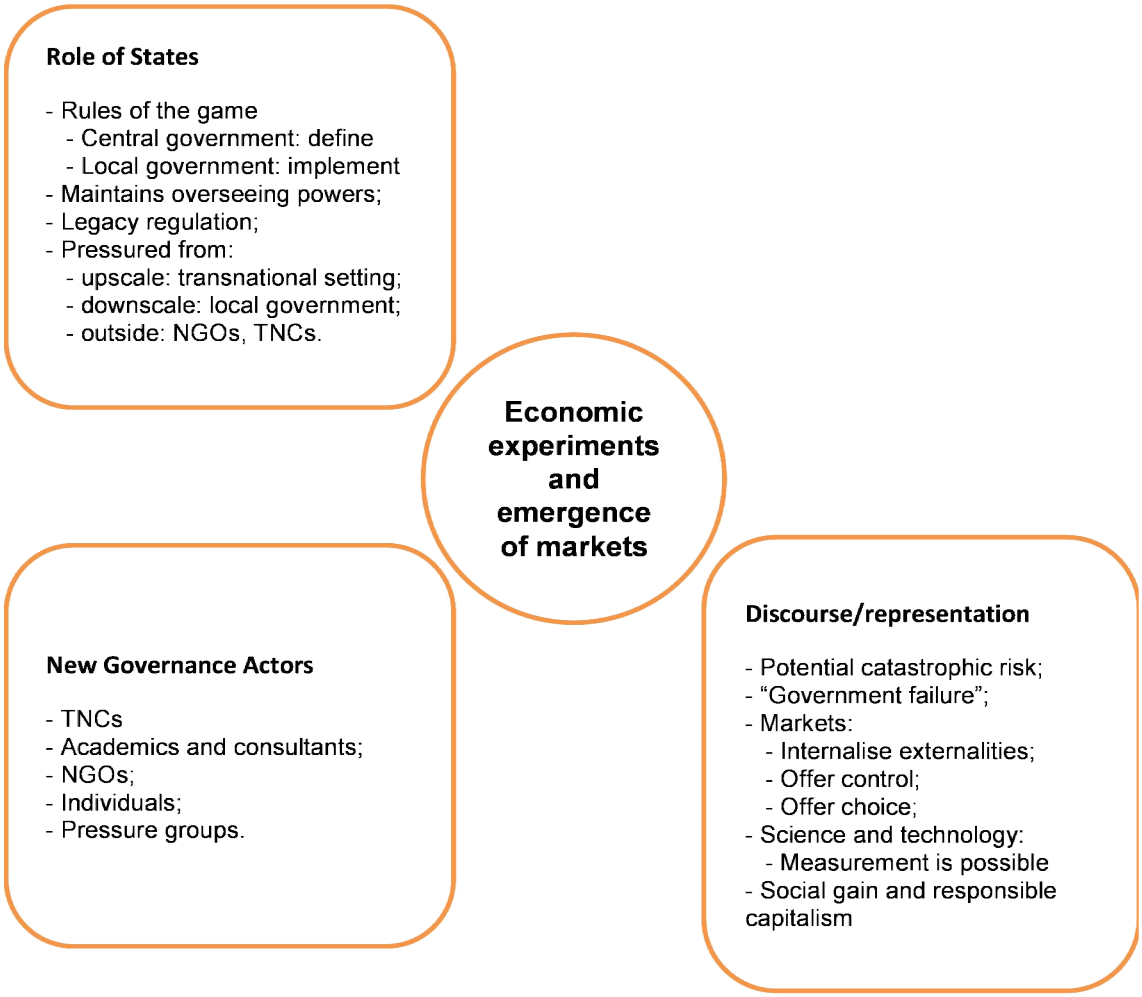
5. The place of biodiversity in the economy: creation of markets for biodiversity offsets

5.1. Introduction

This chapter analyses the emergence of markets for biodiversity offsets. The processes by which these markets are being created result from a series of interacting actions, initiatives and agents, operating at different geopolitical scales. And yet, despite the fact that all these factors have an impact on the process of market emergence, they are not all governed by the same exact logic, nor do they follow a simple, unique rationale.

Figure 5.1 is an adaptation of the framework for the analysis of market emergence and economic experiments, first presented in section 2.5. It highlights which components of that framework will be presented in this Chapter.

Figure 5.1 – Framework for research: process of market emergence



Source: author

This chapter analyses the changing role of the state as a regulator and provider of biodiversity conservation. This happens in the context of a growing number of groups of actors becoming involved in the governance of biodiversity (such as local governments, businesses, academics and consultants, NGOs, individual consumers and pressure groups). All these new actors put pressure on governments to change the ways in which biodiversity is governed. Furthermore, they operate at scales different than the Nation-State, and their objectives can frequently differ. The specific pressures created by these new agents revolve around the perceived risks and consequences of biodiversity loss. Governments are presented as having failed in their role of governance of nature, while markets are argued as a preferable alternative to internalise the externalities of biodiversity. Markets are supposed to allow societal control and choice to be exerted, and to better deliver on the social objective of reducing biodiversity loss. Social gain, for all members of society, and the transformation of capitalism into a responsible form of social organisation are presented as the consequences. However, if national governments see their role as the main governance agent of biodiversity diminished, they still have a number of mechanisms which allow them to maintain an important role: the new markets for biodiversity offsets emerge against a background of previous laws and regulations, and are not independent of those. The state remains a key agent in the governance of biodiversity, and is a core agent in the process of emergence of markets for biodiversity offsets. Overall, the chapter presents markets for biodiversity offsets as the result of performativity of economics related to biodiversity. Markets for biodiversity offsets constitute economic experiments, social innovations resulting from the performing of economics. This performativity of economics (Callon, 1998b; D. MacKenzie et al., 2007) results in a deliberate process of market creation, with political, scientific and economic consequences. By interweaving a set of actions, entities and representations related to biodiversity and markets, economic sciences contribute to the construction of economic settings, actors and institutions which result in new configurations of biodiversity governance.

The chapter is organised as follows: section 5.2 discusses the changing representations of nature and biodiversity. The current discourse on what biodiversity is; what it is for; the causes for its loss; and potential solutions is presented and analysed, placing the emergence of these markets in a wider context. This is followed by section 5.3, which presents the stakeholders with a claim to a role in the governance of biodiversity, and the actions they undertake. It also highlights the scales at which the different actors operate, discussing how market governance is organised and distributed at different scales. The rationale for action of different groups of agents is analysed, which is used to present some of the logics and obstacles prevalent. Section

5.4 examines the role of governments in the process of market emergence, demonstrating how non-existent demand is produced by regulation. Examining the three cases studied, it describes the impact of pre-market conditions, highlighting that the geopolitical and historical conditions have a significant bearing on the mechanisms by which markets for biodiversity offsets emerge. Section 5.5 reflects on these findings and discusses a generative mechanism through which markets for biodiversity offsetting are currently emerging.

5.2. The changing representations of biodiversity and markets

This section examines changes to the way in which biodiversity is thought of and represented in society. The changes relate not only to the way in which biodiversity is seen in public and policy discourses, but also to the reasons why it is being lost and should be conserved, as well as the best available instruments to produce that conservation.

There is a specific intellectual tradition and a set of historical contingencies in the background to the deployment of market mechanisms for biodiversity conservation, anchored in the field of environmental economics (Baumol & Oates, 1988; Hanley et al., 2007; Perman et al., 2003). Together, these result in the creation of conditions for the political action – including regulation and central government support. The creation of markets for biodiversity offsets is not the result only of the emergence of new classes of agents, whose agency produces novel ways in which society provides for conservation, nor is it merely the product of political action and developing regulatory statutes. In democratic societies in particular, there needs to be some shared representation of why it is that said changes to the ways in which biodiversity is governed would be positive, and make society better off. But a representation of “what should be done about biodiversity loss” is not enough: it needs to be framed in terms of the causes of biodiversity loss as the solutions proposed need to fit with a given problem. Further, it also requires that the reasons why biodiversity loss is a problem are established in the public perception.

The first component of this representational change refers to a definition of what biodiversity is. The view presented is increasingly one where biodiversity and the economy are intricately connected, and where biodiversity losses have a negative impact on economic activity and growth. This was explained by a leader of a transnational organisation working on biodiversity conservation:

> Once, sustainability was PR; now, it is operational. It drives efficiencies and plays to a regulatory approach. Increasingly, what matters is not the environmental economics' motto of “given the economy, what do we do

about the environment"; instead, the focus is on the ecological economics' [*question of*] "given the limits of the environment, what do we do about the economy?" [*Interviewee B8*]

Economic sciences are increasingly pointed out as a matrix to approach the understanding of biodiversity. Ecosystem services, an approach made systematic in the influential Millennium Ecosystem Assessment report (MEA, 2005), defends a view of biodiversity both as a source of utility and benefit to humans, and as natural capital, which can be accounted for and invested in. Increasingly, biodiversity is viewed mainly as an economic dimension, to be analysed with the tools of economic sciences. This is especially visible on the approach of the influential The Economics of Ecosystems and Biodiversity (TEEB) report, which specifically calls for the economic valuation of the benefits of biodiversity and ecosystem services (TEEB, 2008, 2010).

The second component of this set of representations refers to the identification of the underlying causes of biodiversity losses: that biodiversity and the related ecosystem services consist of externalities, which leads to their under-valuation when choices between development and conservation need to be made. In the opinion of a proponent of biodiversity offsetting working in the UK:

> ...we are where we are with regard to biodiversity in this country because we have managed to under-sell it and under-value it dramatically. It is the thing that underpins everything we do, and yet we put zero value on it, and treat it as a luxury. (...) if you over-exploit them, then you won't have natural resources in the future to use sustainably. [*Interviewee I1*]

A similar opinion is given by a researcher working in the United States:

> So you have this, you know, very valuable natural resources that don't have a price on them [*Interviewee I4*]

The assertion that modern societies possess a *defective economic compass* (TEEB, 2008), cemented the idea that the relationship between the modern economy and biodiversity is faulty, as the former consistently fails to value the latter. The idea echoes some interpretations of Gareth Hardin's concept of the "tragedy of the commons" (Hardin, 1968, 1994), assuming that lack of property rights in nature's goods and services causes underinvestment and excessive extraction, thus compromising long-term sustainability (R. J. Smith, 1981). Biodiversity is assumed to suffer from the same problem. But while the TEEB study defends that the problem is based on lack of an understanding of the economic value of biodiversity, one of the interviewees defends

that more than valuation, it is necessary that mechanisms which allow value capture are developed:

> ...it's nice to put a value on something, but that really is only helpful for maybe a government making a decision (...) you can't pay someone in theoretical dollars. [*Interviewee I4*]

A second cause of biodiversity loss is also identified. In neoclassic economic theory, one of the possible answers to the effects of externalities is government intervention, to correct for potential market failure. This already happens in the case of biodiversity; in most situations, provision for compensation of biodiversity losses resulting from the activity of developers is already in place, operating through the planning process. In practice, such provision consists of ad-hoc negotiations between local regulators and developers, and they are strongly dependent of the different regulators' traditions, culture and informal norms. This means they are often not consistently applied, and it also means that resources for enforcement are scarce. According to one interviewee, a partner in a biodiversity offsets operator in England:

> …the developer will sign up to anything prior to him getting planning permission. Once he's got the planning permission he'll start to try and negotiate: "This will be a bit too difficult and too costly. I don't think we can do this…", and local authorities don't say "Right, stop the development now, or cease your development, or sell your site, because you've broken your agreement on mitigation". They just have to work with the developer to work round it, and it ends with nothing being delivered. [*Interviewee I1*]

From these two failures (market failure, on the one hand, and government failure, on the other) follows an idea of what can be done to fix it. In this case, the proposed solution is more measurement of biodiversity stocks and ecosystem services, and market creation – in other words, a process of economising and framing. Marketisation of biodiversity is seen as the key to welfare; the rationale is entirely consistent with attempts to perform the market:

> Society's defective economic compass can be repaired with appropriate economics applied to the right information. This will allow existing policies to be improved, new policies to be formed, and new markets to be created: all of which is needed to enhance human well-being and restore the planet's health. (TEEB, 2008, p. 47)

The examples of relevant policies given follow this rationale: "rethink today's subsidies to reflect tomorrow's priorities; reward unrecognized benefits, penalize uncaptured

costs; share the benefits of conservation; measure what you manage" (TEEB, 2008, p. 47). The second and fourth points are crucial: externalities, both positive and negative, are to be brought to bear in the calculations and decisions of agents. This can only be done by developing and deploying a sociotechnical system of measurement. As a result, nature's (economic) values would be made explicit, and the economics of nature mainstreamed (TEEB, 2010).

The ways to make this come to fruition are also consistent: calls multiply for the creation and deployment of technologies for measuring biodiversity, on the one hand, and for making the potential trading in offsets more efficient. Biodiversity offset markets originate out of this context, through agreements between regulators (national and local), promoters, firms and academics. The most common feature that distinguishes the transition between pre-market and market is the explicit enunciation (either as an objective or as a legal requirement) that development should result in *No Net Loss of Biodiversity* (NNL). NNL is both a normative device, which translates a desirable state of affairs and societal objective, and specific guidance for the design of the technological infrastructure necessary for marketisation: only clear measurement of impacts and compensations can ensure NNL. The creation of the market requires that an edifice of market devices is erected, to serve as a base for calculation[56].

5.3. New governance actors: towards a distributed governance of biodiversity

This section identifies the different classes of agents involved in the process of market emergence. The importance, preferences and scale of operation of each class of agent is described. The classes of agents presented here are not pre-existent; they have emerged in the context of this research[57].The changing representation of biodiversity in public discourse is not without consequence. As the new social constructions of nature are shaped, different groups of agents emerge to promote their preferred actions in response to said representations. In doing so, it becomes apparent that not all of these agents command the same degree of influence in the process, nor do they operate at the same geopolitical scale. The range of agents involved in the emergence of markets for biodiversity offsets includes groups so diverse as national and local governments, transnational institutions, proponents and promoters, academics, environmental NGOs, transnational corporations (TNCs), practitioners (such as sellers and consultancies), intermediaries and biodiversity offset buyers. This list is not exhaustive[58], but it is the

[56] The development of technologies and measurement devices is the subject of Chapter 6.
[57] As described in table 4.1, sub-section 4.4.2.
[58] The exceptions are too many to be counted, and would require a level of detail which befits a case study. However, some examples can be raised from our country examples: in the United States the National Mitigation Bankers Association (NMBA) is exclusively constituted of private

product of the research into the topic and discussions with actors involved. The length of the list reflects the complexity and distributed nature of the process: the groups of actors mentioned operate at geopolitical scales ranging from the local, to the state and federal (nation) and international scale. Some groups are constituted exclusively of public institutions, some are entirely private, and some others can be both private and public.

Among proponents and promoters, one stands above all other for its importance in terms of biodiversity offsets. Operating at the transnational scale, Forest Trends is a network of Non-Governmental Organisation (NGO) dedicated to the promotion and expansion of markets for environmental commodities. This network includes two independent organisations which approach biodiversity offsetting from two different angles: the Business and Biodiversity Offset Programme (BBOP), which aims to promote best practice standards for biodiversity offsetting schemes; and Ecosystems Marketplace (EM), which aims to be an information provider about the existing programmes worldwide. BBOP operates by entering partnerships with governments, transnational corporations (TNCs) and environmental non-governmental agencies (NGOs), and has become a by-word for biodiversity offsets:

> …for [*biodiversity*] offsets (...) the only game in town that I can think of, really, is the BBOP. [*Interviewee I4*]

> There are many countries that are setting up these schemes. I think that they refer heavily to BBOP; if you do a Google search for biodiversity offsets, the first ten results are from BBOP. So, whenever they put someone to do an exploration of the issue, it's your first entry point. They are framing the debate. [*Interviewee I5*]

However, interviewees were quick to point out that the BBOP's potential influence is biggest in countries with no previous experience in implementing biodiversity offsetting, and more limited in those where offsetting has been going on for longer:

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providers of offsets, and as such works to foster their specific interests; by contrast, in Germany the Bundesverband der Flächenagenturen fordert Qualitätsstandards für Flächenpools (Federation of Area-Agencies for Quality Standards in Surface Pools – BFAD) includes mostly publicly-run biodiversity offsets banks ("compensation pools"), and attempts to devise standards. In the UK, one unique feature was the creation of the Ecosystem Markets Task Force (EMTF), a privately-run project working within the Department for the Environment, Food and Rural Affairs (DEFRA) to study the economic growth potential of various potential environmental markets. The EMTF identified biodiversity offsets as the best possible such option (EMTF, 2013).

> I'm not sure they are having a lot of impact in countries where schemes are old and well-established. No one refers to BBOP in doing wetland mitigation in the US or offsetting in Germany [*Interviewee I5*]

Beyond BBOP and EM, a number of transnational institutions are also involved in promoting biodiversity offsetting, albeit in different capacities. For example, the European Commission (EC) has sponsored research on the topic of market mechanisms (eftec & IEEP, 2010). The United Nations (UN) has also shown interest in the possibilities of biodiversity offsetting, especially the United Nations Environmental Programme – Finance Initiative (UNEP-FI) and the United Nations Development Programme (UNDP – which is specifically interested in pursuing the possibilities of biodiversity offsetting in Latin America). In order to inform policy makers and connect them to scientist's findings, the UN has created the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), which is sympathetic to the concept of offsetting. The UN is also hosting TEEB – The Economics of Ecosystems and Biodiversity, a Germany-started and EU-funded study on the economic significance of the global loss of biological diversity, as part of the Potsdam initiative for biodiversity (TEEB, 2008). TEEB has endorsed biodiversity offsetting as one of the mechanisms for recognising, measuring and capturing the economic value of biodiversity (TEEB, 2010).

Academics, consultants and other technical specialists are also an important part of the consortia promoting biodiversity offsets, especially when developing the technical instruments upon which the markets depend to operate[59]. However, their input is not the last word, and these technical developments are not always adopted uniformly by operators or regulators. The development and adoption of these often involves significant negotiation:

> When there's a difficult situation to asses, what usually happens is that the government authorities will consult with academics, and that's only a consultation, they don't have authority, but nevertheless they can work on that. And so they can try to input to what is an appropriate indicator or protocol. (...) Then you probably start setting up working groups to try and develop shared indicators that everyone can abide to, because of course the issue is that the regulation itself doesn't specify the protocol and the indicators, so there has to be some consensus in the use of the indicators, because you can't legally impose it. [*Interviewee I5*]

[59] These technical instruments, their development and their importance are reviewed in detail in chapter 6.

Environmental NGOs are also involved in biodiversity offsetting worldwide, and not only in partnership with other organisations. Large transnational NGOs, such as the World Wildlife Fund for Nature (WWF), national-level organisations such as the Royal Society for the Protection of Birds (RSPB) or Ducks Unlimited, or local organisations are involved as stakeholders, bringing expertise international conservation efforts and local planning processes. Their role can also be of legitimising or condemning the concept of offsetting, being imbued with a significant amount of authority for their moral and ethical public image. This puts these agents in a strange and potentially contradictory position. In the words of the head of Environment Research of a large environmental NGO, there is nothing new about using biodiversity offsets, and the issue can easily be framed in existing frameworks:

> ...[*biodiversity*] offsets are not a new idea; instead, they constitute a mix of two existing policies: the principle of compensation – that can be required by local authorities in the context of the planning process, and the Polluter-Pays-Principle. [*Interviewee B5*]

Simultaneously, the same interviewee raised significant questions associated with the concept:

> The [*Interviewee's NGO*] does not condone the concept of offsetting, fearing it may be taken as a “licence to trash”. [*Interviewee B5*]

Some of the practitioners felt this attitude position on the part of NGOs is difficult to justify, as some of the NGOs' operations share some of their form of operation with biodiversity offsetting:

> [*Biodiversity offsetting*] is not unlike what some of the conservation organisations in the US do. (...) An NGO, a non-profit, even though they're non-profit, they're still sort of a private organisation. (...) They'll go out, they'll buy land knowing it's high value conservation land, put it under a conservation easement, knowing that they can sell it to a government agency in 5 years and get their money back. So, they're sort of out there on the vanguard, making the conservation and then selling it to the government. [*Interviewee I3*]

Another common issue pointed out is that some of the biggest NGOs' financing initiatives resemble offsetting. Some market practitioners go as far as believing that these initiatives can go some way into making biodiversity offsetting acceptable on the eyes of consumers:

> ...from a business point of view WWF send out how many of those letters with the cute little snow leopard on (...) Those kind of business models from the non-profit world I think it's going to go a long way to helping demand, because without that we're not going to be able to really develop this market to the extreme that we could. [*Interviewee I8*]

Practitioners – such as biodiversity offset producers, specialised intermediaries and consultants – in the markets have a significant, if variable, role in defining how the exchange comes to be organised. In the process of transferring responsibility for the provision of biodiversity from the state to private providers, a lot is made of the "on-the-ground" experience of these providers: practitioners' expertise and technical input are highly valued, and they collaborate in the designing of the market, by helping write any regulation necessary, being involved in the production of the technical standards governing market practice, and verifying the correct application of those same standards. Practitioners often become promoters in their own right, and consequently can wield a significant amount of influence. Despite this, they remain dependent of regulation, as these are not naturally-existing markets. They see regulation as both a necessity and a hindrance, and tend to be divided between asking for more, more stringent regulation requiring offsetting, and at the same time less regulation to allow for market intensification and expansion. For example, Interviewee A1, the founder of a company poised to work as intermediary in the English Biodiversity Offsets programme, notes this relationship with regulation:

> It would be much better, at some stage in the not-too-distant future, if government supported a more regulatory, required approach. (…)I think I'd like to see a regulated – didn't need to be hard regulation – but some form of better, soft regulatory framework for offsets, which would stimulate third-party investors in buying credits as an investment opportunity. [*Interviewee A1*]

Likewise, Interviewee A2, a consultant, transmits the paradox between wanting some regulation, while not wanting to be encumbered by it:

> The only way really you're going to get a market is a compliance market, which means regulation that people need to comply with, as with carbon. (…) but I think the State's input should be as little as possible, in that they are just the people that protect the public interest [*Interviewee A2*]

A class of agents about whom there seems to be little information is the buyers of biodiversity offsets, a point which was commented on by several interviewees,

including practitioners and promoters. One researcher-promoter commented that "...we don't know much about the buyers" (Interviewee I3). However, this statement requires qualification: one particular category of buyers whose motives are well understood are those agents who need to acquire biodiversity offsets to discharge a legal requirement to provide compensation for losses to biodiversity derived from their activities:

> ...[*the biodiversity offsets market*] is not sort of, like, retail – since it's basically home developers, all land developers that would need conservation credits (…) those are the buyers, and (...) at this point, the demand side is very practical, they just want something that has been approved. [*Interviewee I3*]

These buyers approach the market looking for something that will fulfil their legal obligations and obtain planning permission for their activities as quickly as possible:

> ...time is money. Let's say you're a big private sector developer, if a permit takes you two years to get through, because one year goes to figure out good mitigation for your project, and you can do your project in a year, that's a year in which you don't have that carrying cost. It was interesting at the beginning, the development community became very supportive of banking, because it made their development a lot more efficient, and yet at the same time it actually provided greater ecological benefits than it previously had. [*Interviewee I8*]

For this reason, the actual price of an offset may be of comparatively little interest when compared to the time saved by the buyer. From this aspect, a biodiversity offset banking model is superior to one-off offsets, as explained by a former biodiversity offset banker based in the United States:

> I think for a buyer that's new to this, when they see a conservation credit, they think that the price can look pretty high, $15,000 for an acre of wetland seems sort of ridiculous when the price of land is $5,000 or something, or hundreds of thousand dollars in some cases. The standard story that I've heard, and I actually don't know this first hand, in many case a potential buyer has decided to try to do the offset themselves, and then been stuck in the permitting process for years, and invested a lot more money than they would have if they'd bought a credit – and in some cases, will pull out of the process and go buy a credit. So, I guess the answer is they're looking for... time, is a big thing and I think it's one of the appeals of banking and

> credit. The credit is already created, it's already proved, all they need to do is buy it and run it through the process. So, it's quick. [*Interviewee I3*]

These comments refer to the experience of US-based operators in the biodiversity offsets market, where the majority of buyers enter the market because of regulation constraints. For this reason alone some demand is assured, and so there seems to be little incentive to learn more about what other factors could drive buyers. All the responsibility, up to and including any reputational issues, is discharged on the seller: one of the interviewees remarked that "...as a buyer of [*biodiversity offset*] credits, you basically go off on reputation, of the [*biodiversity offset*] banker." (Interviewee I3).

However, not all potential biodiversity offset buyers are driven by compliance alone. Another class of (potential) buyers are companies with customer-facing operations, which could expect to benefit from different types of offsetting – including, but not limited to biodiversity – as a Corporate Social Responsibility (CSR) mechanism:

> ...corporates needing to offset their environmental impacts by buying credits for things like water, carbon, nutrients, etc. (…) companies required to offset the impact on flood risk, or offset the impact on water quality/quantity, there's these things. [*Interviewee I1*]

However, despite the industry's best hopes, the number of companies which choose to offset their biodiversity impacts is limited. One representative of an international tobacco industry outfit, for example, remarked that:

> [*the company*] is not concerned with buying [*biodiversity*] offsets. As far as I know, [the company] has only ever bought one [biodiversity] offset, and that should not have been bought at all, which caused some problems. (...) [*the company*] would be a lot more interested in being involved in forms of nature governance which are not competitive. [*Interviewee B6*]

Equally, a representative of an international food and beverages company highlighted that:

> [*the company*] does not identify the question of biodiversity offsetting as particularly relevant; [*it*] understands the importance of ecosystem services for the future development of the businesses, but not the importance of the compensation/mitigation logic. Probably would not buy voluntary [*biodiversity offsets*] either. [*Interviewee B7*]

International companies' understanding of what their consumers wish them to do in terms of impacts on biodiversity is encapsulated in a prosaic formula, which two companies' representatives mentioned separately:

> [*the company's*] line on no net loss of Biodiversity is that consumers want full traceability. They also generally want to be reassured that no unnecessary harm has been perpetrated on sourcing whatever it is they are buying. But they don't necessarily want to know how this is achieved [*Interviewee I12*]

> On the other hand, [*the company*] understands reputation risks. Our clients are not very engaged with the [*sustainability*] issues, apart from a dislike of the idea of companies needlessly trashing the environment. [*Interviewee B7*]

Listening to potential buyers, it becomes clear that, in spite of proponents, policy-makers and biodiversity offset sellers' hopes, the reality of these markets is one in which demand does not come naturally. Biodiversity and the associated ecosystem services are traditionally externalities, and companies have no incentive to compensate for their impacts if their customers do not require them to do so. In fact, these companies' claim that end consumers are only interested in being assured that their personal consumptions do not lead to the companies they buy from inflicting unnecessary damage on biodiversity. This may or may not be accurate[60], but it is the reasoning that these companies are operating under. The immediate result of this is that companies will not voluntarily acquire biodiversity offsets. The resulting problem of lack of demand is one of the most pressing for emerging markets in biodiversity offsets.

5.4. The role of the state: geopolitical and historical framing

This section presents the main solution employed to produce the missing demand in biodiversity offsets markets: the definition of the “rules of the games”, requiring that developers present evidence that their impacts on biodiversity are compensated for.

Among the roles states can take[61], one of the most important is to draft regulation and sponsor pilot projects. While it falls to central government to decide on what science to take into account and legislate accordingly – at least in theory – they are forced to relinquish not only the delivery of biodiversity offsets, but also the actual

[60] In any case, it seems reasonable to at least assume that not all consumers have the exact same opinion on the issue, and that some will be more engaged than others. Consumer behaviour is not, however, the topic of this research.

[61] See Crowe and ten Kate (2010) for an outline of what the BBOP believes are the roles and options for governments, and the TEEB report for governments (TEEB, 2009) for a similar view from a transnational take on the same issue.

implementation and decision-making on the ground, while balancing out the interests of different stakeholders and interest groups.

The arrangements for the governance of biodiversity offsets vary on a country-by-country basis, usually depending on what agencies were responsible for governance of this sector in the pre-market phase. In the United States, this responsibility ultimately rests with two federal agencies – the United States – Fish and Wildlife Service (US-FWS) and the United States – Army Corps of Engineers (US-ACE). This arrangement is the result of the regulations which established the legal requirement to protect endangered species and wetlands[62]. While the US-FWS has a claim to environmental expertise, the US-ACE's core capacities lie elsewhere. This historical accident is specifically identified as a source of problems faced by practitioners in the US:

> I think that one of the problems that we have in the US is that the Army, military brand, is involved in wetland regulation. (...) There's historical reasons for it, but it doesn't make any sense. Of course they have lots of firewalls and stuff for information, [*but*] they're also the military, so they don't have like a core principle of protecting the environment. I guess if I had a wish list, you know, it would be that the regulation is housed in an agency that is intended to care about that, and that they're historically very transparent about their information. I think that is sort of the best scenario for starting something out. [*Interviewee I4*]

In England there is no specific governance structure for biodiversity offsetting in place yet, following from the fact that there is no regulation in place to require offsetting, and the British government considers that the initiative should have a voluntary character[63]. However, as the pilot projects were launched and started to operate, agents began to discuss how a future biodiversity offsets market could be governed, specifically with regards to which agency should have oversight powers. In the opinion of a private intermediary and promoter, this task should in the future fall to Natural England (Interviewee I1). From the point of view of those regulatory agencies, in turn, it is felt that the drive for the creation of the biodiversity offsets pilots is a party-political project:

> The reason that DEFRA is looking at biodiversity offsets is because when we had an election [*and*] one of the parties that formed the coalition government had in its manifesto an undertaking to look at what it then

[62] The regulations in question are known as the Endangered Species Act and the Clean Water Act. See section 4.3 for details.
[63] The voluntary nature of the English biodiversity offsetting project, and the pilot projects in operation, are discussed in detail in section 5.4.3.

> called conservation credits, as a means of delivering a better approach to compensating for adverse impacts from development. [*Interviewee I13*]

Perhaps for this reason, regulatory agencies are feeling the need to look beyond biodiversity protection alone in the development of these pilot biodiversity offsetting schemes:

> The current policy I suppose is to gather more evidence through the pilots. It's reflecting that sort of balance across government, the commitments on the regulatory agenda, and our targets on not increasing costs to business. [*Interviewee I6*]

But more than balancing out the interests of the environment and business concerns, the British government, particularly through the Ecosystem Markets Task Force (EMTF), has embraced one of the core tenets of ecological modernisation: through the use of markets, biodiversity can be mobilised to foster economic growth. Discussing the possibility of future development and expansion of biodiversity offsets in England, it was mentioned that:

> ...the government's priority at the moment is growth, and as part of that building a green and growing economy, because the government believe that green growth is an economy [*that*] can be both green and growing. So within that context I am sure that if evidence emerged that said offsetting was a really good opportunity for business (…) and therefore good for growth, and also good for the environment of course, than I think the debate would be quite finely balanced. [*Interviewee I7*]

In Germany, the Impact Mitigation Regulation (*Eingriffsregelung*) programme, which consists of a biodiversity offset-type market mechanism, is the responsibility of the Federal Ministry for Environment, Nature Conservation and Nuclear Safety (eftec & IEEP, 2010). It is the only of the three programmes discussed in detail in this thesis which is based on a specific piece regulation, the German Federal Nature Conservation Act (BnatSchG) (Darbi et al., 2009). Besides having presided over the creation of the biodiversity offsetting programme, the German government has been a driving force in reforming it, including the provisions for *compensation pools* – a type of biodiversity bank – to be used, made possible by changes to the Federal Building Code (in 1998) and the Federal Nature Conservation Act (in 2002). Compensation pools were initially ran mostly by local authorities, but increasingly also by private companies (eftec & IEEP, 2010). Government is therefore steering the rules of the game.

If central governments have the capacity to define the rules of the game and ultimately create markets (Crowe & ten Kate, 2010), they are often unable to force the implementation of said measures. This task falls to local governments. Local governments must negotiate with local stakeholders, a fact which gives them a much closer appreciation of the challenges and problems resulting from the need to balance out development and biodiversity conservation. Even before the implementation of biodiversity offsetting, local governments are usually already equipped with tools to balance out these two objectives, through planning regulations. Speaking about the English case, a regulator remarked that:

> I would typify our development control system is a plan-led system, whereby local authorities take a look at what sort of development should go where. But essentially, even within that, any person can put forward any development proposal in any place […] We have a planning system that has developed over a century now, and so we are trying to develop a system which meshes with the planning and development control system that we have. [*Interviewee I13*]

This situation, where there is a strong historical precedent for local authorities to have the power to block development altogether or at least require some form of compensation, creates a problem: compensation requirements are not applied equally, as decisions fall to the discretion of local planners and their preferences:

> …if a developer came along and wanted to build something that would damage something of good biodiversity quality but that wasn't legally protected, it would be very much down to the local planning authorities, maybe under pressure from an NGO or from a statutory nature conservation agency who recognised the value of the biodiversity on that piece of land and said “that's valuable, we'd rather it got protected” (...) So, it's on the discretion of the local authority, whether they push a developer to provide an offset. [*Interviewee I10*]

Biodiversity offsets markets are being rolled out not in a context where a form of requirement to offset already exists, but one where informal rules and negotiation are the main forms of agreeing on what constitutes appropriate compensation for biodiversity losses.

The situation in Germany is different in institutional terms, but displays a number of similarities. Despite the involvement of central government in effectively legislating the creation of a market for biodiversity offsets, the implementation falls to State and local

governments – most of which design and enforce their own standards. This results in confusion for outsiders and potential investors:

> The Germans sort of regional governments are quite interesting. (...) There was not enough transparency (...) because the markets are all run by the regional governments – the *Länder* – and people in Germany have said to me that they're not very transparent in what they do. The planning authorities and the people signing off the offsets are very often the same people, or certainly they're in the same administration [*Interviewee I2*]

So, despite the much heavier involvement of the German central government, the prominence of local government agents in decision-making remains an important factor.

The third example of experience with markets for biodiversity offsets in the United States, reveal some of the same issues. The offsets markets are overseen locally by the regional and state bureaus of the federal regulators (the US-FWS and the US-ACE), which liaise with local authorities in matters of planning. As a result of this arrangement, there are significant differences in the decision-making from state to state and area to area. Interviewee I3, a promoter of markets for environmental products and services, recounts an attempt to produce a database of all operating markets which was frustrated by this very reason:

> The US is very fragmented. When [*the company trying to create the* database] came back to us they were totally exasperated. They'd done a lot of complicated financial and carbon and other commodity registries, and the fragmentation within the mitigation banking and conservation banking in the US was so great, and the lack of communication was so great, that I think they sort of threw their hands up [*Interviewee I3*]

Part of the issue seems to be with the regulatory agencies themselves, which have different preferences and interpretations of the existing regulations: in some locations, regulatory agencies display a significant preference for mechanisms which compete with biodiversity offset banking. The problem became so acute, particularly in the field of wetland mitigation, that in 2008 the National Mitigation Bankers Association (NMBA) eventually required – and received – assurances from the US-ACE that, where available, offset banking ought to be given preference over alternatives (Kett, 2010). But by early 2012 concerns remained that the situation had hardly changed:

> Even to that [*set of assurances*] is resistance, cultural resistance some times within the agencies, because people are making money off the environment. [*Interviewee I9*]

Overall, in all cases lack of demand is an important obstacle to the emergence and evolution of markets for biodiversity offsets. Public goods, such as biodiversity and ecosystem services, have traditionally been kept out of the reach of market governance, in part because of difficulties of excluding potential beneficiaries from the benefits. As two respondents, both experienced biodiversity offset bankers operating from the United States, put it,

> ...from the buyer point of view, you need a reason to buy. As a colleague of mine used to say, nobody wakes up in the morning as says “I want a bowl of wetlands”. [Interviewee *I8*]

> The US is a world where a gun to the head is the only reason why people buy these credits. Other than that, nobody is going to be buying. [*Interviewee I9*]

Most buyers, developers and infrastructure builders, are looking for a quick way of complying with regulation; their interest is to discharge their legal obligations, and to do so as quickly as possible. This lack of demand, described by agents as the main challenge faced by markets for biodiversity offsets, is inherent to the way in which the relationship between the economy and biodiversity has historically been organised. As a result, when moving from a pre-market to a market form of governance, there is an imbalance between supply and demand for the biodiversity offsets:

> I think there's a number of people and organisations who are willing to supply habitat offsets and restoration, but there's not a lot of demand for it. In the US, funny enough, we actually do have one of the most advanced biodiversity markets for wetlands and endangered species, just because of the rules and regulations. [*Interviewee I8*]

The result has been attempts to use the regulatory role of governments to produce demand:

> The key factor, the driver of this kind of markets is the level of regulation. The only way really you're going to get a market is a compliance market, which means regulation that people need to comply with, as with carbon. (…) regulation that says “we want you to try and compensate and avoid loss of biodiversity from development” [*Interviewee I2*]

The regulation on which biodiversity offset markets depend is, itself, dependent of the geopolitical and historical context, being affected by legacy regulation and practice. The emerging exchanges are grounded on a set of formal and informal regulations, traditions and governance structures, such as local planning regulations, Environmental Impact Assessment rules and conservation agreements, National Parks or, in the case of European Natura 2000 protected areas, supra-national rules. This pre-market setting cannot be surpassed, eliminated or substituted by the emerging market regime; markets for biodiversity offsets are obliged to co-exist, and at times compete, with these previous arrangements. The different geopolitical backgrounds and pre-market scenarios lead to specific adaptations of the biodiversity offsetting programmes on a case-by-case basis; the development of markets for biodiversity offsets shows a degree of path-dependence. The three case studies below demonstrate this observation.

5.4.1. A bowl of wetlands in the morning: the US Mitigation Banking programme

This sub-section analyses the experience in producing demand in the United States Mitigation Banking programme. It describes how an earlier regulation created excessive limitations to development whenever biodiversity was impacted, to the point that not only was economic growth affected, it also had negative impacts on biodiversity itself, creating perverse incentives against the conservation of endangered species. As a result, the regulator eventually allowed developers to acquire offsets from third parties which would provide the compensation required to assure *no net loss of biodiversity*.

The experience of development of a biodiversity offsetting scheme in the United States is based around a response to regulation requiring that compensation to any damages to biodiversity[64] is demonstrated to a regulator. The Species Banking mechanism follows on from the successful creation of markets for mitigation of wetland losses, as a result of the approval of the Clean Water Act (CWA) of 1972 (Gardner, 2011; Mead, 2008). The Endangered Species Act (ESA) of 1973 specified that any species listed as endangered were warranted legal protection, and that their continued survival should take precedence over economic gains from land development. This led to a situation where proposed development projects would be denied planning permission on the basis that they would result in losses to those protected species. Soon after, local regulators and developers began to find that the balance between conservation of biodiversity and economic development had shifted excessively to the side of conservation. Interviewee I8, a long time biodiversity offsets banker in the United States who started his career with the Environmental Protection Agency (EPA),

[64] In this specific case, endangered species.

explains how the regulators found themselves without tools to re-balance this conservation-development equation, and set about looking for suitable mechanisms:

> What we were finding is we were winning the battles but losing the war: as regulators for overseeing wetland habitats or endangered species habitats, we were stopping bad projects, with really bad impacts, but we could only stop them. If there were good projects that were good projects and needed to move forward, there wasn't much we could do, there were no kinds of offsets in place; if there were, they were very bad, they were piecemeal mitigation, where people would impact ½ ha, and restore something behind a mall, and these things were just destined for failure, they were not ecologically viable.
>
> And so, we as regulators in the 90s – and this was happening throughout the nation – got together and said "this doesn't make sense, to protect this little piece of fragmented habitat, let's go find someone". Typically you would find a farmer or someone down the road who had some habitat you wanted to see protected or restored, and you would tell the person they needed a permit to move forward, to just give that person down the road some money to protect something or fix something. We, unofficially, started creating these things called mitigation and conservation banks. [*Interviewee I8*]

The problem did not affect developers alone. While the regulators were looking for ways to compensate for what they saw as the worst excesses of the regulation, the restrictions posed by the ESA were having unintended negative consequences for the species they were supposed to protect. Confronted with the discovery of an endangered species, landowners and developers working on areas of proposed development had all the incentive to eradicate all individuals of said species from the area. To allow the continued existence of endangered species in a piece of land could severely impact the potential economic value of the area, often by stopping the proposed development altogether. So common was this practice of selective eradication of endangered species that it became known informally as the "Three S's Approach to Species Management: Shoot, Shovel and Shut Up" (Bayon, Carroll, & Fox, 2008, p. 5). This increased the search for mechanisms that would allow development to go ahead, while simultaneously requiring developers to provide assurance that endangered species would be protected. The ESA did not specify that compensation should be provided by offsetting for losses of endangered species, nor did it make provisions for said offsets to be acquired from a third party; but crucially,

nor did it specify otherwise. Other forms of compensation besides the market approach – such as one-off offsets and in-lieu fees – were also being developed, the former offering a case-by-case compensation for impacts, and the latter consisting of payments to the authorities which would channel them towards compensatory activities. These became the backbone of US mitigation and offsetting policy between the 1970s and 1990s (Mead, 2008). As a result, when in the 1990s species biodiversity banking began to emerge as a market-based form of biodiversity offsetting[65], it came to co-exist with these other mechanisms for compensation.

The relationship between the market and non-market forms of biodiversity offsetting has been characterised by a degree of competition. The different mechanisms for compensation of biodiversity losses compete for buyers, as all allow developers to discharge their legal obligations. Simultaneously, they also compete in another arena: regulator preference. Since in the United States there is no actual law requiring biodiversity offsetting (the mechanisms available result from informal guidance to allow biodiversity conservation and development to co-exist), the ultimate responsibility for deciding what is an acceptable as a biodiversity offset rests with the regulators – the EPA and the US-ACE. Mitigation banking, the market form of biodiversity offsetting, is at a competitive disadvantage in terms of cost, because of the significant legal and financial obligations that mitigation banks must follow before approval. Because of this situation, proponents of biodiversity banking have long lobbied the regulators to assure that, in cases where more than one potential form of offsetting is available to developers, the market form is given priority over the alternatives, on the basis that it offers greater ecological and financial assurances of success in the long term (Bonnie & Wilcove, 2008). However, several respondents have raised concerns that this preference is not always observed.

5.4.2. Evolving by regulation: the German IMR programme

This sub-section analyses the emergence of a market for biodiversity offsets in Germany, the IMR programme. This programme is rooted in regulation emanating from the German federal government, requiring that development should not lead to losses of nature. The responsibility of providing the offsets was, until the late 1990s, the responsibility of local authorities. However, the programme has suffered numerous criticisms, and in time the regulation evolved to allow private agents to be involved as sellers of biodiversity offsets, and a more market-like system has been implemented. The emergence and evolution of this particular scheme is very dependent of regulation changes.

[65] The first species bank became operational in 1992 (Bayon, Carroll, & Fox, 2008).

The *Eingriffsregelung* (Impact Mitigation Regulation – IMR) procedures have existed since 1976 and are fully integrated with urban and landscape planning and with the EIA process in Germany (eftec & IEEP, 2010). Its application is mandatory, and the legislation requires comprehensive and total mitigation of impacts – that is, there is a specific requirement for *no net loss of biodiversity* (NNL). It also features strict additionality requirements (Madsen et al., 2010). The regulation was later integrated with the Federal Building and Spatial Planning regulations (during the 1990s), giving the delivery of offsets greater flexibility, specifically through the constitution of compensation pools. Compensation pools are the equivalent of mitigation banks in the United States Mitigation Banking programme, consisting of mapped-out collections and concentrations of sites used for the purpose of compensating for impacts (Wende, Herberg, & Herzberg, 2005). Many of the existing compensation pools were created and are run by local authorities. Private operators have been allowed to provide conservation pools since 2002; at the same time, municipalities are being encouraged to try and achieve compensation by creating their own pools. Several of the German states have enacted ordinances in support of this practice, therefore establishing the basis for the occurrence of professional public and private providers of compensation services, aggregated under the Federal Association of Compensation Agencies (Bundesverband der Flächenagenturen in Deutschland e.V.).

The reasons for these evolutions to the programme rest with a dissatisfaction with the results that were achieved until recently. The programme is considered a very strict planning instrument, but it has so far failed to prevent the deterioration of nature and the landscape, as well as species loss (Wende et al., 2005). Further, it has created important restrictions to economic activity, in the form of land availability constraints. Farmers, in particular, are opposed to the idea that good quality farming land should be reserved for biodiversity offsetting purposes, and worry that land, overall, is becoming scarce and excessively expensive (Madsen et al., 2010). As an attempt to deal with this problem, some of the compensation pools, created to offset for specific impacts, are afterwards used to offset impacts elsewhere. This practice is permitted by changes to the regulation which loosened both the spatial and the functional connection between the area developed and the offset (eftec & IEEP, 2010). However, this has led to increased problems in demonstrating *no net loss of biodiversity* and additionality.

In order to try and resolve these problem, the Federal Nature Conservation Act of 2010 has established the concept of “natural areas” (areas within which offsetting is acceptable), and created an ecosystem unit. Designated “eco-points”, these are a form of biodiversity credit – offsetting must provide the same number of eco-points as the damage. It also attempted to stop the use of high-priority agricultural land for

biodiversity compensation (Madsen et al., 2011). All of these changes have been put in place to try and balance the necessity to conserve biodiversity with the needs of maintaining economic activity.

5.4.3. A voluntary market: the Biodiversity Offsets programme in England

The Biodiversity Offsets programme in England is being piloted without regulation to force developers to acquire offsets. The British government supports the scheme, and has provided potential participants with technical guidance, while attempting to learn from the experiments taking place. While no regulation for biodiversity offsetting exists, the practice of requiring compensation in the context of Environmental Impact Assessment (EIA) is well established, and there is the expectation that local governments might use it to nudge developers to acquire biodiversity offsets in the market.

The third case examined in this thesis is the development of a programme of biodiversity offsets in England. The English case is characterised by the existence of a series of regulations and arrangements with regards to the provision of compensation in the case of damage to biodiversity. The main regulation authorising the use of compensation in case of damage to biodiversity is the Section 106 of the Town and Country Planning Act 1990 (Latimer & Hill, 2007). This framework leaves it for local authorities to decide when and what to require in terms of compensation for important damages to biodiversity resulting from land development. However, this system has had its own problems, specifically in terms of a significant disparity of criteria for applying the regulation, and ongoing difficulties in verifying the continued provision of compensation after the permission to develop is achieved:

> ...the Section 106 Planning Condition approach, where the ecologists working for the developers say “it's going to impact on X, Y and Z, and this how we're going to mitigate it”, (...) but what you find is there's no enforcement, there's nobody going out in five years’ time to check what they've done to see if it's working and to hold them to account. What usually happens is it all gets watered down. The developer personnel change, people say “well, that was set up three years ago, before my time, and I don't know anything about it”, the local planning authority's personnel change, there's nothing written down that's legally binding, that has a come-back position that will say “you'll pay X-million pounds in fines if you don't do your mitigation appropriately”, and it doesn't work. So, effectively what you have is a situation where mitigation is a bit of a “wish-list”, with no enforcement and no guarantees that it can work. [*Interviewee I1*]

One of the reasons why the mechanism is being deployed is deliberate political preference – specifically, an electoral pledge by one of the parties in the governing coalition which launched the scheme, as mentioned by Interviewee I13[66], a bureaucrat working for one of the regulatory agencies involved in the implementation of the Biodiversity Offsets programme in England. But there is some evidence that various of the government agencies affected by this programme are not in agreement with the project. The boundaries between market and non-market forms of governance of biodiversity in England are being disputed within government:

> These agencies are trying to defend their current functions and maintain themselves against some people in the government that would like to get rid of them, basically, or certainly weaken them substantially. They've already been weakened in the cuts, so they're trying to defend themselves like that, rather than expand their functions. [*Interviewee I2*]

The suggestion is that the agencies worry that the potential development of a market for biodiversity offsets as the main mechanism for governing biodiversity in England would strip them of their responsibilities and importance as the most important biodiversity governance agents. The state may be trying to develop a market, but some of its most important parts oppose this, even if not openly.

The biodiversity scheme in England is, for now, seen as voluntary. A number of pilot cases have been set up to try and test the feasibility of biodiversity offsetting in England, starting in 2012. Both local authorities and private providers have applied to be involved in these pilots. Local authorities, in the absence of a regulation that would allow them to force developers to acquire offsets, were forced to try and promote the merits of the scheme in terms of increased ease of approval for development projects.

> Because it's voluntary that might put some people off – certainly that's the vibe that we're getting at the moment. I've spoken to several developers about this who are perhaps less keen because it might cost them more, and they're not obliged to do it, so they won't do it. There would have to be more compulsion to do it in the future, of this is rolled out nationally, there might have to be more pressure on developers to do. [*Interviewee I15*]

As a result, no developer is forced to acquire biodiversity offsets, nor are local authorities permitted to require that they do so; the scheme is only one among a number of ways which a developer can select in order to prove to the authorities that the project under appreciation compensates for unavoidable damages to biodiversity.

[66] Quoted above.

At the same time, it is clear what the government's position is in terms of regulating for biodiversity offsetting: it should only become legally enforceable if it is found – through the biodiversity pilots – which it has the potential to contribute to economic growth. But the reluctance in creating new regulation is notorious in the way government specialists approach the issue:

> …if evidence emerged that said offsetting was a really good opportunity for business (...) to be involved in (…) it will contribute to growth in the economy... and the evidence went further than that and was able to say these are the specific market conditions that are needed, and we think that a regulatory approach is the best, then the government – if that evidence existed – then I suppose the government would be thinking "well, on the one hand there seems to be this evidence that offsetting will contribute to growth, and that's something that we're very much interested at the moment; but on the other hand our approach to regulation is to try to make that as intelligent and smart regulation as possible". And often that means not adopting a hard regulatory framework, and looking at what other means exist, through encouragement or some sort of fiscal or monetary incentive of some kind. So, I suppose I'm saying that it's not clear quite how the government would view at the moment, because it's interested in growth in one hand, so if there was evidence that this would support growth, then it might be minded to consider it, but there would be other wider political agendas in play as well. [I*nterviewee I7*]

5.4.4. Different backgrounds, comparable processes?

Table 5.1 summarises some of the main characteristics of the three case studies analysed in this chapter.

Table 5.1 – Markets for biodiversity offsets

	Species Banking	**IMR**	**Biodiversity Offsets**
Date started	c.1992[67]	1976	2012 (pilot projects)
Requirement to offset?	Yes	Yes	No

[67] Since the Species Banking programme began by operating on an informal basis and remains so to this day, there isn't a specific starting date. 1992 is, as mentioned above, the data in which the first species bank began to operate.

Relevant legislation	Endangered Species Act. US-FWS Guidance, 2003.	Impact Mitigation Regulation	Voluntary. Section 106 of the Town and Country act 1990.
Type (Madsen et al., 2010)[68]	Mitigation Banking	Compensation	One-off offset
Noticeable tensions	Developers/endangered species conservation. Species Banking/other offsetting mechanisms	Requirement to offset/developers. Land set aside for offsetting/farmers.	Planning regulations/developers

Source: author

The analysis has demonstrated that functioning markets for biodiversity offsets are heavily dependent on regulation, such as the German IMR and the US Endangered Species Act. Even in the situation where the schemes are voluntary, regulation is an important support for biodiversity offsets: in England, the voluntary acquisition of offsets is related to the concession of planning permissions, via the EIA mechanism.

In all three cases discussed, evidence points to the fact that biodiversity offsets consist of a measure favoured by central governments, interested in trying to forward policies that allow both development to take place and conservation objectives to be achieved. In all cases, the process of market emergence is characterised by the appearance of a set of individuals and organisations interested in offsetting, advocating for changes to regulation itself or to the way in which it is implemented. The emergence of markets for biodiversity offsets in developed countries appears related to a need to balance out the expressed preference – at local, national and international scale – for conservation of biodiversity, and the economic imperative to permit continued land development and reap the associated economic benefits. A market for biodiversity offsets is a balancing out mechanism. However, it is not the only mechanism available: regulations, such as planning permission and EIA rules, have been a part of this balancing act for some time. Marketisation of biodiversity offsets consists of a change in the instituted economic processes involved in biodiversity conservation, a shift in the boundaries between the non-market and the market forms of biodiversity governance, increasing the importance of the latter in opposition to the former. The set of changes occurs at institutional and regulatory level.

5.5. Reflections and conclusions

This chapter has examined the emergence of markets for biodiversity offsets. In doing so, it has identified changes at the institutional and regulatory level, but which are at least partially grounded at the level of the actors' shared representation of biodiversity and markets.

[68] The Madsen et al. typology of biodiversity offsetting programmes was discussed in section 3.4.

5.5.1. Instituting

The emergent markets for biodiversity offsets are both historically and geographically contingent, following the description of markets as instituted economic processes (Polanyi, 1957c; Randles, 2002). And just as predicted by this description of markets, the result of the specific processes instituting for each market for biodiversity offsets is variety (Randles, 2003). This is visible when considering which policies each instituted market for biodiversity offsets counters, and the way it is designed: the US-based Species Banking programme allows offsetting of endangered species in different locations against the background of the Endangered Species Act (ESA) – the specifics of which allowed for developments to be stopped in land where endangered species are found. In doing so, it balances out the limitations to development imposed by the ESA. Conversely, the design of the market aspect of the German Impact Mitigation Regulations programme is related to the initial design of that piece of legislation: the programme requires that biomes in each area are protected, but increased development (and the associated setting aside of land for compensation) has led to protests by farmers that too much prime agricultural land is being used for conservation; as a result, the liberalisation of the programme and introduction of market aspects to it is expected to help bring some flexibility to what land is set aside for conservation. In fact, as will be seen in Chapter 6[69], the design is such that, through land management and improvements, lower quality land will attract the greatest number of credits. Finally, the Biodiversity Offsets programme being piloted in England is in many respects targeted at compensating for the apparent difficulty in obtaining planning permission for development. By acquiring offsets from a third party, developers will – theoretically – be able to obviate local authorities' restrictions to development. In their recommendations to Government, DEFRA's Ecosystem Markets Task Force (EMTF) quoted biodiversity offsets as their first priority, justified as such:

> Designed correctly, a nationwide system of biodiversity offsetting would: save developers time and money through reduced risk and uncertainty and a more streamlined planning approval process, as well as offering reputational benefits and more efficient and valuable net developable areas. (EMTF, 2013, p. 10)

While going on to quote benefits in terms of increased total conservation area and opportunities in the land management sector, it is clear that the streamlining of England's planning regulations to permit business is the most important concern. As a result, far from designing a market centrally, government has left for local authorities to test what works best in terms of biodiversity offsetting in practice. The variety of

[69] Specifically, in sub-section 6.2.3.

instituting of these economic processes (M. Harvey, 2007) follows from the reason why the market for biodiversity offsets is being created in each context.

The creation of markets for biodiversity offsets consists of a counter-movement, on the direction of increased liberalisation of land development and land-use change. Through it, land – which Polanyi would describe as an element of industry – is brought back into the service of economic growth, from which it had been partially removed by regulation. In *The Great Transformation*, Polanyi (1944) described the economic history of the 19th Century as a double movement composed of economic liberalisation, on the one hand, and protection through regulation on the other. In his work, the author implies that a counter-movement for protection follows from the movement for liberalisation; conversely, in the examples of the creation of markets for biodiversity offsets presented, liberalisation appears as a counter-movement, borne out of a necessity to balance out what appears as excess protection to a number of groups of agents. Of course, the two components of this double movement co-exist – they are synchronous (Barthélemy & Nieddu, 2007). As shown in the cases presented, one of the most important problems which the governance of biodiversity in developed nations must tackle is the balance of land use between nature (biodiversity) conservation and development. In all the three examples presented, governments have in the past created and enacted regulation to protect nature within their territory: planning regulations and Environmental Impact Assessment (EIA) employ a set of methodologies which allow decision-makers and planners to assess the potential impacts of allowing developments. In many situations, restrictions have been put in place to stop developments to take place whose damages to biodiversity are deemed unacceptable. In England, local authorities have a long tradition of maintaining strong power over planning permissions; in Germany, legislation has been put in place which demands that no nature is lost in a given area, leading to conflicts between local authorities, developers and farmers; and in the United States, the demonstrable presence of a listed endangered species in an area would mean that no development could take place therein. In all three cases, the balance towards protection created problems to developers and local policy-makers, who sometimes felt that the movement towards protection and conservation had gone too far.

Once the process is initiated, markets for biodiversity offsets do not emerge on a vacuum; a pre-market situation is already instituted and functioning, and more often than not producing results in moderating the relationship between biodiversity conservation and economic development. These pre-market instituted economic processes do not follow a market logic; they are focused on protecting biodiversity from harm in the first place, and only on exceptional cases is the possibility of acquisition of

compensation from a third party contemplated. The process of shifting the boundaries from a non-market to a market exchange (Randles, 2007) form of providing for biodiversity conservation via offsetting is difficult, as these pre-market forms of exchange are not easily de-instituted or re-instituted (M. Harvey, 2007): no single market for biodiversity offsets has, at this point in time, been able to become the main, let alone the only, mechanism for governing the conservation-development problem. In all cases, biodiversity offset markets have to operate alongside, and at times compete with, non-market mechanisms.

In this situation of co-existence and competition, the development of the market depends on its proponents' ability to identify and propose answers to specific concerns with the non-market way of providing for biodiversity. This takes two forms: first, to characterise the non-market mechanism as infective in terms of biodiversity conservation, presenting the mechanisms in operation as less capable of delivering the desirable conservation outcomes than the alternative market schemes; and second, looking specifically at the problem of accepting or stopping development, to characterise the planning process in the absence of markets for offsets as excessively bureaucratic and obstructive. By proposing to streamline planning by offering developers and authorities a mechanism for compensating for inevitable impacts of development, biodiversity offsets appear to offer the best of both worlds, a situation where development can be easily and quickly approved, while allowing biodiversity losses to be compensated and the net amount of biodiversity kept constant. More than just specific development situations, biodiversity markets offer the possibility to rethink and reconfigure the relationship between nature and the economy, maintaining the productive aspects of biodiversity but stopping it from constraining development. From the point of view of proponents of biodiversity offset markets, biodiversity is not only preserved, but put in its (economic) place.

5.5.2. Performing a market for biodiversity offsets

Biodiversity, and the ecosystem services associated with it, are logically difficult to bring to market, since they constitute externalities, public and common goods. The design of a mechanism for biodiversity governance such as a market for biodiversity offsets is complex, and in the cases analysed made more complex by the set of environmental regulations and procedures previously in place. If the reasons for changing the way in which biodiversity is governed are related to the need to moderate the balance between development and conservation, markets are not necessarily the obvious answer. For markets for biodiversity offsets to come into existence, there needs to be a mechanism that functions to promote markets as a mechanism worth creating.

These observations are analysed in the context of the hypothesis put by Michel Callon (1998b) that economic sciences are not just a mechanism for describing economic reality, but a set of instruments, discourses and practices which contribute to the construction of economic spaces – such as markets –, economic actors and economics institutions. Economics intertwines representation, entities and action, moving between description and action. This is visible in the context of markets for biodiversity offsets: the representations of what biodiversity is, what it is for, why it is being lost, and what should be done about those losses are all rooted in economics discourse. An anthropocentric view of nature, which divides it into biodiversity (stocks, production facilities of benefits to humans) and ecosystem services (flows, benefits enjoyed by humans) means that nature – and its benefits – can be presented as a source of utility. From this, trade-offs, such as the ones economic agents are theorised to make in markets, can be modelled employing standard econometric techniques – even where they have little descriptive or predictive capacity when describing biodiversity and ecosystem services "on the ground" (Ferreira, 2011; Spash & Aslaksen, 2012; Spash, 2011). As observed in other situations (Holm & Nielsen, 2007; Holm, 2007; D. MacKenzie, 2009a, 2009b; Mitchell, 2007), the examples of markets for biodiversity offsets are not the result of a natural process of emergence; there isn't an "invisible hand", a market-like process which results in the emergence of a market for biodiversity offsets. These markets are social innovations, resulting from the work of actors who want to change the balance of power between developers and planning officers. The change from pre-market to market is not a simple development of the existing governance relationships; it is the implementation of a deliberate project – the social construction of a market. These markets are being constructed as economic experiments *in vivo* (Muniesa & Callon, 2007), as highlighted by designations such as "biodiversity offset pilots", in England. Economics is being performed in the creation of markets for biodiversity offsets.

At this point, the existing markets for biodiversity offsets differ in many ways from the objective perfectly competitive market that neoclassical economics focuses on, as presented in sub-section 2.2.1. Competition is limited by the (as yet) limited number of buyers and sellers in the markets, a problem which is exacerbated by important barriers to entry for sellers[70]. Buyers coming into the market are even fewer, and generally driven by the need for demonstrating compliance with regulatory demand. While all agents may act as rational utility maximisers, their behaviour is complicated by the fact that the products traded – the biodiversity offsets – remain non-

[70] The parallel issues of barriers to entry and small number of agents involved in the market are, in part, related to the technological infrastructure of these markets. This issue is discussed in greater detail in chapter 6.

homogenous. And while the creation of these rules-based governance mechanisms may contribute to a sense of increased transparency *vis-à-vis* the situation where developers negotiated case by case with planners to obtain permission, the reporting of prices remains patchy and insufficient, to the point that the main reports on the status of evolution of these markets maintain serious reserves about the data available (Madsen et al., 2011, 2010). In many ways, the existing markets for biodiversity offsets deviate significantly from the idea of market.

5.5.3. Biodiversity offsets and social responsibility?

The fact that virtually all demand for biodiversity offsets derives from the need to comply with regulation presents questions in terms of their role as mechanisms for buyers to demonstrate their commitment towards environmental and social responsibility. But there is no doubt that the use of a clear objective – *no net loss of biodiversity* – invests these economic experiments with a purpose which goes beyond the business as usual in the context of the development-conservation debate. But perhaps more important in terms of social responsibility is the expansion of the number of groups of agents involved in the governance of biodiversity. A number of groups of agents, which until now were more or less explicitly in the fringes of markets, now find themselves at the very core of those markets; the governance arrangements are now much more diffuse, and allow different positions to be taken into account. For this reason, the creation of markets for biodiversity offsets is not just a process of economisation, but "a joint process of politicization-economization-scientification, [*which*] constantly produces new differences from existing ones and attributes new significations to economics, politics or science" (Callon, 2009, p. 545).

The most important arena in which this problematisation of economics, politics and science occurs and new meanings are constructed is the design and implementation of the technological infrastructure on which the market is built. Chapter 6 analyses the role and creation of these technologies.

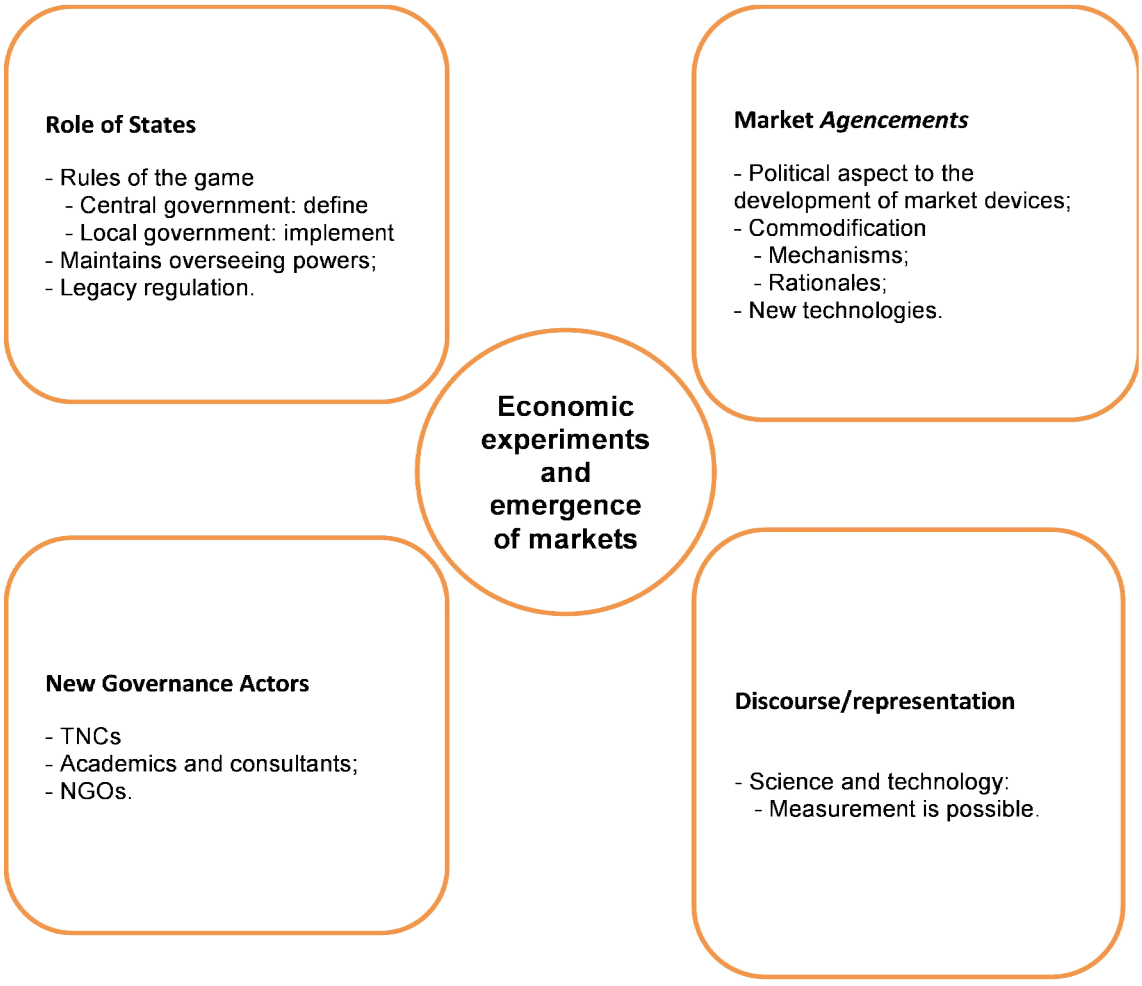
6. Technology as market-enabler: measurement, calculation, equivalence and exchange

6.1. Introduction

This thesis now turns from the emergence of markets for biodiversity offsets to a discussion of the exchange process taking place in those markets. In doing so, the objective is to provide a detailed examination of the actual technologies involved in the markets' operations, as well as their development. In these technologies we observe the translation of discourse and representations into market practice; this opens them to an analysis based on a Science and Technology Studies/Social Studies of Finance framework.

Figure 6.1 is an adaptation of the framework for the analysis of market emergence and economic experiments, first presented in section 2.5. It highlights which components of that framework will be presented in this Chapter.

Figure 6.1 – Framework for research: the role of technology



Source: author

The markets for biodiversity offsets currently being developed have one feature in common: the premise that, through offsetting, a development project should result in *no net loss of biodiversity* (NNL) (BBOP, 2012b, 2012c; Crowe & ten Kate, 2010; Ecosystem Marketplace, 2013a; ICMM, 2005b; Natural Capital Initiative, 2010a, 2010b, 2010c; ten Kate et al., 2004; ten Kate & Inbar, 2008; Treweek et al., 2009). More than just an express objective, NNL serves as an engine for the development of markets for biodiversity offsets: it is a driver of the performativity of economics (Holm, 2007). NNL is based on a representation, shared by most proponents of the market: that biodiversity losses taking place in one location can be equated to biodiversity gains in another location. This assumes that science and technology have developed to a point where the measurement of biodiversity and associated ecosystem services is possible and precise to a good degree: agents possessing the relevant biological and ecological expertise engage with the problem of measuring biodiversity, and developing the rationales, mechanisms and, finally, technologies for commodifying biodiversity.

In his analysis of the prospects of carbon offsetting as a mechanism for "civilizing markets", Michel Callon suggests a direction of research to develop "further analysis and understanding of the more general process of constitution of collectives comprising large numbers of different actors from diverse temporal and spatial horizons, working on the conception and explicitation – mainly theoretical – of new market *agencements*" (Callon, 2009, p. 538). The concept of market *agencement*, reviewed in Chapter 2, refers to the set of devices which renders things, behaviours and processes economic and commensurable (Muniesa et al., 2007). The term *agencement* is used to highlight that these market-making entities are composite, incorporating market devices (technologies) and calculating agencies (humans). This chapter analyses the existing market *agencements* in three markets for biodiversity offsets and their evolution.

The analysis uncovers an important issue, which extends the research on market *agencements*: as composite entities, the market *agencements* developed in the context of markets for biodiversity offsets incorporate the work of both biologists and ecologists, and sets of technical devices, working alongside each other. However, there is a tension in this functioning: biologists and ecologists tend to work according to their individual preferences and judgement, treating the measurement and calculation of the appropriate offset of each offset case individually. While making sense in terms of the scientific practice, this creates uncertainty in terms of the commodification of biodiversity, and goes counter to the needs of market functioning. This creates a tension in the context of the market *agencement*. The agents more affected by this – (sellers, buyers and intermediaries) are driven to ensure that the market devices – commodification mechanisms – are developed further, and that the biologists and

ecologists have their range of action limited by the devices. These tensions for primacy between agents and devices within the *agencements* play out differently in different contexts; they too are geographically and historically contingent. It should be clear that all these aspects of commodification have a political dimension – the different groups of agents try to promote, through the commodification processes developed, their preferred model of market structure, market operation, and biodiversity conservation. The state remains an important stakeholder in this process: on the one hand it maintains a significant amount of overseeing power over the development of commodifying mechanisms, by defining what is acceptable as an offset. On the other hand, the continued existence of pre-market regulations also impacts what is acceptable – and legal – in the developing markets for biodiversity offsets.

The role of technologies as market enablers in the case of markets for biodiversity offsets is not limited to commodification, as it is well known that technology is a component of market infrastructures (Fligstein, 2001; D. MacKenzie, 2009b). Complex technological infrastructures are being developed to support markets which are cost-saving and permit agents to engage in arms-length exchange. While discussion continues about the development of measurement technologies, algorithms are being built into databases and applications and deployed – an example of how economic experiments can progress even in the absence of agreement about the commodification techniques that should precede it.

This chapter is structured as follows: section 6.2 explores the problem of measurement of biodiversity, defining and discussing the dimensions that biodiversity measurements must answer in a context of marketisation. Examining the three case examples, the specifics of what is measured in each case are discussed. Section 6.3 describes some of the market devices that are either in use or under development in each of the case examples. Other technologies, designed not to address the issue of externalities but the problem of market efficiency, are also presented. Section 6.4 concludes, highlighting how processes of instituting markets and developing market-enabling technologies relate.

6.2. What matters get measured? In search of equivalence

This section describes the techniques of measurement of biodiversity employed in three markets for biodiversity offsets – United States, England and Germany. The difficulties in accurately measuring biodiversity are highlighted: being a composite construct, biodiversity has multiple meanings, even at the level of ecological science. These different meanings in turn impact the possibility that components of biodiversity can be successfully isolated and measured. However difficult this might prove, it is

essential for the creation of markets for biodiversity offsets that some measurements are made, in order to permit the claim that offsetting results in no net loss of biodiversity. Two types of equivalence are identified: quantitative and qualitative.

As was discussed in Chapter 3, the key element in the creation of a biodiversity offset market is the pledge that the acquisition of an offset will result in *no net loss of biodiversity* (NNL) in the context of a development project. NNL, it was argued in Chapter 5, is the engine of performativity in the markets for biodiversity offsets, a supposedly measurable objective, by which sellers and buyers can reassure regulators and other groups in society that development is not resulting in damage. The capacity to measure and demonstrate NNL is vital for a successful biodiversity offsets programme.

It is acknowledged in scientific, policy and market proponent circles that measuring biodiversity is a challenging endeavour[71]. The multidimensional and systemic aspects of biodiversity make it impossible to appropriately describe "biodiversity" in a single moment and a single location. Likewise it is challenging to predict its state over time, bearing in mind how said location interacts with surrounding human and natural systems. To add to these difficulties, the demonstration that NNL has been achieved requires that equivalence between two distinct areas is established. Two types of equivalence between damage and offset must be simultaneously achieved: quantitative equivalence and qualitative equivalence.

Quantitative equivalence refers to the stocks of individuals or species involved. Numbers of animals and plants in the development area must be compensated by at least the same number of individuals in the offset area; alternatively, the total area affected by development can only be offset if the compensation zone is at least the same size. But quantitative equivalence can also refer, in other cases, to the flow of goods and services: the offset area must provide the same quantity of services such as flood defence, or groundwater recharging, for example, as the development area. For quantitative equivalence to occur, the two areas must present the same values on measures such as these. Qualitative equivalence, on the other hand, refers to the character of nature in the development and offset zones. When the concept of ecosystem services became prevalent, it was assumed by most economists that a situation of perfect exchangeability was about to develop: that as long as quantitative equivalence between the services in different areas could be assured, it would not

[71] As discussed in section 3.5.

matter how these services were produced[72]; however, this was not the case[73]. Biodiversity offsetting programmes where the focus is on ecosystem services services (as opposed to species) must assure that the two different "biodiversities" are as closely comparable as possible in terms of species, habitats and biotypes. One form of equivalence must follow from the other, and in no situation can an offset claim to result in *no net loss of biodiversity* unless both forms of equivalence are demonstrated. Where quantitative equivalence has the objective of allowing comparison and trade-offs to exist – creating the possibility of exchanging between different states of the world – qualitative equivalence limits the trade-offs that can be made: offsetting and trade-offs can only occur between two broadly comparable states of the world.

In each biodiversity offsetting programme in operation these two forms of compensation are achieved through sets of formal rules, representations, technological mechanisms, measurements and equations. As of 2013, it appears that no two markets employ the same exact market devices. Furthermore, since markets for biodiversity offsets are emerging in context where formal mechanisms for assuring compensation are already in place[74], so too are these quantification and qualification technologies being developed against a background where these calculations were already undertaken. The difference between the pre-market and the market forms of calculating equivalence is, in part, a matter of formality: pre-market is characterised by informal bargaining between individual actors in the context of the planning process, while the emergence of a market relies on a number of formal mechanisms of commodification. However, it is more appropriate to refer to market *agencements*, as the analysis demonstrates that individual groups of agents maintain an important role in complementing – and at times overruling – the role of the measurement technologies. The three case studies illustrate these observations.

6.2.1. The US approach

This sub-section analyses the measurement techniques currently employed in the Unites States Species Banking biodiversity offsets market. The programme's objective is to assure the compensation of losses to endangered species, but the more common measure of equivalence is habitat area lost and gained. There are no standardised measurement techniques in use; in fact, regulatory guidance from the United States Fish and Wildlife Service (US-FWS) accepts a number of possible forms of measurement. One of the consequences of this is the ongoing reliance on biologists

[72] In other words, that total and perfect exchangeability could be achieved, individuals' preferences being complete and discrete – a condition for the perfect market in neoclassical economics, as discussed in sub-section 2.2.1.

[73] An observation made several times by interviewee B1, an academic who leads an important network working on nature valuation.

[74] The pre-markets mechanisms for determining compensation, referred to in Chapter 5.

and ecologists, each of which apply measurement techniques according to their own preference. In time, this has created tensions with sellers and intermediaries, who have sought new guidance limiting the degree of personal interpretation by individual ecologists and biologists.

The Conservation Banking biodiversity offsets programme (and the Wetland Mitigation Banking scheme, which inspired it) in operation in the United States focuses on a comparatively narrow understanding of what components of biodiversity are to be compensated in case of loss. As the name indicates the focus is on endangered species, and making sure that any "take" these suffer is offset. Once a species is listed as endangered by the US-FWS, offsetting of any losses resulting from development is only permitted for individuals of the same species – in this sense, only like-for-like conservation is permitted. As a result, the very design of the programme attempts to pre-empt questions in terms of quality equivalence: by requiring that a given loss in a narrowly-defined species is offset by another individual of the same species, it sidesteps the problem of offsetting losses for something which isn't exactly the same[75]. Further, by specifying that this offsetting occurs within a given service area[76], it assures that the species is offset in a nearby region. All these measures, which are endemic to the programme's design and institution, diminish the amount of mechanisms necessary to produce quality equivalence.

On the contrary, there is a plethora of biodiversity quantification mechanisms in use simultaneously. The programme works by establishing a measure – designated credit – which serves as a currency for exchange:

> Credits are the quantification of a species' or habitat's conservation values within a bank. The conservation values secured by a bank are converted into a fixed number of credits that may be bought, sold, or traded for the purposes of offsetting the impacts of private, State, local, or Federal

[75] According to the speciesbanking.com website, as of December 2010 the species contemplated by the programme were: Alameda whipsnake, Baker's stickyseed, Bakersfield cactus, Bakersfield Saltbush, Ben Lomond's buckwheat, Ben Lomond's spineflower, Black-capped vireo, Blunt-nosed leopard lizard, Bogg's Lake hedge hyssop, Bone cave harvestman spider, Bonny Doon manzanita, Brittlescale, Burke's goldfield, Butte County meadowfoam, California black rail, California red-legged frog, California tiger salamander, Carolina heelsplitter, Cheat Mountain salamander, Chinook salmon, Coastal California Gnatcatcher, Coffin cave mold beetle, Conservancy fairy shrimp, Contra Costa goldfields, Curly-leaved monardella, Delhi Sands Flower-loving Fly, Delta green ground beetle, Delta smelt, Delta tule pea, Dwarf downingia, Eastwood's Manzanita, Florida panther, Florida scrub jay, Gaviota tarplant, Giant garter snake, Giant kangaroo rat, Golden eagle, Golden-cheeked warbler, Gopher tortoise, Greene's Tuctoria, Heartscale, Least Bell's vireo, Legenere, Longfin smelt, Mason's lilaeopsis, Mount Hermon June Beetle, Nightingale reed-warbler, Northwestern pond turtle, Orange throated whiptail, Oregon Chub, Otay tarplant (Ecosystem Marketplace, 2011). Some of these are entire habitat types which, like the species, have been listed as endangered, and thus subject to offsetting requirement.

[76] See section 3.2 for a discussion of the role of service areas in biodiversity offsetting.

> activities. (…) In general, the credit system for a conservation bank should must be expressed and measured in the same manner as the impacts of the development projects that will utilize the bank. (…) The method of calculating bank credits should be the same as calculating match project impact debits. (US-FWS, 2003, p. 9)

However, while the guidance indicates that the same methodology must be used to calculate both species losses and the respective offset (thus ensuring that both sides of the quantitative equivalence refer to the same construct), it does not specify what said methodology is. The most common approach is to use a proxy currency – the habitat area size (Bonnie & Wilcove, 2008; Fox & Nino-Murcia, 2005). In this commonly used form of measurement, credits lost are quantified as the number of acres of habitat of a certain species lost; the loss is offset when the developer acquires the same number of acres of the same habitat from a conservation bank.

The use of area as a proxy for credits has the advantage of simplicity and doing away with the need for complex measurements and calculations. However, even this simple measure results in difficulties. New calculative agencies became involved in the process – biologists and ecologists. These new agencies, trained in biological and ecological sciences, worked according to principles which were not conducive to the best interests of the market: instead of a standard mechanism of calculation, each different calculative agency employed the same measurement devices in a different way, and consequently produced different results from other calculative agencies. This divergence of operation in the market *agencements* threatened to imperil the functioning of the market, and required an attempt to standardise these market *agencements*:

> …in 1987 we had the 1987 US-ACE manual on wetland delineations. What it did was, it developed a process by which anyone not ecologist would go out to the field, follow certain steps to determine if a piece of land was a wetland or not, and what the function and value of that wetland was. And that was a protocol that was issued, that everyone had to follow, we got certified in it, you get trained in it. Natural habitats and ecology are all very subjective, and even though it's based on science, it's still very subjective. Until that point in time you couldn't really get two ecologists to agree on value of a wetland, it just wasn't possible. But with the 1987 manual, it got to the point where you could take two ecologists with very diverse backgrounds, and following the steps in the manual, they would come probably within 5 or 10% of a value of that wetland, whether they liked it or

> not. (…) It guided us. It became a fungible unit – again, with ecology beauty is in the eye of the beholder, even though it's supposedly based on science. And yet... you couldn't get people to agree, but once the 87 manual came out for wetlands, people also said “OK, we can agree on basically what this is, what the value is”. And also, you could start having trade-offs. [*Interviewee I8*]

Market *agencements* which were too heavily weighted on the calculative agency and not enough on the market device became a hazard to the functioning of the market. They did not allow for a standardisation of measures and, ultimately, imperilled the quality agreement which must underpin the market. This was solved by regulating the *agencements*' operation, and effectively inducing a situation of “standardisation by decree”.

However, even with these attempts to standardise procedures, this simple measure of area equivalence became increasingly contested. Methods have been sought to extend the range of components in the credit calculation, including “...habitat quality, habitat quantity, species covered, conservation benefits, including contribution to regional conservation efforts, property location and configuration, and available or prospective resource values” (US-FWS, 2003, p. 9). Examples of these attempts have involved using numbers of actual animals in breeding groups in a suitable habitat as currency, for animals living in discrete breeding groups (such as red-cockaded woodpecker), or the used of predicted natural carrying capacity for a predicted population of a type of animal (such as gopher tortoises) – the estimation of the required carrying capacity of a habitat coming, again, from expert opinions. Expert opinions are also used in different situations to calculate mitigation rations – for example to compensate for uncertainties in the offsetting process (Bonnie & Wilcove, 2008). In these situations, regulators can decide that *no net loss of biodiversity* cannot be assured through a 1:1 equivalence, and may require that more credits are allowed for the development to proceed. In all these situations, non-standardised approaches impact the quantification methodology. The market *agencement* has so far failed to reach a stable, standardised form.

6.2.2. The English approach

This sub-section analyses the experience in developing the measurement mechanisms applied in the context of the English Biodiversity Offsets programme. Despite absence of regulation requiring offsetting, the regulatory agencies have produced extensive indications of what mechanisms to employ in order to assess losses and gains to biodiversity. Using a set of procedures which weigh the different parts of the measurements produced differently, the resulting set of equations produces a single

numerical score for each area, allowing agents to assess qualitative and quantitative equivalence between two areas.

The biodiversity offsetting pilots in England benefit from guidance issued from the Department for Environment, Food and Rural Affairs (DEFRA, 2011). The report provides guidance on how to establish a biodiversity "metric":

> Biodiversity in its entirety is impossible to measure so a 'metric' is used to represent, and provide a measure of, overall biodiversity. Metrics are surrogates, or combinations of measurements, that together provide an assessment of the biodiversity value of a particular area. The metric allows the biodiversity impact of a development to be quantified so that the offset requirement, and the value of the compensatory action, can be clearly defined. Metrics are transferable between sites and habitats, allowing an impact on one habitat type to be offset with conservation action elsewhere, or involving a different habitat type and/or quality of habitat. (DEFRA, 2011, p. 2)

The DEFRA guidance results in a calculation mechanism which takes data from two different sites – the impact site and the offset site – and produces a single score, by entering that data in a set of equations. It is, therefore, a quantification technology, which provides agents with a unified, quantitative, indicator. Based on this quantitative indicator, agents are thus able to frame biodiversity, creating a shared calculative space; buyers, sellers and remaining actors in the emergent market are able to economise, comparing between states of the world (the biodiversity scores), and choosing their preferred one. However, the metric serves a second function: it allows comparison between biodiversity at different locations. Strictly speaking, the biodiversity existent in one location cannot be equated with the biodiversity existent other locations; they are qualitatively different, in terms of representing different, potentially unique, and consequently incomparable and not equivalent *biodiversities* as being equivalent and interchangeable. As explained by an academic and consultant who has worked in the measurement of ecosystem services for several years, much of the possibility of creating a market issue rests with the potential to create systems which assure ecological equivalence:

> The problem with biodiversity is it's not so fungible, it's always very specific. So, it really depends... and that's why this issue of ecological equivalence is so central, if you have a very broad definition of the different components of biodiversity that are required to be offset, then you will be able to generate the flexible, and sort of deeper market. [*Interviewee I5*]

More than quantifying biodiversity, the biodiversity metric works by reducing the multivariate aspects of biodiversity to a single digit, allowing comparison of different states of the world and changing the meaning of what is being discussed. Through the action of the commodification technologies, the meaning of biodiversity as a localised set of goods, services and values is changed: the metric, a technological "black box" of equations and spreadsheets (whose working most actors are probably not aware of), normalises and establishes equivalence, permitting a language of "credits" and "debts" which is at the root of the concept of *no net loss of biodiversity*. The metric economises biodiversity.

The actual workings of the metric proposed by DEFRA result of an adaptation of the habitat-hectares method approach presented in a previous scoping study for offsets in the English context (Treweek et al., 2009). It proposes a model which takes into account four habitat types, distinguished by bands in terms of their distinctiveness (Table 6.1).

Table 6.1 – Habitat type bands in the proposed biodiversity offsetting metric

Habitat type band	Distinctiveness	Type of Habitat	Type of Offset
Very high	High	Biodiversity Action Plan (BAP) with "no loss" target.	Bespoke. Local Planning Authority discretion as to whether offsetting should be used.
High	High	Rest of BAP habitats.	Like for like.
Medium	Medium	Semi natural non BAP.	Within band type of trade up.
Low	Low	Intensive agricultural.	Trade up.

Source: DEFRA (2011).

The necessity to include habitat distinctiveness in the context of the metric illustrates how the development of this market device for biodiversity offsetting is not independent from the pre-existing political and institutional context in which it occurs. Distinctiveness "...includes parameters such as species richness, diversity, rarity (at local, regional, national and international scales) and the degree to which a habitat supports species rarely found in other habitats and/or their Biodiversity Action Plan (BAP) designation." (DEFRA, 2011, p. 4). Offsets are required to work within the context of existing biodiversity conservation arrangements and regulations, such as the English Biodiversity Action Plans, and in some cases Local Planning Authorities can overrule

biodiversity offsetting, in order to preserve other, presumably higher, values. It is also noticeable that the rules devised require there should be no “trading down” in habitat distinctiveness – that is, no damage can be compensated for in an area with lower habitat distinctiveness. The degree of local influence over offsetting is also apparent in the offsetting instructions, which specify that “...offsets should be targeted geographically, and towards which conservation priorities, should be taken at the local level as far as possible. In line with this principle, local authorities in pilot areas, working with their partners, could decide to add conditions to the metric to reflect their particular circumstances and priorities.” (DEFRA, 2011, p. 5). This is already happening in the context of the pilots in operation, as confirmed by two planners responsible for biodiversity offsetting in local authorities where pilot offsets are in operation.

The DEFRA metric goes on to specify that a score is given to habitats according to their distinctiveness – 6 points to a High distinctiveness habitat, 4 to a Medium distinctiveness and 2 in the case of Low distinctiveness. Likewise, the same areas are scored for habitat condition, in a scale which goes from Optimum (4 points), Good (3), Moderate (2) and Poor (1). The two scores are multiplied, giving a score of biodiversity units per hectare (Table 6.2):

Table 6.2 – Scoring the development and offset areas

		Habitat Distinctiveness		
		Low (2)	Medium (4)	High (6)
Condition	Optimum (4)	8	16	24
	Good (3)	6	12	18
	Moderate (2)	4	8	12
	Poor (1)	2	4	6

Source: DEFRA (2011).

The resulting score is multiplied by the number of hectares for both the impact area and the offset area. An offset is said to result in *no net loss of biodiversity* whenever its total score is at least equal to the total score for the site impacted. A number of cautions are applied to this value, due to the uncertainties involved in the process: for example, regardless of the scores the area of the offset must never be inferior to the area of the area impacted – which follows BBOP suggestions (2012c). Furthermore, multipliers are employed to account for risk of success in the delivery, risk associated with the area where the offset is built, and the projected time the offset site will take to reach the same condition as the impacted site. Because of these multipliers, it is projected that the offset site will be, in general, significantly larger than the impact site.

Overall, there are no standardised measures of distinctiveness or of habitat condition in operation. Local authorities, especially planning managers, remain the most important calculative agencies, and are allowed to adapt and override the DEFRA metric.

6.2.3. The German approach

This sub-section focuses on the measurement approaches used in the German *Eingriffsregelung* (Impact Mitigation Regulation – IMR) biodiversity offsetting programme. The biodiversity measurement approach followed in this programme is, again, different from the US and English experiments, but it combines components seen in both of those – namely a significant importance of local regulators as calculative agencies, and the use of a single score approach – the *eco-accounts* and *eco-points*.

The IMR programme covers a wide range of biodiversity values and components to preserve, focussing on ecosystems, their capacity and natural scenery, and including selected natural resources (such as animals and plant species and conservation areas) (Darbi et al., 2009). The measurements employed follow this logic.

Since 1998 the IMR system has instituted *eco-accounts*, covering a municipality or district, meaning that the process of measurement and establishing equivalence is driven at local level. Municipal landscape plans define local areas of existing high ecological value (which cannot be used as compensatory measures) and areas with potential to become "high quality biotopes". These "high quality biotopes" are defined as areas whose ecological potential is judged to be higher than the current status, and which can therefore be improved. Improvements are quantified in terms of *eco-points*, which are a measurement of the improvement of ecological conditions, multiplied by the number of hectares in the improved area. Once the improvements are undertaken, the relevant area becomes a part of the compensation pool, managed by the local authorities (Küpfer, 2012). Development project have their impact quantified in terms of eco-points as well, and are legally required to acquire the equivalent number of eco-points from a compensation pool, thus assuring *no net loss of biodiversity*. Costs per point vary, but reports indicate values between 1€ and 5€ per m^2 of impact. One of the German states, Hessen, has officially fixed the price at 0.35€ per eco-point (Prokop, Jobstmann, & Schönbauer, 2011).

Two important issues regarding the actual market devices employed in the calculation of eco-points should be highlighted. The first point regards the issue of quality equivalence. The regulation has an in-built preference for *like-for-like* offsetting, but the design of the eco-account/eco-points system is such that it benefits improvements to existing biodiversity and biomes, from which compensation must be acquired. The eco-

points system levels differences in ecosystem/biome, species and habitats, instead focusing on the improvement of overall ecological conditions at the municipal and state level. Again, as seen in the case of the English biodiversity offsets programme, the points-based market *agencement* produces both quantity and quality equivalence, effectively "making things the same".

The second point refers to the balance between calculative agencies and commodification technologies. There is a multiplicity of quantification methods in operation:

> The Federal Nature Conservation Act enables the German states to develop guidelines for the assessment and accounting of impacts on nature and landscape. This led to the emergence of a variety of methodological approaches over the past thirty years (...) at least forty-two published assessment approaches. (Treweek et al., 2009, p. 65)

The programme requires that full compensation for impacts is achieved, and that when no net loss is not possible to achieve, a "compensation payment" must be made. For this reason, two measures – two currencies – can be involved in the same offsetting process: the first is a measurement of losses and appropriate offsetting, in the eco-points unit; and the second is a monetary value. Naturally, these two currencies are not cannot be added to one another and produce a value which is equivalent to ecosystem units lost to development. As a result, the market devices – the technologies of calculation – alone are not enough to produce equivalence. At the decision-making level – at the Bundesländer (State) and local scale – the decision rests with planners:

> ...the markets are all run by the regional governments – the Länder – and people in Germany have said to me that they're not very transparent in what they do. The planning authorities and the people signing off the offsets are very often the same people, or certainly they're in the same administration, what they do isn't very transparent. They don't publish how they calculated the offset, for example – and therefore what the offset is; they just say "We've permitted this much development a year, and these are sites where we've got enhancement" – all sort of amalgamated some times. So there's little clear information [*Interviewee I2*]

These comments from Interviewee I2, a consultant who has worked extensively in the issue of biodiversity equivalence calculations, can be better understood in a context of performativity: the openness and transparency which he is calling for is a main tenet of neoclassical accounts of markets, in which quantities and qualities are mutually agreed

on by the application of standardised market devices. The decision-making mechanism, however, is more complex than that: planners act as calculative agencies, complementing – and sometimes overriding – the results produced by the market devices. Here too, these assemblages of standardised market devices and agents constitute market *agencements*, which are responsible for the actual calculations which take place. They are, as such, a challenge for market operation. So much is this the case that the standardisation of quantification methods has been identified as one of the main improvements required in the IMR programme (Madsen et al., 2011, 2010).

6.2.4. Framing the debate, framing the devices? The BBOP Standard

This sub-section analyses the most important endeavour to standardise the measurement and equivalence-production mechanisms so far attempted, the BBOP standard. It reflects on the BBOP principles, and how they translate into practice.

For all the diversity in technologies of measurement and commodification in use, the change from pre-market to market forms of biodiversity offsetting includes, in any case, an attempt to develop, in the market, a rules-based form of deciding on appropriate compensation. As important element in terms of market performativity, the market devices created in each programme are, as developed above, on the one hand very diverse, and on the other very dependent of calculative agencies. For this reason, questions remain in terms of who governs the measurement and commodification methods, and the development of calculation mechanisms and biodiversity standards is a contested field. A plethora of measurement technologies and principles are available and development continues, with competing standards resulting in slightly different results for the same situation. Issues such as the basis on which each standard is built, the thoroughness of application and the governance of the changes the standards will eventually suffer impact their potential usability, but also the ultimate effect of marketisation on nature.

The most important initiative to confront the issue of variety of measurement mechanisms has been the publication of the Standard on Biodiversity Offsets by the Business and Biodiversity Offsets Programme (BBOP, 2012c). As explained by one high-ranking member of the BBOP, it is designed to address very specific lacunae in the existing market devices:

> The BBOP work deals with both the standards and the related methodologies of quantification. The majority of currently existing biodiversity standards are not quantitative. They neither quantify losses and gains hierarchically, nor deal with risk. The BBOP standard has 3 starting points: How to quantify companies' footprints? How to manage risk? How to

> demonstrate no net loss to stakeholders? (…) A standards for offsetting is usable, if it bears in mind, who are the audiences, how might they use them, and guides the application of the mitigation hierarchy. [*Interviewee B2*]

The standards are especially geared towards the type of calculation which business requires – the quantification of footprints, especially those which are directly the responsible of the company; the management of risk; and the production of results which can demonstrably result in *no net loss of biodiversity*. In general, businesses do not see biodiversity conservation as a core activity; their interest in involving in biodiversity offsetting is to demonstrate their positive actions in "civilizing markets" (Callon, 2009), as a form of corporate environmental responsibility (ten Kate et al., 2004; ten Kate & Inbar, 2008). In order to achieve this, the BBOP Standard prescribes ten biodiversity offsetting principles, each with criteria of success associated and a number of indicators – measurable states which allow agents to assess if the criteria for success have been met (Table 6.3).

Table 6.3 – The BBOP Standard principles

BBOP Principle	Requirement
1	**Adherence to the mitigation hierarchy:** A biodiversity offset is a commitment to compensate for significant residual adverse impacts on biodiversity identified after appropriate avoidance, minimisation and on-site rehabilitation measures have been taken according to the mitigation hierarchy.
2	**Limits to what can be offset:** There are situations where residual impacts cannot be fully compensated for by a biodiversity offset because of the irreplaceability or vulnerability of the biodiversity affected.
3	**Landscape context:** A biodiversity offset should be designed and implemented in a landscape context to achieve the expected measurable conservation outcomes taking into account available information on the full range of biological, social and cultural values of biodiversity and supporting an ecosystem approach.
4	**No net loss:** A biodiversity offset should be designed and implemented to achieve in situ, measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity.
5	**Additional conservation outcomes:** A biodiversity offset should achieve conservation outcomes above and beyond results that would have occurred if the offset had not taken place. Offset design and implementation should avoid displacing activities harmful to biodiversity to other locations.
6	**Stakeholder participation:** In areas affected by the development project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision-making about biodiversity offsets, including their evaluation, selection, design, implementation, and monitoring.
7	**Equity:** A biodiversity offset should be designed and implemented in an equitable manner, which means the sharing among stakeholders of the rights and responsibilities, risks and rewards associated with a development project and offset in a fair and balanced way, respecting legal and customary arrangements. Special consideration should be given to respecting both internationally and nationally recognised rights of indigenous peoples and local communities.
8	**Long-term outcomes:** The design and implementation of a biodiversity offset should be based on an adaptive management approach, incorporating monitoring and evaluation, with the objective of securing outcomes that last at least as long as the development project's impacts and preferably in perpetuity.

9	**Transparency:** The design and implementation of a biodiversity offset, and communication of its results to the public, should be undertaken in a transparent and timely manner.
10	**Science and traditional knowledge:** The design and implementation of a biodiversity offset shall be a documented process informed by sound science, including an appropriate consideration of traditional knowledge.

Source: adapted from BBOP (2012c).

Among these principles, the one related directly with market *agencements* is Principle 4, No Net Loss. As discussed above, the principle of no net loss implies a quantification of biodiversity losses, in order to ensure that equivalence between losses and offsets is possible. Specifically, Criterion 4-2 requires that explicit calculation of gains and losses is undertaken, in order to demonstrate how No Net Loss can be achieved. However, there is no indication that a single measurement technology should be employed. As mentioned by one director of BBOP, when it comes to measurement technologies,

> To have one single approach does not make sense. Where does this leave "standardised"? Two ideas: Principles-based, and quality but flexibility. We need to work from principles, into specificities, and choose methodologies accordingly. [*Interviewee B2*]

On the topic of developing a biodiversity currency or metric, the BBOP Standard follows much of the guidance issues by the US-FWS for the conservation banking programme: that "...area alone is not a good measurement of biological diversity" [*Interviewee B2*], and "...should capture the type, amount and condition of the biodiversity that is being lost and gained" (BBOP, 2012b). The current state of the art, however, is that in most cases "...area x condition rules" [*Interviewee B2*]. Overall, the BBOP Standard does not prescribe any specific method of quantitative calculation of biodiversity losses and gains; instead, it attempts to guide practitioners in best-practice, in the process binding the variety of indicators which should be taken into account. In maintaining some flexibility, the Standard attempts to balance agency and device within the market *agencement*.

In terms of quality equivalence, the BBOP guidance focuses on the preference for life-for-like offsets. However, unlike the United States' Conservation Banking programme, the BBOP does not contemplate offsetting endangered species alone, but has a more holistic approach: like the English and German programmes, biodiversity is understood in a more holistic form, including habitat and different species. For this reason, the Standard needs to specify the dimensions along which like-for-like must be respected in order to assure equivalence. These dimensions are the type of biodiversity, space and time (BBOP, 2012b).

It is acknowledged that the most challenging dimension to assure equivalence of is type of biodiversity, because on the one hand no two sets of biodiversity are equal, and on the other there are no accepted methods for assuring equivalence when exchanging dissimilar biodiversity. In the absence of standardised methods for assuring this quality equivalence, the Standard develops four "exchange rules" to guide decision-makers. The exchange rules postulate (1) limits on the exchangeability of species of known conservation importance; (2) limits to the extent in which increased area ration can be used to compensate for inferior

quality of the offset site; (3) limits to which increases in one attribute in the offset site can be used to compensate for lack of other attributes; and (4) that the offset takes into account the context in which it is inserted. Geographic distance is also to be considered when accounting for spatial equivalence – although no specifics are given – and temporal equivalence is to be assured by using single multipliers for area, or applying discount rates in calculating the equivalence.

6.3. Devices in context: the promises of transparency and connectivity

This section discusses the market infrastructures and technologies which are being developed using the measurement and commodification mechanisms discussed above. Aspects of performativity are in evidence, as technologies to aggregate, connect and distribute information are created, in attempts to perform a specific, neoclassical model of what a market should operate as. The translation of the market *agencements* discussed above into actual devices employed in the context of the operation of biodiversity offset markets is limited, in part because the markets are still quite small, at least in terms of number of transactions[77]. Furthermore, a number of actors interviewed manifested reserves in terms of the consequences of making decisions in terms of biodiversity offsetting depend *agencements* which are not yet agreed on. However, if some of the criticism focuses on the state of the technology, proponents of biodiversity offsets reply with calls for further technology development.

Three important phases of the development of a market infrastructure for biodiversity offsets are identified: aggregation, connection and distribution. To each corresponds one key technology and a set of objectives (Table 6.4).

[77] Estimates of market sizes worldwide, both in terms of total area affected and total transaction value, are offered in chapter 3.

Table 6.4 – Developments in market infrastructure in markets for biodiversity offsets

Market infrastructure development phase	Representative technology	Objectives
Aggregation	Database	- To collect, normalise and centralise data; - To submit data to quality control; - To establish the parameters of a market schedule.
Connection	Application	- To minimise transaction costs in the market; - To standardise a given market device; - To spread the usage of that standard over a network of practitioners.
Distribution	Exchange platform	- To aggregate all supply and demand; - To make all supply dependent of a given standard; - To establish a degree of control over the market schedule.

Source: author.

These three components are described in the following section, which analyses the creation and deployment of specific technologies in markets for biodiversity offsets. All the examples refer to the US species banking and England biodiversity offsets examples. No comparable technological development was found in the analysis of the German Impact Mitigation Regulations. This is potentially due to the very informal nature of the calculations which take place in this case[78].

6.3.1. Aggregation: the calls for databases

This sub-section analyses the first of the three market-infrastructure technologies being developed in the context of market for biodiversity offsets. Databases collect, normalise and centralise the relevant data about possible offsetting sites from various sources, submit that

[78] This issue is reprised in sub-section 7.3.1, where Interviewee I5 explains that "…each development project, or each municipality (…) would invent its own indicator. You see, it would be just a verbal argumentation, you would sort of justify why this is an appropriate offset. But everyone would justify in their own personal way".

information to quality control, and can thus be used to establish the market schedule. This is characterised as the data aggregation phase.

The aggregation phase is a product of the pre-market dispersion of information about existing biodiversity. As discussed above[79], there is a significant degree of imbalance between supply and demand for biodiversity offsets, the existing potential biodiversity offsetting locations far outstripping (potentially by several degree of magnitude) what is required. However, information on the exact land areas, types of biodiversity, state of conservation and locations (among others) are either missing or scattered over several authorities, and when available they may be in a variety of formats. All of this impairs the fundamental (neoclassical) function of the market: to bring supply and demand together in an efficient manner. The first stage of the development of a market device is, therefore, to collect, centralise and normalise all such information. This is achieved through creating and updating centralised biodiversity databases, which establishes a baseline of existing biodiversity. This is important, especially when the lack of such baseline information is one of the objections raised against offsetting, as seen here in the words of the scientific coordinator of a large NGO:

> We don't have a comprehensive set of habitats inventories, in terms of where the key habitats are, what condition they are in – so, what quality they are. There are some habitats that we will probably know each individual field where that habitat is, but there's a lot of habitats where baseline information is very poorly know (…) in terms of detailed mapping and GIS inventories that can tell a local authority precisely where a particular habitat is, and comment on if it is a good quality – or poor – example of that habitat, and therefore assign value to it, so that they can make sensible decisions about whether it merits protection or not. [*Interviewee I10*]

The idea that such information does not exist is contested by other actors. Local and central governments possess the results of land surveys, and Geographic Information Systems (GIS) are a promising and cost-effective tool for decision-making at a reasonably fine scale. According to local planners and consultants, a large amount of structured data is available. The goal then becomes to capture and normalise as much information as possible about potential offset sites, regardless of the source of said information, including public-owned or managed and privately-owned land. This is the process taking place in England, where a private company is undertaking this process of aggregation:

[79] In chapter 5.

> ...we've already got all of the Forestry Commission good quality sites of biodiversity (...) and then you've got a whole range of bespoke landowner/farmer solutions, where they've got land that they want to put into conservation credits land, that will bring those forward slowly but surely to be registered on the platform. (…) we're not desperately keen on seeing conservation credits' funds just spent on existing conservation sites; you see, you've gotta spend it on pretty awful sites, that could be brought back and restored, because that's where you have most of your impact (...) And I think that... we haven't really had any problem with people giving us this information about those land parcels where we might be able to do this work. [*Interviewee I1*]

One currently-existing database is the Regulatory In lieu fee and Bank Information Tracking System (RIBITS[80]). Created and maintained by the United States Army Corps of Engineers, it is designed to keep track of all the offsets employed in the wetlands mitigation programme, and was initially designed to work as a registry for regulatory purposes. However, this system does not include the functionalities that would make it useful from a market point of view – especially in terms of accessibility and compatibility of the information therein:

> ...you can look up mitigation banks in an area, but it's not automatic, and it's pretty clunky, quite frankly. There's certain queries that you can do, but it doesn't just allow you to query any type of information in any format. It would be lovely if it was just sort of open database, and you could say "I want all banks in this area for tidal credits in this watershed, that have been transacted in the last 30 days or something". But right now there's some information that you can kind of put all into one web page, and you can copy and paste it yourself, and you can export it to an x-file, and export the x-file into an Excel file [*Interviewee I4*]

This difficulty in operating the database and using the information it contains means it is not a satisfactory market enabler. Although the users and consultants involved would like to use it as a market device, the ongoing difficulties in managing information flows between the different actors, specifically in being compatible with different data formats, creates significant problems. To compound the issue, there is another problem with RIBITS: poor quality of the information it contains.

> I've had experience where you do a formal Freedom of Information (…), which basically allows you to request any information to the federal government, and some times the information that you get back is, like, crap. (…) Someone did a

[80] RIBITS is an online database, found at http://geo.usace.army.mil/ribits/index.html.

> query for us once, the area of impact and area of mitigation, and when we added all the figures up it was stream length longer than the Amazon. (...) And there are all kinds of errors in the information. [*Interviewee I4*]

As a market-following tool RIBITS is backward-looking (it only lists past transactions, and not the potential future offsets), and yet it fails to maintain a publicly accessible registry of quantities of offsets sold and the prices for which they have retailed. This means that market agents are unable to keep up with the market schedule. Calls for improvements and more transparency have multiplied from the side of sellers, promoters and consultants operating in the market:

> …the ACE data on banking is absolutely abysmal, horrible, totally unusable – basically remiss on banking and offsetting and mitigation, and they're embarrassed about it, it's like pulling teeth trying to get it from them, because they know that it's not accurate. We've asked them, we've put together group letters from 10 or 15 people involved in the industry, asking them to work with us to help them make it better. I mean, it's not even like they need to spend a whole lot of money on it, but just let other people into the process to help them make it better, and we've heard nothing back from them. So, in some cases they listen, in some cases they don't, I guess it's the short answer. [*Interviewee I3*]

Readily available databases with information on the existing areas where compensation can take place are important assets. Even considering they may include poor data, they are the first, primordial component of calculation by economic agents: information. Upon determination of the score of a development site, the intermediaries in the market want to be able to search for an area capable of delivering a comparable score, hence guaranteeing the equivalence requirement and *no net loss of biodiversity*. Connecting the database to the determination of an appropriate offset is the topic of the next step of technology development, connection.

6.3.2. Connection: the development of quantification applications

This sub-section describes the second type of technology being developed in markets for biodiversity offsets, the application. This phase is characterised as connection: applications connect agents measuring biodiversity assets “on the ground” to information stored on databases. In doing so, applications allow for the strengthening of market infrastructures, by increasing their user base under similar standards. Their main effect is to lower the transaction costs involved in biodiversity offsetting.

The second step in the development of market *agencements* for biodiversity offsets is to connect the mechanisms for measurement and commodification of biodiversity[81] with the databases containing information about existing biodiversity. In other words, the objective is to feed the information contained in the databases into these calculation mechanisms. This holds the promise of lowering the transaction costs, which some participants in the market believe have held back marketisation so far. Interviewee I2, a consultant and co-author or several reports on the potential of biodiversity offset markets, made considerations about the increased potential for marketisation of biodiversity which is derived from the availability of computing power and GIS information:

> The level of detail of spatial information to analyse biodiversity impacts, which we have (...) and much better computing and GIS systems. We can do that [*calculating potential impacts*] now in ways that weren't feasible a generation ago. 30 years ago you couldn't call up a map to say "where's all the heathland in England? Where's all the soil that could be converted back to heathland?", and overlap that with, say infrastructure development. (...) That analysis is easy to do now; 30 years ago that would have been very complicated, so would have been very hard to understand where offsets could be used efficiently. Now, it's much easier to analyse those things. (…) Technological changes have lowered the transaction costs, the analysis costs of offsets. [*Interviewee I2*]

The point made by the interviewee refers both to the potential to demonstrably achieve *no net loss of biodiversity* according to a given measure – the efficacy of the technology – and to respond to concerns about the cost of these programmes – the increased efficiency the technology may deliver. The point is potentially important in terms of the impact it may have on the possibility of these markets competing with other forms of organising compensation for biodiversity losses[82]: given the existing diversity of forms of exchange, the market may win or lose traction according to the associated transaction costs. Should the extensive regulatory and technological infrastructure required to appropriately marketise biodiversity prove excessively costly, it could make a market for biodiversity offsets a niche concern, used only in marginal situations. Technology holds the promise of reduced transaction costs in the market, potentially increasing its attractiveness.

A step further in the development of connection components concerns the deployment of biodiversity measurement applications ("apps"), developed to work with the databases.

[81] Such as those described in section 6.2.
[82] The pre-market mechanisms, like those described in section 5.4.

There is at least one such experiment taking place in England, by the same company which is developing a database. The promise of connectivity is, for these agents, clear:

> …we want the environmental consultancy community, or land audits, to be able to use a software application, which will enable them to calculate the conservation credits – or eco-credits – that a development or a land-use impact is having, and then it can automatically be uploaded to the trading platform, and then we can match it with what credits are required. And that's a bit more sophisticated (…) getting software that will enable us to capture the site-based information. (…) the theoretical models are, the actual software engineering is something that we're doing now. [*Interviewee I1*]

The app would connect to the database controlled by the intermediary company, searching for matching locations where an offset could be acquired. The connectivity function would again highlight the competitive advantage of some agents: for these agents, the connectivity provided by this platform – the database-app system – is fundamental. This technology, if it works, is seen as a market enabler.

Just as important as the enabling and connecting functions of the application is the standardisation effect it has. The application works according to specific models of measurement, and is as such a “black box” for potential users. Even if the agents using that application – consultants, planners – have their own preferences in terms of measurement techniques, their agency is limited by the fact that the application only requires them to input data, not actually develop the calculation. As such a method is applied repeatedly, the premises, normative values, preferences and representations of what biodiversity “is” and “what it is worth” - all of which are built into the equations inside the application – will circulate and spread. Indirectly, the potential use of this (and similar) applications is an important component of the balancing device and agent within the market *agencement*, and it decisively favours the former over the latter.

Of course, the other function of this application is that it is subsidiary to the specific platform it connects to. As a device, it locks the practitioners into a view of market which relates only to a given company, and a given understanding of what the market is. For these companies, the next step in developing of market infrastructure is to distribute the results of database-application linkage to potential sellers and buyers, *making* a market. This is achieved by an exchange platform.

6.3.3. Distribution: putting together exchange platforms

This sub-section characterises the third type of technologies under development in markets for biodiversity offsets, the exchange platforms. Following closely from similar technologies used in financial markets, these platforms would theoretically be able to connect potential buyers and sellers of biodiversity offsets. This would assure that similar measurement standards are adhered to. By aggregating all supply and demand, it would also allow intermediaries to maintain a degree of control over the market schedule.

The exchange platforms are proprietary systems under development by a private UK company involved in biodiversity offsetting (The Biodiversity Bank, Inc.) and a private American company which runs the same technology in the United States (Mission Markets). These platforms adapt existing technology – the online financial trading platforms widely used in financial markets worldwide – to the case of biodiversity offsets. In the context of markets for biodiversity offsets, exchange platforms are the visible result of integrating biodiversity databases and biodiversity measurement applications, and creating an interface which allows supply and demand-groups of agents to interact. A self-contained "market", it provides the infrastructure and services which buyers and sellers of biodiversity offsets require. In the views of the companies developing them, it is the market-enabling technology:

> ...what interests us is to convert that into a fully functioning market, and we're doing that through our trading platform. (…) something like [*the*] London Stock Exchange [*Interviewee I1*]

The platform operated in the United States by Mission Markets conglomerate, Earth Exchange, "...is operated as a separate exchange exclusively facilitating transactions for environmental credits and other market based mechanisms (...) there are no investor accreditation limitations on the Earth Exchange and [*it*] is open to all registered members." (Mission Markets Inc, 2010b). Registration to the Earth Exchange platform is open to any user, and there are no listing or membership fees; agents are cleared to enter and exit the market at any time. Current users include sellers and buyers from both the compliance (biodiversity offsetting programmes) and the voluntary biodiversity offsetting schemes (Mission Markets Inc, 2010a). The platform also aggregates credits from regional credit marketplaces "[w]hose members can list and monetise credits in a more efficient manner" (Mission Markets Inc, 2010a). The credits traded are certified by a third party which serves as guarantee of quality of the credits sold, MarkIt (Markit Group Limited, 2011).

This results in an expanded and more complex market infrastructure, some industry reports noting the implementation difficulties of these exchange platforms (Madsen et al., 2010).

Information is one of the priorities. Upon signing-up, the platform offers a “dashboard” with environmental market news, internal announcements and all rights, bids and offers presently on the exchange. Each offers includes a range of information that may prove relevant to the potential buyers, including the service area (in effect, the area in which the credit will be valid for compliance reasons). Another piece of relevant information provided with each credit is the contact details of the seller. It is acknowledged that “…conservation finance is a high-touch business process” (Mission Markets Inc, 2010a) – hence the acknowledgement for a need to dealing with a person, as opposed to merely acquiring the credit over a computer screen. The exchange itself occurs through a bidding process. After credits get certification from the environmental registry, sellers post the offers on the platform and buyers bid, indicating both the size and the price they wish to pay for the order. The buyer can include comments in the bid, such as willingness to further negotiate the price, and she can also simply indicate interest in acquiring a given without bidding – letting the seller know of the willingness to buy a certain amount of credits, but leave the price negotiation for a latter moment in the exchange (Mission Markets Inc, 2010a). All of these factors indicate an openness to allowing ongoing bargaining, a potential social embeddedness of the exchange that seems to belie the neoclassical model of the perfect market. Perhaps to counter this, Mission Markets plans to expand the platform to include reverse bidding: buyers are to be able to request proposals for compensation to specific projects. While this may diminish the indiscriminate production of offsets (and hence, the excess offer that lowers prices), it will allow buyers' to opt for the lowest possible bid (putting another type of downward pressure on prices, through competition).

Based on the same technology, the Environmental Credits Exchange contemplates only biodiversity offsetting exchanges valid for the English pilot programmes. In this particular case, although access to the platform is free, the entering of potential offset land into the system is limited. The Environment Bank calculates (for now) the credit value of potential offsets, and exerts control over the available supply of offsets:

> People can register and be certified with us, but they can't actually generate credits on those until we've gone through the metrics process, and we wouldn't necessarily go through the metrics process until you've got a potential development requiring those offsets. So, what you don't want is, I think, a big supply of offset sites with it all worked out. We need to actually manage the flow of those offset sites in such a way that it doesn't swamp the market. [*Interviewee I1*]

In this model, the company which owns the platform acts as a broker, and used the market-enabling suite technology which it controls (database-application-platform) to control the supply of offsets, according to demand. This presents a situation where a single intermediary concentrates all the information necessary for the market to function, standardises its market devices to be used by all other market participants, and uses this to manage the market schedule. Perhaps paradoxically, the elements of performativity of a perfect (neoclassical) market, and the development of an infrastructure of the relevant market *agencements*, have the potential to result in a series of managed outcomes, which have little to do with the supposedly unmanaged functioning of a perfectly competitive market.

6.4. Reflection and conclusions

This chapter has examined the development of the technological infrastructure upon which markets for biodiversity offsets are anchored. Market devices and market *agencements* in use have been described and analysed, bearing in mind their objectives and the tensions involved in their development.

6.4.1. An engine for biodiversity offsets

As described in Chapter 4, the concept of *no net loss of biodiversity* is a core component of the emergence of biodiversity offsets. This formulation of the objective of biodiversity offsets serves different roles, and it informs the process of creation of the respective markets.

First, it requires that the development and offset areas are demonstrably equivalent. This means that a technical edifice of measurement and calculation needs to be constructed and integrated, in order to demonstrate equivalence when the exchanges take place. But at the same time, NNL implicitly accepts the presumption that exchanging biodiversity lost in one place for biodiversity gained elsewhere is possible, and the correct thing to do in the context of an agent's environmental responsibility; it becomes, discursively, the right thing to aspire to. *No net loss of biodiversity* is therefore a normative device, which is folded into the infrastructure of the market. In this sense, it serves as the integrating aspect upon which the market is built; it is the engine of the market, the driver of performativity.

6.4.2. Making things the same: multiple biodiversities and the role of market agencements

Market *agencements* – composite assemblages of market devices and calculative agencies – are fundamental market enablers. First, they allow for a space of calculation to emerge and develop. Biodiversity results in economic externalities; they are, as such, generally not governed through markets, as many of the benefits (and costs) associated with them overflow the market. Economics suggests that these overflows can be identified and

contained (Callon, 1998a): through the use of scientific and technological devices (Muniesa et al., 2007), it can be proved that the economic overflows exist; the associated agents affected by them identified; and the effect of those overflows on each agent quantified. By taking these three steps, the overflows can be framed, and a collective calculative space – a market (Callon & Muniesa, 2005) – can be drawn up, a situation which agents recognise as economic, and in which context they behave as so (Callon, 1999). If this logic follows the performativity of economics argument, it also highlights that in the absence of the appropriate scientific and technological devices there can be no market. This much is observed in the context of biodiversity offsets: the project of construction and development of markets proceeds through the creation, implementation and refinement of technical mechanisms, which demonstrate the existence of the overflow, for example demonstrating the existence of a given endangered species in a certain area, or identifying the flow of ecosystem services; identifying to whom these benefits and costs associated accrue; and quantifying these benefits and costs, for example counting the stocks of numbers of animals and species or estimating the ecosystem services flowing from certain areas.

However, biodiversity presents fundamental challenges to the attempts to frame its overflows: in order to function, markets require that agents agree in terms of the quality – the properties – of the commodity traded; only when this has been achieved can a market schedule (quantities and prices) emerge (Favereau et al., 2002). Biodiversity is a complex construct, and can refer to so many dimensions within the same habitat area, that it is almost impossible to compare two different areas, regardless of how apparently similar and geographically close they are. Greater investment in developing ever more precise technical devices for the commodification of biodiversity, which can identify ever finer distinctions between two areas, may paradoxically result in greater restrictions to the comparability and exchangeability of development and offset area[83] (Robertson, 2004). However this comparability and exchangeability – the possibility that agents can evaluate the trade-offs between two distinct states of the world and choose between them – is at the core of the existence of a market. It is also implicit in the designation of NNL, the engine of the performing of that market. As a result, it is necessary that the market devices also perform a qualification role, demonstrating that biodiversity lost in the development area equals biodiversity gained in the offset area. *No net loss of biodiversity* requires a set of market *agencements* that work by making things the same (D. MacKenzie, 2009a).

[83] The biodiversity offsetting industry and practitioners have become well aware of this paradox between precision in their metrics and fungibility of the commodity, which has come to be known as the “middle-aged great blue herons who don’t like shrimp” problem (Quétier, 2012) – inspired by the idea that it would be possible to identify habitat for a eponymous middle-aged great blue heron which dislikes shrimp, but difficult to achieve satisfactory ecological equivalence for it elsewhere.

These qualifying market *agencements* are currently under development. Both the English and the German programmes have devised metrics that involve calculating a single score for both areas in an offset transaction. These single scores aim to bring into the calculation aspects such as the state of biodiversity in both areas, or the rarity of the areas involved – qualifying aspects. In other words, these devices seek to quantify quality: they make explicit the programmes' concerns about quality differences in the calculation of equivalence.

6.4.3. Tension within the agencement*: framing biodiversity as a* hot topic

One of the topics explored in this chapter is the evidence of tension within the market *agencements* at the core of the infrastructure of markets for biodiversity offsets. Market devices – mechanisms for measurement and commodification, such as the plethora of commodification rationales, spreadhsheets and equations described early in this chapter – play a key role of the development of markets for biodiversity offsets. The creation of market devices is, however, not enough to diminish the importance of agents involved in the determination of equivalence between damage and offset. These are, in effect, market *agencements*, in which calculative agencies complement the market devices and maintain significant control over the results of the calculation.

However, the agents which complement the market devices in the context of the *agencement* can at times operate according to individual logics. Often with biological or ecological training, these technicians can operate independently from the market logic, and undertake their role as calculative agencies on a case-by-case logic. While perfectly acceptable within the remit of biological sciences, this creates uncertainty and can reduce the fungibility of a biodiversity offset. To the strict predictability of the market devices, the agents' adaptations result in unpredictability. It is accepted that the design of mechanisms to frame overflows often involves controversy; these are the hot situations, sometimes also called *hybrid forums*, which involve contestation from various groups (Callon, 1998a, 2009). But in the context of biodiversity offsets we observe tension *within* the components of the offset, which diverge in their framing activities. Biologists and ecologists on the one hand, and market intermediaries and sellers on the other, operate according to diverging logics, and it becomes apparent that *the logic of biological sciences, with its stochastic approach to the problem of measurement and equivalence of biodiversity, is a poor fit for the needs of a developing market in biodiversity offsets.*

The answer to the poor fit between science and market is to draw in the third dimension of this process: a political logic. In their quest for predictability and fungibility, market practitioners have lobbied regulators to produce guidance for practitioners. These sets of guidelines are designed to severely limit the personal interpretation which technicians and

scientists have in their practice - achieved by removing part the decision-making from calculative agencies, and placing it with devices. This is manifest in the cases examined the attempts to take the responsibility of framing biodiversity from agents and giving it to market devices.

6.4.4. Strengthening the frame: other market enabling technologies

The use of technology in markets for biodiversity offsets is not limited to market devices. The use of information technologies and computing is also having an impact, with important infrastructures under development even as the discussions about the algorithms and instituted governance structures are not concluded. Following the logic of performativity of economics, databases, applications and exchange platforms are under development, aggregating, connecting and distributing information about biodiversity and offsetting possibilities. The prospect of diminishing transaction costs and simplifying the approval of biodiversity offsets is tempting for proponents of these technologies. Although fraught with problems and difficulties, these technologies are market enablers. Questions should be raised, however, about the amount of power concentrated in the agents controlling all the information, especially when these agents have the capacity to manage supply to match demand, and impose their preferred market schedule.

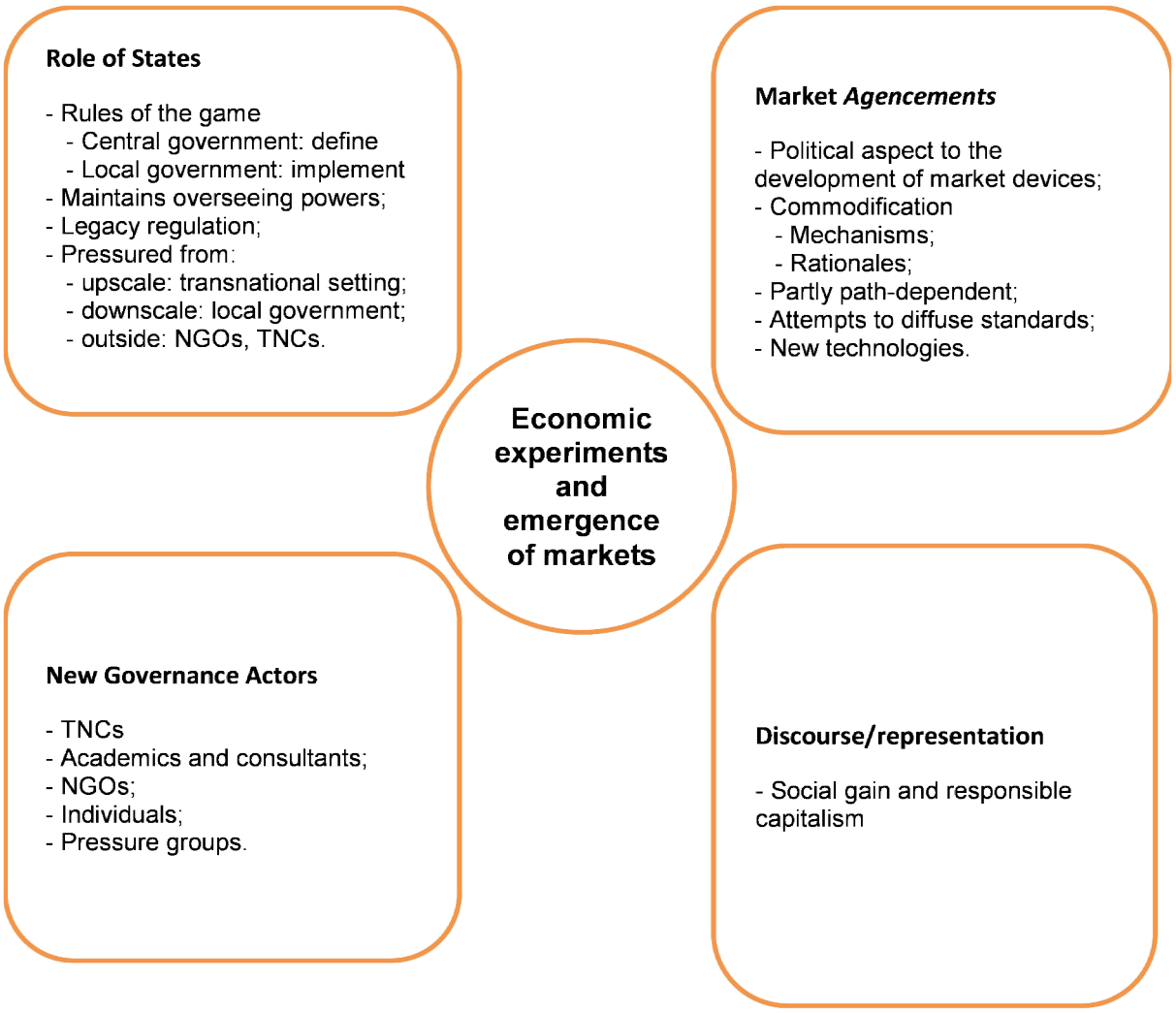
In all cases, the technologies analysed in this chapter are based on rules for operating in a market for biodiversity offsets. By creating and diffusing common rules, these technologies open the door for market expansion to occur. The next chapter explores this possibility of expansion in the case of biodiversity offsets.

7. Expanding markets for biodiversity offsets: local resistance, partial circulation

7.1. Introduction

This chapter analyses the paradox involved in the attempts to expand markets for biodiversity offsets: that while most benefits of biodiversity are enjoyed close to the location where biodiversity resides, the development of a market infrastructure and commodification mechanisms creates the condition for expansion of the market. However, attempts to expand the market are countered with resistance to expansion at local level. Figure 7.1 is an adaptation of the framework for the analysis of market emergence and economic experiments, first presented in section 2.5. It highlights which components of that framework will be presented in this Chapter.

Figure 7.1 – Framework for research: expansion of markets



Source: author

The proliferation of new rationales, mechanisms and technologies for commodifying biodiversity contributes to institute markets, by developing a technical infrastructure for biodiversity offset markets. These infrastructures are costly to develop; sellers and intermediaries in these markets need to increase the number of transactions in order to recoup their costs. Simultaneously, academics, consultants and NGOs are keen to seek models of "best practice" in biodiversity offsetting, such that "best outcomes" can be achieved in different locations; and potential buyers seek reassurance that their claims to contributing to social gains and the construction of a responsible capitalism that promotes society's values can be demonstrated. Previous research has demonstrated that the diffusion of standards can have the effect of uniting separate markets for the same commodity which operate separately. Historically the creation of standards contributed to this by reducing the uncertainty and transaction costs associated with trading with agents operating under distinctive logics (North, 1990); this contributes to the expansion of the unified market. Examples where this has been demonstrated to happen include the development of a standard for wireless telephony in Europe (Mina, 2003), and the creation of carbon standards, leading to a market in carbon offsets (Broderick, 2011).

However, the continued existence of legacy pre-market regulation about the compensation of biodiversity losses creates difficulties to this process. Existing commodification mechanisms are difficult to converge into single standards; they tend to suffer path dependency, and maintain characteristics and dimensions from the pre-market phase of governance of biodiversity. Further, the diffusion of existing standards is made difficult by opposition to expansion of the areas covered by the markets felt at local level. In part, this is felt at the level of the commodification mechanisms and technologies themselves: even as standards are adopted, local changes and adaptations force a degree of divergence in the forms of calculation. This leads to the continued existence of separate, discrete markets. There is evidence that this situation can take place, as communities of practice cannot agree and standards fail to crystallise (Delemarle & Larédo, 2006). This, however, does not necessarily mean that the markets remain isolated: one of the reasons why economics is performative is the fact that components of markets – economists themselves, but also market devices, ideas and representations – can circulate (D. MacKenzie et al., 2007). This chapter examines evidence that some of these components circulate, even if the markets remain isolated.

Chapter 7 is organised as follows: section 7.2 examines the reasons why the expansion of markets for biodiversity offsets is a deliberate project by agents involved, and illustrates some of the directions currently being proposed for this expansion. Specifically, the increased costs of developing a market *vis-a-vis* alternative forms of organising the

governance of biodiversity are explored. Section 7.3 analyses how these attempts, which usually emanate from national and transnational-scale groups of agents, are met with resistance at the local level. Evidence of resistance to expansion by developing specific market *agencements* and maintaining the locally preferred form of operation is presented. Section 7.4 discusses how, even as markets remain separated, attempts to standardise and converge market *agencements* are in fact having some expansionary effect over local markets. This is demonstrated by the partial circulation of components of the market infrastructure. Section 7.5 concludes.

7.2. In search of a fungible commodity

This section analyses the most important issue involved in the expansion of biodiversity offsets: the potential for creating fungible commodities. Most programmes only accept biodiversity offsets acquired from a given area; for markets to expand, a fungible commodity – which can be freely exchanged between agents – may be necessary.

One of the substantive strategies currently at play in the development of markets for biodiversity offsets is the progressive expansion of the remit of the exchange. This project was referred to by several interviewees as the expansion (or altogether elimination) of service areas, which would allow biodiversity offsets to be acquired from the lower cost supplier, regardless of their distance to the impact area. While apparently simple, and theoretically capable of delivering lower cost and higher economic efficiency in the context of an ideal market for biodiversity offsets, the idea of expanding the areas within which trading in offsets is acceptable raises welfare, distribution and ethical challenges. In more specific terms, to do so would implicate a radical reconstruction of the biodiversity-offset-as-a-commodity traded in markets – and, likely, the market *agencements* which are involved in the production of these commodities as well.

The main reason for this attempt to expand the areas of exchange lies with the costs associated with marketising biodiversity: the instituting of markets for biodiversity offsets involves the design and deployment of significant market infrastructures. The investment required for the development of technologies which allow the market to function alone is considerable. This means that these emergent markets are saddled with both sunk and transactions costs which are higher than those faced by pre-market forms of compensation for damages to biodiversity resulting from development. The high start-up costs involved in markets for biodiversity offset must be recouped during the lifetime of the programme; actors therefore need to spread these costs through as many transactions as possible – market growth and expansion is in their interest. However, it is not clear how the market may

expand. This is made especially complex by the highly regulation-dependent nature[84] of markets for biodiversity offsets. Often operating with demand created almost by decree, sellers, intermediaries and proponents find it becomes difficult to expand into new areas of business which are not regulated for. Overall, agents are attempting to expand markets for biodiversity offsets through the extension of the geographical areas covered by the markets. However, the status of the biodiversity offset as a commodity is not independent of the area where it is exchanged. From the very design of most programmes, biodiversity can only be offset within a given area. The status of biodiversity as an exchangeable entity is geographically limited, and it loses its commodity status outside the designated service area. However, this is not the only limit to the fungibility of biodiversity offsets as commodities, as the next section explores.

7.2.1. The problems of fungibility

This sub-section analyses the challenges involved in creating a fungible commodity, and what options there are for agents attempting to do so.

The first limit to the fungibility of biodiversity offsets which impacts the potential for market expansion relates to the issue of quality equivalence – specifically, the potential for exchange between unequal pieces of biodiversity. “Trading up”, as it is sometimes described, raises the prospect that the markets could meet demand more easily, by pairing demand for a given offset in a specific location with existing supply in another location. It is for this reason that so much effort is dedicated to *making things the same*: if the operators were reduced to offsetting losses solely by providing exactly equal components of biodiversity in very close proximity to the losses, the scope of the markets would be very limited. Furthermore, the land management activities required to reproduce a given habitat elsewhere to the smallest details would likely increase even more the costs of offsetting biodiversity.

Regardless of these attempts to permit the establishment of equivalence and to exchange different “things”, markets for biodiversity offsets are limited in terms of what is traded by the regulation which underpins the market. As seen in Chapter 5, this regulation diverges: in Germany and in England[85] the markets contemplate many aspects of biodiversity, while in the United States, the focus is on endangered species. Ultimately, the US experience is especially limiting for operators and intermediaries, which can only sell offsets of species

[84] The crucial role of regulation in the emergence and operation of markets for biodiversity offsets is discussed in section 5.4.

[85] The programme in England is voluntary, and as such does not involve any particular piece of regulation; however, the DEFRA guidelines discussed in sub-section 6.2.2 clearly indicate a preference for a wide understanding of biodiversity.

listed and recognised as endangered, while German and English operators face a larger set of potentially tradable values. There is limited opportunity for operators to establish trade-offs, depending on how the quality equivalence between different values is determined. This stops the markets from expanding:

> ...you can get divergence within a market. But the more you divide up a market, the fewer people you get involved, so the less market efficiency you get. So, there's a trade-off there. The extreme example is one of the Australian systems, where they really try to maintain native vegetation, but they've subdivided the market into dozens of different specific habitat types. And the result of that is to significantly increase the costs for people damaging those, because where there's that native vegetation left in place, they want it preserved. And then the costs of damage are quite high, and there's very little trading between habitat types. There's only a bit of trading up. But then you've got a large number of very small markets, the costs in each are quite high, and the main effect is a deterrent to damage. [*Interviewee I2*]

The definition of the commodity can be too specific and thus result in diminishing possibilities for exchange, as observed in the United States. The Species Banking programme is presently in the situation where the same regulation which has contributed to developing the market also severely limits its potential for expansion:

> A lot of us sitting around joke that if we got to be king for a day, we would get rid of the Clean Water Act and the Endangered Species Act, and have the Endangered Habitats Act, because it's about habitats, not about a particular species or wetland type. (…) Trying to come up with the fungible unit that people can all agree to is one of the biggest challenges in this field, and I think secondly coming up with the unit that can group those habitat types. One of the big things you're seeing today is a push for being able to trade some kind of ecosystem services unit, a unit that looks at not only the wetland value, or species value, but also looks at the water quality value, the open space value, the linkages between habitat types, as well as the carbon storage value. [*Interviewee I8*]

A more holistic approach to biodiversity – or, more specifically, to ecosystem services – would allow the markets to expand by promoting trade-offs of different aspects of biodiversity – the quality equivalence, a component of fungibility. At present, there is a trade-off between the strictness of ecological equivalence and the expansion of the market:

> The problem with biodiversity is it's not so fungible, it's always very specific. So, it really depends... and that's why this issue of ecological equivalence is so central, if you have a very broad definition of the different components of biodiversity that are required to be offset, than you will be able to generate the flexible, and sort of deeper market. [*Interviewee I5*]

This lack of fungibility of biodiversity also impacts, indirectly, the possibility of directly targeting of end consumers as buyers of biodiversity offsets. The principle raised here is simple, and follows the reasoning put in place to create voluntary markets for carbon offsets: that individual consumers are aware of the impacts of their consumption habits over biodiversity, and can be asked to voluntarily offset them. However, the problem of quantifying the impacts of individual consumers, necessary to assure equivalence between biodiversity impacts and offsets acquired, becomes even more difficult to tackle in these situations. Individual's impacts over biodiversity are not direct; theoretically, the consequences of a single individual's consumption choices for biodiversity can spread as far as the supply chain of individual products goes. The challenges of quantifying these individual small and disperse impacts are more than current *agencements* can contemplate. These limits to calculation pose serious issues for the expansion or elimination of service areas and free exchange of biodiversity offsets. The capacity to produce a fungible commodity, which can freely circulate, remains limited.

Simultaneously, states are interested in maintaining control, or at least oversight, over the functioning of offsetting mechanisms. As a result, states attempt to standardise procedures and regulations, often under the guise of creating a "level playing field", to which several of the interviewees contacted referred to. As described in Chapter 6, among the most important pieces of regulation produced by central governments which affect biodiversity offsetting are pieces of technical guidance about how to demonstrate equivalence, qualitative and quantitative. Examples of these technological regulations include the biodiversity offsetting metric suggested by DEFRA in England (DEFRA, 2011), and the guidance issued by the US-FWS in the United States (US-FWS, 2003). Both consist of attempts to institute standardised technologies to permit calculation, and then diffuse those standards for application in different locations. Likewise, in Germany the central government has vowed to reform the IMR biodiversity offsetting programme by helping converge the many forms of calculation currently in use (Darbi et al., 2009; eftec & IEEP, 2010; Madsen et al., 2010). The rationale of these attempts to standardise the market *agencements* is to guide local practice to converge, thus assuring that the coverage of the markets is national. In the opinion a specialist within the UK civil service:

> One of the things that we would look to develop through an approach to offsetting is something whereby there is a more consistent, long-term approach to monitoring and enforcement. (…) in a full-blown scheme of offsetting, we would envisage that there would be a process of certification, which would quality-insure the competence of offset provider. So you wouldn't be able to participate in this scheme of offsetting unless you were certified, local authorities would be able to go to certified offsets providers or people who are doing that in terms of habitat banking, have got certification. [*Interviewee I13*]

Other groups are involved in promoting the expansion of the fungibility of the commodities traded in markets for biodiversity offsets. These groups include some NGOs, proponents and academics, which operate under strong normative models of conservation, and defend the deployment of scientific and technical mechanisms to try and achieve their objectives. The result of the actions of these groups is the creation of biodiversity offsetting standards. The most important among these was published by the Business and Biodiversity Offsets Programme (BBOP, 2012c), which attempts to stabilise a particular form of organising agents and the roles they play in the market – a specific "way of doing things". Simultaneously, private operators are developing their own technical devices, such as the databases that match of impacts and compensations, offer and demand, buyers and sellers, potentially across an entire country.

However, just as market *agencements* are constituted of series of technologies but also of specific sets of normativities, attempts to diffuse nation-wide standards must transport those same normativities to different, locally-run programmes. This attempted diffusion of market *agencements* consists of a move towards the instituting of a specific set of normativities. This is not the only result of standards for biodiversity offsetting. As they underpin the functioning of market as a calculative space where agents take action, shared *agencements* tend to increase the likelihood that the operation of local biodiversity offsetting markets might converge into a unitary market at the nation-state scale.

7.3. Resisting expansion: transnational project, local obstacles

This section analyses the resistance to the expansion of markets for biodiversity offsets. The issue of scale, in particular, is highlighted: standardisation initiatives in terms of harmonisation and convergence of forms of calculating equivalence are promoted at transnational and national level, but actively resisted by agents operating locally. The reasons for this resistance are both biological and political.

Attempts to grow markets for biodiversity offsets and expand the areas between which trade occurs face a number of potential obstacles. While there are a number of biodiversity offsetting programmes in operation, notionally designated as markets, and their numbers have been steadily increasing[86], their importance remains small when compared to other forms of governance of biodiversity overall. If this can potentially be framed in terms of competition between markets and pre-existent non-market forms of deciding on compensation for development impacts over biodiversity, it is also noticeable that the existent programmes remain localised exercises. In many ways they remain economic experiments, and have apparently failed to develop into full-fledged reconstructions of the relationships between nature, society and the economy. Despite being capable of producing local impacts, markets for biodiversity offsets are facing significant challenges to their capacity to expand, especially in terms of the geographical areas involved. Challenges to the expansion of markets for biodiversity offsets come from a number of local specificities associated with biodiversity: biological and ecological, but also political and cultural. The result of these specificities is action to resist the expansion of markets for biodiversity offsets.

7.3.1. Convergence and divergence in market agencements

Biologically and ecologically, most biodiversity is a localised phenomenon: species and ecosystem relationships are strongly dependent on habitats (land area) for their survival. This has important implications in terms of the governance structures devised: despite the continued attempts to develop market *agencements* which allow for quality equivalence to be calculated[87], these species and relationships struggle to be replicated in distinctive areas, even where the calculations would appear to indicate that equivalence is possible. As a result, agents involved in the governance of biodiversity maintain a degree of personal choice with regards to how these *agencements* are employed in practice – another aspect of the tension between agents and devices occurring at the heart of market *agencements* in markets for biodiversity offsets.

The result is difficulty in converging the existing forms of calculation and commodification. The creation of standards, such as the BBOP Standard on Biodiversity Offsets (BBOP, 2012c) is designed to obviate these issues. A unified practice and set of devices could have the effect of leading all markets to converge, the principles of operation and commodities traded becoming similar. But the evidence suggest that even when standards – BBOP or

[86] As detailed in section 3.3.
[87] Examples of these include the “credits” (in the United States conservation banking programme), the “metric” developed in England and the “eco-points” system in operation in Germany – as developed in Chapter 7.

government-led – are adopted and there is a degree of convergence, it is followed by divergence of forms of operation and calculative mechanisms. The process of development of the market *agencements* observed in all three cases used as entry points in this thesis reflects this. The project of convergence of markets for biodiversity offsets becomes a is usually initiated at national level, with a view to allow for expansion and growth of the market. To do this, central governments make use of transnationally-developed systems of best-practice, such as the BBOP Standard, and the support of market advocates, academics and some NGOs. However, governments cannot specify a single set of market devices to be employed everywhere. Two reasons for this are suggested by an academic and consultant – adaptation to local situations, and innovation in the *agencements*:

> ...you want to be flexible to actually be able to adapt your protocol, your indicators, your methods to a very wide range of ecological situations. (...) I wouldn't trust the government agency to come up with the miracle method that works everywhere all the time. (…) the second thing is you want to be able to be innovative. If you have a new type of measurement, a new device, whatever, you want to be able to use that. If change can only come from the top, then it's never going to come – and so, you will be stifling innovation and that would be a bad idea. (...) It's very good that the regulation gives lots of freedom to actually doing your best locally, per project. And that's why I think all these standardised approaches involve a lot of bottom-up standardisation. [*Interviewee I5*]

This need for constant development of standards is also felt by the BBOP itself. One member of the organisation remarked that, in terms of market *agencements*, the main decision consists in deciding between prescriptive and flexible techniques:

> A flexible standard is preferable, because it is not possible to arrive at a unique approach to such diverse scales, species, and impacts to measurement. (…) To have one single approach does not make sense. Where does this leave "standardised"? Two ideas: principles-based, and quality but flexibility. We need to work from principles, into specificities, and choose methodologies accordingly. [*Interviewee B2*]

In all three cases studied in this thesis, divergence – not convergence – of market devices can be observed. As a result, variety of forms of calculating *no net loss of biodiversity* has become a feature of the markets. In the case of the United States compensation banking, there is almost a specific form of calculation in every place:

> …each region has sort of its guidelines for how you credit both credits that have been created and also impacts. (…) that's at regional level, although certain regions do the same methods and standards. (...) There's thirty eight different regulatory regions, in the US, [*and*] potentially you would have thirty eight regimes [*of calculation*]. [*Interviewee I4*]

The degree of variety is not only large; it seems to be the result of informal decision. It becomes difficult to even understand current practice in a given location and how it relates to practice elsewhere, let alone diffuse and institute new standards. Attempts by agents interested in the convergence of standards in operation in markets for biodiversity offsets to understand this complexity have so far proved fruitless. One such attempt involved Ecosystem Marketplace and MarkIt (a provider of registries for financial markets), eventually failed because of the divergence of market devices in use:

> We spend a lot of time trying to help it in the infrastructure, and familiarise the regulators with it, and we worked with MarkIt Registries. We tried to do a pilot with them, out in California, to get the FWS and bankers on a registry system, where they could account for and track the credits (...) [T]he US is very fragmented, when they came back to us they were totally exasperated. They had done a lot of complicated financial and carbon and other commodity registries, and the fragmentation within the mitigation banking and conservation banking in the US was so great, and the lack of communication was so great, that I think they sort of threw their hands up and said that it wasn't worth it. [*Interviewee I3*]

A very similar situation has developed in the biodiversity offsets market operating in Germany, the Impact Mitigation Regulations (IMR):

> The Germans sort of regional governments are quite interesting. There's a piece of work that was done for a German Bank, looking at the German market in some details a few years ago, apparently considering investing in it. And they decided that the regional differences in the market were too great to justify a kind of national investment. There was not enough transparency for them to understand as an investor. And that's because the markets are all run by the regional governments – the *Länder*[88]. [*Interviewee I2*]

[88] The *Bundesländer* are the federated states which constitute the Federal Republic of Germany.

This situation is not ideal and, as mentioned previously, attempts[89] to standardise the *agencements* in use in the IMR programme are ongoing. There is some evidence that, at least in part, these attempts have met with some, albeit limited, success:

> ...each *Länder* still has its own method. But in each *Länder*, that method, you have to use it, whereas the situation before that was that each development project, or each municipality, did its EIA, would invent its own indicator. You see, it would be just a verbal argumentation, you would sort of justify why this is an appropriate offset. But everyone would justify in their own personal way (...) And so, they've gone beyond that, now they have scoring methods, and everyone has to use the same scoring method. Everyone inside the same *Länder*. [*Interviewee I5*]

In both the United States and Germany, the biodiversity offsetting programmes have been in place for significant amount of time. Perhaps as a result of this, the existing market *agencements* appear partially path-dependent, and attempts to converge procedures and *agencements* have met with only limited success. The focus remains on the local scale; as commented by a former US regulator and biodiversity offsets banker, there is overall little appetite for a market in biodiversity offsets which isn't focused on local biodiversity:

> When the internet age came out, they talked about the World Wide Web versus the bricks-and-mortar businesses. And I've always considered wetlands and endangered species as a bricks-and-mortar business. It's local, it's in your city, it's in your county, it's in your region, versus air, or carbon, which is a global market. [*Interviewee I8*]

This criticism extends to the possibilities created by credit trading platforms, such the one developed by Mission Markets and currently in operation the United States (and, with adaptations, in England[90]). The comments about these exchange platforms, offered by the director of a company operating a number of biodiversity offset banks in the United States, reflect an interesting point: that attempts to perform a financial market in the context of biodiversity offsets may prove inadequate to the commodity. His preferred metaphor for performing a market for biodiversity offsets is the real estate market:

> I frankly think it [*Mission Markets*] took a Wall Street kind of mind-set and applied it to what really follows more the real estate model. (...) It [*biodiversity offsets*] is not a very liquid market, it's not a very robust market, and it follows much more

[89] See Chapter 6.
[90] See sub-section 6.3.3 for a review of biodiversity offset exchange platforms.

> the real estate, local market scenario. If you look at real estate in the US, it is not sold on any trading platform. It's got multiple listing services, you've got a lot of local brokers still playing a fairly active role, because it's not as fungible an asset. [*Interviewee I9*]

The problem of translating biological and ecological reality into fungible commodities is only one aspect limiting credit trading platforms. In the opinion of this interviewee, these are markets which cannot operate without intermediaries and market-makers:

> So then you say all right, we'll take certified credits and put them on our platform. When I am dealing with somebody who's looking at buying our credit, you need nuance. Typically, about what's the type of credit; that's still done by the bank operator, who might not be super-efficient, but on the flip side these markets don't want the commoditised view of the world! They [*Mission Markets*] have taken the long model and tried to apply it and theoretically wean efficiencies, and I think these guys can't be end-all. [*Interviewee I9*]

It can be argued that this apparent opposition to credit trading platforms is strategic – these agents are intermediaries in the existing markets for biodiversity offsets, and would object to being the target of a process of disintermediation. However, the objections they raise follow the same ground as those brought about by NGOs and environmental activists:

> ...for someone to say “OK, we're going to allow in the Thames people who dump there to offset by doing stuff up in Scotland”. While you can say it's an offset, it's going to cause the River Thames to turn into a cesspool, basically. You can't have that. [*Interviewee I8*]

This particular criticism – that biodiversity offsetting has the potential to result in displacing the damage to biodiversity and thus have negative local impacts – is shared by environmental activists and some in the NGO sector. The criticism that these agents offer is that an expanding biodiversity offsetting market could simply function as a mechanism of companies to obtain a *license to trash*:

> Some people have seen offsetting as almost a license to trash: a developer can damage that [*biodiversity*], pay a sum of money and wash their hands with the situation. [*Interviewee I15*]

The expression *license to trash* has become an important symbolic qualifier to describe the creation of markets for biodiversity offsetting, used to the opposite effect as *no net loss of biodiversity*. In academic, industry and even policy domains, critics of the idea of offsetting

biodiversity speak of these markets as a *license to trash* whenever they want to highlight their disapproval. The term itself is multidimensional in the aspects it covers. It encompasses worries about offsetting displacing damages, as mentioned above; uncertainty about the possibility that *no net loss* can be achieved; and, most importantly, a set of concerns about the ethical and equity aspects of allowing private companies – potentially rich and powerful – a free hand at destroying the common good. A member of a large international NGO explained how their organisation does not condone biodiversity offsetting, connecting both environmental and political concerns:

> [*Opinions within the NGO*] range from quite positive and interested in the idea of offsetting, the opportunities it raises, to the highly sceptical, highly cynical, who think it's just another way of developers being allowed to get away with damaging sites and not really paying the true costs (...) because all the experience elsewhere around the world suggests that if you don't, then wildlife loses out. [*Interviewee I10*]

These views were corroborated by other interviewees and informants. In spite of promoters' and advocates' enthusiasm for the potential of markets for biodiversity offsetting, even actors who have operated in this field for a long time are sceptical of the possibility of a classical market expansion – one in which market *agencements* are standardised and widely adopted, producing fungible commodities which can be freely exchanged. In the view of these experienced market agents, the theoretical economic advantages offered by biodiversity offset trading platforms are not enough to compensate for the downsides that marketisation might bring. These downsides are especially important in terms of reputation damages to the companies acquiring biodiversity offsets, especially if these are widely seen as a *license to trash*.

The idea of a *license to trash* shows that part of the symbolic dimension of biodiversity offsets is not in control of the proponents and advocates of offsetting, and it is being used to resist the use and expansion of these mechanisms. The term encompasses not only an environmental concern, but it counters claims to sustainability best practice and social and environmental responsibility by companies acquiring biodiversity offsets. The possibility that voluntary biodiversity offset markets might develop if a fungible unit can be developed, as carbon offset markets did before, seems compromised at the very start:

> If it's about green-washing, then it's easy, because it's just a matter of... whatever your impact, you can buy rainforest [laughs]. You know, it doesn't matter. And there's plenty of that on sale, so it's easy to set up a market for that. But when you have to comply with specific offset requirement that say “you have to

> purchase, restore and manage for 30 years 130 ha of habitat that is favourable to this specific butterfly species, and it has to be in this administrative region of South West of France", there's no market for that. [*Interviewee I5*]

The two programmes discussed in this section – in the United States and in Germany – constitute fairly "mature" markets, which despite constant evolution have been in operation for many years. The development of local market *agencements* has been happening for some time, which implies longer path dependence. In contrast, the English case is a new programme[91], supposed to start from first principles and based on best-practice standards. The next section analyses how expansion and resistance are playing out in this context.

7.3.2. Resistance in practice: the English experiment

This sub-section presents a detailed analysis of a specific context in which there is evidence of active resistance to the creation of fungible commodities and market expansion: the English Biodiversity Offsets programme.

As discussed in chapters 5 and 6 of this thesis, the English Biodiversity Offsets programme currently being piloted is completely voluntary. It is also experimental: DEFRA and Natural England wish to have, by their own assumption, a fair idea of the diversity of mechanisms that can be employed, and what is it that works best. In terms of the market *agencements* employed, DEFRA has published extensive guidance about the calculation of the offset credit – the metric[92]. At the same time, it has given the actors involved significant freedom to experiment with changing that metric, in order to try to understand what "best practice" consists of. This was explained by a planning officer in one of the pilot areas:

> At the end of the pilot they want a really good range of methods used and tried over the six pilot areas, and from that they are looking at developing a potentially national project. [Interviewee *I15*]

At this point, opinions diverge. The private company which is more heavily involved in the development of markets for biodiversity offsets in England (The Environment Bank), is investing in the development of not only a platform and applications to go with it[93], but also in the standardisation of a metric which would underpin these technologies. The objective of this metric is to allow for offsets to, potentially, be bought outside the jurisdiction of the local authority where the impact takes place. Instead of mutually isolated market nodes, these agents would like to promote the emergence of a unified, single market for biodiversity

[91] As discussed in sub-section 5.4.3, the English Biodiversity Offsets pilot project started in 2012.
[92] This is discussed in detail in section 6.2.2.
[93] As detailed in section 6.3.

offsets in England. And key to this is the development of appropriate measurement technologies which can reliably produce equivalence in different areas:

> [*There is*] still somewhere to do on the equivalence of the metrics so that you could apply the metrics in one geographic location, and they'd be the same in another. (...) You need to have a national system. I think if you have a fragmented system, everyone has a listed site, it would drive the prices down, and you wouldn't be able to choose a great deal (…) I think the offsets will enable things to be done even off-site, which then gives someone else the jurisdiction to manage – and they're getting paid for it proper value and proper rates. [*Interviewee I1*]

Fungibility is crucial to this understanding of biodiversity offsets. However, this position does not meet with the acquiescence of other agents operating in these economic experiments. One planning officer in a local authority where a pilot biodiversity offsetting project is taking place spoke of maintaining local control over where offsetting for local damages takes place. In the opinion of this agent, there is no room for a fungible commodity in a biodiversity offsets market. The local preference, quoted by him, is for compensation to take place within the community. In fact, he recalled a situation where carbon offsetting – a market where a fungible commodity exists – would only be allowed occur if the offset was within the community. The opposition, in this case, is entirely political, and based in the preferences of local constituents. It is not the concept of offsetting which creates resistance – it is the idea of a geographically expanded market which the community objects to.

> [*Biodiversity offsetting*] has got to be within the district, definitely. There's no way that we're going to... we had a discussion with Future Forest some time ago. We did a calculation on our carbon emissions, and how many trees would need to be planted to offset that. They were talking about planting trees in different part of the country, and I said “well, our members would not sign up to something that didn't see value improvements in this area”. We're very localised, parochial on those things. That's elected members, probably wouldn't accept it further afield that the district itself. [*Interviewee I11*]

At a second pilot biodiversity offset council, another planning officer expressed similar views:

> Our steering group is very keen that the offset provision is done within the [*local authority*] area, smaller than the county. They want it to try to be as close to the development as they can. The approach we are taking is to tie it in as locally as possible. (…) One of the reason for that is local people are often concerned

> about the wildlife in their area, and if they see an area they know is quite good for wildlife being lost, it is important they also see the local benefits of the offsets. I think tying it geographically to where the damage is being done is crucial that will be needed to take local people and communities to support the project. [*Interviewee I15*]

Respect for local preferences is seen as key for the acceptance of the projects in the eyes of local people. The issue of environmental credibility – and how it related to the market *agencements* being developed – cannot be ignored in this context. At least two of the planning officers working on the biodiversity offsetting pilot recounted how they have been adapting the DEFRA metric to suit the local biodiversity – in one case going as far as changing the focus of the calculation from ecosystems to species. As a result, and because of the say that local planning authorities maintain over planning permissions, no biodiversity offsets calculated under a metric different from this planning officer's preference would be accepted. So in addition to the cultural and political opposition to the expansion of markets, the understanding of nature and what should be protected is also coming to the fore as the pilots develop.

The situation within the Biodiversity Offsets programme in England illustrates how, even in an economic experiment starting from first principles, it is possible that agents' local interests and preferences contradict expansion of biodiversity offset markets. Resistance, as seen, does not focus on the concept of offsetting itself; what is resisted to is the apparent loss of control over the governance of local biodiversity, over local nature. Even where they accept biodiversity offsetting as a useful mechanism, local governments are not prepared to relinquish their responsibility for accepting or rejecting a planning application, especially on the basis that the local area could suffer the consequences in terms of biodiversity loss, while the benefits of the offset would be felt elsewhere. Alongside this, there is also a concern about the equity consequences of displacing biodiversity damages. It would appear that agents promoting and steering biodiversity offsetting markets need to choose between expansion or public acceptance and environmental credibility.

The surprise comes in the forms this resistance takes. Local authorities have preferred to engage with the biodiversity offsetting market, and by doing so became market agents in their own right. Through this, they have gained the capacity to institute separate, unique markets in their area, based on their own interpretation of the standards and *agencements* emanating from DEFRA. In some cases, they have directly changed the market *agencements* themselves, the very technologies of calculation which underpin the market. As the pilot projects continue, these technologies are diverging, even where they are based

on a set of standards promoted by the regulator. As happened before in the German IMR and the US Conservation Banking programmes, attempts to deploy a best-practice standard for biodiversity offsetting and convergence the local practice in biodiversity offset markets are resulting in a degree of divergence.

7.3.3. Markets for biodiversity offsets: a nodal structure

As seen in the sections above, resistance to the expansion of biodiversity offset markets can be based both on environmental and on political grounds. While the development of market *agencements* has, as described in Chapter 6, focused on producing a commodity with some degree of fungibility, success in doing so may simply result in increased opposition. Tellingly, experienced actors in these markets reject the concept of expansion, apparently stepping away from expanding the economic experiment to its limits. While there is evidence of performativity of economics in the movement towards marketisation of biodiversity, there is also a sense of a counter-movement. Ultimately, the limits to fungibility constitute attempts to restrict how much the market is allowed to govern biodiversity. This counter-movement is being played, in part, in the diversity of market *agencements* kept in operation: attempts to converge mechanisms of measurement and commodification have resulted in divergence at the local scale. The different local markets use specific *agencements*, which result in mutually incompatible commodities being traded in each.

The problems with expansion of markets for biodiversity offsets described in this section have at least one important consequence in terms of the structure of these markets. While each biodiversity offsetting programme[94] refers to the national scale, in the sense that it is either authorised or initiated by central governments, the real existing markets for biodiversity offsets operate at a local scale. Each programme includes a number of markets, operating according to the same law or guidance, but doing so in isolation. There is no exchange between these different local markets, and as such there is no national market. Instead, what we observe is a number of discrete market nodes trading in biodiversity offsets, separate from one another. Biodiversity offsets within one node are not acceptable in either of the other nodes. Ultimately, the geographical and geopolitical location of biodiversity lost is one of the components of commodity exchanged, and biodiversity in two different locations differs in terms of this key qualitative dimension. So far, no market device has been able to produce equivalence in this key dimension, the biological/ecological and political objections to it proving impossible to resolve. For the foreseeable future, and

[94] As discussed in section 3.3, a biodiversity offsetting programme consists of "... any law or policy established, enhanced and/or preserved for the purpose of generating certified credits that may be sold for compensatory mitigation for impacts to biodiversity" (Ecosystem Marketplace, 2013a).

regardless of the continuous development of calculative devices and agencies, markets for biodiversity offsets are poised to remain operating as isolated nodes.

7.4. Partial circulation: blocking expansion, sharing standards

This section details how, even in the face of active resistance to biodiversity offsetting expansion, some components of the market infrastructure circulate between the individual markets. While expansion remains blocked for now, and the commodities do not have the necessary level of fungibility, there is evidence of the circulation of a number of components of the market infrastructure.

The difficulty in expanding the geographical reach of the markets for biodiversity offsets, and the fact that they seem poised to remain separate – because of the impossibility of creating an acceptable fungible commodity – does not mean that the different market nodes do not share any aspects. The organisation of these emergent markets remains in flux, and the evidence is that some components of the market infrastructure are circulating. It is possible to identify at least three dimensions – knowledge, representations and governance structures – which are being actively shared between different market nodes. In circulating, these components represent three mechanisms by which different market nodes continue to be developed as independent mechanisms, but sharing a common basis (Table 7.1).

Table 7.1 – Market components circulated among biodiversity offset market nodes

Component circulated	Driver of circulation	Examples
Representations	Transnational organisations, such as the BBOP and TEEB.	“Defective Economic Compass”. “No Net Loss of Biodiversity”.
Knowledge	Agents operating simultaneously in multiple market nodes.	Companies operating biodiversity offset banks in different market nodes.
Governance structures	National governments and transnational organisations	Regulation. “Best-practice standards”.

Source: author.

The first dimension is a set of representations about biodiversity, the relevance of its loss and what actions might be taken to mitigate it. The role of these representations has been discussed in chapter 5, where it was argued that they constitute an important driver of performativity of economics. Shared representations such as the importance of ecosystem services, the concept that modern societies are guided by a *defective economic compass* that leads to biodiversity being undervalued and thus lost, and a belief that development should result in *no net loss of biodiversity* are indeed shared by all the agents contacted in

the context of this research, from the transnational to the local level. All informants acquiesced to the importance of creating mechanisms which balance out the perceived imbalance between the economy and the environment – even those who signalled reluctance to accept market mechanisms as the end-all of environmental governance and policy. No specific form of calculation of equivalence follows from the acceptance that *no net loss of biodiversity* should guide environmental governance; what it does entail is the fact that *some* form of equivalence – hence, trade-off – is possible, and potentially desirable in conservation and welfare terms. Whether or not the fact that these representations originate from transnational, quasi-academic and apparently a-political sources adds to their power of persuasion is an important question.

A second component which is circulating is knowledge. This knowledge can take many forms, but is especially important when it refers to ways of operating. Private companies and individuals, for example, can operate in several of the existing market nodes, obeying specific local rules and mechanisms of operation, as well as similar markets in different commodities. The agents operating across boundaries transport knowledge and a specific ways of doing things between the boundaries. This was exemplified by the director of an operator of species and wetlands banks, which works across different American States:

> One issue is a lot of the conservation banks in the US are more preservation focused – preservation and management – while a lot of the CWA, wetland stream banks are restoration focused – a lot of activities that would generate the restoration practice. I think some of the things that we're seeing crossing borders at this point is the concept of long-term endowment and stewardship. Really that concept came from conservation banking, and is being translated to the wetland banking world now: what do you do after you do the restoration? [*Interviewee I9*]

Based on their experience and knowledge acquired working across the different markets, these agents are successfully lobbying the regulator in one market to enforce the more stringent standards in place in the other market. While apparently counter-intuitive, this move is in the interests of conservation and wetland mitigation bankers: all demand for biodiversity offsets in American markets comes from regulatory requirement, but there are other mechanisms[95] which compete with conservation bankers to supply that demand. These competing mechanisms are older than offsetting, and tend to follow lower technical requirements for acceptance by the authorities. Higher requirements act to diminish the perceived cost advantage and "corner-cutting" of competitors which do not follow the biodiversity offsetting logic – a common theme, mentioned by all American respondents in

[95] The pre-market mechanisms – as discussed in section 5.4.

this research. This transposing of knowledge of ways of doing things from one market to the other and lobbying for “higher standards” - or “best practice” – is, therefore, a competitive strategy.

A third component circulated is governance structures, which can emanate from both transnational and national agents. In terms of transnational influences, one important example of attempts to circulate some basic components of a market for biodiversity offsets is the BBOP standards, which recommends principles and forms of organising the principles, technical aspects and best-practice of biodiversity offsetting (BBOP, 2012a). While not encompassing all the aspects of offsetting, it makes a clear attempt to produce one single set of standards for all possible situations where biodiversity offsetting can be a possibility:

> You don't have one for in-lieu fees, one for permitee-specific, one for banks; you have one standard. All three forms of mitigation have to apply the same standard, BBOP. There's not an outlet for just because you're an in-lieu fee. The BBOP standard is good in that regard, it is one standard that is equivalent and theoretically applies across the board (…) BBOP gets less to the procedural questions, how you set up your credit, as opposed to how do you quantify what you're doing. It does lead something to be desired on the procedural sides, which are important. How do you get your credit certified? What are the minimum standards of that certification? How long does that take? Do I have to have financial assurance? BBOP gets to what's the minimum technical NNL standard. You need both the technical and the procedural to really be included when you talk about a standard. [*Interviewee I9*]

This appetite for common procedures and “best practice” is shared by environmental NGOs. The research director of one such NGO explained how his organisation felt that, in the absence of a set of quality assurances, environmental results could potentially vary with location – a scenario which they would not endorse:

> Under the current way of thinking, the need for decentralisation and devolution of power down to the local level, I find it very hard to picture how a system would work effectively in terms of biodiversity outcomes. (…) I can see how it might work in terms of local decision-making, if you just let each local authority do its own thing; I don't think that would work for developers, and I think the market would become highly fragmented. There would be no clear market, to be absolutely honest, because all my experience with developers is, they don't just work in one small local authority area, or very few of them do, but work across multiple local authority areas, and it might be one region of the country, or the big

> developers clearly work across the whole country. The one thing they are most interested in is a level playing field. If they don't get that, you might find them gravitating towards the area where the offset system, such as it is, is weakest, because the standards are weakest. [*Interviewee I10*]

The idea that localised markets for biodiversity offsetting could provide perverse incentives to localise all damage in some locations and all compensation in other locations is an important challenge to the credibility of markets for biodiversity offsets, as seen before, and one which can lead to complaints that they serve only as a *license to trash*. To counter this, the interviewee goes on to specify the need for standards defined directly by central government, which helps understand how the transnational and national scales may have common interest in circulating some of these components. Guidance emanating from central governments means that local markets within the same country are covered by the same regulation, and can only diverge within the parameters which said regulation leaves to local adaptation. In all cases presented the regulatory agencies are currently developing these standards and negotiating what degree of freedom over biodiversity offsetting is reserved for local agents.

The situation is one where specific (local) sets of market *agencements* are being developed over common (national) sets of regulation and guidance. There is neither evidence of convergence of the markets alone, nor of development and divergence of each local market. Instead, at this point, there is both convergence at the national scale and divergence at the local scale. The two movements, of expansion and resistance of markets for biodiversity offsets, are not mutually exclusive. Furthermore, a degree of divergence does not necessarily result in an obstacle to market growth and expansion, at least when it happens over some previous degree of standardisation and convergence. Standards can create a shared set of understandings and practices, over which local, divergent, innovations can occur.

Markets for biodiversity offsets are, for now, capable of expanding and growing by increasing the number of nodes, without agreement over technical standards and convergence of practice. At present, questions such as public credibility and the capacity to demonstrably produce “no net loss of biodiversity” are a much more relevant obstacle to the expansion of markets for biodiversity offsets than the apparent incapacity of merging existing local markets. To maintain a structure where market nodes operate independently and commodities do not circulate is, in part, a mechanism to respond to objections posed to offsetting biodiversity impacts via the market. In order to claim its role as a mechanism for responsible governance of nature, the market is being deliberately restrained.

7.5. Reflections and conclusions

This Chapter has analysed the paradox faced by proponents and practitioners in markets for biodiversity offsets: how to grow and expand the reach of these markets. Despite the growth in the number of programmes in operation and land area under conservation easements[96], biodiversity offset markets remain limited in their role as mechanisms for the governance of nature. Part of the reason for this is related to the current limitations in terms of the maximum geographical distance between development and offset areas: in all the three cases studied, offsets are only acceptable if the offset area is within the same geopolitical area as the area affected. For this reason, the possibilities for expanding the number of suppliers, increase competition and perform the market more closely to the neoclassical model are limited. It also means that biodiversity offset markets are limited in competing with other mechanisms for biodiversity governance.

7.5.1. Expansion and resistance

In the neoclassical economics logic, maximum welfare would be achieved by allowing offset buyers to acquire biodiversity offsets from any seller in the open market, regardless of the distance between the area affected and the offset area: as long as equivalence between the two could be demonstrated, it would be desirable that more sellers were allowed to offer biodiversity offsets, as competition would lower the cost of offsetting. However, this ignores that the commodity status of a biodiversity offset is geography-dependent. There are both biological and political reasons to oppose the commodification and exchange of biodiversity across wide geographical areas.

The biological and ecological reasons to oppose the geographical expansion of biodiversity offset markets are related to the problem of assuring qualitative equivalence – the problem of "making thing the same" (D. MacKenzie, 2009a), which was analysed in Chapter 6. That analysis discussed how markets *agencements* are being developed in all cases discussed, attempting to assure equivalence when and where different types of biodiversities are exchanged. The role of said *agencements* is to allow differences in quality to serve as weights in the process of reducing biodiversity in a location into a single number. But it would seem that these mechanisms cannot entirely assure equivalence of qualitatively different biodiversities across space. This happens because the geographic location of biodiversity appears to be a key component of the qualitative definition of that biodiversity. As a result, there is a limit to the action commodification technologies involved in the expansion of the market; as remarked by Kopytoff (1986), markets tend to expand as far as the commodification technology will comfortably support it.

[96] As detailed in sub-section 3.3.1.

Beyond the limits of the commodification technology, the opposition to the expansion of markets for biodiversity offsets is felt in the political and cultural arena. A battle of representations is ongoing, whereby different groups of agents attempt to define in the public's mind what biodiversity offsets are. In opposition to the proponents of biodiversity offsets' preferred core value of biodiversity offsets – *no net loss of biodiversity* – opponents are building a representation of offsets as a *license to trash*, a mechanism that would allow developers to bypass environmental regulations for a price. As this idea entails clear distributional problems, it helps build an opposition against the development of these markets, especially in the cases where compensation is perceived to take place away from the impact area. Culturally, a biodiversity offset is only acceptable as a commodity within a limited area. The commodity status is culturally dependent, as demonstrated by economic anthropologists (Appadurai, 1986)

7.5.2. The emerging structure of markets for biodiversity offsets

The process of commodification, as discussed above, "...lies at the complex intersection of temporal, cultural and social factors" (Appadurai, 1986, p. 15). The commodity status of a *thing* – such as a biodiversity offset – is only assured at the moment of exchange. At any other moment a process of decommodification can occur in which, for whatever reason – temporal, social and cultural – the commodity is no longer deemed appropriate for exchange, acceptable as an object of exchange. In the case of biodiversity offsets, one of the most important drivers of this decommodification process is distance – geographical and geopolitical. It is not acceptable to compensate damages to biodiversity in a location by acquiring an offset from a far-away seller, and it is this that leads to opposition to the expansion of the markets for biodiversity offsets. The result is the establishment of mutually exclusive spheres of exchange (Appadurai, 1986; Zelizer, 1998): cultural, social and – in the case of biodiversity offsets, legal and representational – barriers are erected around each market, outside of which a biodiversity offset is decommodified. Biodiversity offsets are only acceptable as commodities within those spheres of exchange, and cannot circulate or be exchanged outside of them.

The result is a very specific structure of markets for biodiversity offsets. The difference between biodiversity offsets programme and biodiversity offsets market is a key distinction: within the same global framework for offsetting – a national biodiversity offsets programme – several markets can emerge and operate. The distinction between programme and markets means that the overall structure is of a series of market nodes in each programme. Nodal structures have been identified in economic analysis, focusing on the problems associated with this form of economic organisation: Garella (2002) discusses how a monopolist can

develop by locating away from a market node for durable goods and exploit the existence of transaction costs to have impact on prices, thus affecting the economic welfare obtained from the market. Concurrent results are presented by Babaioff *et al.* (2009). These authors see the individual market nodes as parts of a network. However, the Actor-Network perspective which this thesis uses in its theoretical framework, proposes that markets are networks themselves, where agents and devices come together and perform operations of calculation and exchange (Callon, 1999). This does not preclude the study of the topology of a network composed by market nodes, however, as demonstrated by Bush in his study of the changes to social and spatial fish trading networks in Laos (Bush, 2004). As remarked by Murdoch, the conceptions of space – and distance – are formed within networks; in fact, networks and space are co-constructed:

> …networks are built out of heterogeneous materials in accordance with the constant need to make actions durable through time and mobile across space. Networks draw together materials, which have their own space-times, into new configurations which, to some extent, reflect the types of relations established in the network (that is, networks and spaces are generated together). (Murdoch, 1998, p. 361)

Through political and representational means, as the market for biodiversity offsets is created, so is a space for it negotiated between the various stakeholder groups: those who see biodiversity as interchangeable, a source of economic growth, and whose designs for it are based on a logic of no *net loss of biodiversity*; and those who see biodiversity as local, not subject to negotiation, and the target of attempts to obtain a *license to trash*. As they come together to construct the market, these agents also construct a space – the "local" space – wherein it is acceptable to offset. The delimitation of this co-constructed space corresponds to the economic spheres within which the commodity status of a biodiversity offset holds. The nodal structure which characterises these markets' operation at the current state of evolution is the result of a process of emergence and evolution, not design and performativity. It is the result of dialectics playing out between market expansion and resistance to it.

7.5.3. The role of technology in instituting economic processes

Two competing movements can be observed in the context of markets for biodiversity offsets. The first is the attempt to expand the market, increasing the area within which a biodiversity offset is acceptable as a commodity. This movement is in part sponsored by national governments and some transnational organisations. The counter-movement is the resistance to the expansion of marketisation, and an attempt to maintain local control of

biodiversity. So far, the result of this counter-movement has been variety within the same programmes, and the emergence of a nodal structure. However, the situation remains in flux, and there are continuing attempts to expand the acceptability of the commodity, and evidence is present that at least some components of the local markets circulate. Neither of the two movements – expansion and resistance – determines the outcome of this development; what we observe is a set of dialectical interactions between the two movements, a dialectical double movement (Randles & Ramlogan, 2007; Randles, 2004), by which groups of actors negotiate the borders of the market as a form of biodiversity governance.

It is worth noting that the resistance to market expansion discussed does not mean that convergence of the market *agencements* discussed does not take place. Governance agents at transnational and the nation scale – such as the BBOP and national governments – are continuously taking steps to standardise the functioning and the market *agencements* involved of biodiversity offsetting. These measures are designed to increase the coverage of the programmes. However, the evidence points to convergence of *agencements* being followed by a process of divergence, and not resulting in the extension of the exchange areas; trading in biodiversity offsets remains circumscribed. The fact that the commodity loses its exchange properties beyond the boundaries of the area where damage takes place points at a situation of incomplete or imperfect framing: there are bio-geo-chemical, ecological, political and cultural components of biodiversity which limit its commodification. The market *agencements* which commodify biodiversity also reflect those limitations: they are influenced by the specific characteristics of the good commoditised. The emerging nodal structure of markets for biodiversity offsets is as much a product of local political resistance to marketisation as of the perceived negative impacts that unhindered market expansion would have over nature.

8. Conclusions

8.1. Introduction

This thesis has explored the emergence, development and expansion of markets for biodiversity offsets. This was done based on three case studies of biodiversity offsetting programmes: Species Banking (in the United States); Impact Mitigation Regulations (in Germany); and Biodiversity Offsets (in England). The roles of normative representations of biodiversity, regulation, historical backgrounds and socio-technical infrastructures in these processes (of market emergence, development and expansion) were discussed. This chapter aims to summarise the findings of the research, discussing the empirical, theoretical and methodological contributions of this thesis, as well as recognising potential limitations and suggesting future avenues of research.

Section 8.2 summarises the empirical contributions, in terms of the most important dimensions identified in the case studies. Following from this, section 8.3 discusses the theoretical contributions of the thesis. The framework for research, which was first presented in section 2.5, is reappraised in the light of its usefulness for researching changes to economic processes, and more general comments are provided in terms of the potential for complementarity between the neo-Polanyian Instituted Economic Process perspective and Science and Technology Studies-derived scholarship – especially with regards to the concepts of performativity of economics and market devices. This is followed by section 8.4, which offers considerations in terms of methodological issues, and by section 8.5, which discusses the limitations of the research and points to future research directions. Section 8.6 considers possible future directions of markets for biodiversity offsets.

8.2. Empirical contributions

This thesis sought to examine the emergence, development and expansion of markets for biodiversity offsets. In order to do so, three case studies were selected, each representing one existing form of market for biodiversity offsets (Madsen et al., 2010): Species Banking (in the United States), a Mitigation Banking programme; Impact Mitigation Regulations (in Germany), a Compensation programme; and Biodiversity Offsets (in England), a One-off Offsets programme. It was decided early on in the research to analyse only western countries. By no means are these countries considered “equal” in this thesis; their different institutional characteristics are well discussed elsewhere in the literature. However, it was felt that these countries would be sufficiently similar in terms of important institutional variables to diminish the presence of confounding variables. Some of those common variables include such as the role of states as the main agent in terms of biodiversity governance before the market, and the primacy of the rule of law.

The thesis identified, within the context of the emergence of markets for biodiversity offsets, a set of core groups of agents involved, the connections between them, the representations they share, and their objectives for the market. These groups of agents were not circumscribed to a single programme or geopolitical scale; as demonstrated, they would be simultaneously operating in different programmes, influencing the outcomes of the emergence of markets from different scales (transnationally as well as nationally and locally), and at times accumulated different roles within the same market.

Based on this, four research questions were devised, and answered in the context of the empirical chapters. These research questions were:

1. What is the background to the emergence of markets for biodiversity offsetting?
2. How are the exchanges being organised?
3. What are the mechanisms by which biodiversity is being brought to the market?
4. What are the limits to expansion of markets for biodiversity offsets?

In all three cases, markets for biodiversity offsets have emerged as a response to the need to balance out development and economic growth against biodiversity conservation. As a result of policies[97] designed to protect biodiversity, the capacity of economic agents to develop land has been diminished, to the point that it has a detrimental impact on economic activity, and consequently on economic growth. In all three cases, the process of emergence of markets was a part to changes to the landscape of environmental governance. The actions of increasingly assertive and powerful groups of agents (such as private companies, environmental NGOs, local governments and citizen groups, among others), paired to the changing role of governments, resulted in increasingly distributed biodiversity governance arrangements, where larger numbers of agents demand a say over decisions in terms of the choices made between land development (and the potential for economic growth) and biodiversity conservation. It is in the nexus of these changes that biodiversity offset markets emerge.

To support their operation, these markets required complex socio-technical infrastructures – much more complex than what was required from previous biodiversity governance arrangements. These socio-technical infrastructures involved assemblages of mechanisms for measuring and commodifying biodiversity and calculative agents. It fell to this socio-technical infrastructure to demonstrate that there was equivalence between biodiversity losses in one location and biodiversity gains in another – in other words, that the market

[97] These policies frequently consisted of conservation regulations, including the Endangered Species Act (United States), the Impact Mitigation Regulations (Germany) and planning regulations, such as Section 106 (United Kingdom)

delivered *no net loss of biodiversity*. This equivalence was two-fold: quantitative equivalence, in which the numbers of similar components of biodiversity were equal in both locations; and qualitative equivalence, in which different aspects of biodiversity in different locations were judged to be directly exchangeable. While quantitative equivalence is comparatively easy to achieve – through counting and measuring of either stocks of biodiversity or flows of ecosystem services – assuring qualitative equivalence was often a strongly contested process. Each case studied was different in its approach to qualitative equivalence. The Species Banking programme simplified the problem of qualitative equivalence by requiring like-for-like trade-offs, while the IMR and Biodiversity Offsets achieved qualitative equivalence by calculating single biodiversity scores.

This thesis demonstrated the existence of significant tensions at the core of the market *agencements*: human agents attempted to employ scientific logic and calculations individually to each case and location, while market devices (measurement standards and technologies) were designed to be applied in the same fashion to all situations. Market agents – buyers, sellers, intermediaries – had a distinctive preference for the latter approach, which was more predictable from their perspective. This resulted in attempts to reduce the importance of humans within the *agencements*, through regulation and approval of standardised forms of measurement and calculation. Furthermore, even as this tension continued to develop, other technological features were being developed and implemented which strengthened the logic of technical mechanisms over that of agents: databases, applications and exchange platforms constituted some of the steps in the development of a socio-technical infrastructure which would allow markets for biodiversity offsets to operate more efficiently and widely.

The development of a socio-technical market infrastructure created the potential for a wider use of biodiversity offsets, and for expansion of the reach of these markets, trading damages and improvements to biodiversity from areas further apart. This resulted in a contested situation, with considerable resistance to such expansion from various sectors. This resistance was based on various objections to increasing the role of markets in the governance of biodiversity. The two most important types of resistance were based on both ecological/biological concerns and on political issues. Not only were the benefits of biodiversity usually enjoyed locally – meaning that delocalisation of biodiversity would result in local losses of utility –, the preference of agents involved in biodiversity governance were for control and decision-making to remain at local level. The historical and geographical background of biodiversity governance mechanisms cannot be ignored when designing and rolling out new forms of governance. One of the consequences of these local preferences was the proliferation of varieties of *market agencements*: in all three case studies presented

the data demonstrated that, within the same biodiversity offsetting programme, each localised biodiversity offsets market used its own specific forms of calculation. This kept the commodity value of biodiversity circumscribed to geographical and geopolitical boundaries, and stopped trading with the other markets. The resulting market structures were of nodes within the same general market, isolated between each other. Unlike what happens with markets for carbon offsets, where a tonne of carbon in one location is the same as a tonne of carbon anywhere else (Broderick, 2011), biodiversity in one location was qualitatively different from any other biodiversity elsewhere. However, regardless of there not being exchange market nodes within the same programme, some components of the market infrastructure circulated between them. Some of these components included representations, knowledge and ways of doing things, which were shared and cross-pollinated between markets for biodiversity offsets. Communities of practice (Delemarle & Larédo, 2006) – such as the ones which the researcher observed in this thesis – were emerging to circulate these components as far and wide as possible. Overall all three cases presented remains in flux; these three markets were, for now, far from stable.

A degree of backlash against governance of biodiversity by the market was also in evidence, especially in the light of accusations that biodiversity offsets were a form of green-washing at best, and a *license to trash* at worst. Environmental NGOs in particular, while remaining involved in discussions about these issues, were opposed to the idea of offsetting biodiversity, especially where it involved a component of marketisation. But while the prospects for biodiversity offset markets remained difficult, the need to manage the balance between conservation and development in such a way that allowed economic growth, and to produce efficient mechanisms that achieve such balance, remained unresolved. Biodiversity offsets may not have the same potential for worldwide expansion as carbon offsets, for example, but the claim to achieve demonstrable *no net loss of biodiversity* was a powerful one, and looked poised to guide the developments in this area in the foreseeable future.

8.3. Theoretical contributions

Beyond the empirical considerations, this thesis makes a number of theoretical contributions. These can be divided into two components. The first is the understanding on the processes involved in the emergence, development and expansion of markets for biodiversity offsets. This refers a number of issues, including: the importance of shared representations about the object of governance; the continued importance of central states in the governance of biodiversity, even as the number of stakeholders involved multiplies and governance becomes distributed; the difficulties and tensions involved in developing a socio-technical infrastructure for markets, which extends the current understanding of market *agencements*;

and the geographical dependence which the commodity (the biodiversity offset) maintains its commodity status, leading to a peculiar nodal structure of the markets. The second component of the theoretical contribution of this thesis is the development of a framework for the analysis of processes of market emergence more generally. This framework is especially relevant for the research of cases which involve the creation of markets where none existed, such as what happens with environmental goods and services, or other types of public goods and externalities. This framework combines a wide, political-economy and institutional dimension of analysis of the economy (the Polanyian-derived Instituted Economic Process approach), with an analysis that sees the economy, and markets in particular, as embedded in the economic sciences. It focuses attention on "…the materiality of markets: their physicality, corporeality, technicality (…) physical artefacts and technologies" (D. MacKenzie, 2009b, p. 2), while acknowledging that these exist in the context of governance arrangements. These two literatures focus on different levels of the same economic objects, and their analyses are not always necessarily complementary. These issues are discussed below.

This thesis has characterised the process of emergence of markets for biodiversity offsets as a form of performativity of economics. It illustrates the power and significance of performativity of economics, supporting the assertions made by Callon that markets are embedded in economics (Callon, 1998b). Markets for biodiversity offsets are constructed by groups of actors with different objectives and normative positions, collectively involved in designing and deploying calculative devices.

This performativity depends on two factors. First is the increasingly distributed nature of nature governance. The increasing number of stakeholders claiming an interest on the topic of biodiversity conservation and the right to influence decisions in this area has led to a situation in which governance is increasingly heterarchical (Jessop, 1998, 1999, 2002). At the same time, states maintain an important role in setting the "rules of the game". Consequently, the role of both central and local governments in this performing of economics remains very important, other actors notwithstanding. It is governments which set about creating and implementing the economic experiments which become biodiversity offset markets. The state is an enabler of marketisation, for example through the creation of quasi-markets (Le Grand, 1991), implementation of contract-based provision of public services (Deakin & Kieron Walsh, 1996), and the stimulation of markets for green innovation (Jänicke & Jacob, 2004). The state is a driver of marketisation (Castree, 2008b), often in a logic of deregulation and reregulation: abdicating of direct control, and regulating to promote markets. The complex relationship between biodiversity offsetting markets and regulation, which this thesis has demonstrated, follows these lines. Biodiversity may be perceived as a

fundamentally local matter, but it is one for which western governments at least are often held to account for by their constituencies, even locally. However, governance by local organisation and institutions is subject to the same problems and shortcomings and governance by central governments (Nugent, 1993). This means that governments are required to act, and to do so in ways which allow the preferences of society at large to be taken into account.

The second factor guiding the search for different governance mechanisms for biodiversity is the need for effective and economically efficient ways of doing this. Economic sciences present a series of models and internally normative representations of the relationship between biodiversity and the economy, which serve as a guide for performativity. Chief among these representations are the idea of ecosystem services, which makes the explicit connection between biodiversity conservation and human utility; and the conceptualisation that biodiversity loss can be ultimately attributed the deficiencies in the economic system. The image of the *defective economic compass* (TEEB, 2008, 2010), as a representation the causes of biodiversity loss, is a powerful one: it does not prescribe actions, unlike previous widespread representations, such as the *tragedy of the commons*. By limiting its reach to the issue of valuation of nature in the context of the economic system, the idea of the *defective economic compass* avoids the schisms between agents who saw the *tragedy of the commons* as a call for private initiative, and those who saw it as a call for more government intervention to protect the commons. In contrast to these debates, the idea that the economic system does a poor job of considering the importance of nature is almost unanimous. As a result, it "lowers the temperature" on the hot topic of biodiversity governance (Callon, 2009).

These two aspects – the increasingly distributed governance of biodiversity and the shared normative representations of the causes and consequences of biodiversity loss – are fundamental for political action. Markets for biodiversity offsets are the result of political action, at least in the western nations which constitute. Through economic experiments central governments perform economics – especially environmental economics. The market is social and politically constructed: "buyers" and "sellers" are created through regulation; commodities depend of specifically designed market infrastructures; and a pricing often involves managing of supply by intermediaries.

The analysis presented in this thesis goes beyond the typical remit of STS and SSF, by appreciating that the economic experiments which this example of performativity of economics involves have institutional backgrounds. The social construction of markets for biodiversity offsets does not occur against a vacuum; states have been providing for

biodiversity conservation, using other methods and forms of governance, for a long time. The process of instituting (M. Harvey, 2007) a market involves operating changes to the economic processes instituted, and is therefore historically and geographically contingent. Specifically, it involves instituting market-type exchanges in situations where regulation, for example, was the norm. Government agencies[98] instituted processes to balance out conservation of biodiversity and development before the market emerged. In each case (and, in the context of each case, in different locales) the experiment of performativity comes into contact with historical, geographical and political specificities. The result is variety of forms of biodiversity offsetting, as described in chapter 7.

The existing variety of forms of biodiversity offset markets is difficult to explain from the perspective of performativity of economics alone. Performativity of economics should result in degree of uniformity of forms of biodiversity offsetting. This happens because the agents engaged in the social construction of the market attempt to perform the perfectly competitive market of economic theory (Garcia-Perpet, 2007). This is not the case in the process of emergence of markets for biodiversity offsets. Instead, the experiments in performativity engage dialectically with the existing historical and geographically instituted biodiversity governance mechanisms. These dialectics are the result of some of the tensions described in this thesis: between localisation and expansion; between change and stasis; and between market and non-market forms of governance. Likewise, there are dialectics operating within the market *agencements* being developed, in terms of the agents' and the devices' role in determining the value of goods and services exchanged. The result of this is a different iteration of the market in each case, a different variety of biodiversity offsetting. The variety of forms of organising biodiversity offsetting is the result of these dialectic double movements (Randles & Ramlogan, 2007; Randles, 2004).

The Polanyian-inspired Instituted Economic Process approach is a key complement to the STS-derived idea of performativity of economics. Between the two perspectives, it is possible to understand how the markets emerge, as well as the mechanisms by which they diverge. From a common generative mechanism, it is possible to observe variety of forms of market organisation. The framework for research, first presented in section 2.5, accounts simultaneously for the role of agency and technology, but also for the importance of history and geography in the processes of emergence, development and expansion of markets for biodiversity offsets.

[98] Be it federal agencies, as seen in the United States; state governments, as seen in Germany; or local governments, as in England.

These results can be extended beyond the realm of the emergence of markets for biodiversity offsets. The change to heterarchical governance (Jessop, 1990, 1998) processes for environmental and other public goods has been identified as a growing tendency in political economy, related to a growing preference for governance over government (Kazancigil, 1998). Likewise, the performativity aspect of economics has been demonstrated to extend to other problems of economic governance (Callon, 2007; D. MacKenzie et al., 2007; D. MacKenzie, 2009b; Muniesa & Callon, 2007). However, neither of these observations should be taken to suggest that the state is loses its importance where markets emerge. Central and local governments play a central role in the process of market emergence. This role includes the production and enforcement of regulation which opens the possibility of economic experimentation, performativity of economics and the emergence of these markets. This continued role of governments should not come as a surprise: even where they allow for biodiversity to be measured, packaged into offset credits, and exchanged freely between agents, governments remain the ultimate the guarantors of biodiversity, and are held responsible for the results of conservation by their constituencies. This explains in part why it is that alternative forms of biodiversity governance are not set aside to pave the way for marketisation: they serve as a guarantor of good results in case the economic experiments fail. It also means that even after the markets have been in operation for a long time, central governments remain responsible for both the institutional soundness of the market, and the socio-technical system which serves as the market infrastructure. Evolution of the forms of exchange depends in part on what governments declare is feasible or not: for example, there is no market for derivatives of biodiversity offsets anywhere, despite positive comments about the advantages these would make in terms of broadening the market and increasing liquidity, because biodiversity offset derivatives are not accepted by regulators.

The central governments and their agencies also play a central role in developing and assuring the technical devices on which the markets are based. As discussed in this thesis, the problem of demonstrating *no net loss of biodiversity* from development requires that equivalence between biodiversity losses and offsets can be demonstrated. The difficulty in measuring biodiversity, discussed elsewhere on this thesis, means that the development of technical devices to produce the commodity traded is a contested area. This is another of the hot situations mentioned by Callon, in which the development of a socio-technical system of measurement and calculation is a contested process (Callon, 1998a). Consequently, governments in all the three cases moved to recommend and assure measurement and commodification mechanisms. By participating in the creation of market *agencements*, governments maintain an overseeing role in market functioning.

It is surprising that the analysis demonstrated governments' reach extend so much, to the point that it could be mistaken for micromanaging the infrastructure of the market. However, there is good reason for this. This thesis demonstrated[99] that this technical infrastructure is inherently unstable. The calculation of equivalence requires not only market devices, but market *agencements*: composite calculative agencies, which include both technical devices *and* the work of human agents. Ecologists and biologists operate the technical devices, and the ways in which equivalence is produced depends in part on human agency – choice, preference, interpretation. This creates uncertainty for the remaining agents operating in the market, and requires the active intervention of governments to assure that the market can function predictably. The governance of the market needs to extend to the level of the production of the commodity, in order to ensure the stability of the market *agencements*.

These dynamics are partly replayed at the local scale, resulting in the nodal structure of markets for biodiversity offsets. The biodiversity offset markets analysed in this research all present the same characteristic structure, in which a country-wide set of regulations – a programme – results in local-scale markets, isolated from each other in exchange terms. No commodities are traded between the different nodes, since the commodity status of the biodiversity offset is only maintained locally. Biodiversity cannot be dissociated from the habitat it occupies, and to try to do so results in resistance by agents at local level. But the difficulties in expanding the market go beyond the biological or political; they have a technological dimension as well. Again, biodiversity offsets are not instituted locally against a blank canvas; in all three cases analysed there are always pre-market governance mechanisms, instituted processes which pre-date the market and function according to specific logics. These governance arrangements are dependent of local agents, practices and cultures, and they are reflected in ways of doing things: forms of measuring and quantifying biodiversity and ecosystem services, technologies and principles of impacts assessment, and instituted ways of deciding what an appropriate compensation for damages to biodiversity is in each case. The attempts to implement and institute a certain set of market devices locally result in a new set of dialectic double movements, in which guidance from regulators interacts and is influenced by the existing pre-market forms of calculation. The result is, again, variety of forms of exchange – within the same programme. These results, the framework suggests, can be extended to other markets in which strong local contingencies impact processes of market emergence and performativity.

[99] In Chapter 6.

8.4. Methodological considerations

This thesis addressed important research lacunae in terms of the understanding of the process of emergence of biodiversity offsets markets. It provided a detailed understanding of the importance that historical and geographical backgrounds have in the institution of these mechanisms for nature governance, and argued that these institutional differences were behind the observed variety of markets for biodiversity offsets. It also detailed the role of technology in the process of instituting these forms of exchange, especially the way in which technology both influenced and was influenced by the institutional setting in which it was developed. This was achieved through the collection and analysis of qualitative data – secondary and primary, in the form of interviews and ethnographic observation in relevant forums of agents. The selection of case study methodologies, informed by the decision to engage in an intensive research approach (Sayer, 2010), provided a wealth of data which allowed answering the research questions posed. This resulting data was rich, textured and allowed for an understanding of the process dimension behind the emergence of markets for biodiversity offsets. These markets emerged as social, economic and institutional innovations. However, while this thesis made a significant contribution to the academic literature on the issue of market emergence for biodiversity governance, a number of limitations remained, related to the methodological approach employed.

The first issue related to the sample of informants involved in this research. This study analysed the creation of market infrastructures, not actual market activity. While the agents interviewed and observed were specialists in the area, possessing relevant insights about the processes involved, only one was a seller of biodiversity offsets at the time of the interview, and another had been a seller in the past. Likewise, none of informants were actual buyers, although several were classified by the biodiversity offsetting industry as potential buyers. As a result, at no point in the data collection was an actual transaction between buyer and seller examined; all knowledge of what took place in the market came to the author via surrogates, mostly market intermediaries. While the importance of the role played by market intermediaries, as well as the impact of their actions, is widely accepted as a relevant field of research (Hodson & Marvin, 2008; Howells, 2006; Medd & Marvin, 2006, 2007; Randles & Mander, 2010; van Lente, Hekkert, Smits, & van Waveren, 2003), the actual moment which characterises a market in economic theory – the bargaining between buyer and seller – was not observed in this thesis. This was because the research questions were guided this research were interested in background, organisation and process of the exchange mechanisms, not the actual exchange itself.

A second issue, again related to the sample involved, were the questions this thesis raised about the potential of biodiversity offsetting to demonstrate to final consumers that the companies involved which offset their impacts over biodiversity are involved in a greener, more responsible capitalism. To transmit to consumers the image that a company was acting responsibly required that said company operated in accordance with a normative set of directions about what it was to be responsible to consumers. The research did not identify whether or not this is the case; there was no sense of what consumers considered responsible – apart from the idea that consumers wanted only to be reassured that no unnecessary damage was meted upon nature[100]. This was significantly different from the principle of *no net loss of biodiversity*, which proponents of the offsetting mechanism defend should guide the balance between development and conservation. This research did not identify consumers' normative representations on this topic – again, this was not contemplated by the research questions, and probably could not be researched with the methodology employed here.

A third issue concerned the process of development and stabilisation of standards for the production of equivalence between biodiversity losses and gains. These technical devices are currently being developed, within communities of practice which include market practitioners, government agencies, non-governmental organisations, consultancies and academics. Biodiversity standards are poised to constitute fundamental market devices going forward; judging by the actions of actors involved, attempts will be made to solve the tension at the heart of *agencements* by promoting the diffusion of biodiversity standards. However, these communities of practice do not always succeed in producing crystallisation of standards (Delemarle & Larédo, 2006). This thesis observed some of the attempts to design these biodiversity standards, but did not follow the processes involved at length.

A fourth concern related to the fact that the case studies all took place in western countries, with broadly similar institutional structures. Biodiversity offset markets are also being experimented within countries with different institutional backgrounds[101]. It is very possible that the processes involved in the instituting of markets for biodiversity offsets in these countries are different from what was observed here. For example, the BBOP pilots that took place in these countries were related mainly to extractive industries (Anglo Platinum, 2009; Berner, Dickinson, & Andrianarimisa, 2009), and were specifically designed to obtain a "social license to operate" (ten Kate et al., 2004) from local stakeholders, not obtain planning permission. A study of the market structures and the normative logics presiding over the

[100] This perception was discussed in chapter 5.
[101] See section 4.3 for details of worldwide prevalence of biodiversity offsetting programmes.

emergence of biodiversity offset markets in developing countries would complement the analysis produced in this thesis.

Finally, questions remained in terms of the limitations of the research process. Qualitative research is, by nature, limited by the fact that it is subjective, and as such is subject to greater potential bias than quantitative research. However, the extensive use of triangulation of data in this thesis – through the use of secondary data and seeking confirmation from other interviews and observations – contributed to ensure that opinions expressed were representative, thus reducing the potential bias.

8.5. Future research directions

This research has produced a relevant contribution to the academic literature on biodiversity offsets, and further afield on the governance of biodiversity and ecosystem services. Furthermore, the theoretical contribution in terms of bringing together two distinctive field of literature – Polanyian-inspired political economy and STS – responds to an increased push to develop perspectives which allow the critical analysis of economic processes, and provide frameworks for the analysis of both the processes dimension and the practices of bringing public goods to the fold of the market. Nevertheless, this research presents new questions indicating possible future directions of research. These directions are explored in this section.

A first direction concerns the actual exchange process. As was mentioned in the previous section, at no point did this research follow the actual exchange, the buying and selling of biodiversity offsets. While much could be inferred from intermediaries and other market agents, the research would benefit from a closer examination of the market activity. Based around one case study alone – a biodiversity offsets programme – a research agenda focusing on the actual exchange would employ ethnographic methodologies, as have been used successfully in the context of other markets (Abolafia, 1998; Geertz, 1978; D. MacKenzie, 2009b). This research would observe in detail the processes involved, and if (and how) the *praxis* in the market diverges from what is predicted at theoretical and policy level. Furthermore, such a research agenda would identify the different market nodes within said programme, and repeat the ethnographic approach over several subsets within the case. This would allow the possibility of comparing and contrasting local implementations of the policies, and demonstrate exactly how the dialectic double movements (Randles & Ramlogan, 2007; Randles, 2004) theorised here result in local adaptations.

A second direction of research would involve exploring the normative dimensions of end consumers, and what role do they attribute to the companies they buy from in this field. The

performativity of economics which this research identified as being at the root of the emergence of markets for biodiversity offsets, and the ongoing attempts to civilise markets, assumes some acceptance and legitimation by consumers if the markets are to expand. In other words, a company acquiring biodiversity offsets would expect a positive impact in terms of reputation. Public legitimation of biodiversity offsetting would contribute to legitimate the market, and increase the possibility that consumer-facing companies might opt to offset their biodiversity impacts voluntarily. Companies would be tempted to acquire offsets if their consumers recognised and shared the normative vision which presides to biodiversity offsetting: *no net loss of biodiversity*. Further, considering that the effect of distance on consumers' economic valuations of biodiversity has been demonstrated in the economic literature[102] (Bateman et al., 2006; Campbell, Hutchinson, & Scarpa, 2009; Campbell, Scarpa, & Hutchinson, 2008; Concu, 2006; Hanley et al., 2003), the issue of the distance between the area where the impact and the offset take place and the consumer's location is a relevant issue. Research on consumers' normative preferences on biodiversity offsetting should account for this, taking steps to understand if consumers understand that the impacts of the products they acquire can extend over long supply chains. It should also assess if the consumers change their preferences when the impacts are perceived to be distant. A survey methodology would interrogate end consumers as to their normative values with regards to *no net loss of biodiversity*, and the desirability of a market for biodiversity offsetting. These would then be compared to existing representations prevalent among proponents of biodiversity offsetting and policy makers, such as those shown in this thesis.

A third extension to this research concerns the development of biodiversity standards, which are later translated into market devices. There has been a proliferation of biodiversity standards, often following different logics and not producing comparable results (UNEP-WCMC, 2011). As these standards diffuse and are adopted at different locations, they can become ingrained in the functioning of markets for biodiversity offsets and impact the emerging market structure. At the same time, there are projects to converge the standards, including the BBOP's attempt, and United Nations Environmental Programme – World Conservation Monitoring Programme on the harmonisation of national reporting (UNEP-WCMC, 2013a), and the Business, Biodiversity and Ecosystem Services programme (UNEP-WCMC, 2013b). As activity is undertaken to converge existing biodiversity standards, there is the opportunity for research to analyse the processes of knowledge creation involved in the harmonisation and the diffusion of these instruments. Ethnographic

[102] While not a topic of analysis of this thesis, economic valuation of non-market goods – particularly where stated preference methods are employed – is an expression of performativity of economics: it constitutes a situation in which a group of agents are directly asked to consider what their actions would be in case a market did exist.

methods and semi-structured interviews would be used to illuminate the prospects and problems of diffusing standards, the experiences of doing so, what kind of local adaptations happen because of localised concerns, and which components circulate across different locations.

Finally, this thesis has hinted at the possibility that the emergence of markets for biodiversity offsets in locations with different institutional backgrounds to the cases presented here – such as developing nations – could have different characteristics. While on the one hand the impacts of advocates and intermediaries operating at the transnational level would still be felt, how this impact translates into the instituting of markets for biodiversity offsets in the context of different types of states and different local arrangements remains to be seen. While there is much research in terms of the consequences of the appropriation of land for conservation and the creation of national parks in developing countries (Brockington, Duffy, & Igoe, 2008; Brockington & Duffy, 2010; Igoe & Brockington, 2007; Igoe, 2010; McAfee, 1999), the processes of emergence and development of these markets present interesting research avenues. In particular, the recent developments in the South African biodiversity offsets project, and the experiment taking place in Tanzania, which seems to be related in part to a BBOP pilot project, could present interesting research avenues.

8.6. Post-script: between marketisation and protest, performativity of economics

In September 2013 the Department for Environment, Food and Rural Affairs (DEFRA) launched a consultation process, with a view to produce legislation requiring the offsetting of impacts to biodiversity in the United Kingdom (DEFRA, 2013). This consultation follows the recommendations of the Environmental Markets Task Force (EMTF), but is surprising in the sense that it did not allow the different pilot biodiversity schemes in operation in England to report, at least formally. Endorsing the creation of statutory legislation, the minister for the environment Owen Paterson, MP suggested that:

> Some planning decisions take too long and the outcome can be too uncertain, which can hinder development. At the same time biodiversity impacts are not always adequately taken into account, or mitigated or compensated for in ways that deliver enduring environmental benefit.
>
> Biodiversity offsetting has the potential to help the planning system deliver more for the environment and the economy. (Paterson, 2013)

The consultation process was not met with universal approval. In fact, most environmental NGOs publicly opposed the idea of the creation of a market for biodiversity offsets. At the

time of writing, a market for biodiversity offsets was being openly presented in the press as a *license to trash* (Birdwatch, 2013; Carrington, 2013; McGrath, 2013), a flawed idea, and ripe for abuse (Heath, 2013). As the British government overcomes its initial reluctance to legislate a requirement for biodiversity offsetting, the resistance from several groups of society to the creation of a market for offsets looks set to continue. Market proponents seem poised to continue to have to contend with the idea that what they are asking for is a *license to trash.*

Whether or not resistance will be vanquished and legislation approved is uncertain. However, during the data collection for this thesis not one respondent questioned the development of market *agencements* to measure and quantify biodiversity; likewise, the idea of *no net loss of biodiversity* seemed to be universally accepted. The basic tenets of performativity of economics applied to biodiversity seem, therefore, ingrained in the majority of actors. What was often decried was the idea of allowing decisions about conservation or destruction to be taken by the market and, worse, by actors distant to the place where impacts occur.

Much of the discussion and resistance taking place concerns issues of governance, not of measurement. Based on conversations with stakeholders, it seems entirely plausible that, should there not be statutory regulation supporting a future market for biodiversity offsets in Britain, the general principles of said market would, nevertheless, be active in practice. Section 206's requirements to compensate could be used more frequently to force developers to offset their impacts, and *no net loss of biodiversity* could become the common denominator of these situations. The circulation of market components, including knowledge and actors, would only add to this tendency. The result would be that the technical market infrastructure currently under development for a potential market for biodiversity offsets would remain active in practice. Even in the absence of statutory regulation, a market in all but name could eventually be performed, where economic agents would actively calculate and exchange to maximise their utility, based on a set of market *agencements*. There is nothing inevitable about the emergence of markets, but the dynamics associated with the performativity of economics seems poised to have a strong impact in future governance arrangements.

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Annex A: Sample Interview Guide

Career and position; experience and involvement in biodiversity offsets

1. Could you tell me about your professional career so far?

2. Based on your experience, how would you define what a biodiversity offset is?

3. I've seen mentions to both biodiversity offsets and conservation credits. Would you say the two ideas are related? How?

3.a. Would you say that biodiversity offsets/conservation credits can compare to, for example, carbon offsets? If so, in what sense?

4. Is there a "typical" case in biodiversity offsetting?

If the participant says no:

4.a. Do you believe it would be possible to put a standard mechanism in place?

4.b. What could a more standardised offsetting consist of?

4.c. What is currently missing for that to happen?

5. Were there other mechanisms for compensation of biodiversity loss before offsets were used? What did they consist of?

5.a. Who was involved in those mechanisms?

5.b. Was there a particular moment in which biodiversity offsets gained importance?

6. What advantages does biodiversity offsetting have over those mechanisms? What was it that made the difference?

7. What techniques do you employ to decide on the loss and the appropriate compensations?

7.a. Do you develop them case by case, or is have you developed a standard set of techniques?

If the techniques originate elsewhere

7.b. Where do they originate? (*Academia, other operators, other eco-markets?*)

8. Do the measurements focus on the entire ecosystem, or are there some parts which are more important to measure then others?

If necessary, prompt: endangered species, ecosystem services, all species, functional relationships?

8.a. Which, and why?

8.b. And would it make sense to trade credits both for species alone and for entire ecosystems?

9. How do the industry rules relate to the existing laws?

9.a. If you or any of the people working on biodiversity offsets were to submit suggestions to [the regulator], how confident are you that they would be well received?

10. From your experience, what are buyers more interested in when they look at biodiversity offsets?

If necessary, prompt:

10.a. Do buyers of voluntary offsets look for different things in biodiversity offsets than buyers who buy them for compliance reasons? (*Without asking directly, try to identify what makes a good exchange, where everyone involved is happy with the result*.)

11. Can you identify key people and organisations involved in the development of biodiversity offsets?

If the respondent only mentions local/national organisations probe for international, and vice-versa:

12. Could new supplier entries have to be regulated to ensure the sustainability of the market?

13. What do you think are the changes we'll see in this area in the future?

14. Are you aware of the existence of electronic exchanges for conservation credits?

If respondent says yes, prompt:

14.a. Do you think this is a useful development?

14.b. In your opinion, should all transactions that happen there be publicly listed? Why?

14.c. Do you think an electronic platform should allow for bargaining, or would you prefer that all acquisitions and sales involve bidding?

15. How do you feel about people other than developers – such as financial institutions, NGOs, local authorities, private companies or end consumers – coming into the market to buy conservation credits?