Promoting Sustainable Development in Brazil: the role of the Clean Development Mechanism

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Abstract

The international trade of carbon permits through the Clean Development Mechanism (CDM) was envisaged to have dual functions. First, the CDM was proposed as a way of funding sustainable development in, and increasing technology transfer to, developing countries party to the Kyoto Protocol. Secondly, the CDM was seen as a means of achieving a greater reduction in global greenhouse emissions through enabling more cost-effective reductions to be made by Annex I countries than they could make domestically, through the trade of Certified Emission Reductions (CERs). This thesis examines the effectiveness of the CDM in promoting sustainable development by analysing the carbon trading relationship between Brazil and the European Union (EU), using the Netherlands and the United Kingdom (UK) as case studies. Brazil is the third largest host of CDM projects, by project number and by generation of CERs, behind China and India. The largest buyer of CERs, both worldwide and from Brazil, is the EU, and the UK and the Netherlands constitute much of the EU’s demand for CERs. This thesis examines whether investment in Brazilian CDM projects by the UK and the Netherlands is promoting sustainable development in Brazil. Three different sustainable development assessment methods are applied to CDM projects registered in Brazil prior to May 2011. The first method uses the Brazilian Designated National Authority’s (DNA) definition and assessment of the sustainable development contribution of CDM projects. The second method incorporates the sustainable development priorities of Brazil as identified through Brazil’s Agenda 21 and the Millennium Development Goals and by the Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics). The third method uses a multi-criteria assessment to quantitatively score projects based on their claims to contribute to sustainable development. As well as an overall assessment of the promotion of sustainable development objectives, an assessment based on project type and project scale is also presented. This research demonstrates that the contribution of the CDM to sustainable development is limited by a lack of incentive within the CDM processes and market to promote meaningful sustainable development. There is a lack of demand for CERs generated from projects that claim higher levels of sustainable development, and very little regulation of the sustainable development objectives of the CDM. This research finds that, while the results of an assessment of the contribution of the CDM to sustainable development depend largely on the definition of sustainable development and the choice of indicators used in the assessment, the overall contribution of the CDM to sustainable development in Brazil is limited, particularly by the lack of value for projects claiming higher levels of sustainable development, and by the lack of involvement of local communities in choosing CDM projects and in monitoring project outcomes.
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Where the thesis includes work to which others have contributed, the thesis must include a statement that makes the student’s contribution clear to the examiners. This may be in the form of a description of the precise contribution of the student to the work presented for examination and/or a statement of the percentage of the work that was done by the student.

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This thesis does not contain work that I have published, nor work under review for publication.
Acknowledgements

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The time and expertise volunteered to me by the people in the UK, the Netherlands, Brazil and beyond who agreed to participant in interviews for this research is greatly appreciated, and I hope I have done justice to the valuable information that I gathered during these interviews. Having said that, all views and opinions presented in this thesis are my own, and for which I am solely responsible.

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### Abbreviations

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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AAU</td>
<td>Assigned Amount Unit</td>
</tr>
<tr>
<td>AIJ</td>
<td>Activities Implemented Jointly</td>
</tr>
<tr>
<td>AOSIS</td>
<td>Alliance of Small Island States</td>
</tr>
<tr>
<td>BOP</td>
<td>Balance of payments</td>
</tr>
<tr>
<td>CAF</td>
<td>Corporacion Andina de Fomento</td>
</tr>
<tr>
<td>CCBA</td>
<td>Climate, Community and Biodiversity Alliance</td>
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<tr>
<td>CCPO</td>
<td>Climate Change Projects Office (United Kingdom)</td>
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<td>CDCF</td>
<td>Community Development Carbon Fund</td>
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<tr>
<td>CDM</td>
<td>Clean Development Mechanism</td>
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<tr>
<td>CER</td>
<td>Certified Emission Reduction</td>
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<tr>
<td>CERUPT</td>
<td>Certified Emission Reduction Procurement Tender (Netherlands)</td>
</tr>
<tr>
<td>CFC</td>
<td>Chlorofluorocarbon</td>
</tr>
<tr>
<td>CIMGC</td>
<td>Comissão Interministerial de Mudança Global do Clima (Interministerial Commission on Global Climate Change - Brazil)</td>
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<tr>
<td>CO</td>
<td>Carbon monoxide</td>
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<td>CO₂</td>
<td>Carbon dioxide</td>
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<tr>
<td>COP</td>
<td>Conference of Parties to the United Nations Framework Convention on Climate Change</td>
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<tr>
<td>DECC</td>
<td>Department of Energy and Climate Change (United Kingdom)</td>
</tr>
<tr>
<td>DNA</td>
<td>Designated National Authority</td>
</tr>
<tr>
<td>DOE</td>
<td>Designated Operational Entity</td>
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<tr>
<td>EB</td>
<td>(United Nations Framework Convention on Climate Change) Executive Board</td>
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<tr>
<td>EC</td>
<td>European Commission</td>
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<tr>
<td>EE</td>
<td>Energy efficiency</td>
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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>EPRA</td>
<td>Emission Reduction Purchase Agreement</td>
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<tr>
<td>ERU</td>
<td>Emission Reduction Unit</td>
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<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>EU ETS</td>
<td>European Union Emissions Trading Scheme</td>
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<tr>
<td>EUA</td>
<td>European Union Emission Allowance</td>
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<tr>
<td>FAO</td>
<td>Food and Agricultural Organization of the United Nations</td>
</tr>
<tr>
<td>FBOMS</td>
<td>Fórum Brasileiro de ONGs e Movimentos Sociais para o Meio Ambiente e o Desenvolvimento (Brazilian Forum for Environment and Development)</td>
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<tr>
<td>FDI</td>
<td>Foreign direct investment</td>
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<td>FIRJAN/IFDM</td>
<td>Índice FIRJAN de Desenvolvimento Municipal (Index of National Development – Brazil)</td>
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<tr>
<td>GDP</td>
<td>Gross domestic product</td>
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<tr>
<td>GHG</td>
<td>Greenhouse gas</td>
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<tr>
<td>GNP</td>
<td>Gross national product</td>
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<tr>
<td>GWh</td>
<td>Gigawatt hours</td>
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<tr>
<td>HDI</td>
<td>Human development index</td>
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<td>HFC</td>
<td>Hydrofluorocarbon</td>
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IBGE  
Instituto Brasileiro de Geografia e Estatística (Institute of Geography and Statistics)

IBRD  
International Bank for Reconstruction and Development

IETA  
International Emissions Trading Association

IFC  
International Finance Corporation

INFCaF  
International Finance Corporation – Dutch Carbon Facility

IOB Evaluations  
IOB-evaluatierapporten (IOB Operations Evaluations Department – Netherlands)

IPCC  
Intergovernmental Panel on Climate Change

IRR  
Internal rate of return

ISI  
Import substitution industrialisation

JI  
Joint Implementation

kCERs  
Thousands of Certified Emission Reductions (CERs)

LDC  
Least developed country

LoA  
Letter of Authority

LULUCF  
Land use, land use change and forestry

MATA-CDM  
Multi-attributive assessment of CDM projects

MCA  
Multi-criteria assessment

MDG  
Millennium Development Goal

MDL  
Mecanismo de Desenvolvimento Limpo (Clean Development Mechanism – Brazil)

MOP  
Conference of the Parties serving as the Meeting of Parties to the Kyoto Protocol

MST  
Movimento dos Trabalhadores Rurais Sem Terra (Brazilian Landless Rural Workers’ Movement)

MW  
Megawatt

N\textsubscript{2}O  
Nitrogen dioxide

N\textsubscript{2}O  
Nitrous oxide

NAMAS  
Nationally Appropriate Mitigation Strategy

NGO  
Non-governmental organisation

NO\textsubscript{x}  
Mono-nitrogen oxides

ODA  
Official development assistance

OECD  
Organisation for Economic Cooperation and Development

PDD  
Project design document

PFC  
Perfluorocarbon

PIN  
Project identification notes

PNUD  
Programa das Nações Unidas para o Desenvolvimento no Brasil (United Nations Development Programme – Brazil)

POP  
Persistent organic pollutant

PPP  
Purchasing power parity

PV  
Photovoltaic

REDD  
Reducing emissions from deforestation and forest degradation

SD  
Sustainable development

SF\textsubscript{6}  
Sulfur hexafluoride

SMART  
Specific, measurable, action-oriented, realistic and timed

SO\textsubscript{2}  
Sulfur dioxide

SSN  
SouthSouthNorth

UFBA  
Universidade Federal da Bahia (Federal University of Bahia)
<table>
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<tr>
<th>Abbreviation</th>
<th>Full Name</th>
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<tbody>
<tr>
<td>UK</td>
<td>United Kingdom</td>
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<tr>
<td>UN</td>
<td>United Nations</td>
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<tr>
<td>UNCSDE</td>
<td>United Nations Commission on Sustainable Development</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
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<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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<tr>
<td>US</td>
<td>United States</td>
</tr>
<tr>
<td>VCS</td>
<td>Verified Carbon Standard (formerly Voluntary Carbon Standard)</td>
</tr>
<tr>
<td>VER</td>
<td>Voluntary Emission Reduction</td>
</tr>
<tr>
<td>VROM</td>
<td>Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieu (Ministry of Housing, Spatial Planning and Environment – Netherlands)</td>
</tr>
<tr>
<td>WCD</td>
<td>World Commission on Dams</td>
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<tr>
<td>WCED</td>
<td>World Commission on Environment and Development</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<tr>
<td>WMO</td>
<td>World Meteorological Organization</td>
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<td>WWF</td>
<td>World Wide Fund for Nature</td>
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Introduction

The international trade of carbon permits through the Clean Development Mechanism (CDM) was envisaged to have dual objectives. First, the CDM was proposed as a way of funding sustainable development in, and increasing technology transfer to, developing countries party to the Kyoto Protocol. Secondly, the CDM was to assist Annex I countries to achieve more cost-effective reductions through the trade of Certified Emission Reductions (CERs) and thereby affect a higher global reduction in greenhouse emissions. There has been substantial research attention given to analysing the success of the CDM in achieving these dual objectives (Andrade et al. 2009; Andrade, Nascimento & Puppim de Oliveria 2010; Boyd et al. 2009; Brown et al. 2004; Cosbey et al. 2006; Cosbey et al. 2005; Ellis et al. 2007; Friberg 2009; Haya & Parekh 2010; Olsen & Fenhann 2006; IOB Evaluations 2008; Lohman 2006; MacDonald 2010; Pearson 2006; Schneider 2007; Sutter & Parrerio 2007; Watson & Fankhauser 2009). Within this research, there is considerable contestation about how to measure the outcomes of the CDM and also what the optimum institutional arrangements are for facilitating effective use of the CDM that meets the dual objectives. This thesis extends this field of knowledge by critically reviewing the methods used to measure the success of the CDM, and exploring the extent to which the CDM has contributed to sustainable development in Brazil through the use and comparison of three different assessment methodologies. The first method uses the Brazilian Designated National Authority’s (DNA) definition and assessment of the sustainable development contribution of CDM projects. The second method incorporates the sustainable development priorities of Brazil as identified through Brazil’s Agenda 21 and the Millennium Development Goals and by the Instituto Brasileiro de Geografia e Estatistica (Brazilian Institute of Geography and Statistics). The third method uses a multi-criteria assessment to quantitatively score projects based on their claims to contribute to sustainable development. As well as an overall assessment of the promotion of sustainable development objectives, an assessment based on project type and project scale is also presented.

This thesis attempts to place the CDM in a geopolitical context, examining why the CDM has been limited in achieving its dual objectives in Brazil. The scope of projects for which this assessment is conducted is limited to projects hosted by Brazil and registered by the United Nations Framework Convention on Climate Change (UNFCCC) Executive Board (EB) by 1st May 2011 according to the UNEP Risø Centre (United Nations Environment Programme Risø Centre on Energy 2011), a range of scope and a frame of analysis that has not, to date, been the subject of in-depth research.
This thesis builds on the available research measuring the success of the CDM in Brazil (Guillen 2010; Andrade unpublished; United Nations Framework Convention on Climate Change 2011), and analyses the carbon trading relationship between Brazil and the European Union (EU), using the Netherlands and the United Kingdom (UK) as case studies. It does this by looking at the ways in which the institutional framework of the mechanism and the national policies of Brazil, the Netherlands and the UK affect the level of sustainable development achieved through the CDM. The CDM has enabled the development of a new frame of reference for assessing the relationship between the countries of the EU, in particular the Netherlands and the UK, and Brazil.

Understanding the factors that contribute to the on ground outcomes of sustainable development projects associated with the CDM is critical given the total investment being made in the sector. The total value of the primary CDM market 2012 was US$990 million (United States dollars) (Kossoy & Guigon 2012) and whilst this has declined from a peak of US$33 billion in 2008 (United Nations Framework Convention on Climate Change 2012c), the CDM still constitutes the largest international trading of carbon emissions in the world. Given that an extension to Kyoto was negotiated in Durban and agreed to in Doha, in the form of a second commitment period to 2020, the market for tradable carbon permits continues (Kossoy & Guigon 2012; United Nations 2012a; United Nations 2012b). It is important to study the way that the CDM has and will affect the relationships between those countries with binding emission reduction targets under Kyoto (Annex I countries in the UNFCCC) and those countries that are signatories but without binding targets (non-Annex I countries in the UNFCCC). It is important to assess the success of projects in promoting sustainable development so as to better inform policy makers regarding potential revisions to either the institutional structure of the mechanism, or the national policies of credit buyer and host countries. This research is therefore relevant to any country considering introducing an emission trading market that allows for CER units, or for any country considering hosting a CDM project in the future if the object of sustainable development is to be achieved.

The objectives of this thesis are to:

1. Assess the impact of United Kingdom and Dutch policy towards the CDM on the success of Brazilian CDM projects in promoting sustainable development;
2. Assess the impact of Brazilian policy towards CDM projects and development priorities on the success of Brazilian CDM projects in achieving sustainable development;
3. Examine the sustainable development assessment methodologies used in compliance carbon markets, and use three of these methods to assess the sustainable development benefits of projects registered in Brazil prior to 1st May 2011. This assessment will be conducted for all registered projects, and also by project type and project scale;
4. Compare the development objectives of CDM projects registered in Brazil with development priorities identified for Brazil by the Brazilian Government, the UN, non-governmental organisations and researchers; and

5. Examine why the CDM has been limited in achieving its dual objectives in Brazil.

This research is an inductive analysis of Brazilian hosted CDM projects and uses both quantitative and qualitative approaches including an analysis of the publicly available documentation for each registered project, semi-structured interviews, policy reviews and a review of the literature. This thesis focuses on Brazil as a host country as it is one of the largest host countries for CDM projects by both project number and CERs generated. Brazil also has the most diverse project portfolio across different industries and scales of these top three host countries (United Nations Environment Programme Risø Centre on Energy 2011). The UK and the Netherlands have been selected as the case study buyer countries for this study based on the strength of their current carbon trading relationship with Brazil and their large-scale participation in the CDM. Both the UK and the Netherlands dominate much of the European market for CERs through the EU ETS (European Union Emissions Trading Scheme) (United Nations Environment Programme Risø Centre on Energy 2011), the largest emissions-trading scheme in the world, and the EU ETS is likely to continue to dominate the international carbon market in the coming years. The Netherlands was also involved in the pilot stage of the CDM so has been able to assess and reflect on its investments over a longer period of time than other European countries.

It is proposed that the EU, Dutch, UK and Brazilian national policies regarding the CDM, as well as the institutional framework in which the CDM operates, discourage rather than facilitate sustainable development benefits for CDM projects in Brazil. It is also shown that differing definitions and assessments of sustainable development contribute to the variation in results across research to date, and to the findings of this thesis. Project type and project scale are both assumed to be key determinants of the sustainable development benefits of a project in the literature (MacDonald 2010; Olsen & Fenhann 2006; Olsen 2005; Cosbey 2006; Cosbey et al. 2006; Guijarro, Lumbreras & Habert 2008; Murphy 2006), and this research will also explore these assumptions.

This thesis is divided into eight chapters. Chapter One will examine the development of the CDM offsetting mechanism under the Kyoto Protocol, including perspectives of developed and developing countries; the current status of Brazil, the UK and the Netherlands in CDM trading; negotiations on emission reduction targets and in particular the role of the UK, Dutch and Brazilian delegations. The methodological research methods used in the research for this thesis will also be outlined in Chapter One.
Chapter Two will elaborate on the meaning of ‘sustainable development’ as an objective for the CDM including a discussion of the origins of the concept; why defining it was left for host countries to determine in the CDM; and different perceptions of ecological problems and development between the developing and developed countries. The current development status and priorities of Brazil are examined and priority areas for development with relevance to the CDM are presented for further comparison against the actual outcomes of the CDM in Chapter Six.

Chapter Three reviews Dutch and UK official policy on the CDM over the past decade with an emphasis on the importance of sustainable development outcomes of projects and purchasing incentive to encourage such projects. This is followed by a review of Brazilian policy towards the CDM, Brazilian priorities for hosting CDM projects and an exploration of how Brazil implements the procedures of the CDM in national legislation.

Chapter Four examines the structural limitations of the CDM in relation to its ability to contribute to sustainable development within host countries, as debated in the literature and with an emphasis on the experiences of the Brazilian CDM market. This review will focus on the weaknesses of the design of the CDM and the UNFCCC regulations regarding it, and include a discussion on if other determinants of CDM projects, such as scale and project type, can impact the sustainable development outcomes of projects.

Chapter Five reviews the sustainable development definitions and assessment methods used by host countries, in particular Brazil and past and present sustainable development standards set by credit buying countries. A critical analysis is provided of the sustainable development assessment methods developed throughout the past decade for both the compliance and voluntary carbon markets and the three sustainable development assessment methods used in this research are outlined and justified.

Chapter Six analyses the results of the three assessment methods, with reference to the sustainable development priorities as outlined in Chapter Two, supplemented with data collected from interviews with Brazilian, Dutch and UK CDM participants. A sustainable development assessment will also be conducted according to project type and project scale to assess whether these project characteristics can affect the sustainable development outcomes of projects.

Chapter Seven examines the results outlined in Chapters Six with specific regard to the geopolitical context of the relationship between Brazil, the UK and the Netherlands. Limitations of the CDM in promoting sustainable development in Brazil are also linked to the procedural limitations of the UNFCCC and suggestions for improvements are outlined.
Chapter Eight concludes the thesis and provides a discussion of the implications of the findings of this research for countries looking to establish carbon trading schemes that would include the use of CERs or countries that are looking to host CDM projects in the future.
1 The Kyoto Protocol, the CDM and Carbon Offsetting

Introduction

The CDM is a mechanism through which emission reductions can be achieved globally in the most efficient, least cost way. The mechanism is the outcome of negotiations that preceded the Kyoto Protocol. The aim of this chapter is to examine the context through which the CDM came into existence and the purpose of this mechanism. Through an analysis of the UNFCCC and Kyoto Protocol processes, a discussion of the difficulties in negotiating international agreements (which is relevant to the weaknesses of the processes and rules of the CDM), and an overview of the rules of the CDM, this chapter provides a context through which to explore some of the reasons why the CDM has been criticised for its lack of contribution to sustainable development within host countries. This chapter also contains an overview of the international CDM market and the methodology of this thesis.

Climate change refers to cyclical fluctuations in the temperature of the earth over time. These changes have been taking place throughout the entire history of the earth as shown by geological, ice core and other such evidence (Intergovernmental Panel on Climate Change 2007). What is fuelling the current level of concern about climate change is the increased rate of change over the past half-century, referred to as global warming, and the belief that this warming is being driven by anthropogenic causes, unlike historical climatic cyclical fluctuations which are believed to be solely the result of natural processes (Intergovernmental Panel on Climate Change 2013).

Specific attention to the potential impact of human activity on cyclical climate fluctuations grew in the late 1950s, when temperature increases from the first four decades of the 1900s were first linked to an increase in atmospheric carbon dioxide (Anderson 2001). Since 1990, the International Panel on Climate Change (IPCC), which was established in 1988 by the UNEP (United Nations Environment Programme) and WMO (World Meteorological Organization) (Intergovernmental Panel on Climate Change 2012), has released Assessment Reports every five years outlining the culmination of research conducted by climate scientists from around the world. These reports have become more certain about linking recent climatic changes and anthropogenic causes. The have also become more certain about the need for an immediate and severe reduction in the volume of greenhouse gases emitted into the atmosphere via anthropogenic means to reduce the rate of change of temperature over the next century (Intergovernmental Panel on Climate Change 2007).
The challenge of global warming requires global action in order to address it and achieving this action is complicated by a lack of clear responsibility for who should resolve the problem. The anthropogenic causes and impacts of climate change represent truly global problems that transcend traditional state and regional boundaries. One of the difficulties in allocating responsibility for the problem lies in the temporal nature of it, in that greenhouse gas emissions emitted historically are still present in the atmosphere today and some of the greenhouse gases being emitted today will continue to contribute towards the warming of the atmosphere for the next century.

Climate change is the ultimate example of the ‘tragedy of the commons’ (Hardin 1968). Global warming is related to many anthropogenic causes on local, national and global scales and therefore finding a solution through mitigation will affect in some way every facet of human behaviour through the inclusion of a traditionally excluded economic externality, the cost to the atmosphere. One of the challenges of tackling climate change is the ability of states to cooperate, as it is a very long-term public policy problem (Summers 2007), which is not the sort of problem easily resolved at an international inter-state level. This makes cooperation difficult to realise, as there is no overarching international environmental governance arrangement to force states into cooperation. States themselves are each subject to the whims of their domestic polity that results in diversity amongst state actors in their stances towards global warming. When large-scale cooperation is required, it is difficult to avoid succumbing to the lowest common denominator. Due to the difficult nature of solving this problem, incentives to induce agreement must be offered. The following section outlines the history of the international climate negotiations and their mixed successes in achieving emission reductions and mitigating global warming.

1.1 International Climate Negotiations

International conferences and negotiations held to discuss the changing climate began in 1979 with The First World Climate Conference (Anderson 2001; United Nations Framework Convention on Climate Change 2000). This was the start of many climate related conferences whereby the overarching aim was to find a solution to the problem of increasing anthropogenic greenhouse gas emissions and their impact on global warming. Agreement on a plan to address climate change that involved binding emission reductions was not reached until the Rio conference in 1992. The current climate regime focuses on the United Nations Framework Convention on Climate Change adopted in 1992 and the Kyoto Protocol to the UNFCCC adopted in 1997.
Despite the proliferation of climate change conferences, international negotiations have stagnated and greenhouse gas emissions have continued to rise to unprecedented levels, propelling the world towards a likely 2.6 and 4.8 degree rise in temperature to 2100 (relative to a 1850-1900 baseline) (Working Group I of the Intergovernmental Panel on Climate Change 2013). The international climate regime has been unsuccessful in meeting the stated objectives and targets of acceptable temperature increases because of the weak outcomes of negotiations. Negotiations have more often than not become victim to the problems of seeking unanimous outcomes, where the interests of the party least willing to respond to the issue have often dictated the outcome of the international response. In international negotiations, the dominance of the state hinders the ability to create and enforce international regimes, and climate negotiations are no different. The absence of any overarching governing authority has created an environment where agreements are subject to the realpolitik of states in the international system. States can not be forced legally to surrender the sovereign power they hold over their geographical region, yet in order to create international agreements, states are required to surrender some control or freedom over their territory, albeit usually only a small amount, to an international regime, and this can be extremely difficult to negotiate, especially if it is not in their perceived strategic interests or if there is a penalty for non-compliance. Whilst smaller states can be coerced into agreements through the use of economic incentives or the like, persuading larger, more powerful states to surrender control over some aspect of their sovereign authority is much more difficult. The ability to negotiate a successful international regime rests upon the willingness of states to take the agreements seriously, which in turn depends on the importance of the problem itself to the state and its polity (Breitmeier, Young & Zürn 2006).

The specific nature of the problem of global warming produces another set of difficulties when it comes to negotiating international agreements, and these can be summarised in the following five points. First it is a problem that has a longer term time horizon than any other public policy issue to date (Summers 2007). Secondly, due to the unbounded nature of the atmosphere, the effects of global warming have unlimited geographical spread and are entirely independent of the location of the original emissions (Aldy & Stavins 2007). Thirdly, global warming involves problems of allocating responsibility for the costs of mitigation and adaptation, given the temporally and geographically uneven contribution of greenhouse gas emissions. Allocating responsibility for past, present and future levels of greenhouse gases in the atmosphere is where most negotiations on international climate change fail as responsibility and mitigation are contested geographically and temporally. The responsibility for mitigation costs for climate change remains a contentious issue between developed and developing nations (Timmons Roberts & Parks 2007). If responsibility for emissions is determined to be a factor when allocating the costs of mitigation (the user-pays principle), a gauge for measuring responsibility
must be developed. Developing states hold that developed states are largely responsible for the current levels of greenhouse gas in the atmosphere based on historical emission levels, and should therefore be held liable for the majority of the costs for mitigation and adaptation (Timmons Roberts & Parks 2007). By contrast, developed states highlight the contributions that large-scale population growth and industrialisation in developing countries will have on present and future emissions. Four main methods of calculating responsibility have been proposed in international negotiations, including: grandfathering, where every nation has a right to produce emissions, yet each nation should not bear the costs of reductions equally (Aldy & Stavins 2007; Parks & Timmons Roberts 2008); carbon intensity, where emission permits are allocated based on national GDP (gross domestic product) (Campbell 2013; Carraro & Egenhofer 2007); contract and converge, based on a per capita calculation (Cazorla & Toman 2000); and the fourth method, which uses a complex Brazilian developed method that incorporates historical responsibility for emissions into the calculation (Cazorla & Toman 2000; Timmons Roberts & Parks 2007).

Fourthly, and perhaps the most pertinent at the domestic level, the economic costs of reducing greenhouse gas emissions affect nearly every aspect of human activity. Democratically elected governments are not suited to the production of long term strategies, which is the type needed to ensure that emission reductions are achieved. Some countries are proving themselves to be exceptions to this assumption, with action on global climate change achieving widespread support amongst policy makers and the general public (see for example the voluntary emission reduction strategy of the UK government – (Government Procurement Service 2013)).

Lastly, while there is a strong consensus amongst climate scientists as to the seriousness and causes of climate change, other interest groups with strong lobbying power continue to debate the findings of climate scientists. These groups consist of: climate change deniers; those who believe that future generation will be in a better position to resolve the problem given the long term nature of climate change; and those who believe that there are more important issues to address, especially for the developing countries where more immediate environmental concerns such as desertification or drought are given a higher priority. The continuation of the debates over the urgency of the issue threatens the ability to negotiate a binding worldwide agreement (Breitmeier, Young & Zürn 2006). So given these numerous and broad ranging difficulties, why then has there been a continual push to develop an international climate change regime, and why has the UNFCCC and Kyoto Protocol attracted such a large degree of support in terms of signatories and ratifications?

The UNFCCC was negotiated in the two years prior to 1992 by the Intergovernmental Negotiating Committee, who presented the document to the Rio Earth Summit participants for
signing later in 1992. The Convention came into force in 1994 when the required number of signatories and ratifications were achieved.

The ultimate objective of the UNFCCC is to:

‘achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system’ (United Nations Framework Convention on Climate Change 1992a).

The UNFCCC incorporated the outcomes of the Toronto Conference on the Changing Atmosphere (1988), the Noordwijk Ministerial Conference (1989), the Bergen Conference (1990) and the Second World Climate Conference (1990), which recognised the need for developed countries to accept greater responsibility for the current rate of climate change (Rowlands 1995; United Nations Framework Convention on Climate Change 2000; United Nations Framework Convention on Climate Change 1993a; United Nations Framework Convention on Climate Change 1993b; Lenzen 1997). Principle seven of the UNFCCC states that:

‘in view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command’ (United Nations 2011b).

The UNFCCC also recognised that it was the responsibility of the developed world to assist developing countries in mitigating emission reductions (Rowlands 1995; United Nations Environment Programme 1989). An outcome of the Noordwijk Ministerial Conference that recognised the sovereign right of states to have control over the use of their natural resources and the right of states, in particular developing ones, to sustainable development, was also incorporated into the UNFCCC (United Nations Framework Convention on Climate Change 1993b).

1.1.1 Kyoto Protocol

It was at the third COP (Conference of Parties to the United Nations Framework Convention on Climate Change) in Kyoto that emissions reduction targets for 2008-2012 were set. The Kyoto Protocol fulfilled the need for quantified targets and rules, such as an agreed list of gases to be included, a timeframe for achieving such reductions and the participation of the developing countries in producing an annual inventory and report on emissions occurring from within their country as distinct from binding emission reduction targets applicable for all Annex I countries.
signing and ratifying the Kyoto Protocol (Annex I countries being developed countries who were required to abide by binding emission reduction targets should they sign and ratify the Kyoto Protocol). The Kyoto Protocol also set out the framework for abatement mechanisms such as the CDM, Joint Implementation (JI) and the trade of Assigned Amount Units (AAUs) between countries. The details for these mechanisms and trading rules were not established until later Conferences of Parties negotiations.

The Kyoto Protocol to the Framework Convention on Climate Change boasts 192 signatories and 191 ratifications (the US has signed but not ratified the Kyoto Protocol), with the EU signing in 1998 and ratifying in 2002 on behalf of both the Netherlands and the UK, and Brazil also signing in 1998 and ratifying in 2002 (United Nations Framework Convention on Climate Change 2012d). Of these 191 ratifying countries, 38 Annex I countries and the European Union have signed up to binding emission reduction targets alongside a further 152 non-Annex I countries who have signed up and ratified the Protocol, but as yet do not have binding emission reduction targets. As acknowledged by Anderson:

‘The Kyoto Protocol is by far the most complex environmental treaty that governments have ever attempted. It does not affect merely one restricted class of products like the Montreal Protocol on stratospheric ozone. It does not affect merely one industry, like a fishing treaty. In a world that runs on fossil fuel, the Kyoto Protocol reaches nearly every industry, nearly all forms of transportation, and most households (2001, p. 22).’

The IPCC indicated that in order to reduce emissions to a level that would keep climate change to a two degree rise, a rise deemed likely, agreement on strong binding emission reduction targets would be required (Working Group I of the Intergovernmental Panel on Climate Change 2013, p. TS59). The difficulties in attempting to compromise on an agreement satisfying the interests of all 193 members of the United Nations in seeking to achieve binding emission reduction targets weakened the required scope of the UNFCCC and made it likely that the maximum level of emissions recommended by the IPCC would be exceeded. The stance of the European countries was to push for deeper emissions reductions targets than those based on 1990 levels whereas the US pushed for as small a reduction target as possible (Anderson 2001; Yamin 1998). Mitchell (2005) classifies the negotiating parties into three categories – committed parties such as the EU (countries who act unilaterally and who choose to comply regardless of the actions of other states and who are willing to fund climate change mitigation in other states); contingent countries (those that are likely to comply so long as the cost is not too great and other states also participate in reductions); and resistant countries (those that are unlikely to participate in the climate regime due to a perceived high cost of participation). As it was, the Kyoto agreement has the EU emission reduction target at 8% based on 1990 levels, the US by 7% and all the industrialised countries together by a total of 5.2%. The main outcomes of
the Protocol are the requirement from Annex I countries (developed or industrialised countries) for annual greenhouse gas emission inventory and reporting requirements along with binding emission reduction targets, and annual greenhouse gas emission inventory and reporting requirements for non-Annex I countries (the developing or industrialising countries).

The overarching theme of the COP3 discussions was based on the UNFCCC ‘common but differentiated responsibilities’ in which countries historically responsible for current emissions for the most part agreed to sign up to legally binding reduction targets (Timmons Roberts & Parks 2007). The common responsibility was to reduce the production of GHG (greenhouse gas) emissions, although this theme acknowledges that not all countries are economically able to achieve equal responsibilities and hence, responsibilities for emission reductions are differentiated based on both historical responsibility and on ability to reduce. Countries determined to be developing, non-Annex 1 countries, were excluded from the first round of legally binding emissions and were instead invited to become non-Annex I signatories to the Protocol. Both Annex I and non-Annex I countries are obligated to report on the inventories of greenhouse gas emissions produced within their borders. The extent of the legal obligation to achieve the targeted reduction and file annual reports is limited by the lack of an overarching international authority to enforce the agreement. The penalty for noncompliance relates only to stricter future emission reduction targets for the noncompliant party in the second compliance period with the non-compliant party having to repay the number of tons exceeded plus a 30% penalty (Aldy & Stavins 2007). This provides an economic incentive to achieve the reduction target, however there is no requirement to continue as a party to the Protocol, nor to sign future agreements, so barring the persuasive trade and bureaucratic measures countries take in order to encourage compliance with international agreements, there is no legally enforceable punishment for withdrawal from either the Kyoto Protocol, nor any future climate change negotiation. Canada’s withdrawal from the Protocol in 2011 is an example of this (Environment Canada 2011), as is New Zealand, Russia and Japan’s refusal to participate in the second commitment period (Khor 2013).

The weakness of the agreement is key to the almost universal ratification of the Protocol. The emission targets negotiated were far less than those recommended by the IPCC (Campbell 2013). Binding emission reductions were agreed upon by only 38 countries and the EU, while developing countries, where the majority of future emissions will come from, were exempt from binding emission reductions. After the negotiations, the world’s largest emitter, the US, refused to ratify the agreement. The weakness of penalties that could be imposed under the Protocol, which could be sidestepped through simply refusing to agree to a second commitment period as exemplified by Canada, Japan and New Zealand, also made ratification of the agreement attractive. Lastly, flexible mechanisms in order to make compliance with the emission reduction
targets cheaper, replaced any financial penalties for non-compliance as proposed by Brazil. It has also been argued that the short term, five-year commitment periods offer no incentives or surety for long term low carbon investment (Hepburn 2007).

1.1.2 The Significance of the UK, the Netherlands and Brazil

The EU is one of the main actors in the international climate negotiations through a continual push for the adoption of binding emission reduction targets by the developed world. Within the EU, both the UK and the Netherlands have played lead roles in their commitment to strong binding emission reduction targets, and in the case of the Netherlands, even a commitment to voluntary reduction targets prior to the Kyoto Protocol negotiations. Brazil played a crucial role in the development of the Clean Development Mechanism at the Kyoto Protocol negotiations and has promoted itself as the voice of the developing world within the series of international climate negotiations.

The EU, representing both the UK and the Netherlands, arrived at the Kyoto COP with a proposal to reduce global greenhouse gas emissions by 15% after having negotiated a burden-sharing proposal amongst the EU member countries earlier in 1997 (Baker 2006; Andresen & Agrawala 2002; Yamin 1998). The strong EU stance on negotiating binding emission reductions was first voiced in 1990 at the Dublin European Council meeting and the EU sought to rectify the lack of binding emission reduction targets in the UNFCCC (Baker 2006). The EU push for stronger climate change agreements is related to its objective to distinguish itself on an international stage, and the refusal of the US to ratify Kyoto or partake in any binding emission targets without the participation of developing countries or further research, has enabled the EU to take the lead in negotiations (Baker 2006; Afionis & Stringer 2012; Grant & Papadakis 2004; Imber & Vogler 1996). The EU is considered to be a normative power, in that it is guided by the norms upon which it was founded, including democracy, the rule of law, human rights and as part of this, sustainable development, and the EU has pursued this outlook through bilateral and multilateral international environmental, trade and development policies (Afionis & Stringer 2012). At the COP3, the EU was the main advocate for effective action to mitigate climate change, rejected US and Japanese suggestions for temporal flexibility or the inclusion of reductions through sinks or land use change and forestry, together with Brazil, and expressed concern about the use of flexibility mechanisms to achieve national reduction targets (Yamin 1998). The EU eventually shifted from opposing the use of a flexibility mechanism like the CDM to being the major investor in it, due to a combination of pressure to demonstrate leadership following the withdrawal of the US in the climate negotiation space, the influence of groups within the EU, and in particular the UK, advocating for the use of flexibility mechanisms, and also the tactical change from framing flexibility mechanisms as weakening
emission targets to one of using them to promote effective and efficient action on climate change without damaging the European economy (Bailey, Gouldson & Newell 2011; Birger Skjærseth, Bang & Schreurs 2013; Hovi, Skodvin & Andresen 2003; Schmidt 2008).

The UK’s role in international climate change negotiations changed from one of reluctance to one of leadership during the 1990s (Andresen & Agrawala 2002). Increased environmental awareness within the UK, in conjunction with a major change in UK energy supplies that had reduced GHG emissions from the 1990 baseline year, helped the UK push forwards both within the EU and independently towards stronger emissions targets (Andresen & Agrawala 2002). Continuing on from this stance, in 2009, the UK committed, as part of the UK Climate Change Act 2008, to reduce GHG emissions by 34% below 1990 levels by 2020, or 42% if an international deal was agreed upon, as well as to sourcing future electricity needs from renewable sources (DB Climate Change Advisors 2009).

The Netherlands has been a forerunner and leader in climate change negotiations, in the formation of the CDM through the AIJ (Activities Implemented Jointly) and in climate related science. The Netherlands was the first country to take on voluntary emission reduction targets for CO₂ (carbon dioxide) in early 1989 through the National Environmental Policy Plan, and when these targets were met, further reduced its targets in the mid 1990s (Andersson & Mol 2001). This action, coupled with the action undertaken by other EU countries, prompted the EU to push for binding emission reduction measures to be achieved by 2000 based on 1990 emission levels at an international level (Andersson & Mol 2001). Prior to the Kyoto Protocol, the Netherlands was a major party in negotiating the EU burden sharing agreement, which allowed the EU to suggest the need for a 15% reduction in emissions based on 1990 levels at COP3 (Kanie 2003). The Netherlands is considered too small politically and economically to wield a lot of power in international climate negotiations (Andersson & Mol 2001). Yet its position as a geographically low lying country vulnerable to sea level rises, with an open economy that would benefit from internationally agreed upon, rather than unilateral, measures to reduce emissions and a history of environmentally conscious civil society has spurred the Netherlands into pushing for legally binding international targets (Andersson & Mol 2001). As some commentators note, the Netherlands has a likely strategic interest in the transition phase of reducing the use of more atmospherically ‘dirty’ fossil fuels because it is a gas exporting country, which has influenced the Netherlands to use its power within the EU and as host of key climate negotiations such as the Hague and the Noorwijk Conferences, to exert influence on the international climate change architecture (Andersson & Mol 2001).

According to Viola (2003), Brazil’s objectives at the Kyoto Conference were to confirm the right to development, promote a vision of development coupled with environmental
sustainability, encourage funding from developing countries for emission reduction projects in the developing world, to try and establish Brazil as a leader in international negotiations and to avoid internationalising control of the Amazon in order to retain sovereignty over this resource. All but one of these targets were achieved outright: the establishing of binding emission reduction targets for Annex I parties only; the prominence given to the Brazilian negotiating party over the CDM negotiations; and the inclusion of clean technology transfer in the CDM; and despite the lack of outright rejection of the proposal, the use of carbon sinks and inclusion of land use changes in Kyoto was not included immediately and left open for potential later inclusion (Viola 2003). The issue of land use change and forestry for Brazil was complicated by Brazil’s desire to retain sovereignty over the development of the Amazon region (Johnson 2001), however this stance changed recently to one where Brazil supports some international assistance for avoiding deforestation (Friberg 2009). Brazil argues that avoided deforestation should not be included in a carbon crediting system and instead that developed countries should help finance countries that are successful in reducing deforestation rates (Friberg 2009). The Brazilian party was one of approximately 130 member parties making up the G77 negotiating group at COP3, and the major concern of this group was with overseeing the implementation of binding emission reduction targets on the Annex I parties who were seen as historically responsible for climate change, without themselves having to adopt binding emission reduction targets that they saw as a detrimental impact on the social and economic development of their countries (Yamin 1998; Johnson 2001). Brazil was in favour of a strong international climate regime, aligning itself with the EU on this matter (Viola 2003), and in favour of ensuring that developed countries could use flexible mechanisms only in conjunction with domestic emission reductions (Johnson 2001). Along with this aim, the G77 negotiated for additional financial resources to be made available to developing countries in order to meet the implementation costs of the Kyoto Protocol, which included the provision of regular greenhouse gas inventory reporting (Yamin 1998).

1.2 Carbon Offsetting

During the first Conference of Parties held in Berlin, parties signatory to the Convention were unable to successfully negotiate a role for flexible mechanisms, or carbon offsetting. As a compromise between those parties who supported the use of flexible mechanisms for assisting Annex I countries to achieve their emission targets and those countries that were against such mechanisms, a Pilot Phase of the AIJ was agreed to in order to provide a more coherent basis upon which to base negotiations on Joint Implementation (Werkman 1998). In this Pilot Phase, countries could experiment with emission reduction projects in other countries, however no
credits would be granted as a result of any emission reductions (Werkman 1998; Olsen 2005; United Nations Framework Convention on Climate Change 2012a).

The main Annex I participants in the AIJ were the US, Norway and the Netherlands, who were the countries most in favour of the use of flexible mechanisms to assist compliance with emission reductions (Werkman 1998). The US was strongly in favour of introducing market mechanisms in order to reduce the financial burden of the reduction targets on the Annex I countries, whereas the EU and developing countries initially argued that domestic emission reductions should be the primary way in which country specific targets were met (Bodansky 2001). The EU was concerned about the use of a project based mechanism in collaboration with host parties that were not obliged to undertake emission reductions (Werkman 1998). A majority of members of the G77 and China were against the use of flexible mechanisms for fear that developing countries would be in unequal bargaining arrangements with the Annex I countries and this would develop into an imposition of new conditions for access to financial resources and technological transfer (Werkman 1998). However there was no consensus amongst the G77, with countries who had successfully hosted projects under the AIJ, such as Costa Rica, largely supportive of the use of flexible mechanisms (Werkman 1998).

Prior to the start of COP3, the Brazilian Government had introduced a proposal whereby countries failing to reach their emission reduction targets would be obliged to contribute in the form of a penalty payment, to a Clean Development Fund that would fund development, mitigation and adaptation strategies for climate change in the developing world (Olsen 2005; Johnson 2001). This suggestion did not enjoy widespread support amongst the developed countries likely to be held liable to it (Olsen 2005). The United States in particular was vehemently opposed to the penalty suggested by the Brazilian negotiating party (Olsen 2005) while the proposal had the support of the G77 (Werkman 1998). The EU regarded the proposal with suspicion, concerned that the establishment of another fund and institution may weaken the viability of the Global Environmental Facility which held the role as the institution which administered the UNFCCC adaptation and mitigation funds (Werkman 1998). Under the Chairmanship of Brazil, the informal contact group had been issued with the task of negotiating the use of the compliance penalty, however discussion focused instead on the merging of the clean development fund proposal with joint implementation (Werkman 1998). The resulting Article 12 of the Kyoto Protocol, which established the basis for the Clean Development Mechanism, changed the essence of the agreement from a ‘penalty for not complying’ to one of ‘contributing to compliance’ (Olsen 2005; Johnson 2001). The agreement was optimistically called a ‘surprise double win’, as non-Annex I countries could benefit from the agreement with funding for sustainable development and technology transfer, whereas the Annex I countries
could access cheap abatement options in order to reach Kyoto commitment targets, and could therefore agree to take on stricter targets.

In essence, the Clean Development Mechanism allowed for investment by Annex I countries in emission reduction projects in non-Annex I countries in order that the Annex I country can count the emission reduction towards their Kyoto Protocol reduction target. This trade of carbon permits is seen as having a number of benefits for both the Annex I and non-Annex I countries. The Annex I country benefits through the ability to fund emission reductions in locations where the cost of such reductions may be cheaper than domestic reductions, leading to a lesser financial commitment needed for Annex I countries to adopt binding reduction targets. The non-Annex I country benefits through the foreign direct investment in less carbon intensive technologies and, due to the rules regarding the Clean Development Mechanism, there is also a requirement for projects to contribute to sustainable development in the host country. The international trade of carbon permits through the CDM was envisaged to have these dual functions, first as a possible contribution to funding sustainable development in developing countries and secondly as a means to achieve a reduction in global greenhouse gas emissions through cheaper reduction alternatives for Annex I signatories. As stated by the Protocol itself:

‘The purpose of the clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3’ (Paragraph 2, Article 12 (Kyoto Protocol to the United Nations Framework Convention on Climate Change 1997, p. 11).

The Kyoto Protocol came into force in 2005 with the December 2004 ratification by Russia, which met the dual requirements of at least 55 countries ratifying the agreement which represent 55% of 1990 Annex I emissions (Aldy & Stavins 2007).

While the adoption of the Kyoto Protocol led to widespread expectations and hope that sustainable development, including poverty alleviation and technology transfer for developing countries would result from the CDM, it was not until COP7 in 2001 that the Marrakech Accords and Marrakech Declaration outlining the rules and modalities of the CDM were finalised and the CDM Executive Board was established (Olsen 2005; Stokke, Hovi & Ulstein 2005). The Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol (also known as the Meeting of Parties or MOPs), is held alongside the Conference of Parties on an annual basis. The countries party to the Protocol meet to discuss the implementation of the Protocol, including the implementation of the CDM. After receiving a
report from the CDM Executive Board, the MOP negotiates recommendations to be passed to the CDM EB in order to make changes and improvements to the workings of the CDM.

Carbon trading or offsetting is a way of reducing the financial cost to countries or organisations of internalising the environmental costs of production and consumption that have been traditionally externalised from economic/cost calculations. Internalising a previously externalised cost is expensive, so carbon trading allows for the integration of this cost at a reduced financial price through implementing emission reductions in locations where it is financially cheapest to do so. The use of emissions trading, with an overall cap set by the government and the price determined by the market, was first proposed in 1966 (Burtraw et al. 2005). In international practice, trading of environmental pollution permits began in the United States in the 1990s for SO$_2$ (sulphur dioxide) and NO$_x$ (mono-nitrogen oxides) trading as part of the Montreal Protocol (Hepburn 2007; Fuhr & Lederer 2009). The objective of carbon trading is to reduce the financial impact of privatising the cost to the global commons through the creation and trade of property rights over pollution permits, by allowing emission reductions to take place at locations where such emission reductions can be made cheaper than in the domestic economies of the Annex I signatories (Hepburn 2007).

The Kyoto Protocol attributes national reduction targets to each signatory Annex I country. How each country decides to achieve this national reduction is up to the national government. Some countries use a carbon tax to encourage cleaner production technologies through making them more economically feasible, and to fund emission reduction research through the funds generated from taxes, for example Norway. Other countries use a carbon-trading scheme with a limited number of industries, where permits for emissions are either allocated or auctioned off by the national government or authority, for example the UK and the Netherlands. In order to avoid exceeding this permitted amount and being subject to penalties, carbon trading allows for the trade of carbon permits between companies that are subject to the reductions. This way, a company can decide whether it is economically feasible to make the technological changes required to reduce emissions from production, or to purchase another company’s emission reductions that they have made in excess of their requirements.

The Netherlands has outlined a national allocation plan that freely distributes emission permits to selected installations that come under the EU list of industries obligated to reduce emissions in line with both the Kyoto Protocol and internal EU policy (Ministry of Housing 2006). In addition to these freely distributed permits, 4% of the Netherlands allowances will be auctioned off to industry. In order to supplement the Dutch emission allowance which equates to a 6% reduction from 1990 levels, the Netherlands Government has purchased 20 mega tonnes per year of CO$_2$, equivalent to 20 million CERs, from CDM projects to increase the total allowance
available to the Netherlands whilst still abiding by the terms of the Kyoto Protocol (Ministry of Housing 2006). The Netherlands has also allowed the affected installations to purchase CER, ERU (emission reduction unit) or EUA (EU emission allowance) credits to a maximum of 12% of their emission reduction targets in order to reduce the financial burden of emission reductions on Dutch industry, and if necessary, the rest of the emission reductions are to come from domestic reduction within the installations themselves (Ministry of Housing 2006).

The United Kingdom has taken a similar approach in their national allocation plan, which allocates 93% of the allowances freely to installations and auctions the remaining 7%. The Government has placed an 8% (of freely allocated permit number) cap on the use of credits from the Kyoto mechanisms (CERs and ERUs) for any one installation and allows banking between years within the 2008-2012 phase II of the European Trading Scheme (Department for Environment 2007). This represents approximately two-thirds of the gap between the business as usual emissions and the emission reduction target (Department for Environment 2007). The UK Government also decided to voluntarily offset the emissions created through the actions of parliament including travel, emissions from offices and the like through the purchase of CERs. These CERs are retired and are not used towards the UK Kyoto target of a 12.5% reduction on 1990 emission levels (Department of Energy and Climate Change 2010b).

Under the Kyoto Protocol, there are three carbon permit trade measures that are incorporated to enable an international trade of carbon permits. International permit trading allows for countries to purchase carbon permits that would enable them to meet their emission reduction targets in much the same way that companies can do in the domestic carbon trade scenario. However, international permit trading allows for companies located in Annex I countries, who may be subject to domestic emission reduction targets, to purchase carbon credits or fund projects in other countries that result in emission reductions.

The first lot of permits are called Assigned Amount Units, which for the most part, are owned and sold by countries of the former Soviet Union which, like all ratifying parties, were allocated emission reduction targets based on their 1990 emission levels. Following the collapse of the Soviet Union and a stark reduction in highly polluting industries in these locations since 1990, the permits allocated to these countries are over and above what is required even if no reduction is made, hence the more popular reference to these permits as ‘hot air’ (Andresen & Agrawala 2002). The over-allocation of AAUs diluted the international carbon credit market, potentially reducing the need for credits from other mechanisms. According to the rules of the Kyoto Protocol, these permits to emit can be sold on the international carbon market to countries or companies who consider it cheaper to purchase carbon permits rather than reduce domestic emissions. The impact of these units on the international carbon market is not as devastating as
was first predicted due to international pressure on carbon purchasing countries not to accept them in domestic carbon markets (Turkowski 2012).

The second carbon permit trading mechanism incorporated into the Kyoto Protocol is called Joint Implementation. This is where Annex I countries invest in emission reduction projects located in other Annex I countries, enabling the investing Annex I country to count the emission reduction total towards their national reduction target. The emission reduction permits generated through this mechanism are referred to as ERUs.

The third carbon permit trading mechanism, and the subject of this research, is the Clean Development Mechanism. This is the outcome of negotiations between Brazil and the US on paying for the costs of funding sustainable development in developing countries and penalising Annex I countries that do not meet their obligations in the first commitment period. It is claimed that ‘[t]he mechanism stimulates sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reduction limitation targets’ (UNFCCC 2009). The reduction in greenhouse gas emissions for each project is calculated and a proportionate number of Certified Emission Reduction (CER) permits are then created (one CER equals one metric tonne reduction in CO\textsubscript{2} or CO\textsubscript{2} equivalent) and then issued to the credit buying Annex I country via the UNFCCC registry. This allows the credit buying party to achieve the legally binding Kyoto emission reduction target while the host country benefits from access to technology and sustainable foreign investment. CDM projects are required to be additional to those changes that would have occurred regardless of CDM investment. The requirement of additionality for CDM projects ensures that investment should result in an overall global reduction in emissions. The avoided production of more than 2.36 billion tonnes of CO\textsubscript{2} equivalent emissions through CDM projects is estimated to have occurred within the first Kyoto commitment period from 2008-2012 (United Nations Environment Programme Risø Centre on Energy 2013).

Using the example of the Netherlands, Figure 1-1 demonstrates how the Netherlands can achieve their Kyoto emission reduction targets using the mechanisms of the Kyoto Protocol.
To be eligible to participate in the CDM, both the country hosting the project and the country to which the carbon permits will be sold (or the country from which the company purchasing the carbon permits is situated) must have signed and ratified the Kyoto Protocol. The credit buying country is the Annex I country and the host country must be a non-Annex I country. All parties must have established a Designated National Authority, which is responsible for the implementation of the CDM, including the provision of a Letter of Authority giving formal government approval for each project, and for the host country, in addition to this Letter of Authority, also providing documentation stating that the project does lead to sustainable development for their country. Participation is entirely voluntary and this must be stated by the DNA of each country party to a CDM project in the Letter of Authority.

The rules governing the CDM have some basic premises, but are often criticised for their complexity and fluidity, which deters long term and future investments in the mechanism (CDM Project Developer 2, 2011, pers. comm., 25 February). This is not unexpected, due to the recent and unprecedented nature of the trading mechanism. Under Article 12 of the Kyoto Protocol, for projects to be eligible for recognition under the rules of the CDM, they must be additional (Paragraph 5), contribute to sustainable development in the host country (Paragraph 2), not result in a diversion of official development assistance and assist with achieving the objective of the UNFCCC, that is, to stabilise greenhouse gas emissions at a level that would prevent dangerous anthropogenic interference with the climate system (Paragraph 5) (Kyoto Protocol to the United Nations Framework Convention on Climate Change 1997).
For a project to be additional, it must meet additionality requirements set out by the Executive Board of the UNFCCC, the governing body which is responsible for the CDM and the emissions registry showing the progress towards the emission reduction targets (CDM Rule Book 2011d). The EB deems a project to be additional if it would not have happened without the use of the CDM. Projects can claim additionality by overcoming any of the following obstacles: an investment barrier, access to finance barrier, technological barrier, barrier due to prevailing practice or other barriers (CDM Rule Book 2011d). Investment barriers are where there is a financially cheaper alternative technology available that would have led to higher emissions. The ability to claim a financial barrier rests on proving that a developer was not able to access finance for the project without the CDM component of the project. The technological barrier is where an alternative, higher emission technology is available that would involve lower performance uncertainty risks. A barrier due to prevailing practice would involve being able to show that the project is either the first of its kind in the host country, or is only one of a few projects of that type. Certain projects such as smaller scale (less than 5 MW) renewable energy projects are automatically additional if located in a least developed country, located in an area not receiving more than 12 hours of grid electricity per day or that end users of the systems are households or communities (CDM Rule Book 2011b). Some energy efficiency projects are considered to be automatically additional if meeting certain criteria, including being under 20 GWh (gigawatt hours) per year in size (CDM Rule Book 2011b).

Contribution to sustainable development in the host country is a requirement for all CDM projects as outlined in Article 12, Paragraph two of the Protocol (Kyoto Protocol to the United Nations Framework Convention on Climate Change 1997). Due to the lack of a universally accepted definition of sustainable development (discussed in Chapter 2) and as a recognition of the sovereign right of non-Annex I countries to define what is considered to be sustainable development within their boundaries, the definition of sustainable development under the CDM is left entirely for the host country to decide upon. Approval of a project’s contribution to sustainable development is granted with the Letter of Authority via the host country’s DNA (CDM Rule Book 2011a). Projects must not be funded by Official Development Assistance (ODA), which refers to the financial flow from the OECD (Organisation for Economic Cooperation and Development) Development Assistance Committee (the developing countries) to a list of aid recipients (CDM Rule Book 2011c). This is to ensure that the funds used to finance CDM projects are additional, not a substitute for any existing development assistance provided. Lastly, projects must support the overall objective of the UNFCCC, that is, a stabilisation of emissions. CDM projects therefore must lead to a reduction in emissions and to prove this, they must not create greater emissions through the construction, transportation or other emissions generating activities in the installation and operation of the CDM project. Any
such increases in emissions due to the CDM project must be included in calculations of overall emission reduction totals included in the project. All gases included under the Kyoto Protocol are eligible for inclusion in the CDM, provided that the CDM EB approves a methodology for the emission reduction project.

Nuclear projects are specifically excluded from the CDM whereas afforestation and reforestation projects can only be used to a maximum of 1% of the baseline emissions for each year of the commitment period due to continuing uncertainties about their effectiveness in reducing carbon emissions (United Nations Environment Programme Collaborating Centre on Energy and Environment Risø National Laboratory (no date)). Some countries place their own restrictions on the inclusion of certain types of CDM projects. The EU precludes the use of large-scale hydro power projects larger than 20 MW (megawatt) without the credit buying country ensuring that projects comply with the 2000 World Commission on Dams report (European Commission 2010). The EU also precludes temporary forest credits from afforestation and reforestation projects in the EU Linking Directive (Directive 2004/101/EC), which is the Directive linking CERs and ERUs to the EU ETS (European Commission 2010).

CDM projects are subject to a comprehensive and lengthy approvals process that attempts to ensure that each project meets the objectives of the CDM. The stages of the process are outlined in Figure 1-2. Should a project fail to succeed in one of the following steps, progression through the process will be suspended pending either a successful appeal, changes to the project or withdrawal of the project.
| **Project Identification Note (PIN)** | • Provided by some project participants to the host country DNA to advise of the potential for a CDM project and to gauge support for, or objection to, a project. |
| **Project Development Document (PDD)** | • Document required by the CDM Executive Board, outlining the project location and timeframe details, proof of additionality, the methodology used and monitoring plan. |
| **Letter of Authority (LoA)** | • Document required by the CDM Executive Board to establish voluntary participation in the CDM and ratification of the Kyoto Protocol by both countries. For host countries, this is where the country confirms that the project will contribute to sustainable development within their country. (This is usually required prior to validation, however in the case of Brazil, the Brazilian DNA requests that it reviews the preliminary validation report draft prior to provision of the LoA). |
| **Validation Report** | • The validation report is undertaken by an independent auditing body with approval from the CDM Executive Board, known as a Designated Operational Entity (DOE). The DoE is charged with ensuring that all statements made in the PDD are correct, both LoAs have been received and that all methodology, monitoring methods and other standards comply with the rules of the CDM and the DoE must make the PDD available for a period of public comment. At the end of this period, all comments must be addressed in the report. |
| **Executive Board Approval** | • The CDM Executive Board needs to grant approval of all CDM projects before they can be registered. |

Figure 1-2 Approvals process for CDM projects (CDM Rule Book 2012).
1.3 The CDM Global Market

1.3.1 Current Status

The global supply of CERs from CDM projects is dominated by China, India, Brazil and South Korea, both in terms of number of projects and total supply of CERs. According to the UNFCCC Risø Pipeline May 2011 data, which includes projects at the public consultation stage of validation through to the registration and issuance phases, Brazil is ranked third in the number of CDM projects and in terms of total number of CERs expected to be produced from these projects. Table 1-1 demonstrates the dominance of these three countries using data obtained from Risø May 2011.

<table>
<thead>
<tr>
<th>Host Country</th>
<th>Total number of CDM projects</th>
<th>Total number of CDM projects as percentage</th>
<th>Total expected CERs to 2012 (in thousands)</th>
<th>Total expected CERs to 2012 as percentage of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Republic of China</td>
<td>2517</td>
<td>40.9%</td>
<td>1 489 897</td>
<td>54.1%</td>
</tr>
<tr>
<td>India</td>
<td>1603</td>
<td>26.1%</td>
<td>444 293</td>
<td>16.1%</td>
</tr>
<tr>
<td>Brazil</td>
<td>354</td>
<td>5.8%</td>
<td>166 693</td>
<td>6.0%</td>
</tr>
<tr>
<td>South Korea</td>
<td>85</td>
<td>1.4%</td>
<td>106 995</td>
<td>3.9%</td>
</tr>
<tr>
<td>Global Total</td>
<td>6147</td>
<td>74.2%</td>
<td>2 755 870</td>
<td>80.1%</td>
</tr>
</tbody>
</table>

The financial value of the CER market in 2010 was US$10 billion, declining from a high of US$33 billion in 2008 (United Nations Framework Convention on Climate Change 2012c). The CER market is highly sensitive to shocks, and given the present lack of a successive emission reduction regime to the first round of Kyoto, the withdrawal of Canada from the Kyoto Protocol second commitment period and the widespread criticism of the CDM, severe price fluctuations are common.

In terms of demand for CERs, the biggest buyer market by far is the EU ETS. Table 1-2 shows the breakdown of CERs purchased by governments or companies in the EU and other buyer countries for the CDM market to 1st May 2011 based on the issuance of LoAs from Annex I countries. Buyers can come from more than one country, which explains the difference in total
number of projects listed here and in other data. Projects at the public consultation phase of validation through to issuance of CERs are included in the following calculations. For the projects that have a listed buyer, 5500 in total, the EU countries make up 62.7% of CER buyers, by number of projects, which is somewhat surprising given the initial negative stance of the EU negotiators at COP3 towards the use of flexible mechanisms. Prominent non-EU buyers are from Japan and Switzerland (10.0% and 15.9% respectively).

Table 1-2 Number of projects by credit buying country

<table>
<thead>
<tr>
<th>Buyer country</th>
<th>Number of projects</th>
<th>Percentage of projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU Member States</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>98</td>
<td>1.8%</td>
</tr>
<tr>
<td>Belgium</td>
<td>27</td>
<td>0.5%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>2</td>
<td>&lt;0.0%</td>
</tr>
<tr>
<td>Denmark</td>
<td>98</td>
<td>1.8%</td>
</tr>
<tr>
<td>Finland</td>
<td>54</td>
<td>1.0%</td>
</tr>
<tr>
<td>France</td>
<td>106</td>
<td>1.9%</td>
</tr>
<tr>
<td>Germany</td>
<td>264</td>
<td>4.8%</td>
</tr>
<tr>
<td>Ireland</td>
<td>16</td>
<td>0.3%</td>
</tr>
<tr>
<td>Italy</td>
<td>86</td>
<td>1.6%</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>31</td>
<td>0.6%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>499</td>
<td>9.1%</td>
</tr>
<tr>
<td>Portugal</td>
<td>16</td>
<td>0.3%</td>
</tr>
<tr>
<td>Spain</td>
<td>178</td>
<td>3.2%</td>
</tr>
<tr>
<td>Sweden</td>
<td>308</td>
<td>5.6%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1663</td>
<td>30.2%</td>
</tr>
<tr>
<td><strong>EU TOTAL</strong></td>
<td><strong>3446</strong></td>
<td><strong>62.7%</strong></td>
</tr>
<tr>
<td>Other buyers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Australia</td>
<td>6</td>
<td>0.1%</td>
</tr>
<tr>
<td>Canada</td>
<td>80</td>
<td>1.5%</td>
</tr>
<tr>
<td>Japan</td>
<td>551</td>
<td>10.0%</td>
</tr>
<tr>
<td>Liechtenstein</td>
<td>1</td>
<td>&lt;0.0%</td>
</tr>
<tr>
<td>Norway</td>
<td>60</td>
<td>1.1%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>875</td>
<td>15.9%</td>
</tr>
<tr>
<td>OTHERS TOTAL</td>
<td>1573</td>
<td>28.6%</td>
</tr>
</tbody>
</table>

The EU had stated that they would continue to require member states to reduce their emissions through EU binding targets, even without a successor agreement to Kyoto being negotiated (Europa 2009b). The EU remains committed to reducing emission levels after the completion of the current Kyoto period by a rate of 20% less than 1990 levels by 2020 if other countries fail to reach an agreement, or by 30% should other developed nations commit to similar targets and this will prolong the demand for credits into the foreseeable future (Europa 2009b), providing a small, but somewhat encouraging signal to the CDM market. Given that the EU ETS currently accounts for nearly 63% of the global trade in CERs, it is expected that there will still be a market for carbon permits from CDM projects into the future, albeit not as large a market as with a binding international agreement. The global financial crisis has affected the size of the CDM market due to reduced demand for CERs from Europe in particular (Watson 2012). This impact of this can be seen in the drop in contribution of the CDM towards Brazil’s GDP since 2007-2008.

The projected future of the CDM market and of CER prices are heavily influenced by the future of international climate negotiations. The severity of targets set by the countries involved, the elimination of lowest hanging fruit projects in the first commitment period to 2012, technological advances in low carbon technology making domestic abatement cheaper and the participation of developing countries in adopting binding targets, could affect the strategic interest of states and consequently their negotiating stances in international negotiations (Thomas Reuters Point Carbon 2010). An extension to the Kyoto Protocol, in the form of a second commitment period was negotiated at Durban and agreed to at the COP18 in Doha, with scope for new emission reduction targets to be negotiated in 2020, and this has provided a
future for the CDM (United Nations 2012a; United Nations 2012b; Kossoy & Guigon 2012). Whether or not the binding emission reduction targets negotiated under the post-Kyoto period in 2020 will be strong enough to provide a demand for CERs in the international arena will determine the future prices of CERs.

Brazil agreed to take on a voluntary emission reduction target in 2009, outside of its Kyoto reporting commitment, and in response to the COP13 Bali Road Map, which proposed voluntary mitigation efforts by the non-Annex I countries (Kasa 2013). The target has been issued by presidential decree and has been approved by government (Portal Brasil 2009). The target is to reduce emissions by between 36.1 and 38.9% by 2020 compared to business as usual for each year (Portal Brasil 2009). The impact that this could have on the supply of CERs in the market place has not been quantified, however one would assume that the Brazilian government would try to take advantage of the lowest hanging fruits, that is, the cheapest emission reduction projects within Brazil that still remain after the first commitment period of the Kyoto Protocol. Other non-Annex I countries such as South Africa are also set to introduce a carbon tax and emission reduction targets in the near future (Winkler 2013).

Brazil is the third largest supplier of CERs in the global market by both project number and quantity of CERs. Brazil was a frontrunner in the CDM market, being both a prominent voice in the negotiations leading to the formation of the CDM and also as the first host country to host a registered CDM project. Due to the high proportion of renewable energy sources in Brazil’s energy matrix through hydropower, Brazil has been unable to capitalise on the CDM to the extent of China and India, however the national government has actively encouraged the use of the CDM and Brazil continues to have a political and economic profile that encourages foreign investment (Thomas Reuters Point Carbon 2009; CDM Project Developer 4, 2011, pers. comm., 18 February; UK Government Representative, 2011, pers. comm., 11 January), which has resulted in a proliferation of projects in the country. The high level of organisation of the CDM in Brazil has also facilitated greater investment in the CDM in the country (CDM Project Developer 5, 2011, pers. comm., 18 February). In 2009, Brazil was ranked 5th in the list of countries with investment climates most conducive to investment in CDM projects based upon factors such as the investment climate, government willingness, potential for projects and existence of climate institutions (Thomas Reuters Point Carbon 2009). Despite the relatively non-polluting nature of the energy matrix in Brazil, with a high reliance on hydro, Brazil has experienced a large rise in emissions of 49% over the past 13 years due to land use changes and increasing energy use (Thomas Reuters Point Carbon 2009). Sources of Brazil’s greenhouse gas emissions include deforestation at 61%, the agricultural sector at 19%, energy at 15%, industry at 3% and waste treatment at 2% (Portal Brasil 2012), which suggests that a large range of emission reduction projects are possible across a range of industries or land uses (Thomas
Brazil has experienced a great regional diversity in the uptake of CDM projects, with the number of projects in each state correlated to the GDP of the host state (Fuhr & Lederer 2009). Figure 1-3 and Figure 1-4 below show both the sectoral breakdown of current CDM projects and the growth in the number of projects over time.

**Figure 1-3** Sectoral breakdown of current CDM projects within Brazil according to UNFCCC project categories

**Figure 1-4** Growth in project numbers in Brazil by number of projects sent to validation (United Nations Environment Programme Risø Centre on Energy 2011)
The EU ETS commenced in January 2005 and is the oldest and largest multi-country, multi-sector scheme in the world, considered to be at the forefront of internationally integrated carbon trading systems (Europa 2009a). Membership of the EU ETS is compulsory for all 28 EU member countries, includes non-EU members Norway, Iceland and Liechtenstein, and covers approximately 45% of all EU CO₂ emissions from a range of industries (Delegation of the European Commission to Australia and New Zealand 2008). EU wide legislation excludes the use of nuclear and temporary forest credits, the latter of which is currently allowed under the Kyoto Protocol, however member states can decide on the inclusion or exclusion of the remaining project sectors (Europa 2009c). Major hydropower projects (over 20 MW installed capacity) are subject to special consideration to ensure that the design of hydropower projects is not environmentally damaging (Europa 2009c). CERs and ERUs are relabelled as EUA units (European Union Allowances) on an equal rate of exchange to enable them to be traded within the EU ETS. Whilst the EU ETS is currently not linked to any other international markets, this could take place in the future (Bell & Drexhage 2005), and arrangements had been made for this to occur with the planned Australian trading market for instance (Department of Climate Change and Energy Efficiency 2013). The EU ETS is divided up into phases, the first being the pilot phase from 2005-2008, the second including National Allocation Plans from 2008-2012 and the third phase commenced in 2013 (Delegation of the European Commission to Australia and New Zealand 2008). All phases include the use of CDM and JI credits.

The Netherlands and the UK are the two single largest buyers of CERs within the EU. The influence that these two buyers have in the Brazilian carbon market is substantial. Using data about the projects at the public consultation stage of validation through to the issuance of CERs as at May 2011, investment by the Netherlands and the UK in the Brazilian CDM market is shown in Table 1-3 (United Nations Environment Programme Risø Centre on Energy 2011). Together, the Netherlands and the UK represent 53.2% of credit buyers for registered projects and at least 9.8% of credit buyers for future projects (those at validation, requesting registration or under review), although this does not take into account credits likely to be purchased from unilateral projects (projects with domestic rather than international investment) in Brazil. This is one of the reasons for the choice of these two countries in this research, in addition to the length of their participation in the AIJ and CDM for the Netherlands and the historical relationships between these two countries and Brazil. The Netherlands has a Memorandum of Understanding with Brazil regarding the CDM, which was signed in 2004 (European Commission 2007).
<table>
<thead>
<tr>
<th>Credit buyer country of origin</th>
<th>Projects at Registered, at Validation, Requesting Review and Requesting Registration</th>
<th>Projects at Registered, at Validation, Requesting Review and Requesting Registration as a percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>18</td>
<td>5.1%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>93</td>
<td>26.3%</td>
</tr>
<tr>
<td>Netherlands and United Kingdom</td>
<td>6</td>
<td>1.7%</td>
</tr>
<tr>
<td>Unilateral projects (credit buyer not yet stated)</td>
<td>180</td>
<td>50.8%</td>
</tr>
<tr>
<td>Other</td>
<td>57</td>
<td>16.1%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>354</td>
<td>100%</td>
</tr>
</tbody>
</table>

### 1.4 Weaknesses of CDM

The concept of CDM carbon permit trading is considered to be a win-win situation for both host and credit buying countries (Olsen 2007; Matsuo 2003). There is, however, a large amount of criticism of the CDM for its inability to contribute to meaningful sustainable development within host countries, and in some specific cases, its contribution to harming the sustainable development and well-being of stakeholders. This criticism results in large part from the belief that a market mechanism such as the CDM is unsuitable as a tool to promote sustainable development and that structural weaknesses in the CDM prevent it from achieving its stated objectives under Article 12 of the Kyoto Protocol. Common criticisms of the CDM focus on the structural weaknesses in the design of the CDM and its approvals processes, a questioning of the motives of credit buyer country governments in favouring cheap abatement options and a questioning of the ability or willingness of host country governments to prioritise the contribution of the CDM to sustainable development over their pursuit of foreign direct investment in the form of CDM financial transfers.
One of the main criticisms of the CDM relates to how the ongoing COP negotiations have failed to define or identify guidelines for the definition of sustainable development (Sutter & Parrerio 2007; Burian 2006; Olsen & Fenham 2008; Müller-Pelzer 2009; MacDonald 2010; Cosbey et al. 2005). Out of respect for the sovereignty of host countries and a belief in their position to best identify their internal development needs, the definition of sustainable development is left entirely to the host country to make and this was a key component of gaining the support of the developing countries during the COP3 negotiations on the CDM. A lack of international consensus on a definition for the concept, and a perceived inability to apply any such definition universally, have led to the legal requirement for CDM projects to being assessed only by the host country government rather than by the Executive Board or any independent auditor such as the DOE. This potentially enables the assessment of a project’s contribution to sustainable development to be swayed by external influences, such as a host country’s motivation to encourage foreign direct investment and increase the tax base from income generated by CDM projects.

It has been suggested that expectations for the CDM to bring about technological and infrastructural changes may not be realistic under the current framework (Bell & Drexhage 2005). The framework of the CDM places a monetary value on the generation of CERs, which fulfils one objective of the CDM, to reduce greenhouse gas emissions, however there is no monetisation of the contribution of a project to sustainable development, leading to a lopsided emphasis by project developers on achieving emission reductions rather than on ensuring that the project contributes to sustainable development. In addition, compulsory monitoring of a project is, in the majority of cases, restricted to the monitoring of emission reductions and not for the contribution of a project to sustainable development (Müller-Pelzer 2009; Olsen & Fenhan 2006).

These critical weaknesses of the CDM are discussed in further detail in Chapter Four with reference to the particular case of Brazil as a host country and the UK and the Netherlands as credit buying countries. Overall, this thesis aims to assess the impact of UK, Dutch and Brazilian policies towards the CDM on the success of Brazilian CDM projects in achieving the objective of sustainable development and the methodology section below outlines how this aim will be achieved.

1.5 Methodology

This thesis investigates the case study of Brazil and its CDM trading relationship with the Netherlands and the UK and how institutional frameworks influence the on-ground sustainable
development outcomes of CDM projects. The data collection and analysis methods used in this thesis are documented in the following paragraphs.

Scholarly literature and policy documents formed an important resource for this thesis. A systematic review was conducted of published peer-reviewed scholarly literature to document the development of the CDM through the Kyoto Protocol, the role of the different negotiating parties and the roles of the EU, Brazil, the Netherlands and the UK. The literature review, coupled with an analysis of policy provided information about the development needs of Brazil, and in particular those needs that were of direct relevance to the CDM.

A comparative analysis of policy on CDM and climate change was undertaken to identify motivations for the use of international carbon trading as a potential solution to both climate change and poverty. Electronic and hard copies of current and past policy documents were thematically reviewed. The use of the literature review and policy analysis guided the assessment of the UK, Dutch and Brazilian policies regarding the CDM.

Indepth, semi-structured interviews were conducted with policy makers involved in the CDM in the Netherlands and the UK. These interviews aimed to elicit data to enable the comparison of the importance given to sustainable development in the purchase of CERs from host countries. Indepth semi-structured interviews were also conducted in Brazil with a range of academics, policy makers, non-governmental organisations and participants in the carbon market using a guided interviewing approach in order to understand the relevance of sustainable development to the CDM market.

Initially, potential participants were identified by virtue of their employment positions through an Internet search. Potential participants were contacted in the first instance by email with an explanation of the research and a request for interview. In all, 16 interviews were conducted with 18 participants (one interview had three participants in it). Four of the interviews were conducted with Brazilian government officials from the Interministerial Commission on Global Climate Change, one with a Brazilian non-governmental organisation, four with project developers in Brazil, one with a designated operational entity in Brazil, one with a UK government representative, one with a Dutch government representative, one with a voluntary accreditation standard manager and five interviews with CDM researchers in Brazil. These interviews were conducted between September 2010 and February 2011. The length of interviews ranged from 30 minutes to 2.5 hours. Most interviews were conducted in person, with two interviews conducted over the phone and one interview conducted via an exchange of emails. The use of translation was offered to all interviewees, however none chose to accept this offer so all interviews were conducted in English. Those who were willing to be part of the research were provided with the opportunity to nominate the time and location for the interview,
with most interviews taking place in the participants’ place of work. All participants from both Europe and Brazil freely participated in these interviews and were informed that they were free to withdraw at any time in accordance with the University’s ethical guidelines. Participants were not compensated financially for their time as is generally consistent with this type of research and interviewees were advised that interviews results would be treated anonymously. The use of the ‘snowball’ technique was adopted to obtain contact details and possible interviewees who were not identified as being of potential interest at the beginning of the fieldwork stage of this research.

A desktop analysis of the sustainable development outcomes of each of the 178 Brazilian CDM projects registered prior to 1 May 2011, for which all documentation was publicly available, was undertaken. Three approaches were used for this assessment. First, project outcomes were assessed against the Brazilian CDM checklist. Secondly, project outcomes were assessed against a combination of all indicators, with relevance to the development priorities of Brazil, contained within all internationally recognised assessment approaches. Through considering all indicators used across the various assessment tools, the biases that may have been built into different tools were minimised. The assessment tools considered in this step included:

- Brazil’s Annex III checklist criteria (Interministerial Commission on Global Climate Change 2003);
- Sutter’s MATA-CDM (multi-attributive assessment of CDM projects) tool (Sutter 2003);
- The Gold Standard analytical tool (Ecofys, TÜV-SÜD & FIELD 2008a);
- The SouthSouthNorth Clean Development Mechanism Practitioner’s Practical Toolkit (Burian 2006);
- Indicators used by the Grupo de Pesquisa em MDL da UFBA (CDM Research Group of the Federal University of Bahia) (Andrade unpublished; Guillen 2010);
- The Development Dividend (Cosbey et al. 2006);
- The UNFCCC assessment method (United Nations Framework Convention on Climate Change 2011);
- A multi-criteria assessment originally used for Indian CDM projects (Alexeew et al. 2010);
- The Social Carbon methodology (Social Carbon 2011);
- The Climate, Community and Biodiversity Project Design Standards (Climate Community and Biodiversity Project 2008).

Lastly, an adapted multi-criteria assessment was used to numerically score the contribution of projects to sustainable development in Brazil. This was developed based on the multi-criteria
assessment developed by Alexxew et al (2010). Chapter Five provides more detail on these assessment methods as well as presenting a justification for the indicators chosen.

Statistical tests have been conducted to assess the strength of the relationship between various indicators within the three assessment tools and the factors of sustainable development. This analysis is conducted as an overall approach for all projects, as a comparison tool between different project types and between different project scales. The results of these assessments are presented in Chapter Six.

The reasoning being the use of three individual assessment methods involves the wish to comprehensively assess the contribution of the CDM to sustainable development in Brazil and to illustrate how the use of different indicators can considerably influence the ‘success’ of CDM projects. This project was not seeking to deliver a new methodology for assessing sustainable development outcomes from the CDM.

Through the thematic analysis of scholarly literature and interviews, a critical review of policy and statistical analysis of data recording claims about project outcomes, this thesis provides a unique insight into what institutional factors influence the success or otherwise of CDM projects in promoting sustainable development.

1.6 Conclusion

This chapter has explored the challenges of global warming for both developed and developing countries and the difficulties faced by international negotiations to address global warming. The formation of the CDM as a ‘surprise double-win’ compromise between the developed and developing states led to high expectations for the mechanism, however the success in achieving the sustainable development objective of the double-win has been widely questioned. This research will explore the contributions of the CDM towards sustainable development in Brazil, the third largest host country of CDM projects, using two of the largest credit purchasing countries, the UK and the Netherlands, as case studies. Within Brazil, together the UK and the Netherlands purchase credits from over half of all Brazilian projects registered to 1 May 2011, the timeframe of this research.

The methodological framework, as outlined in this chapter, includes the use of literature and policy reviews, interviews and a detailed desktop analysis to allow for a triangulated research approach. The use of multiple assessment methods for the analysis of projects hosted by Brazil will enable a more comprehensive analysis than that which could be achieved through the use of a single assessment method. The following chapter explores the concept of sustainable
development and the major debates about how sustainable development can be measured. It specifically considers the sustainable development priorities for Brazil.
2 Priorities for Sustainable Development in Brazil

Introduction

Growing disillusionment with traditional top down and economic growth based development policies, alongside an understanding that traditional development trajectories have failed to consider environmental carrying capacity, has set the scene for the widespread adoption of the concept of sustainable development, including as one of the two objectives of the CDM.

Focusing on the development priority areas for Brazil as defined by the Brazilian government, non-governmental organisations and Brazilian civil society, this chapter will identify those areas in which the CDM can reasonably be assumed to have an impact, within the framework of the three pillars of sustainable development – environmental, social and economic development. The identification of these priority areas for development will allow for an assessment of the contribution of the CDM towards these development priorities in Chapter Six.

2.1 Sustainable Development in the CDM

In the UNFCCC and throughout the Kyoto Protocol, there is an emphasis on the need for developing countries to continue to develop without impediment, including the international push to stabilise greenhouse gas emissions in order to avoid global warming. The Convention and Protocol call for consideration of the needs of these developing countries and encourage a low carbon development trajectory through adoption of the concept of sustainable development and use of technology transfer. The Protocol stipulates that for CDM projects to successfully generate valid CERs, projects must be confirmed to be contributing to the sustainable development needs of the host country to the project (Kyoto Protocol to the United Nations Framework Convention on Climate Change 1997).

In order to achieve consensus on the integration of the CDM into the Kyoto Protocol, it was decided that the definition and assessment of the sustainable development objective of the CDM would be left entirely to the host country government, or the DNA, acting as the representative of the host government. There were a number of reasons for this decision.

- First, there is no universally accepted definition of sustainable development, although the definition put forward by the 1987 World Commission on Environment and Development and at the 1992 Earth Summit is unofficially recognised as the accepted
definition (World Commission on Environment and Development 1987a; Kyoto Protocol to the United Nations Framework Convention on Climate Change 1997). Nor is there a universally accepted method of monitoring, assessing and pursuing sustainable development;

- Secondly, given the tendency of the individual states participating in the negotiations to actively protect the power they hold over their sovereign territory and the tendency of states to mutually respect these sovereign powers, it was unlikely that developing states would yield power to an internationally negotiated definition of sustainable development even if one existed. Attempting to negotiate a universally accepted definition of sustainable development would have been seen as impinging on the sovereign right of developing states to determine their own pathways to development and would have resulted in the loss of support for the CDM from the developing states during the negotiations; and

- Thirdly, current development thinking emphasises the need to define, monitor, assess and pursue development in response to the specific needs and situation of countries or at an even smaller scale. It was thought that the best organisation capable of making appropriate decisions on what constitutes sustainable development within the host country was the host country government so that projects ‘create and maximise synergies with local development goals’ (Olhoff et al. 2004, p. 7).

In order to prove that a CDM project contributes to sustainable development for the host country, the project developer must obtain a LoA stating this from the host country DNA. There is no further requirement for the project developer to prove to either the DOE or the UNFCCC EB that the project does in fact contribute to sustainable development for the host country.

Given the widespread criticism of the CDM for failing to contribute to sustainable development for host countries, there has been a proliferation of methods and measurements to define, monitor and assess sustainable development, as well as methods for pursuing it have been published. The wide array of sustainability assessments relates to both the compliance (CDM) carbon market as well as the voluntary carbon markets. Some assessments grant the accreditation of a quality standard label for CERs or Voluntary Emission Reductions (VERs) in return for a fee. A review of sustainability assessments is provided in Chapter Five.

2.2 Defining Sustainable Development

The concept of development has a history leading back to the age of Enlightenment where the concept was modelled on the societies of post-revolution Western Europe (Dodds 2002; Power
The concept of development was popularised in the post-World War II era, with the end goal focused on achieving industrialisation, free markets, democracy and high mass consumption, reflecting the priorities of the US government at the time, the main provider of foreign aid to assist in development in the post-WWII era (Dodds 2002; Nustad 2001). This approach was not without its critics, including those who believed that the development success or otherwise of a country was dependent on the structure of the world’s political and economic systems (Hettne 2002). The concept of sustainability is linked to the belief in the carrying capacity of the natural environment, something that was first questioned at an international level in the 1970s, in particular with the publication of the Club of Rome ‘Limits to Growth’ and a resurgence in Malthusian thinking (for details on Malthusianism, see Burgers 2006; Dryzek 1997; Stilwell 2006). Sustainable development, the culmination of these two concepts, emphasises the need for development to occur within the confines of the world’s natural ecosystems, and to incorporate notions of intergenerational and spatial equity of resource endowments between developed and developing countries, recognising that social and economic practices cannot be separated from the natural environment (World Commission on Environment and Development 1987a).

The sustainable development agenda emerged due to a combination of disillusionment with grand meta-theories on development which had led to only isolated development successes, and the growing realisation that the carrying capacity of the environment is a crucial, yet until recently, largely ignored factor in the push for development. Whilst dependency theory touched on the environment through an exploration of environmental load displacement from the core to the periphery (Hornborg 2008), and modernisation was fuelled by the attempted domination of nature (Park, Conca & Finger 2008), the meta-theories of development failed to take into account the role of the environment in aiding, limiting or shaping development objectives (Dryzek 1997).

Sustainable development focuses on the complementarities rather than the conflicts between growth and environmental sustainability (Connelly & Smith 1999). It represents a move away from traditional environmentalism with a pure focus on environmental concerns to one that integrates social, economic and environmental concerns (Carter 2001), and a move away from development focused purely on economic growth or production (Burgers 2006). Proponents of sustainable development suggested that the focus of development or economic growth policies should be on a ‘triple bottom line’, calculating the social, environmental and economic costs and benefits of projects rather than simply focusing on the economic costs and benefits.

In most interpretations of the concept, in order to achieve sustainable development, no major changes to the current political and economic structures either domestically or internationally
are required (Dryzek 1997), yet this view is disputed by others who claim that some weaker versions of sustainable development are little more than green-washing that do not address serious environmental problems (Morrow 2012). The introduction of policies that advocate property rights over environmental goods, market-based or regulatory incentives, which are characteristic of Promethean thinking, are seen as ways to integrate sustainability and development by helping to enable the continuation of a constant natural capital and avoiding a ‘tragedy of the commons’ scenario (Stilwell 2006). This approach views the role of the environment as one of resource provision, and lack of resources as a sign of environmental problems, rather than focusing on the capacity of the environment to absorb the waste by-products of industrialisation (Dryzek 1997).

There is no consensus on a definition for sustainable development and over 40 definitions have been identified in the literature (Carter 2001). The most commonly accepted definition of sustainable development is the one stated in the World Commission on Environment and Development report preceding the 1992 Earth Summit (also known as the Brundtland Report), which is ‘[s]ustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (World Commission on Environment and Development 1987b). Sustainable development is seen as a policy direction rather than an end goal as no society or state, developed or otherwise, has been able to achieve something defined as sustainable development (Dryzek 1997). The WCED report outlines the five requirements necessary to achieve sustainable development as a democratic political system which involves effective and meaningful participatory decision making, the inclusion of the precautionary principle, an emphasis on equity, planning at every level of society and policy integration (Carter 2001).

A number of issues have arisen from the promotion of the sustainable development agenda as a solution to issues of underdevelopment in the developing world.

- First, sustainable development does not offer a clear pathway or set of policies that developing countries can follow (Carter 2001), unlike other ecological theories such as ecological modernisation; (Connelly & Smith 1999; Carter 2001; Dryzek 1997);

- Secondly, sustainable development is a highly contested concept with even the Brundtland definition open to disagreement over terms such as ‘needs’ which are culturally constructed and highly dependent on local environmental or cultural concerns rather than being universal truths (Redclift 2002). This does not undermine the definition of sustainable development, it simply highlights the importance of considering environmental and cultural contexts when developing a definition;
Thirdly, recognition of the differences in what is seen as environmentally damaging behaviour between the developed and developing countries is needed before a universal definition or pathway to sustainable development can be considered. Whilst the assumption cannot be made that views within the developed countries and the developing countries are homogenous, general disparities in the views between the two groups include the effects of population growth on the environment, consumption and the production of waste, links between poverty and environmental protection and the importance of global environmental problems versus those at a local scale. Definitions of the concept of sustainable development are highly contested, yet most view poverty and unequal distribution of wealth as being among the central causes of environmental degradation, particularly in the developing world (Carter 2001). The differences in host country definitions with regard to the CDM and the impact this has on the contribution of CDM projects to sustainable development are discussed in Chapter Five.

The concept was officially recognised at an international level during the UN Conference on Environment and Development in Rio de Janeiro in 1992, which was the largest diplomatic gathering to date on any issue (Vogler 1996). The conference resulted in a plan of action for preserving the environment and promoting sustainable development (Agenda 21) amongst other agreements such as establishing the UNFCCC and the Rio Declaration on Environment and Development (United Nations Department of Economic and Social Affairs Division for Sustainable Development 2012).

This emphasis on the environment and sustainable development in the international arena, including in the area of foreign aid had led to concern from developing countries that environmentally specific aid would supplant traditional forms of foreign aid and therefore retard economic development. The Global Environmental Facility, under the tutelage of the World Bank, was established in order to finance sustainable development and to pay for the costs involved with being party to the UNFCCC, without developing countries needing to divert finances from much needed economic development (Global Environmental Facility 2007).

The enthusiasm and optimism following the Earth Summit in Rio de Janeiro did not translate into widespread success of the ideals of sustainable development, global environmental governance nor human development (Park, Finger & Conca 2007). The series of conferences, including the COP3, have been criticised for underestimating the dynamics of industrialisation, technology and economic globalisation where environmental problems are a result of system-wide pressures, rather than merely transboundary pollution issues; an inadequate understanding of global environmental and development problems; and an emphasis on the state centred change, overestimating the capacity of states to address environmental and developmental
problems without addressing the role of larger global political economy in this process (Park, Finger & Conca 2007).

The surge in environmental consciousness in international relations has involved a discussion of the disparities between the views of developed and developing countries regarding priorities towards the environment, sustainability and development trajectories (Connelly & Smith 1999). One major concern of the developed world that arose in international climate and environmental negotiations was that the developing world, and in particular countries with large populations such as India and China, were following a similar development trajectory as the industrialised countries, and the rate of resource consumption posed a threat to both the ecological capacity of the world and the lifestyles of those people living in developed world conditions (including the richer citizens of the developing nations). Some commentators frame this concern as the developed world demanding that the developing world sacrifice the same level of development so as not to threaten their lifestyles nor place anymore pressure on finite resources (Desai & Potter 2002; Parks & Timmons Roberts 2008). However the single model development approach has been largely abandoned as the ideal trajectory and there is a growing realisation that developing countries should not follow the same carbon intensive trajectory, environmentally damaging development model, nor is this environmentally desirable. Mechanisms such as the CDM and its emphasis on the benefits of technology transfer are designed to help developing countries achieve their social and economic goals without a great increase in carbon intensity through the sharing of technology and information already available to the developed world.

There are important differences concerning which environmental problems are deemed to be more pressing both between and within the developed and the developing worlds. The developed countries have historically set the agendas of international negotiations, and as such, the finances and time of international environmental efforts have tended to focus on the problems that the developed world deems of most importance, such as transboundary pollution, global warming, biodiversity loss and destruction of the ozone layer (Shiva 1994). The developing countries on the other hand argue that local scale environmental problems such as desertification, clean water supply, sanitation, coping with natural disasters and meeting the basic needs of their populations are far more urgent concerns and (Rowlands 1995; Gupta 1995).

The differences in concerns have been acknowledged in allowances made in some negotiations such as the Montreal Protocol, which was subject to a delayed phase-out of CFCs (chlorofluorocarbons) in developing countries in order to encourage agreement by the developing world and recognise their lesser relative abilities to deal with such concerns (Rowlands 1995). Yet in other arenas, such as the objectives outlined for the Global Environmental Facility, the
emphasis is on environmental problems of global concern such as biodiversity loss, global warming, destruction of the ozone layer and preventing pollution of international waterways (Rowlands 1995).

2.3 Indicators of Sustainable Development

The push for development of the developing world has been an objective of governments, state based international organisations, international economic institutions and non-governmental organisations across the world for at least the past 60 years. Yet what success has been achieved through this development agenda and how has success been evaluated? Grand policy programs such as the United Nations (UN) Development Decade of the 1960s and the UN Millennium Development Goals of the 1990s have resulted in some successful cases of development in countries of the developing world, however widespread poverty and inequality are still endemic for a large portion of the member states of the United Nations, including within middle-income countries as well as low-income countries (Summer 2012).

Perhaps a discussion of development can best be had through a comparison of the indicators used to evaluate the success of development within a country. Development, as defined by classical economists, can be evaluated solely on country wide, economic specific indicators such as gross domestic product (GDP), gross national product (GNP which is GDP plus international income) and national debt. These indicators were introduced in late 1940s and gained popularity due to ease in which numbers could be communicated in many countries and the appeal of simple comparative assessments (Hardi & Zdan 1997). These indicators can however be misleading, hiding inequalities and diversity within and between regions, social groups and excluding any indicators on quality of life or other indicators of poverty (White 2002). As Amartya Sen argues:

‘Economic growth, however, is not the same as economic development. The process of economic (and social) development must imply a growth in living standards, but it is a much wider concept than the growth of per capita income alone. Growth, it might be said, is a necessary condition for the economic and social development of nations, but it is not a sufficient condition because an aggregate measure of growth or per capita income pays no attention to how that output is distributed amongst the population; it says nothing about the composition of output (whether the goods are consumption goods, investment goods or public goods such as education and health provision), and it gives no indication of the physical, social and economic environment in which the output is produced. In short, the growth rates of nations cannot be taken as measures of the increase in the welfare of societies because the well-being of people is a much more inclusive concept than the level of income alone’ (Sen, cited in Thirlwall 2002, p. 42).
In response to concerns about the inapplicability of national economic indicators to other forms of development and in particular poverty, the UN developed the Human Development Index (HDI) in 1991, which attempts to incorporate a number of indicators from three different aspects of life in order to rank countries by their HDI and in order to assess progress across time. The HDI recognised that indicators based purely on national wealth were not showing how this wealth transformed into changes in standards of living. The HDI is based on the ability to have a long and healthy life, knowledge and GDP, which is calculated using life expectancy at birth, adult literacy rate and GDP per capita statistics (Singh et al. 2009). Other attempts to provide an indication of welfare include the Centre for Environmental Strategy and the New Economics Foundation which looked at the proportion of economic activity that distributes welfare to people, such as transportation, health and education expenditure, as opposed to the GDP which does not distinguish between activities that would improved or damage quality of life (Singh et al. 2009).

The UN Millennium Development Goals (MDGs), which have achieved widespread support from states in the developing and developed world, include criteria and indicators that emphasise the need for an eradication of extreme poverty and hunger, universal primary education, gender equality, a reduction in child mortality, improvements in maternal health, a reduction in disease, promotion of environmental sustainability and the development of global partnerships for development (United Nations Development Programme 2008). However poverty itself is another problematic definition and there are two types of poverty discussed in the literature, relative poverty (measured against prevailing social standards) and absolute poverty (the inability to meet basic needs such as food and healthcare) (White 2002). The UN MDGs incorporate environmental, social and economic criteria and are a more wholistic set of criteria and indicators for development when compared to purely national economic indicators.

Any study wishing to assess the developmental successes or failures as a result of emissions trading in the CDM needs to first to understand the current political, economic, environmental and societal circumstances within Brazil and the impacts of past development strategies in the country. It needs to be understood that the CDM is not capable of contributing to every development objective within Brazil. The major priority areas for which the CDM can reasonably assume to contribute are discussed in this chapter, starting with a discussion of the major policies that have informed the selection of these priority areas.

2.4 Major Development Priority Areas for Brazil

This study seeks to investigate the sustainable development successes or failures of CDM projects in Brazil. For this it is first necessary to understand the current political, economic,
environmental and societal circumstances within Brazil and the impacts of past development strategies in the country. It is important to recognise that the CDM is not capable of contributing to every development objective within Brazil.

The development status of Brazil has improved significantly since the mid-1990s, including a reduction in inequality and poverty. The percentage of Brazilians living below the $2 per day PPP (purchasing power parity) poverty line, for instance, declined from 24% in 1990 to 10% in 2008 (World Bank 2011c). Brazil is set to achieve many of the MDGs before the 2020 deadline (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010). Brazil has experimented with a variety of development approaches including import substitution industrialisation (ISI), neo-liberal approaches in the 1990s and conditional transfer programs such as the Bolsa Família (Family Scholarship) Program. Of these approaches, the latter has been successful in improving extreme poverty rates and reducing inequality (Lindert et al. 2007). In increasing economic development, Brazil is now the seventh largest economy in the world (World Bank 2012b), attracting US$30 billion in foreign direct investment in 2010, which gave it a ranking of 10th in the world for this (Hornberger 2011), and enabling itself to become the regional leader for South America and a spokesperson for the developing world in international negotiations and a provider of foreign aid to other countries in the developing world.

The history of Brazilian development has been plagued by a number of reoccurring issues, which continue to threaten both equality and democracy within Brazil. The continuing legacy of the way in which lands in the North and Northeast of Brazil were colonised can be seen today in the way that landlessness and land reform are still major political and social issues for Brazilians (Schneider 1991); (Pulsipher & Pulsipher 2008). Regional inequality, inequality between the ethnic groups in Brazil and inequality between rural and urbanised areas has continued to plague Brazil, even when economic development at a national level continues to show signs of improvement (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010). These inequalities threaten to undermine Brazil’s attempts to maintain its status as the regional power. The core focus of Brazil’s development policy continues to be on the production of growth with greater equality of income distribution and opportunities, as demonstrated by the Government’s multi-year plan entitled Plano Mais Brasil (the More Brazil Plan) and the Plano Brasil Sem Miséria (Brazil Without Misery Plan) launched in 2011 (Government of Brazil 2012; Seligmann 2012; Parliament of the United Kingdom of Great Britain and Northern Ireland 2011). The current development status and needs of Brazil vary widely across geographical regions, with the North and Northeast differing greatly from the South and Southeast. Current development statuses and needs also differ greatly along race, gender and age lines.
Economic success on a national level has not resulted in the elimination of poverty, nor a decline in the vast inequalities that many Brazilians experience that could be seen as commensurate with the economic growth that Brazil has experienced over the same time period. Any improvement in standards of living experienced within Brazil over the past decade has not been enjoyed by all Brazilians, despite attempts to reconcile economic growth and increased foreign direct investment with greater equality of income and opportunity (Parliament of the United Kingdom of Great Britain and Northern Ireland 2011; Borges da Cunha, Walter & Rei 2007; Pulsipher & Pulsipher 2008). Brazil is a country of social contrasts and many Brazilians suffer from poverty and inequality despite the nation’s wealth in natural resources (Wilson’s Centre, cited in International Institute for Sustainable Development 2004, p. 11). As part of a 1995 study into Dutch aid to Brazil over the years, it was found that there were ‘few countries in the world where widespread poverty can be as clearly related to social and economic inequality as in Brazil. There are also few countries where the persistence of poverty is as unnecessary as in Brazil’ (Poelhekke 1996, p. 11).

The persistently high Gini inequality index indicates the prevalence of a highly stratified society, with the vast majority of the country’s wealth located in the richest 20% of the population while many still live below the poverty line. There have been some positive signs for reducing this excessive concentration of income (Baer 2008) as shown by a recent decline in the historically high Gini inequality index since 2000 (EuropeAid Co-operation Office 2005). Vast national social programs, including the Bolsa Família Program, have helped contribute to this decline in inequality across Brazil.

This chapter outlines the development priority areas for Brazil as a whole. This information is presented in order to identify and highlight the development requirements of Brazil to enable a comparison of these results with the sustainable development outcomes required by the Brazilian DNA and the results of the assessment of projects presented in Chapter Six. These priority areas are informed by a number of important governmental and non-governmental policy documents such as the United Nations’ Millennium Development Goals, Brazil’s Agenda 21 and sustainable development indicators identified by Brazil’s Institute of Geography and Statistics (IBGE). Data on Brazil’s population, Human Development Index (HDI), the Gini inequality index, life expectancy, housing, GDP, rural development, income inequality and energy supply have informed this selection of priority areas.

Brazil signed the United Nations Millennium Declaration in 2000 and agreed to adopt measures to ensure that development objectives across eight areas and against 18 specific targets would be met (United Nations Statistics Division 2011). The goals were updated in 2007 and Brazil’s reporting against these goals is divided into categories of gender, rural and urban and ethnic
groupings of branca (white) and preta e parda (black and brown). Data for assessment is
gathered by the Brazilian Institute of Applied Economic Research and the Brazilian Department
of Planning and Investment and assessment excludes the rural populations of Rondônia, Acre,
Amazonas, Roraima, Pará and Amapá, due to difficulties in gathering reliable data from such
remote locations (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e
Investimento Estratégicos 2010). The UNFCCC, project developers and many host countries
cite these goals when referring to the sustainable development objectives of the CDM.

Rather than being an official policy document, the Brazilian Agenda 21 is a social contract
between the government and society and is a major influence on public policy decision making
in Brazil (Ministério do Meio Ambiente 2012). The Agenda was signed by the Brazilian
President in 2002 in preparation for the World Summit on Sustainable Development and was
created through the collaboration of civil society and the government as a response to Rio
Agenda 21 (International Institute for Sustainable Development 2004). The Agenda is praised
for being the most extensive evidence of participatory planning in Brazil (Comissão de Políticas
de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004a). It focuses on six themes
including: natural resource management, sustainable agriculture, sustainable cities,
infrastructure and regional integration, reduction of inequalities and the development of
sustainable development technology (International Institute for Sustainable Development 2004;
Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b). The
Agenda is implemented through education, local development actions, programs and activities
of all tiers of government and partnerships with forums such as the Brazilian Forum of NGOs
(non-governmental organisations) for Environment and Development (FBOMS) (Ministério do
Meio Ambiente 2012).

In 2010, IBGE released 55 sustainable development indicators, in an attempt to integrate
principles from the UN Commission on Sustainable Development (UNCSD) in 2002 and from
the principles from Agenda 21 (Instituto Brasileiro de Geografia e Estatística 2010c). The 55
indicators are guided by four aspects including distributive equity, efficient and rational use of
resources, adaptability and taking into account the needs of future generations (Instituto
Brasileiro de Geografia e Estatística & Ministério do Planejamento 2010; Compendio Para a
Sustentabilidade - Todos os Direitos Reservados 2008). IBGE highlights the need to specifically
focus on socioeconomic inequalities and environmental impacts (Instituto Brasileiro de
Geografia e Estatística 2010c). Social impacts that are identified by IBGE as concerning
include: persistent ethnic income and educational inequality; regional inequalities and high Gini
Index; regional inequality for life expectancy and infant mortality; inadequate provision of
water supply, sewage disposal or garbage collection and large regional variation in those
hospitalised due to sanitation problems (Instituto Brasileiro de Geografia e Estatística 2010c).
Brazilians development has shown great improvements over the past two decades in terms of achieving or being on target to achieve the Millennium Development Goals, and towards the attainment of the Brazilian Government’s sustainable development priorities, discussed in the following section. Indicators such as the HDI show that Brazil ranks at 84 out of 187 countries using selected health, economic and educational indicators (United Nations Development Programme 2011; Singh et al. 2009).

Brazilian development has not taken place evenly however, and there is a high level of regional and ethnic diversity in the development that has been achieved. For most social indicators, including education, employment, income and household access to services, the preta e parda (black and brown) population lacks the same level of development as other groups within society. When the HDI is adjusted to take into account inequality, the HDI falls from 0.718 in 2011 to 0.519 (United Nations Development Programme 2011).

The major challenges for Brazil, as detailed in the following sections, continue to include the need to address these regional, ethnic, land and income inequalities and the problems that they cause for Brazil’s population including high levels of internal migration and persistent health, educational and employment inequalities. The following sections outline the main priority areas for development that can be associated with potential outcomes of CDM projects in Brazil. These priority areas are divided up into environmental, social and economic sections, based on the common sustainable development pillars, although there is some overlap between these areas, such as how CDM projects contribute to employment generation or renewable energy generation for example. These priority areas form the basis of the analysis in Chapter Six as to how well, if at all, CDM projects from different buyers, different project types and at different scales help contribute to these sustainable development objectives for Brazil.

2.4.1 Priority Environmental Issues

2.4.1.1 Reducing Air Pollution in Urban Areas

Reducing air pollution and improving air quality, in particular in urban areas, are stated environmental development objectives of the Brazilian government, as expressed through a number of documents and policies such as IBGE’s sustainable development indicators and Brazil’s Agenda 21 (Instituto Brasileiro de Geografia e Estatística 2010c; Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004a). In particular, the indicators focus on the loss of ozone concentrations in urban areas, and the Southeast is one region where air quality improvements are a priority (Marcilio & Gouveia 2007). This priority is of direct relevance to CDM projects where the reduction of air pollutants and particulate matter are often positive co-benefits from a reduction of greenhouse gas emissions (Ministério do Meio Ambiente 2012).
Reducing deforestation and land degradation are stated goals in Brazilian policy and are included as part of the seventh MDG, including 7A, reversing the loss of environmental resources and 7B, reducing biodiversity loss (United Nations Statistics Division 2011; Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010). Indicators to measure progress on these goals include the monitoring of deforestation rates and protected areas of forest cover. The contribution to CO₂ emissions by sector indicates that the majority of CO₂ emissions are from deforestation and land use changes (mainly in the Amazon) and, despite an overall decline in the energy intensity of the economy from 1970 onwards, overall CO₂ emissions rose 69% from 1990 to 2005 (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010). Reducing deforestation and land degradation is a major component of reducing GHG emissions from Brazil.

As part of the 21 priority action areas of the Agenda 21 document, objective 15 focuses on deforestation control, forestry policies and the implementation of biodiversity corridors (Ministério do Meio Ambiente 2012; Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004a). Deforestation and land degradation are explicitly listed as one of the biggest environmental challenges for Brazil (International Institute for Sustainable Development 2004). Policies suggested to counter these threats outlined in the document entitled Agenda 21 Brasileria Resultado da Consulta Nacional (Brazilian Agenda 21 – Results of the National Consultation) and include the: promotion of the sustainable management of biodiversity; encouraging initiatives to produce native seedlings; improving knowledge about biodiversity; recovery of degraded ecosystems; protection of the soil surface; control of pollutants and contamination, management of solid waste and action against deforestation (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b). Standardised indicators used for reporting on progress towards sustainable development goals throughout Latin America and the Caribbean regions include indicators for land degradation and desertification (Ministério do Meio Ambiente et al. 2007).

IBGE has also adopted a number of indicators related to this priority development area (Instituto Brasileiro de Geografia e Estatística 2010c). The major stated environmental threats to sustainability according to IBGE, include deforestation in the Amazon, Atlantic forest and the Cerrado, which in turn is threatening biodiversity within Brazil (Instituto Brasileiro de Geografia e Estatística 2010c). There is also a concern that water degradation has occurred as a result of land clearing and there is an emphasis on the need to protect wetlands and areas surrounding river systems (Instituto Brasileiro de Geografia e Estatística 2010c).
CDM projects could contribute to this priority area as one of the biggest causes of environmental damage in Brazil, including deforestation, is agricultural production (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b). In particular, cane sugar and swine production are included as part of the main agricultural sectors (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b) and both industries feature prominently in the CDM project portfolio in Brazil. One major concern for deforestation is that the environmental policy, Código Florestal (Forestry Code), which requires between 20-80% of total area of agricultural hills and river banks to be lined with forest cover, is not actively enforced and an estimated 3 million farmers are in breach of this code (Schneider, Shiki & Belik 2010). This is relevant to the CDM because CDM sustainable development claims are not monitored and claims towards improving forest coverage or reducing deforestation may not be implemented, in much the same was as the Código Florestal.

2.4.1.3 Protecting Biodiversity
Similarly to reducing deforestation and land degradation, the protection of biodiversity is an environmental sustainable development objective included in Brazil’s Agenda 21 (Ministério do Meio Ambiente 2012; Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b), in a range of government and research institute documents (Instituto Brasileiro de Geografia e Estatistica 2010c; Ministério do Meio Ambiente et al. 2007) and in the Millennium Development Goals (United Nations Statistics Division 2011), specifically goal 7B. Brazil is one of just 17 nations considered to be ‘mega-diverse’ in terms of biodiversity, something considered by Brazil to be of both environmental and economic importance despite there being an increase in the number of species threatened compared to the past (Instituto Brasileiro de Geografia e Estatistica 2010c; Portal Brasil 2010a). Agenda 21 prioritises the protection of biodiversity of the Cerrado in the Central West and the Amazon in the North in particular (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b).

2.4.1.4 Improving Water Quality
While the MDGs include the improvement of access to safe drinking water as goal 7C (United Nations Statistics Division 2011), of greater relevance to CDM projects is the protection of water quality in basins, rivers and other water bodies from contaminants and pollutants, included as a priority in Brazil’s Agenda 21, specifically the protection of water quality and quantity in hydrographic basins (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004a; Ministério do Meio Ambiente 2012). Water quality and quantity issues were listed as one of the biggest environmental challenges in Agenda 21 (International Institute for Sustainable Development 2004). As part of the supporting strategy to implement Agenda 21, the protection and restoration of surface and groundwater, the control of urban,
industrial and agricultural effluent, the conservation of riparian vegetation and the conservation of water resources were prioritised (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b). The Northeast in particular was identified as a region for which improving water quality and quantity is a priority objective (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b).

IBGE have included the protection of quality of inland waters as one of the priorities of environmental sustainability, and identified the contribution of domestic effluent and of industrial pollutants into waterways as the greatest threats to water quality, and recommended the protection of wetlands and areas surrounding river systems (Instituto Brasileiro de Geografia e Estatística 2010c). The water quality of bays and beaches are affected by these sources of pollution and suggests there is a need to protect marine and water species from the threat of pollutants (Instituto Brasileiro de Geografia e Estatística 2010c). The CDM can play a role in contributing to this priority through improvements in industrial, waste and agricultural processes that currently contribute to reducing water quality throughout Brazil.

2.4.1.5 Increasing the Proportion of Renewable Energy in the Energy Grid

Increasing the proportion of renewable energy in the energy grid has been a long-stated objective of the Brazilian government (United Nations Industrial Development Organization 2003; Brazilian Government Official 1, 2 and 3, 2011, pers. comm., 16 March). Brazil prides itself on having a much greater proportion of energy provided by renewables compared with other countries. A total of 45% of internal energy in Brazil is sourced from renewables compared to the world average of 13%, and 83% of all electricity generated in Brazil is sourced from renewables (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010; U.S. Energy Information Administration 2013). The main contribution to CO₂ emissions in Brazil is from deforestation and land use changes rather than from energy use, and emissions per unit of GDP have remained stable (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010). Despite this, population growth will increase the energy production needs of Brazil to twice 2010 levels by 2030, and this poses a major challenge for Brazil and its attempts to maintain the proportion of renewable energy in its energy matrix (Parliament of the United Kingdom of Great Britain and Northern Ireland 2011; Brazilian Government Official 1, 2 and 3, 2011, pers. comm., 16 March; Instituto Brasileiro de Geografia e Estatística 2010a). Access to reliable electricity in some of the more remote regions of Brazil has remained problematic and line losses are a concern, with Agenda 21 identifying the need to invest in alternative energy sources (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b). Objective four of Brazil’s Agenda 21 is the priority action of sourcing renewable energy from biomass, while the strategy attached to Agenda 21 includes encouraging the use of forest wastes and resources;
the creation of economic-financial mechanisms to promote the use of renewable energy; ensuring that costs and energy use are more efficient with less climatic impact; incorporating new technologies for electricity production from new and renewable sources; encouraging the use of energy conservation technologies and promoting the efficient use and conservation of power; and achieving universal access to electricity (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004a).

The share of renewables in the energy supply and also the lifetime of oil and natural gas supplies until exhaustion is covered under IBGE’s economic indicators (Instituto Brasileiro de Geografia e Estatística 2010c). Renewable energy sources under this indicator include hydroelectricity, firewood, charcoal, sugar-cane derived energy and other primary sources considered renewable (Instituto Brasileiro de Geografia e Estatística 2010c). IBGE states that while there was a fall in the proportion of renewables from 1992 to 2001, it has risen since then and that investment in renewables should continue to insure against uncertainty in oil prices or taxes on GHG emissions from the use of fossil fuels (Instituto Brasileiro de Geografia e Estatística 2010c).

The CDM has the potential to be able to provide reliable and renewable sources of electricity to regions without reliable electricity supply, replacing environmentally destructive or expensive sources of electricity such as diesel generators. The CDM can also provide an alternative supply of renewable energy through biomass energy, hydro and the utilisation of landfill gas, while reducing demand through energy efficiency measures. The provision of renewable energy has not been without controversy in Brazil, with the use of large-scale hydro projects generating not just electricity, but also opposition from environmentalists and communities adversely affected by the damming of river systems or the flooding of large areas of land (Fearnside 2012a; International Rivers 2009). The additionality of these projects has also been questioned (Haya & Parekh 2010; CDM Watch 2012c).

2.4.2 Priority Social Issues

A characteristic of Brazil since colonial times has been large inequality in the distribution of income, growth and opportunities and this has led Brazil to be labelled as a ‘land of contrasts’ (International Institute for Sustainable Development 2004; Baer 2008). The World Bank (2004) has reported that inequality in income and living conditions across different regions, ethnicities and between rural and urban areas contributes to stifling economic conditions and leads to excessive poverty rates within the country. Progress on social indicators in Brazil does not correspond to the achievements in economic development that have taken place (World Bank 2004).
Improving equality in Brazil is the overarching theme of a number of development priorities identified by the Brazilian government and by other parties involved with sustainable development in Brazil. More specifically, regional equality, income equality and bridging the gaps between rural and urban equality are included, as are the need to generate formal employment and promote education and training opportunities. Reducing inequality would lead to reductions in poverty, and improve economic growth, competitiveness and efficiency through a greater educated and skilled workforce (World Bank 2004).

From Brazil’s reports, measuring success against the MDGs, it is obvious that gender, ethnic and rural inequality, while being reduced within Brazil over the recent years, still pose problems for achieving sustainable development. Even when looking at the HDI for Brazil which in 2011 was 0.72, this figure drops to 0.53 when inequalities in income and education are taken into account (United Nations Development Programme 2011). The social indicators used to measure progress towards sustainable development indicate wide discrepancies in income, unemployment, life expectancy, infant mortality rate, access to sanitation and education and housing conditions across the different regions of Brazil, while an entire section of the Agenda 21 Brasileria Resultado da Consulta Nacional is dedicated to addressing inequality (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b).

The priority areas of social sustainable development deemed relevant to the CDM include regional inequality, income inequality, rural inequality, the generation of formal employment and the provision of education and training. Gender inequality, ethnic inequality, youth inequality and inequality of land tenure within favela areas and in rural regions are important developmental needs for Brazil (World Bank 2004; United Nations Statistics Division 2011), however due to the nature of CDM projects, these needs are unlikely to be affected by CDM projects and are therefore excluded from the priority areas assessed in this section. Improvements in health indicators are unlikely to be directly affected by the CDM, although communities located near CDM projects may experience indirect improvements through reduced air pollution and improved water quality, for example. Reducing ethnic inequalities across a range of indicators including health, life expectancy, infant mortality, income, employment and education, is a priority area commonly identified for Brazil (Busso, Cicowiez & Gasparini 2005; Instituto Brasileiro de Geografia e Estatistica 2010b; United Nations Development Programme 2011). According to the World Bank, 12% of inequality within Brazil was related to skin colour in 2004, compared to 2.4% in the United States (World Bank 2004). This priority area is not included below as it is difficult to measure just how the CDM can contribute to achieving ethnic equality within Brazil, and no project documentation or sustainability assessments make mention of this type of aim, however it is linked to regional inequality given the high proportions of preta e parda in the poorer regions of Brazil. Any
improvements in regional equality through employment, income generation or investment in these poorer regions of the North and Northeast are likely to improve equality between the preta e parda (black and brown) and branca (white) populations.

Access to land tenure has historically been unequal in Brazil (Burns 1980) and this problem continues, with many references to it within development objectives for Brazil (World Bank 2004; Ministério do Planejamento & Instituto Brasileiro de Geografia e Estatística 2009; Frayssinet 2009). Access to permanent land tenure is seen as the main resource through which poverty can be avoided (Busso, Cicowiez & Gasparini 2005). This priority area is unlikely to be directly affected by the CDM, however inequalities in land tenure between regions could be improved through CDM investment, employment and improved incomes in the regions of the North and Northeast, potentially challenging the traditional land holding patterns of Brazil’s history (Ministério do Planejamento & Instituto Brasileiro de Geografia e Estatística 2009).

2.4.2.1 Reducing Regional Inequality

Regional equality is defined as the inequalities of income, education, housing and health and employment opportunities between the macro-regions of Brazil and is considered by IBGE to be one of the key and persistent social problems for Brazil (Instituto Brasileiro de Geografia e Estatística 2010c; Compendio Para a Sustentabilidade - Todos os Direitos Reservados 2008). Regional inequality is discussed throughout Brazil’s reporting on progress towards the MDGs, starting with the overall number of people living in extreme poverty as expressed by the first MDG. Despite national-level reductions in extreme poverty rates, the differences between the richer and poorer states of Brazil remained unchanged, with the Northeast region having five-times the percentage of the population living in extreme poverty compared to the South, and at a rate of twice the national average (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010). Inequality in terms of malnutrition and hunger remained at a 15% difference between the Northeast and Southern regions of Brazil. Levels of primary education enrolment are approaching equality between the regions, however this does not extend to secondary education, and in addition to this, illiteracy rates in the Northeast region are much higher than in the Southeast (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010; Instituto Brasileiro de Geografia e Estatistica 2010c). Total years of schooling range from 6.7 in the Northeast to 8.2 years in the Southeast for Brazilians aged older than 15 years (Instituto Brasileiro de Geografia e Estatistica 2010b).

While the CDM can not be considered to directly affect most health indicators, the differences between the regions of Brazil for the fourth MDG, child mortality, show that despite national decreases, child mortality is still 2.2 times higher in the Northeast, with some states nearly
having rates considered to be ‘high’ by WHO (World Health Organization) standards (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010; Instituto Brasileiro de Geografia e Estatística 2010c). Some diseases targeted in the sixth goal disproportionately affect populations of the North and Northeast (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010).

Goal 7C, providing access to safe drinking water and basic sanitation, also shows vast regional differences with just 51.5% of the population of Para (in the North) having access to piped water compared to 98.9% of the population of São Paulo (Southeast) (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010). Children in the Northeast were nearly twice as likely to be susceptible to the severe risks associated with inadequate sanitation compared to the national average (Instituto Brasileiro de Geografia e Estatística 2010b). Indicators for water supply, access to sewage networks and garbage collection were all higher for the Southeast and South, compared to the North, Northeast and the Central West (Instituto Brasileiro de Geografia e Estatística 2010b). Other health indicators such as life expectancy display regional variations with some states in the Northeast having male life expectancies six years below the national average and the number of hospital beds per 1000 persons also being lower in the North and Northeast (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010; Instituto Brasileiro de Geografia e Estatística 2010c).

Regional inequality of income indicators show that median incomes in the Northeast are nearly half that of those in the Southeast, while nearly half of the households living on less than half a minimum wage are located in the Northeast region of Brazil, or 41.5% of the population of the Northeast in 2008 (Instituto Brasileiro de Geografia e Estatística 2010b). Half of the minimum wage can be used as a proxy for those households considered to be living in slums, a total of 19% of Brazilian households nationally (Instituto Brasileiro de Geografia e Estatística 2010b). This proportion varied greatly between the regions, with 36.3% in the northeast, 30.7% in the north, 16.4% in the Central West, 12.2% in the Southeast and 10.9% in the South considered to be living in slum conditions (Instituto Brasileiro de Geografia e Estatística 2010b).

Poverty rates in Brazil vary greatly across the regions. Using the poverty rate from 2009, calculated as twice the extreme rate, or the equivalent to a basket of food with the minimum calories recommended by the Food and Agriculture Organization of the United Nations (FAO) and WHO, Figure 2-1 below shows the percentage of people below the poverty rate across Brazil.
Regional variations in GDP per capita for each state show huge differences, with São Paulo residents having a GDP per capita of US$13,331 compared to Ceará, Paraíba, Alagoas, Maranhão and Piauí states in the Northeast with a GDP per capita of less than US$4,000 (The Economist 2011). Inequality in land ownership was regionally diverse, with some states experiencing a higher Gini index than others for land ownership inequality. States located in the South had Gini land concentration indexes ranging from 0.68 to 0.77, compared to 0.82 to 0.86 in the Northeast (Food and Agricultural Organization of the United Nations 2012).

Using the FIRJAN Index of Municipal Development (Índice FIRJAN de Desenvolvimento Municipal or IFDM) as a proxy for HDI averages for the regions of Brazil, the regional differences can be more clearly seen (Federação das Indústrias do Estado do Rio de Janeiro 2011b; Federação das Indústrias do Estado do Rio de Janeiro 2011a). The IFDM is a ranking of life quality from zero to one, with one representing a high quality of life and the regional differences are shown in Figure 2-2 (Federação das Indústrias do Estado do Rio de Janeiro 2011b).
IBGE’s choice of sustainable development indicators includes a number of indicators assessing regional inequality based on health, educational, income, sanitation and housing data (Instituto Brasileiro de Geografia e Estatística 2010c). The Agenda 21 document acknowledges and seeks to redress the regional differences in Brazil, in particular in the sections ‘infrastructure and regional integration’ and ‘reducing inequalities’ (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004a). The Agenda recommends using regional planning to encourage economic development to encourage a reduction in regional inequality in Brazil, however these attempts have been curbed by economic crises recently, as demonstrated by a in project investment in the Southern and Southeastern states (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004a). Resolving issues of regional inequality is important in order to reduce the impact of internal migration, largely occurring from the poorer states of the north of Brazil to the richer states in the south, which compounds problems within favelas and other densely population areas in Brazil’s cities. The state of São Paulo for instance is home to 21.4% of Brazil’s population, 48% of them living in the city of São Paulo (Instituto Brasileiro de Geografia e Estatística 2010b).

2.4.2.2 Reducing Income Inequality

Brazil historically has had high levels of income inequality, and despite improvements in poverty rates within Brazil over the past two decades, including achieving poverty milestones set by the MDGs, income inequality remains a major issue of concern with 3.8% of the population still living below the $1.25 per day PPP poverty line (United Nations Development Programme 2011; Baer 2008; Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010; Pulsipher & Pulsipher 2008). Figure 2-3
demonstrates the improvements in poverty rates in Brazil over time and the overall rates as of 2008.

According to the Gini Coefficient, Brazil scored 54.7 in 2009, which is high relative to other countries of the world and is towards the higher end of the spectrum of 0.6 (although theoretically a score of 1.0 is possible using this scale, however a score of 0.6 represents the upper threshold in reality) (World Bank 2011c; European Commission 2007). This persistently high Gini index has been identified as of concern by IBGE (Instituto Brasileiro de Geografia e Estatistica 2010b). The Brazilian Agenda 21 objectives for priority action recognise the importance of addressing income inequality through objective eight, addressing social inclusion and income distribution and includes income inequality as one of the biggest social challenges for Brazil (Ministério do Meio Ambiente 2012; Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004a; International Institute for Sustainable Development 2004).

The highest earning 20% in Brazil earned 62% of the total income on average between 1981 and 2009 while the lowest income earning 20% of the population earned just 2.6% of the total income (World Bank 2011c). The change in income across the population quintiles is shown in Figure 2-4. In 2009, the richest 10% of the population earned 34.8 times that of the lowest earning 10% of the population (World Bank 2011c). A total of 22.9% of the population earned less than half of the minimum wage in 2009, with 4.3 million families living on less than a quarter of the minimum wage (Instituto Brasileiro de Geografia e Estatistica 2010b).
Income inequality can affect the ability of the lowest earning population to access adequate food, housing, education, health services and employment opportunities and therefore affect Brazil’s progress towards sustainable development. To demonstrate this, 78% of 15-17 year olds in the wealthiest 20% of families were enrolled in education compared to just 32% of those in the lowest earning 20% of the population (Instituto Brasileiro de Geografia e Estatistica 2010b). Educational attainment can affect income inequality, with estimates that two-thirds of sources of wage inequality are related to educational differences (Kendrick 2013). Low incomes can fuel rural to urban migration as people move looking for employment, perpetuating housing problems within Brazil’s largest cities in both the Northwest and the Southeast.

IBGE recognises that the social impacts caused by high levels of income inequality and income distribution means reducing these impacts is an indicator selected to measure social sustainable development (Instituto Brasileiro de Geografia e Estatistica 2010c). Agenda 21 includes an objective for ‘social inclusion and income distribution’ and lists inequality of income as one of the biggest social challenges faced in Brazil (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004a; Ministério do Meio Ambiente 2012).

The generation of full and productive employment is identified as goal 1B in the MDGs and while Brazil has achieved some improvements in the proportion of people in employment, females and young people are disproportionately represented in unemployment rates, with
young people aged 15 to 24 making up approximately half of all unemployed people in Brazil (United Nations Statistics Division 2012). Despite these differences, overall unemployment in Brazil fell from 12% in 2003 to 4% in 2009 (Instituto Brasileiro de Geografia e Estatística 2010c), however regional differences and disparities in employment income in rural and urban areas still drive internal migration in Brazil towards the larger and more concentrated urban centres. Despite an official unemployment rate of 4%, 22.8% of households were still surviving on less than half of a single minimum wage and 4.3 million families were living on less than one-quarter of the minimum wage (Instituto Brasileiro de Geografia e Estatística 2010b).

The importance of formal employment generation can be seen from its inclusion in the Brazilian DNA Annex III documentation, part b ‘contribution to improvement of labour conditions and net job creation’. Reducing unemployment is included under the section on the reduction of inequalities in the Brazilian response to Agenda 21 (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b).

2.4.2.3 Reducing Rural Inequality

The differences in health, education, employment, income and housing indicators between urban Brazilians and rural Brazilians threaten not only the progress of the nation towards sustainable development and the MDGs, but fuel the constant stream of rural to urban migration, a pattern that started in the 1950s and continues today. Rural to urban migration, either to the cities of the Northeast such as Salvador, or the Southeast cities of Rio de Janeiro or São Paulo, poses problems for the provision of adequate housing and sanitation, unemployment, uncontrolled environmental impact and other such problems for the recipient cities (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b). Addressing rural inequality and the social problems that disproportionately affect rural areas can help to stem migration and support social and economic development within the rural regions of Brazil. Brazil is largely urban, although there are variations between the 99.3% of the population considered to be urban in the state of Rio de Janeiro compared to 61.9% of the population in Piauí in the Northeast (Instituto Brasileiro de Geografia e Estatística 2010b).

A number of development policies have focused on decentralisation and rural development, including the Brazilian Landless Movement (MST) and the provision of technical assistance and credit to small-scale farmers in the 1990s; the food security schemes Bolsa Escola and Bolsa Família which aimed to supply school grants, family scholarships and food vouchers tied to school attendance; and policies to supply meals to school children using produce from local, small-scale farmers and to encourage diversification of agriculture (Schneider, Shiki & Belik 2010; Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010). Policies such as these have been linked to successes in reducing rural
poverty by 16% from 1995 to 2005, and reducing the Gini inequality index by 5.1% over the same period, however absolute poverty levels remain very high at 42% in 2005 (Schneider, Shiki & Belik 2010).

Despite these initiatives, extreme poverty, defined as the proportion of the population living below $1.25 per day PPP, has been extensively reduced at a national level, yet rural areas are still three times more likely to have people living in extreme poverty, at a rate of 12.5% of the population (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010). Secondary-school aged youth living in rural areas are 39% less likely to be enrolled in education than those in urban areas of Brazil, although this gap reduced from 51% in 2005 (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010). Access to drinking water and basic sanitation is goal 7C of the MDGs and despite improvements made, only 32.6% of rural Brazilians had access to piped water compared to 91.6% of all Brazilians, and only 23.1% had access to sewage compared to 80.5% of the whole population in 2008 (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010). Access to electricity is limited in the rural and remote areas of the North and Northeast in particular, where some isolated communities rely on diesel generators for electricity generation (Borges da Cunha, Walter & Rei 2007).

Through the location of CDM projects in rural areas, investment, employment opportunities and the provision of services such as reliable electricity can help reduce rural inequality, and so rural inequality is included as a priority area for development that is assessed in this research.

2.4.2.4 Promoting Education and Training

One of the biggest social challenges identified in the Brazilian Agenda 21 includes low educational attainment (International Institute for Sustainable Development 2004) and the promotion of education and vocational training is highlighted as a specific target in the Agenda’s ‘reduction of inequalities’ section (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b). Average years of formal education remain low for Brazilians, at 7.5 years of education, and lower still for those in rural areas, from lower income backgrounds and for the preta e parda population (Instituto Brasileiro de Geografia e Estatística 2010b). The older working generation, aged 25 and over have average years of schooling rates of just 7.1 years (Instituto Brasileiro de Geografia e Estatística 2010b), which shows improvement for the younger generations, however these figures are worrying low for achieving a skilled workforce in the short-term.

Improvements in educational and vocational training are considered a priority by the World Bank (2004), which suggests that post-secondary schooling can reduce income inequality,
increase the supply of a skilled workforce and ensure Brazil has enough human capital. IBGE includes indicators on enrolment, literacy and education in order to assess progress towards social sustainable development (Instituto Brasileiro de Geografia e Estatística 2010b) and these indicators are included in the 44 indicators identified by Brazil in response to the standardisation of sustainable development indicators in the region (Ministério do Meio Ambiente et al. 2007). Agenda 21 lists low educational attainment as one of the biggest social challenges for Brazil and promotes continuing education as objective six out of the 21 development objectives for Brazil (International Institute for Sustainable Development 2004).

2.4.3 Priority Economic Issues

2.4.3.1 Promoting Technology Transfer, Clean Energy Innovation and Research and Development

Brazil has identified the need for clean energy innovation and technology transfer from both international and domestic sources as priority areas to ensure sustainable and clean economic growth into the future (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b). With a large proportion of internal energy in Brazil being sourced from renewables, Brazil aims to continue the push towards clean energy innovation (Brazilian Government Official 1, 2 and 3, 2011, pers. comm., 16 March). However, energy efficiency, measured in the amount of energy required to produce a unit of GDP, remains low and research is needed into clean energy technological innovation to improve this rate of energy efficiency (Instituto Brasileiro de Geografia e Estatística 2010c).

Energy consumption per capita and energy intensity are economic indicators used to measure progress by IBGE (Instituto Brasileiro de Geografia e Estatística 2010c). Energy consumption per capita has increased over the period 2002 to 2009 and IBGE stresses the need to encourage energy efficiency innovation and the use of new renewable energy sources (Instituto Brasileiro de Geografia e Estatística 2010c). Energy intensity has remained stable since 1995 (Instituto Brasileiro de Geografia e Estatística 2010c).

Spending on research and development overall is an indicator used by IBGE to measure institutional capacity and overall progress towards sustainable development, and includes the national effort towards research and development through public and private sources, measured as a percentage of GDP (Instituto Brasileiro de Geografia e Estatística 2010c). This currently stands around 1%, an increase back to the levels of the year 2000 after a decline in 2004 (Instituto Brasileiro de Geografia e Estatística 2010c). Agenda 21 affirms the need to improve the international competitiveness of small and medium enterprises, farmers and export-oriented sectors of the economy through the provision of technological and financial support (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004a). Specific
strategies outlined in Agenda 21 for the development of sustainable development technology include encouraging clean technology development and dissemination studies; ensuring government support for the technology field, standardised methods of technology and energy efficiency; the integration of research institutions to ensure technological cooperation; and the promotion of business collaboration; encouraging technologies that are compatible with local needs to produce endogenous development (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b).

Through the sale of CERs, the CDM can be seen as contributing to this process and to the provision of alternative credit systems for sustainable management in agriculture, the generation of renewable energy and the generation of new knowledge and practices, some of the more specific strategies stated in the Agenda 21 document (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b). The promotion of the CDM as a tool to encourage clean technology innovation, encourage the use of renewables, energy efficiency and disseminate this information is a stated strategy under the infrastructure and regional integration section of the Agenda 21 document (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004b).

2.4.3.2 Improving the Balance of Trade – Value of CERs to Brazil’s GDP

According to Brazil’s GNI per capita, the country is classed as an upper-middle income country by the World Bank (2011c; 2012a). Brazil’s GDP per capita was US$10 710 and while this varies greatly across the regions of Brazil, its growth over the past few years reflects the greater political and economic stability of the past 15 years, following on from the previous 15 years of economic instability (The Economist 2011; Parliament of the United Kingdom of Great Britain and Northern Ireland 2011). High rates of FDI (foreign direct investment) reflect the current economic stability in Brazil (Parliament of the United Kingdom of Great Britain and Northern Ireland 2011). IBGE has an economic indicator that measures GDP per capita as part of the economic indicators used to measure economic growth, as a proxy for improvements in social conditions and as a possible measure of the pressure exerted on the environment by economic growth (Instituto Brasileiro de Geografia e Estatística 2010c). Taking GDP per capita to measure economic growth and as a potential indicator for social condition improvement, increases in it due to the production of goods and services may be seen as positive progress towards sustainable development, however not all GDP increases are necessarily indicative of improvements to sustainable development, and those resulting in social harm or unsustainable use of resources can not be considered sustainable. The balance of trade, being the relationship between Brazil’s economy and other world economies as calculated through the balance of imports and exports is another indicator used by IBGE (Instituto Brasileiro de Geografia e
Agenda 21 does emphasise that economic growth should not be confused with development and that economic growth is necessary but not sufficient to produce sustainable development and that social, political, institutional, environmental, cultural, scientific-technological and other factors must be included to achieve and measure progress towards the goals of sustainable development (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21 Nacional 2004a). Economic growth is necessary to achieve sustainable development however it is not the only factor to be taken into consideration. Economic growth is something that the CDM can have an impact on, through increasing foreign investment and through improving the balance of trade and increasing GDP through the sale of CERs.

2.4.3.3 Increasing the Generation of Taxes

While not a stated aim of the Brazilian government, the collection of taxes from companies due to higher incomes from CDM projects was mentioned by a number of projects as an economic benefit of the CDM projects and is included in the Annex III documentation produced by the Brazilian DNA. While an increase in taxes could allow for the government to spend more on social programs, the World Bank has identified that just 12% of public spending is allocated towards the poorest 20% of the population in Brazil, despite progressive spending on favela upgrades and direct income transfers (World Bank 2004). Without a reallocation of government spending towards the groups most vulnerable in society, an increase in tax revenue will not necessarily lead to greater levels of equality or progress towards the stated sustainable development objectives for Brazil.

2.5 Conclusion

This chapter has discussed the negotiations surrounding the inclusion of the sustainable development objective in the CDM and the evolution of the concept of sustainable development. It has argued that sustainable development is a difficult concept to define and that there is no universally accepted definition of the concept, nor is there a universally accepted method for measuring progress towards sustainable development.

An analysis of the development priorities for Brazil, as identified by the Brazilian government, Brazilian civil society and international NGOs, has been presented, and the twelve major priority areas for which the CDM can be reasonably assumed to contribute are explored in detail. A discussion of the methods of assessment of the CDM against these priority areas is presented in Chapter Five, and Chapter Six discusses the application of these methods of assessment to the priority development areas outlined above.
The following chapter will present an analysis of the relevant Brazilian, UK and Dutch policies on the CDM in order evaluate the effect of these policies on the success or otherwise of the CDM in leading to sustainable development in Brazil.
3 Dutch, UK and Brazilian National CDM Policies

Introduction

The policies of Annex I countries regarding the use of the CDM and the policies of host country with regard to the implementation of CDM projects, can provide an indication of how the mechanism is perceived by both sets of countries, and also an indication of the likelihood of success of the mechanism in achieving sustainable development. If for instance, the CDM is viewed as a cheap emission reduction abatement option, or source of FDI, rather than as a mechanism with the potential to produce sustainable development in host countries, the likelihood of sustainable development being achieved is reduced. This chapter will argue that the policies of the Netherlands and the UK do not actively facilitate the promotion of sustainable development through the CDM, and will demonstrate this by analysing the policies of the UK and the Netherlands, as well as Brazil, towards the CDM.

The argument presented in this chapter is that neither the Netherlands nor the UK has a clear commitment to ensuring minimum levels of sustainable development for projects from which they purchase credits, outside those minimum standards required by the EU. The main reason for this is that credit buyers view the CDM as a mechanism through which to reduce the costs of meeting emission reduction targets, rather than a mechanism through which to promote sustainable development.

3.1 Dutch and UK Policies on the CDM: Are they helping to achieve Sustainable Development?

The CDM is viewed as an economic mechanism with CERs as the tradable commodity, by both the UK and the Netherlands. The CDM to these countries is a mechanism through which the costs of making emission reductions can be minimised, by making those emission reductions in locations where it is cheapest to do so (Ministry of Housing (no date given); UK Government Representative, 2011, pers. comm., 11 January; Dutch Government Official, 2011, pers. comm., 4 January). The relationship between host and credit buying country is one of trade, rather than being characterised by aid or development assistance.

Both countries have commissioned and released studies that acknowledge the weaknesses in the CDM in its contribution to sustainable development (IOB Evaluations 2008; Lazarowicz 2009). Under the AIJ, the Netherlands supported a pricing structure in order to positively discriminate
in favour of the project sectors deemed to be more beneficial to local sustainable development (Cosbey 2006), however now all CERs are treated equally and the price for them is determined by the supply and demand of CERs in the international market (Dutch Government Official, 2011, pers. comm., 4 January). The UK government stance on sectoral CDM demonstrates that they believe additional requirements are needed to the structure of the CDM to enable it to achieve greater sustainable development benefits (Lazarowicz 2009). The UK Government has a discriminatory purchasing policy towards projects which meet Gold Standard or equivalent criteria in order to meet the voluntary offset targets for government operations, and refuses to allow the purchase of industrial gas generated CERs in this scheme (Department of Energy and Climate Change 2009). This suggests that the UK Government believes that greater contributions to sustainable development can be gained through the application of value-adding standards to CERs, which require them to meet higher standards than what is required by the CDM.

As part of an evaluation of the Dutch AIJ program, it was recommended that the Directorate General for International Cooperation (DGIS) play a role through CDM capacity building programs in host countries, to better determine the development priorities in host countries, and to improve the contribution of the CDM to sustainable development (IOB Evaluations 2008). This would allow VROM to better decide whether a proposed CDM project is beneficial for the development needs of the host country (IOB Evaluations 2008). This recommendation has not been implemented.

### 3.2 EU and the CDM

As members of the EU, both the Netherlands and the UK are required to participate in the EU ETS, and abide by the requirements of the EU ETS regarding the CDM. Membership of the EU ETS is compulsory for all 28 EU member countries, Iceland, Liechtenstein and Norway, and in 2013, covered 45% of all EU emissions from a range of industries (Europa 2013a). The EU ETS has been divided into a number of working phases. Phase I, from 2005 to 2007 was a learning phase with only CO₂ emissions covered and each member state committing to provide a National Allocation Plan that would allocate emission reductions to installations or companies within their country, however allocations were overly generous and easily met and as such, there was a collapse in the price of carbon (Lazarowicz 2009). Phase II from 2008-12 saw tighter EU control on National Allocation Plan caps and the ETS included a further three non-EU countries (Lazarowicz 2009). Phase III started in 2013 and has a EU-wide cap planned rather than country based allocations, with auctioning of at least 60% of allowances to 2020, unlimited banking between Phases II and III, as well as including more sectors and gases. Use of the CERs and ERUs will be limited to 50% of emission reductions and if there is an
international agreement on emission reductions, then the EU emission reduction target will increase (Lazarowicz 2009). The value of the EU ETS in 2011 was €122.3 billion per year (Kossoy & Guigon 2012). EU countries source CERs from 136 out of the 190 registered CDM projects within Brazil, with Switzerland or Japan purchasing from most other projects (United Nations Environment Programme Risø Centre on Energy 2011).

The EU ETS has allowed for CERs and ERUs since the Kyoto Protocol came into force, with all CERs and ERUs converted to European Union Allowances (EUAs) upon their purchase by EU countries (Lazarowicz 2009). EU wide legislation excludes the use of nuclear and temporary forest credits from afforestation or reforestation that are currently allowed under the Kyoto Protocol, however member states can decide on the inclusion or exclusion of the remaining project sectors (Europa 2009c). Major hydropower projects (over 20 MW installed capacity) must abide by the terms of the World Commission on Dams guidelines in order for them to be considered under the EU ETS, a requirement above that which is required for inclusion in the CDM (Europa 2009c). Recently the European Commission has banned the use of industrial gas offsets such as HFC and N$_2$O (nitrous oxide) adipic within the EU ETS, effective from May 2013 (Europa 2011). This will provoke a major change in the composition of CERs purchased by EU countries and installations in the future as in the 2010 trading period the EU surrendered 90.4 million CERs, 77 per cent of them from industrial gas projects (Sandbag 2011).

At present there is no ability to link other markets to the EU ETS, however this could take place in the future (Bell & Drexhage 2005), and it is likely that markets will not be permitted to link unless they can prove that all carbon credits are sourced from projects which abide by the EU ETS stipulated conditions. Input into the EU prior to COP4 indicated that the EU was keen to promote the CDM as a mechanism to ‘encourage investment in, in particular private sector investment in emission reductions in non-Annex I countries and become an incentive for capacity building, as well as development and transfer of environmentally sound technologies and practices’ (Government of Austria 1998). During the first Phase of the EU ETS, policies to encourage such investment were limited to those banning nuclear, LULUCF (land use, land use change and forestry) and large hydro projects (without abiding by the World Commission on Dams requirements), however for Phase III of the EU ETS, policies such as banning the use of CERs from N$_2$O and HFC-23 project types will also contribute to this objective for the CDM. The banning of industrial gas projects related more to concerns about their additionality rather than concerns about a lack of technology transfer and promotion of sustainable development. Other policy statements such as those promoting the use of sectoral crediting and other initiatives to encourage CDM investment in the least developed countries (Government of France 2008) do support the idea that the EU as a whole is interested in improving the
sustainable development outcomes of the CDM within the framework of the UNFCCC, rather than through individual policy measures within the EU ETS.

The EU is committed to reducing emission levels after the completion of the current Kyoto period by a rate of 20% less than 1990 levels by 2020 if other countries fail to reach an agreement, and by 30% should other developed nations commit to similar targets and this will further the demand for credits into the foreseeable future (Europa 2009b). Given the current dominance of the EU in the purchasing market for CERs and the influence that the policies of the EU ETS has over future linked markets, any policies regarding the inclusion or exclusion of CDM listed CERs will have a large effect on the supply of these products worldwide. The change in EU policy regarding industrial gas projects caused a temporary increase in the number of industrial gas projects as developers tried to take advantage of the investment opportunities before the 2012 deadline (Sandbag 2011), however for Phase III of the EU ETS, this policy could encourage a focus on other project types, with greater sustainable development benefits. The EU allows for member countries to define their own rules regarding the use of CERs within their domestic allowance targets and so domestic policies also affect the supply of CERs from particular types of projects. The following sections examine UK and Dutch policies with regard to CER purchasing and the effect of these policies on the CDM market.

### 3.3 Netherlands and the CDM

Under the Dutch National Allocation Plan, the Netherlands Government has purchased an extra 20 mega tonnes per year of CO$_2$ (equivalent to 20 million CERs) for each year of the Kyoto first commitment period from CDM projects to increase the total allowance available to the Netherlands in order to reach the required reduction of 6% below 1990 emission levels, which equates to 199 million tonnes CO$_2$ equivalent (Ministry of Housing 2006). The Netherlands has allowed the affected installations to purchase CER, ERU or EUA credits to a maximum of 12% of their emission reduction targets (Ministry of Housing 2006). In addition to this, sectors not included under the EU ETS will be required to meet reduction targets of 16% by 2020 under the Climate and Energy Package introduced by the European Parliament and Council in 2009 (Ministry of Infrastructure and the Environment 2012).

#### 3.3.1 Dutch Intermediaries

The Netherlands government has designated responsibility for the CDM and all associated DNA duties to the Ministry of Housing, Spatial Planning and Environment (VROM). VROM has outsourced the task of identifying, registering and monitoring potential CDM projects that will source the government purchased CERs to a number of intermediary bodies, including multilateral and regional international financial institutions, private financial institutions and
participation in carbon funds, originally by way of public tender through a Certified Emission Reduction Procurement Tender (CERUPT) in 2001, through participation in carbon funds, multilateral and regional financial institutions and private banks (Ministry of Housing (no date given)). All of the contracted intermediaries except the CERUPT fund were still actively sourcing and registering projects to produce CERs to credit towards the Netherlands Kyoto commitments in 2011. CERs are sourced from intermediaries through the negotiation of an Emission Reduction Purchase Agreement (ERPA) which lists details such as estimated, minimum and maximum volumes, agreed CER price, conditions for payment, plans for managing project risks and for minimising environmental or social impact (Ministry of Housing (no date given)). There is no link between Dutch foreign aid and the CDM, with responsibility for both resting in different government departments, helping to ensure that there is no link between ODA and CDM, a requirement of the CDM (IOB Evaluations 2008). VROM is responsible for issuing the LoA, for which a fee is charged, for CDM projects providing CERs for private installations within the Netherlands, and aside from the EU regulations regarding large hydro and afforestation and reforestation in LULUCF projects, there are no other requirements set for these CDM projects. VROM will issue a LoA only upon receipt of the draft validation report (Ministry of Housing 2003; United Nations Development Programme 2006). The intermediaries are entirely responsible for managing their project portfolios, and as discussed below, the intermediaries have different levels of sustainable development assessment and monitoring.

The Netherlands has stated that they are most interested in projects or bundled projects for government purchase that have combined total reductions of more than 500 000 tonnes CO₂ equivalent, up to and including 2012, due to the concern that projects below this size would not be financially viable given the preparatory costs, although VROM will purchase reductions from small-scale projects through the World Bank’s Community Development Carbon Fund (Ministry of Housing (no date given)). Payment for CERs takes place only once they have been issued and transferred to the Dutch registry by the UNFCCC EB, although VROM may pay for some initial preparation costs in return for a discounted CER price (Ministry of Housing (no date given)). Proposals for CDM projects can be submitted to VROM from developers in any country with no preference given to Dutch developers, although countries with MoUs with the Netherlands are considered to have high CDM potential and appeal (Ministry of Housing (no date given)). There is no longer any preference given to projects from particular sectors, nor an emphasis on acquiring CERs with regional diversity (Dutch Government Official, 2011, pers. comm., 4 January).
Prior to the entry into force of the Kyoto Protocol in 2005, the Netherlands participated in the pilot phase of the CDM which started in 1996 after the first Conference of Parties under the title Activities Implemented Jointly which had the aim of reducing greenhouse emissions (IOB Evaluations 2008). The AIJ did not contain a specific objective of contributing to sustainable development, and instead suggested that ‘activities implemented jointly should be compatible with and supportive of national environment and development priorities and strategies’ (United Nations Framework Convention on Climate Change Subsidiary Body for Scientific and Technological Advice 1995). None of the Dutch sponsored projects were in Brazil (United Nations Framework Convention on Climate Change 2002). During these initial stages and in the period prior to the entry into force of the Kyoto Protocol, the Netherlands had a project ranking system in order to rank projects deemed to have greater sustainable development benefits preferentially in terms of money paid for the emission reductions generated (Dutch Government Official, 2011, pers. comm., 4 January), favouring renewable energy, biomass energy, transportation, fossil fuel switch and methane recovery, and sequestration project types, in that order of preference (IOB Evaluations 2008; Dutch Government Official, 2011, pers. comm., 4 January). After the entry into force of the Kyoto Protocol in 2005, this ranking system was replaced by purchase prices which reflected the demand, supply and risk of projects rather than their perceived contribution to sustainable development, technology transfer or any other factors (Dutch Government Official, 2011, pers. comm., 4 January).

The Operations Evaluation Department (IOB Evaluations) of the Dutch Government released a study in 2008 evaluating the contribution of the initial AIJ phase projects to sustainable development in order to extrapolate and comment on the likelihood of success of the current CDM portfolio. The study found that whilst all sustainable development benefits were dependent on host country legislation, adequate stakeholder consultation and project specific requests from the Dutch government, it was found that small-scale renewable projects including biogas, coalmine methane and hydropower projects were favoured for their contribution to local social, economic and ecological conditions and that industrial gas, biomass energy and geothermal projects had the least number of benefits (IOB Evaluations 2008). The contribution to favourable and sustainable local conditions for landfill gas, wind power and energy efficiency projects was dependent on the implementation by the host country (IOB Evaluations 2008). The conclusions of the report are specific to Dutch investment and state that Dutch investment in the CDM is likely to produce a positive contribution to social and economic development for host countries, however that this contribution is not always guaranteed and reliant on proactive partners who ensure that projects were well designed and implemented, good initial design and
good maintenance of documentation which allowed for early intervention if required (IOB Evaluations 2008).

### 3.3.3 Dutch Policies on the CDM

The CDM is viewed by the Dutch Government as an economic mechanism to cheaply abate greenhouse gas emissions, and the price paid for CERs is determined by the demand, supply and risk on an individual project basis rather than based on the project type ranking used for the AIJ phase (Dutch Government Official, 2011, pers. comm., 4 January). According to the Dutch DNA, VROM (or the Dutch Emissions Authority as of January 2013 (Nederlands Emissieautoriteit 2013a) is interested in ‘maximising the amount of CERs purchased at an acceptable level of quality and price’ (Ministry of Housing 2003, p. 6). It aims to do this in a way which disperses the benefits of CDM geographically across various host countries (Ministry of Housing 2003), however there are no specific policies supporting the purchase of CERs from a broad geographical spread, aside from general support for the Nairobi Framework (the UNFCCC framework for encouraging a greater geographical spread of CDM projects), either for the government purchased CERs or for those purchased by, or on behalf of, installations within the Netherlands (Dutch Government Official, 2011, pers. comm., 4 January). The Netherlands states that it will not participate in projects that ‘may result in adverse social, environmental or political effects’ (Ministry of Housing (no date given), p. 13), although it is unclear as to how this policy is implemented or assessed.

VROM reserves the right to approve or terminate a project through the removal of the LoA at any stage should it fail to deliver on sustainability grounds, yet the responsibility of ensuring that a contribution to sustainable development is achieved is granted to the individual intermediaries through which VROM sources CERs (Dutch Government Official, 2011, pers. comm., 4 January). VROM reserves the right to ask for the application of an Environmental Impact Assessment that meets European quality standards at the PIN stage of the project (Ministry of Housing 2003). Due to the use of intermediaries to source and assess potential CDM projects, VROM has little direct input into assessing the levels of sustainable development and additionality achieved, however it recommends working guidelines for intermediaries based on the OECD Guidelines for Multinational Enterprises, The Gold Standard, The Greenhouse Gas Protocol, The World Commission on Dams report and the ISO 14064 standards for greenhouse gas accounting and verification (Ministry of Housing 2003). Dutch embassies located in host countries are able to offer some advice on the compliance of specific projects with local and national legislation, community consultation and support and the reputation of project participants (IOB Evaluations 2008).
The right of termination of an LoA has not been yet been exercised and is extremely unlikely to be given the stated view of the VROM which is that

‘[t]he Marrakech Accords state that it is the host countries’ prerogative to determine whether and to what extent a project activity contributes to sustainable development. With respect to this decision VROM will not prescribe criteria for sustainability, but will relay (sic) on the declaration of the host country that the project activities contributes (sic) to sustainable development, which should be included in the Letter of Approval for each particular project’ (Ministry of Housing 2003, p. 17).

Yet, VROM also states that

‘[f]or both countries involved, it is crucial to enhance the positive effects of CDM agreements and prevent the negative effects at the same time. CDM projects must never cause (political) damage in the countries involved. Therefore it is the sovereign competence of each country involved to determine which elements are relevant’ (Ministry of Housing 2003, p. 11).

There is no formal requirement for sustainable development monitoring plans to be submitted for Dutch purchased CERs nor for formal monitoring to take place (IOB Evaluations 2008; Dutch Government Official, 2011, pers. comm., 4 January). There are no plans to actively monitor sustainable development outcomes in the future and there are no immediate plans to form Emission Reduction Purchase Agreements (ERPA) with more intermediaries (Dutch Government Official, 2011, pers. comm., 4 January).

The intermediaries which have EPRAs with VROM include the Dutch government agency, Senter, the International Bank for Reconstruction and Development, (IBRD) the International Finance Corporation through the IFC-Dutch Carbon Facility (INFCaF), Corporacion Andina de Fomento (CAF) and Rabobank (Ministry of Housing (no date given); Ministry of Housing 2005). Each intermediary focuses on different project sectors, geographic regions and project requirements.

Senter was the Dutch Government agency responsible for organising the first Dutch procurement of CERs through the CERUPT tender expression of interest process, which was open from 2001 to 2002 (Ministry of Housing (no date given)). During 2003, 18 CDM projects (including one in Brazil – Onyx Landfill Gas Recovery Project – Trémembé) were selected and approved by VROM and the agency still sources CERs from four CDM projects (Ministry of Housing (no date given); United Nations Environment Programme Risø Centre on Energy 2011).

INFCaF has a Latin American, Caribbean and Asian regional focus and offers loans and equity financing for projects and their carbon delivery guarantee attracts a higher selling price for their
CERs (International Finance Corporation 2012). VROM and INFCaF signed an intermediary agreement at the beginning of 2002 for the purchase of 10 million tonnes CO$_2$ equivalent (Ministry of Housing (no date given)). The selection of projects is based on projects being seen to reach short term financial closing and also comply with the IFCs environmental and social standards which include performance standards on labour and working conditions; pollution prevention and abatement; community health, safety and security; land acquisition and involuntary resettlement; biodiversity, conservation and sustainable natural resource management; indigenous peoples and cultural heritage with an emphasis on community engagement (International Finance Corporation 2006; International Finance Corporation 2012). The selection process looks at the risks and impact of projects as assessed by the project developer and assesses their ability and commitment to manage the expected impacts. The IFC ‘is committed to ensuring that the costs of economic development do not fall disproportionately on those who are poor or vulnerable, that the environment is not degraded in the process, and that natural resources are managed efficiently and sustainably’ (International Finance Corporation 2006, p. 2). The IFC requires monitoring of all projects in its portfolio and this is achieved through periodic monitoring reports and social and environmental performance, site visits of projects with expected risks, performance reviews of commitments outlined in action plans, encouragement to publicly report on social, environmental and other non-financial performance aspects and will work with clients to meet commitments or remedy impacts if required (International Finance Corporation 2006). As at 1 May 2011, there was one project hosted by Brazil through this intermediary (Passo do Meio, Salto Natal, Pedrinho I, Granada, Ponte and Salto Corgão Small Hydroelectric Power Plants – Brascen Energética S.A. Project Activity) (United Nations Environment Programme Risø Centre on Energy 2011).

An agreement between VROM and IBRD was signed in 2002 for 16 million tonnes equivalent (Ministry of Housing (no date given)). IBRD does not lend to project developers and instead contracts and pays for CERs upon issuance. As at 1 May 2011, there was one registered IBRD project in Brazil purchasing CERs on behalf of the Dutch Government (Reforestation as Renewable Source of Wood Supplies for Industrial Use in Brazil) (United Nations Environment Programme Risø Centre on Energy 2011).

Corporacion Andina de Fomento (CAF) is a multinational international financial institution and has sourced projects from the Latin America and Caribbean regions for VROM since 2002 (Corporacion Andina de Fomento 2011). CAF signed an ERPA with VROM in 2002 for 10 million tonnes equivalent of CO$_2$ (Ministry of Housing (no date given)). Currently the CAF VROM portfolio has 15 projects, including the Jalles Machado Bagasse Cogeneration and Colombo Bagasse Cogeneration project in Brazil, and it aims to support technical cooperation, new methodologies, provide support during monitoring and CER issuance phases, find potential
buyers and use financing available from member countries for CDM projects (Corporacion Andina de Fomento 2011; United Nations Environment Programme Risø Centre on Energy 2011).

Rabobank is an international operating Dutch bank that provides advice for potential CDM project developers and investors and for certain projects and will provide delivery guarantee for CDM projects, which generates a higher CER sale price (Rabobank 2008). Rabobank and VROM signed an ERPA in 2003 for 10 million tonnes CO₂ equivalent (Ministry of Housing (no date given)).

The Dutch Government has also partnered with other governments and institutions in multilateral carbon funds. The Netherlands participates in the Prototype Carbon Fund (PCF), a World Bank initiative, that has three projects in Brazil (World Bank 2010). This fund commenced in 2000 and had 24 CDM or JI projects before 2010 (World Bank 2010; Carbon Finance Unit 2011). The Fund includes the controversial Plantar Sequestration and Biomass Use project in Brazil and has large investment in industrial gas projects (Carbon Finance Unit 2011; World Bank 2010). VROM became a participant in the World Bank’s Community Development Carbon Fund (CDCF) in 2003, in order to connect least developed countries with carbon finance for small-scale projects, although none of these projects are located in Brazil (World Bank 2011b; Ministry of Housing (no date given); World Bank 2010). Through the World Bank Netherlands CDM Facility in the World Bank Carbon Finance Unit, which was established in 1999, the Netherlands sponsored the first registered CDM project overall and in Brazil (Novogear Landfill gas to energy project) (World Bank 2011a).

Criticisms of the Dutch procurement process have focused on the maximum price paid by the Dutch government for CERs (Carbon Trade Watch 2004). By placing such a cap on the price of CERs, the Dutch government has been accused of ruling out projects that are truly additional, purchasing instead from projects that rely on ‘cheap fixes’ rather than projects which contribute to ‘fundamental change’ (Carbon Trade Watch 2004). One of the 18 projects in particular has been singled out for its lack of additionality, given that the project had commenced prior to the negotiating of any carbon credit agreements (Carbon Trade Watch 2004). Given criticisms of the Plantar project in Brazil, the Dutch purchase of credits this project through the PCF also raises questions about the impact of CDM projects generating CERs for Dutch use. The procurement of CERs based on cost rather than on quality, and their reliance on the host country DNA to assess the sustainable development benefits of projects, strengthens the argument that the CDM is purely used as an economic mechanism to reduce the cost of emission reductions for the Netherlands, rather than being seen as a mechanism through which to promote sustainable development.
3.4 UK and the CDM

Under the Kyoto Protocol, the UK was required to reduce their emissions to 12.5% below 1990 levels during the first commitment period and as of 2009, UK emissions were already 26.3% below 1990 levels (Department for Energy and Climate Change 2010). The UK Government passes on the responsibility for making emission reductions directly to the approximately 1000 installations covered by the EU ETS within the UK through the auctioning of allowances (Department of Energy and Climate Change 2009). Prior to the EU ETS, the UK had its own internal emissions trading scheme which ended in 2006 (Department of Energy and Climate Change 2009). In 2008 at the start of Phase II of the EU ETS, the UK auctioned off 7% of their national emission allowances, or 86 million EUAs, generating £54 million for the UK Government (Department of Energy and Climate Change 2009). Installations that are required to make emission reductions under the EU ETS can use both CERs and ERUs to offset their emissions, however the UK has placed an 8% limit for each installation on the use of these offset credits (Department for Business Enterprise & Regulatory Reform 2010). The UK Government itself does not purchase emission reduction credits for compliance purposes, as all emission reduction obligations are allocated to the installations covered by the EU ETS.

The DNA for the UK since April 2004 has been the Secretary of State for the Department of Energy and Climate Change (DECC) (Department of Energy and Climate Change 2011b). The role of the DNA is limited to the issuance of the LoA and management of the Person Holding Accounts through which CERs are received and allocated to the relevant purchasing installations (Department of Energy and Climate Change 2011b). The DECC charges an assessment and issuance fee of €700 per CDM large-scale hydro project, €250 for all other CDM projects with the exception of those in least developed countries for which the fee is waived (Department of Energy and Climate Change 2011a; Department of Energy and Climate Change 2011b). In order to issue the LoA, the DECC requires copies of the host country LoA, the PDD, a signed declaration stating compliance with CDM rules and for hydro power projects, a hydro-electric compliance report and pre-validation report (Department of Energy and Climate Change 2011b). An assessment of the contribution of projects to sustainable development is left entirely to the host country DNA, with no preference or assessment given to projects from particular sector types or regions, aside from the differing LoA fees (Department for Environment 2005).

While the UK Government itself does not purchase emission reduction credits for compliance purposes, the UK Government voluntarily purchases CDM compliant CERs voluntarily to offset emissions produced through the functioning of government and parliamentary departments through the Government Carbon Offsetting Scheme (Department of Energy and Climate Change 2011a).
Change 2009). These purchased credits are not counted towards the Kyoto commitments of the UK and are instead retired voluntarily (Department of Energy and Climate Change 2009). Within this purchasing scheme, there is a desire for credits to be of the highest quality to ensure environmental robustness and this is reflected in the restrictions based on the purchase of credits from projects not perceived to be contributing towards sustainable development, such as industrial gas projects (UK Government Representative, 2011, pers. comm., 11 January). Initially, it was thought that the purchase of credits should be restricted to those with Gold Standard accreditation, however the UK Government did not want to monopolise the global supply of Gold Standard credits (UK Government Representative, 2011, pers. comm., 11 January). Instead, a Gold Standard or equivalent standard was set and projects are evaluated on a project-by-project basis (UK Government Representative, 2011, pers. comm., 11 January).

The promotion of the CDM within UK industry was allocated to the Climate Change Projects Office (CCPO), however this responsibility now rests with the Low Carbon Economy Team (Department for Business Innovation & Skills 2011). The CCPO was set up in response to the emergence of an international carbon market and the recognition that the UK was in a strong position to take advantage of business opportunities in the carbon market as a result of the financial expertise, environmental technologies and environmental services that had been established to support the voluntary UK emissions trading scheme that operated prior to the EU ETS (UK Government Representative, 2011, pers. comm., 11 January). The CCPO offered advice on the processes of approval from the UK government; the sources of funding; size of and value of potential CDM projects; and specific advice on investing in different host countries, in order to support UK businesses to benefit from the international carbon market (UK Trade and Investment 2011; UK Government Representative, 2011, pers. comm., 11 January; UK Trade and Investment 2009a; UK Trade and Investment 2009b; Department for Business Innovation and Skills 2010). The CCPO did not directly advise on sourcing or developing projects with higher sustainable development contributions as there was little market demand for this in the compliance carbon market, with the focus instead on the value of CDM as a tradable commodity (UK Government Representative, 2011, pers. comm., 11 January).

Through the release of a study into the current international emissions trading environment, the UK has signalled its support for major reform of the CDM (Lazarowicz 2009). The UK supports the transition of the more advanced developing countries to sectoral based, rather than project based carbon trading, in order to provide greater confidence in the validity of emission reductions, focusing more on efficiency and effectiveness, and leaving the CDM as a mechanism for the least developed countries (Lazarowicz 2009; Department of Energy and Climate Change 2010a). The UK claims that if the current scheme is redesigned in this way, the costs of emission reductions could be reduced by 70% and, for the same financial cost, this
would allow the world to reduce emissions by an additional 40-50% whilst supporting developing countries in their transitions to low carbon economies in a more equitable manner than under the current system (Lazarowicz 2009). This recommendation has not discouraged the UK from investing in the CDM and benefiting as a major investor and trader in the international carbon market, focusing on the CER as a tradable commodity instead of a mechanism through which to promote sustainable development.

3.5 Brazilian Government Policies on the CDM

The Brazilian Government was the first non-Annex I country to nominate a DNA, host a CDM project registered and a Brazilian project proposed the first methodology approved by the UNFCCC EB (Miguez 2005). Brazil sees the CDM as a win-win situation in its production of cheaper abatement opportunities for Annex I countries and for the promotion of cleaner technologies, dissemination of information to the developing world and reduction in emissions (Ministério da Ciência e Tecnologia 2011; Frondizi 2009). In a statement made in support of the CDM at the COP4 negotiations to the UNFCCC, Brazil stated that is ‘believe[s] that the CDM is the only meaningful voluntary contribution of non-Annex I Parties to effectively change the trend of global warming in a manner that is consistent with the Climate Change Convention and in a way that it will be advantageous to all Parties involved’ (Government of Brazil 1998). The Brazilian DNA sees the primary potential sustainable development contribution of the CDM as enabling a reduction in Brazil’s emissions (Brazilian Government Official 1, 2011, pers. comm., 16 March).

3.5.1 Brazilian Designated National Authority

The Brazilian DNA is the Interministerial Commission on Global Climate Change (CIMGCC) and was established through a Presidential Decree in 1999 (Article 3, Paragraph IV of Resolution 1), allocating DNA responsibility for developing and updating national inventories of anthropogenic emissions and implementation of the UNFCCC to the Commission (Interministerial Commission on Global Climate Change 2003). The Commission is tasked with providing statements on sectoral policies, contributing information to Brazilian negotiations on the UNFCCC, establishing connections with civil society and promoting the ideals and commitments of the UNFCCC (Miguez 2005). The Commission consists of nine ministries plus the Civil House of the Republic’s Presidency and is Chaired by the Minister of Science and Technology with the Minister of Environment as Vice Chair, and meets every two months (Ministério da Ciência e Tecnologia 2011; Interministerial Commission on Global Climate Change 2003; Miguez 2005). The Commission includes representatives from the Ministries of Agriculture, Livestock and Supply; Transportation; Mines and Energy; Environment;
Development, Industry and Trade; Cities; Foreign Relations; Science and Technology; Planning, Budget and Management; Civil House of the Republic’s Presidency (Miguez 2005). All of the ministries represented on the Commission have the opportunity to read and discuss all project applications, however out of the ministries represented, three are responsible for the technical evaluations of project applications, namely the Ministry of Science and Technology which concentrates on the contribution to sustainable development and additionality of projects, the Ministry for Environment which focuses on the environmental licensing process and the Ministry for Mines and Energy which evaluates energy projects (Brazilian Government Official 1, 2011, pers. comm., 16 March).

3.5.2 Brazilian DNA Rules and Regulations

Alongside the rules outlined by the UNFCCC regarding the evaluation of projects by the host country DNA, the Brazilian DNA has a number of supplementary rules that must be met before the issuance of the LoA. These rules include additional requirements for the submission of a draft validation report prior to the issuance of the LoA and the submission of documents in both Portuguese and English, outlining of the project contribution to sustainable development and stakeholder consultation. All CDM projects must also comply with Brazilian environmental and other legislation, such as legislation governing labour.

3.5.2.1 Annex III

Every project is evaluated by the CIMGC and the documents that must be submitted include the draft validation report by the DOE, a response to the Annex III criteria, a formal distribution of CER units to participants, documents showing compliance with Brazilian environmental legislation, the PDD, a list of invitations sent through registered mail to stakeholders invited to comment and declarations showing compliance with environmental legislation and labour legislation, a DOE declaration showing compliance of the DOE with Brazilian DNA requirements and contact information for the project developers (Ministry of Science and Technology General Coordination Office on Global Climate Change and Interministerial Commission on Global Climate Change 2008 and 26-7; Miguez 2005). The DOEs validating Brazilian projects, in addition to being accredited by the UNFCCC, must have an established representation and office on Brazilian territory and the capacity to assess and ensure compliance with Brazilian legislation (Ministry of Science and Technology General Coordination Office on Global Climate Change and Interministerial Commission on Global Climate Change 2008; Miguez 2005). The PDD, Annex III response, validation report and letters of invitation to comment must be translated into both Portuguese and English (Ministry of Science and Technology General Coordination Office on Global Climate Change and Interministerial Commission on Global Climate Change 2008).
Under the UNFCCC guidelines, the LoA is usually provided prior to the validation process, however the Brazilian DNA requires a draft validation report to be submitted in order to obtain the LoA. This is done in order to allow for greater evaluation of projects at the DNA level once the project has almost passed through the validation process. Upon receipt of these documents and tabling of projects at the ordinary meeting of the CIMGC, the PDD, draft validation report and response to Annex III criteria are made public on the DNA website (Brazilian Government Official 1, 2011, pers. comm., 16 March). At the next ordinary meeting of the Commission, the project is approved, approved with qualification or put into review. No projects are rejected as the DNA tries to help project developers meet the requirements as much as possible if their project falls in the review category (Brazilian Government Official 1, 2011, pers. comm., 16 March). Approved projects have a minimum 60 days wait between initial submissions. Projects approved with qualifications do not need to wait until the next CIMGC meeting, and if the recommended changes are made, they can be formally approved. Projects that are put into review must respond to the concerns of the Commission and be considered at the next ordinary meeting, and as such, the approvals process will take a longer time (Ministry of Science and Technology General Coordination Office on Global Climate Change and Interministerial Commission on Global Climate Change 2008; Brazilian Government Official 1, 2011, pers. comm., 16 March).

After a LoA has been issued in support of a project, the CIMGC still reserves the right to revoke the authority at any stage in the future should the CDM project activity commit an illegal act or acts contrary to the public interest (Ministry of Science and Technology General Coordination Office on Global Climate Change and Interministerial Commission on Global Climate Change 2008). At the time of this research, no LoA in Brazil had yet been revoked or annulled (Brazilian Government Official 1, 2011, pers. comm., 16 March).

The Brazilian DNA is renowned for being stricter during their approvals process than other host countries, and due to this, a higher proportion of projects approved by the Brazilian DNA are registered with the UNFCCC EB (Brazilian Government Official 1, 2011, pers. comm., 16 March). This is mainly related to the additional focus on the technical aspects of the project such as methodologies used and additionality. The extra requirements for outlining if and how a project contributes to sustainable development are set out in the five criteria of Annex III to Resolution One (September 11 2003) and outlined in Chapter Four (Interministerial Commission on Global Climate Change 2003; Ministry of Science and Technology 2011). It is not necessary for a single project to contribute to all five criteria, as different projects lead to different combinations of contributions to sustainable development according to the DNA.
It is stressed to the project participants that they should separate the contributions directly related to the implementation of the project from those that stem from other projects by the same participants’ companies, however in practice, this does not occur. Whilst the information must be consistent with what is outlined in the PDD and pre-validation report, only the Annex III document will be used to assess the contribution to sustainable development by the members of the CIMGC (Ministry of Science and Technology General Coordination Office on Global Climate Change and Interministerial Commission on Global Climate Change 2008).

The information submitted in response to these criteria is used to ‘guide the discretionary decision by members of the Interministerial Commission’ to approve the CDM project (Ministry of Science and Technology General Coordination Office on Global Climate Change and Interministerial Commission on Global Climate Change 2008). Cole and Liverman (2011) refer to the minimum standards that Brazilian CDM projects have to meet, being environmental integrity through additionality and compliance with legislation, as the threshold criteria, and the Annex III contributions as lesser, supplementary goals. If the Interministerial Commission believes that the project does not demonstrate a sufficient contribution to sustainable development within Brazil, it can place the project under review or approve the project with reservations, which must be met prior to receiving the LoA (Frondizi 2009). There is no weighting given to any of the five criteria and the contribution of each project to sustainable development is assessed without the use of a matrix or other guidelines in order to aid an evaluation, in an attempt to avoid further complexity in the process (Brazilian Government Official 1, 2011, pers. comm., 16 March).

These criteria were defined prior to 2001 and have remained unchanged. The criteria selected for the Annex III document were not derived from Brazilian development policy documents such as those concerning the Millennium Development Goals, however there is a large amount of overlap and the DNA believes that the CDM can provide support to Governmental policy priorities such as employment, income generation, and improving health and sanitary conditions (Miguez 2005; Brazilian Government Official 1, 2011, pers. comm., 16 March). The positive contributions coming from CDM projects include other aspects not captured by the five criteria listed in Annex III, such as the ability for the CDM approvals process to encourage better environmental licensing and regulation of environmental systems through, for example, requiring swine farmers to have environmental licences when this is not required by Brazilian domestic law (Brazilian Government Official 1, 2011, pers. comm., 16 March).
Whilst the requirements of the Brazilian DNA with regard to documentation on contribution to sustainable development are more stringent than most host countries, there is still no process whereby such contributions are monitored or evaluated during or after the project’s completion. There have been no instances to date where a LoA has been annulled or revoked. Without active monitoring and evaluation, it is difficult to see how the Brazilian DNA ensures that commitments made at the pre-validation stage are adhered to and implemented in the project operations. There was initially an intention to have an evaluation team, however due to resource limitations this was not implemented (Brazilian Government Official 1, 2011, pers. comm., 16 March). The DNA does not charge any fees for project developers, unlike other DNAs, so it does not have revenue from CDM projects to fund evaluation and monitoring teams (Department of Energy and Climate Change 2011a; Brazilian Government Official 1, 2011, pers. comm., 16 March). As projects must comply with Brazilian environmental and labour laws, consideration of projects from these perspectives is assumed to have already occurred (Brazilian Government Official 1, 2011, pers. comm., 16 March). There is no evaluation or monitoring of the aspects of projects that fall outside of those requirements specifically referenced in environmental and labour legislation. Commitments to contribute to positive environmental, income distribution, capacity building and other outcomes are neither monitored for completion nor evaluated for their effects.

3.5.2.2 Stakeholder Consultation

The Brazilian DNA requires a consultation process in addition to that required by the UNFCCC. The DNA lists a select group of potential stakeholders to which invitations to comment must be sent (Ministry of Science and Technology General Coordination Office on Global Climate Change and Interministerial Commission on Global Climate Change 2008; Interministerial Commission on Global Climate Change 2008). The list of stakeholders that must be contacted is provided in Chapter Four. Invitations must be sent at least 15 days prior to the start of the validation process and all comments received must be incorporated into the validation report prior to submission to the CIMGC (Ministry of Science and Technology General Coordination Office on Global Climate Change and Interministerial Commission on Global Climate Change 2008).

The Brazilian stakeholder consultation process is not considered to be useful by many project developers, or the CIMGC themselves, and increases the timeframe taken to move projects through the pre-registration phase (Brazilian Government Official 4, 2011, pers. comm., 16 March; CDM Project Developer 4, 2011, pers. comm., 18 February; CDM Project Developer 2, 2011, pers. comm., 25 February). Most projects do not receive any responses to the invitations to comment and some of the organisations listed complain that capacity and financial resource
limitations mean that they are unable to participate to a full extent in the consultation process, nor do they have any guidance as to how their contributions are taken into account by the DNA (Econergy Brasil Ltda & Usina Caeté S/A – Unidade Delta (Delta Branch) 2004; Brazilian Government Official 1, 2011, pers. comm., 16 March). The idea of an online evaluation process for stakeholders to comment on project proposals has been floated, as has the idea of eliminating the specific list of stakeholders requiring invitations to comment and replacing this with an open, online invitation to comment, however changes in government have precluded the ability to make such improvements thus far (Brazilian Government Official 1, 2011, pers. comm., 16 March).

3.5.2.3 Project Type Priorities
CDM opportunities in Brazil occur in a range of sectors, as shown in Figure 1-1 (Miguez 2005). The CIMGC does not promote investment in particular project types or regions in order to avoid a conflict of interest with its role as an evaluator (Brazilian Government Official 1, 2011, pers. comm., 16 March). There are however some Brazilian policies, such as the Proinfra program, that try to encourage projects in particular sectors deemed suitable for CDM such as small hydro, wind power and biomass cogeneration (Miguez 2005).

Brazilian per capita CO₂ emissions are very low (5.96 tCO₂ per capita in 2010 excluding LULUCF compared to 10.8 tCO₂ for the UK or 17.2 tCO₂ for the Netherlands) due in part to the clean energy matrix and this is something that Brazil would like to maintain (World Resources Institute 2013; Governo Federal Comitê Interministerial Sobre Mudanças do Clima 2008; Yale Center for Environmental Law & Policy 2011). Renewable energy contributes 45.8% of Brazil’s energy sector compared to 12.9% internationally, or just 6% in developing countries (Governo Federal Comitê Interministerial Sobre Mudança do Clima 2008). At present, 77.1% of Brazil’s electrical energy is sourced from hydropower, however due to recent droughts, socio-environmental problems related to hydro power projects and a potential exhaustion of hydropower options, future expansion in the renewable energy sector will focus on bagasse, wind, solar and solid waste, contributing 11.4% of total electricity supply by 2030 (Governo Federal Comitê Interministerial Sobre Mudança do Clima 2008; Portal Brasil 2010b).

3.5.3 Brazilian Environmental Legislation
Brazilian environmental legislation requires any project likely to cause environmental degradation to undertake an environmental impact assessment (EIA) prior to construction (International Institute for Sustainable Development 2004). The primary responsibility for such an assessment lies with the state environmental agencies, or large municipalities were relevant (International Institute for Sustainable Development 2004). For CDM projects, those project types involved with energy generation are required to undertake some type of assessment, either
as a preliminary or construction assessment, or to apply for an operating licence for the project. Hydro projects are required to undertake an additional assessment. Of the 178 projects analysed for this research, 14% of projects stated that they undertook an EIA, 23% undertook a simplified or preliminary EIA only, 33% stated that they were not required to undertake an assessment and the remainder did not specify. The quality of these assessments and the monitoring of them has been questioned, and there is concern that implementation of environmental legislation in Brazil is ‘lagging behind’ what occurs in other countries (European Commission 2007, p. 12; Brazilian Non-Government Organisation Representative, 2011, pers. comm., 28 February; Non-Governmental Organisation Representative, 2011, pers. comm., 28 February).

3.5.4 Brazilian Government Voluntary Emission Reduction Commitments

Despite the continued belief by Brazil that the current climate problems are due to actions taken by the developed rather than the developing world, Brazil has announced that it is set to make substantial voluntary emission reductions over the next decade (Portal Brasil 2009). This is despite statements made at Kyoto to the contrary (Ministério da Ciência e Tecnologia 2011). President Luiz Inácio Lula da Silva announced in late 2010 that Brazil would be drafting national climate change legislation that would make an emission reduction target of between 36.1 to 38.9% of projected emissions to 2020 legally binding (Portal Brasil 2009; Friberg 2009). This reduction would be split between measures reducing deforestation, promoting a low-carbon agriculture sector and through an expansion in renewable energy, and help to counter the 49% increase in emissions that Brazil has experienced over the past 15 years (Portal Brasil 2009; Thomas Reuters Point Carbon 2009; CDM Project Developer 4, 2011, pers. comm., 18 February). This is part of the National Policy on Climate Change, which in the future will include a Brazilian Market for Emission Reductions (Portal Brasil 2009). This move reflects the fact that Brazilian voters and businesses are very aware about environmental issues and climate change, and are supportive of efforts to tackle such issues (Friberg 2009; Brazilian Forum of NGOs and Social Movements for Environment and Development 2007).

3.6 Conclusion

This chapter has outlined the major policies of the Brazilian, UK and Dutch governments towards the CDM and a brief analysis of how these policies have influenced the ability of the CDM to lead to sustainable development in Brazil. It is apparent that the policies of the UK and the Netherlands focus on the CDM as an economic mechanism, useful for reducing the cost of meeting international emission reduction targets, rather than as a mechanism through which to promote sustainable development for the host country involved. Despite recommendations from
both Dutch and UK government sponsored reports on ways in which the promotion of sustainable development could be improved through the CDM (IOB Evaluations 2008; Lazarowicz 2009), neither country has moved to implement any such recommendations. The emphasis on the right of the host country to determine whether or not a project contributes to sustainable development can be seen as recognition of the host country as the entity with the sovereign right to undertake this determination, as well as a way in which to keep the non-Annex I countries participating in the international carbon market and international climate negotiations. Alternatively, it could be viewed as indicative of the lack of importance of the sustainable development component of the CDM mechanism to the Annex I countries, compared to the use of the mechanism as a way in which to secure access to cheap emission abatement options. As demonstrated through an analysis of the policies of the UK and the Netherlands towards the CDM, this latter priority appears to far outweigh that of the contribution to sustainable development.

In the case of Brazilian policies towards the CDM, there are a number of additional requirements for Brazilian CDM projects to meet compared to projects hosted by other countries, however these requirements have been criticised for their futility in promoting greater levels of sustainable development from CDM projects. Requirements such as translating documents into Portuguese are helpful for soliciting stakeholder participation in the process, however the stakeholder consultation process itself has been criticised for being inadequate and an additional burden for project developers without contributing value to the process (Brazilian Government Official 4, 2011, pers. comm., 16 March; CDM Project Developer 4, 2011, pers. comm., 18 February; CDM Project Developer 2, 2011, pers. comm., 25 February). The requirement for project developers to complete the Annex III documentation may allow for a clearer understanding of the potential benefits of a CDM project, however the implementation of these benefits is undermined by the lack of a thorough assessment process prior to registration and a lack of monitoring and quantification of the claims after project registration.

The following chapter will provide an analysis of the strengths and weaknesses of the CDM in promoting sustainable development, with particular reference to Brazil as a host country and the UK and the Netherlands as credit buyers.
4 The Structural Limitations of the CDM

Introduction

The negotiation of the CDM carbon permit trade is considered to be a win-win situation for both host and credit buying countries (Olsen 2007). However whether or not sustainable development or even a real reduction in global emissions has been achieved is subject to debate (Shiva 2008; Burian 2006). Academics, international think tanks and non-governmental organisations such as Carbon Trade Watch have conducted a wide variety of research into the CDM trade regarding its contribution to emission reductions and to sustainable development.

In terms of achieving low cost abatement options for developed countries, the CDM can be considered a success (Jürgen Stehr 2008; Spalding-Fecher et al. 2013) yet most critics argue that this has occurred at the expense of the CDM delivering a meaningful contribution to sustainable development benefits in host countries (Sutter & Parrerio 2007; Boyd et al. 2009; Murphy, Cosbey & Drexhage 2008; Andrade et al. 2009; Liverman & Boyd 2008; Olsen 2005; United Nations Development Programme 2006; United Nations Development Programme 2007; Figueres 2004; Guijarro, Lumbreras & Habert 2008; Huang & Barker 2009). The main criticism of the CDM that has been identified at an international level is that the structure of the CDM, as a market mechanism, monetises emission reductions, but not the contribution to sustainable development. These criticism includes several related factors, such as: the uneven geographical spread of projects internationally and domestically; the lack of sustainable development monitoring, validation or verification; the dominance of large, end of pipe industrial gas projects; the lack of effective stakeholder consultation; and a lack of technology transfer through the CDM. Other criticisms of the CDM outside those directly affected by the lack of monetisation of sustainable development include: the allocation of responsibility for the definition of sustainable development to host countries and the assessment methods used as a result; the high transaction costs of projects; inconsistencies in the UNFCCC procedures; and the lack of additionality of CDM projects. Each of these criticisms will be reviewed in this chapter.

4.1 The Monetisation of Emission Reductions Only

The CDM was established as a market mechanism to enable Annex I nations to achieve emission reduction targets at lowest cost whilst also contributing to sustainable development.
This encouraged Annex I countries to adopt greater emission reduction targets than they would have done without the use of flexible mechanisms. The design of the CDM as a market mechanism which monetises the production of CERs but not the contribution to sustainable development of projects, results in a trade off in favour of the production of emission reductions (Sutter & Parrerio 2007; Guijarro, Lumbreras & Habert 2008; Cosbey et al. 2005; MacDonald 2010; Boyd et al. 2009; Olsen & Fen hann 2008; Ellis et al. 2007). As Pearson (2006) comments, the CDM is a market, not a mechanism for promoting development or investment in renewable energy and as such, it will not promote development or renewable energy in its current form. In response to complaints that the CDM is not delivering on the dual aims of the mechanism, Pearson argues that ‘…the real problem is conversely that it is working perfectly in doing what a market-based mechanism is designed to do: discover and direct funding to projects that will produce the maximum volume of carbon credits for every dollar invested’ (2006, p. 249). In the case of the CDM, it has produced a market that can generate emission reductions at a cost of US$2/tonne CO$_2$ equivalent for projects with renewable crediting periods and $10/tonne for those with fixed crediting periods (United Nations Framework Convention on Climate Change 2011). In general, markets are not successful at delivering societal objectives whilst simultaneously resulting in an allocation of resources (Brown et al. 2004). Whilst there are some voluntary standards that can be followed by project developers to improve the contribution to sustainable development of CDM projects, and as a consequence increase the monetary value of CERs generated from these projects (Nussbaumer 2009), in the current market, application of these standards is rare and tends to occur mainly in the voluntary rather than compliance carbon markets (CDM Project Developer 3, 2011, pers. comm., 29 March; CDM Project Developer 4, 2011, pers. comm., 18 February).

Cole (2010) argues that the reason why the CDM has failed to deliver on the sustainable development objective is because the original architects of the CDM, the Brazilian negotiating team at Kyoto, did not prioritise that aim. Instead, they focused the CDM on ensuring that developed nations took responsibility for historical emissions and were bound to their emission reduction targets, through access to cheap abatement options. Cole (2010) argues that the Brazilian negotiating team presumed that the mere existence of a project would achieve the sustainable development goal, which was included to placate the desires of the other developing countries at the negotiations in order that they could implement their priorities through the CDM. While the CDM has not been successful in the case of binding all original signatories to the Kyoto Protocol to their emission reduction targets, this narrow definition of sustainable development has been somewhat achieved. However the CDM has not contributed to the level of sustainable development expected by those who hailed the CDM to be a win-win for
developed and developing countries, according to common sustainable development assessment methods.

The policies of the host and buyer countries influence the sustainable development outcomes of projects, as both the buyer and host countries have the right to either approve or withhold approval on the required LoA subject to whatever criteria they wish to impose, and the buyer has the ability to choose the projects from which CERs are purchased (Guijarro, Lumbrañas & Habert 2008; United Nations Development Programme 2006). However when considering the CDM market as a whole, the majority of CERs are generated in industrial gas projects, where the lack of contribution to sustainable development has been highly criticised. It appears that for the majority of buyers or project developers, the main goal is to generate low cost CERs to minimise abatement costs for buyers, and to maximise financial profits for project developers, while meeting only the minimum sustainable development criteria required by the host country (Guijarro, Lumbrañas & Habert 2008).

A conflict of interest has been identified where the project developers in host countries are operating as subsidiaries of parent companies in credit buying countries who wish to offset their emission reduction targets through the purchase of CERs from CDM projects (Guijarro, Lumbrañas & Habert 2008; de Sépibus 2009). In these circumstances, the subsidiary company in the host country is likely to generate CERs at lowest possible cost and the parent company benefits from low cost abatement options, whilst also benefiting from the financial profits generated through the sale of the CERs by its subsidiary company. If there is little or no contribution to sustainable development within the local or wider community through the generation of these CERs, there is little benefit to the host country involved (Guijarro, Lumbrañas & Habert 2008).

The tension between the contribution to sustainable development and low cost abatement options will always, in a market environment, be resolved in favour of the objective that is monetised, and while some critics call for amendments to be made to the current procedures and structure of the CDM, others argue that the requirement to quantify or commodify the contribution to sustainable development for CDM projects on a project by project basis would be difficult, subjective and so expensive as to make investment in the CDM unviable (Pearson 2006). Despite this argument, it is important to at least improve the assessment and monitoring of the sustainable development contribution of CDM projects. As it currently stands, without any assessment or monitoring, and without monetisation of sustainable development, little heed is paid to this objective. Assessment and monitoring techniques have been successfully used by host countries (Olsen & Fenhann 2006). They have also been used for projects where sustainable development monitoring plans are submitted voluntarily by project developers at the
validation stage, for projects with Gold Standard or other accreditation, and have been used extensively in the voluntary market. The problem is not that there is no way to assess and monitor progress towards sustainable development in the CDM. The problem is that it is not prioritised in the current CDM system and this needs to change for sustainable development to be achieved.

The implications of the lack of monetisation of the sustainable development benefits of CDM projects are that the geographical spread of projects is currently very limited; sustainable development benefits are not validated, nor monitored and verified in the CDM process; the CDM is dominated by large, end of pipe industrial gas projects; stakeholder consultation is not prioritised, nor effective; and there is a belief that the CDM does not lead to technology transfer. Each of these implications is explored in further detail below.

4.1.1 Geographical Spread of Projects

Criticism has been made regarding the lack of geographical spread of CDM projects, with China, India and Brazil dominating the CDM market in terms of project numbers (72.8% of global total) and CERs generated (76.2% of global total), with little investment in the LDCs (IOB Evaluations 2008; Minegaki 2009; Nussbaumer 2006; Guijarro et al. 2009; Olsen & Fenhann 2008; Liverman & Boyd 2008; Boyd et al. 2009; Cosbey et al. 2005; Guijarro, Lumbereras & Habert 2008; United Nations Environment Programme Risø Centre on Energy 2011; Lecoq & Ambrosie 2007; van der Gaast, Begg & Flamos 2009; Cosbey 2006; Lazarowicz 2009; Zhu 2012; Piepenbrink 2012). Reports evaluating the CDM, supported by both the UK and Dutch governments, repeat the criticism that there is an unequal geographical spread of CDM projects in favour of the more developed non-Annex I countries (Lazarowicz 2009; IOB Evaluations 2008).

As a market based mechanism, CDM tends to favour investment in countries that display a high attractiveness to FDI, which is influenced by the presence of a stable political and economic climate, availability of infrastructure and skilled labour as well as the incidence of industries or sectors suitable for investment (IOB Evaluations 2008; Zhu 2012). Countries with a high HDI ranking attracted 114 times the number of projects with those with a low HDI according to a 2008 study (Guijarro, Lumbereras & Habert 2008). The LDCs, particularly those in Africa, have not been able to attract CDM projects, for the same reasons that they fail to attract FDI. In addition to this, a perceived lack of technical capacity in encouraging CDM investment or lack of funds to install an effective DNA to promote and attract CDM project developers to the country discourages investment (CDM Project Developer 4, 2011, pers. comm., 18 February).
Brazil has attracted a large share of CDM projects due to its attractiveness as an investment market, which is related to the size of the economy, high levels of domestic consumption, stable government and banking system, advanced level of industrialisation, cultural affinity with Europe and the existence of extensive natural resources (Doehne 2009; Deutsche Gesellschaft fuer Technische Zusammenarbeit (GTZ) & GmbH (Postfach) 2008; Cosbey 2006).

Criticisms of the uneven and unequal geographical spread of projects are not limited to an international analysis. Within countries, there are inequalities in the spread of projects and resulting inequalities in the spread of the contributions that projects can make. Brazil in particular has an uneven spread of projects throughout the country, related in a large part to the same considerations used to assess the attractiveness of countries for FDI. Differences in infrastructure, and availability of skilled and educated labour and local political stability within Brazil, have led to a situation where the wealthier South and Southeast regions of the country host the majority of CDM projects while the poorer Northern and Northeastern regions host only a handful of projects (Andrade, Nascimento & Puppim de Oliveria 2010; CDM Researcher 1, 2011, pers. comm., 24 March). As Bailey surmises, ‘[j]ust as the offset markets reflect other features of neoliberalism, they also embody its tendencies towards uneven development and the (re)production of inequality’ (2011, p. 695-6). Boyd et al suggest that ‘all interventions in the form of aid or investment have the potential to reinforce existing inequalities and change the value and viability of existing livelihood options’ (2011, p. 608).

An important contributing factor to the geographical inequality of CDM projects was the decision, which has since been changed, to develop electricity matrix calculations based upon the regional, rather than national electricity supply matrix (Brazilian Government Official 1, 2 and 3, 2011, pers. comm., 16 March). In the past this favoured energy generating projects in the South and Southeast, rather than in the North and Northeast regions where there already was a larger proportion of energy sourced from renewable energy, hence the energy generated from CDM projects was subject to discounting in order to safeguard additionality (CDM Researcher 1, 2011, pers. comm., 24 March). Since 2008, the interconnectedness of the national energy grid in Brazil is taken into consideration and all CDM projects are subject to the same electricity matrix calculations, yet this has had little impact on the geographical distribution of CDM projects within Brazil (see Figure A.2-9 in Appendix A). The relative wealth and technological advancement of the South and Southeast regions of Brazil mean that some CDM projects should no longer be considered additional in this region, whereas, according to the rules of the UNFCCC, the same projects could still be considered additional in the North and Northeast. Although some critics have questioned the additionality of a range of projects in the country’s South and Southeast, they have not been rejected for registration (CDM Project Developer 4, 2011, pers. comm., 18 February). Another concern is that some cities or locations do not have
the project potential to attract investors, for example 18% of Brazilian projects at registered or requesting registration stage are landfill gas projects (United Nations Environment Programme Risø Centre on Energy 2011), and while this type of project has been popular in Brazil, it is limited to towns with a population over 100 000 inhabitants in order to have landfills big enough to justify the installation of the infrastructure for a CDM project (Americano 2008). Again, for the swine sector in Brazil, biogas projects which are viable for CDM investment are limited to large swine farms unless the bundling of projects from small farms can be arranged (Americano 2008).

A number of initiatives have been suggested in order to rectify the international disparity in geographical spread of investment, including the imposition of a price premium on CERs generated in the least developed countries (LDCs), and these are discussed in Chapter Seven (IOB Evaluations 2008; MacDonald 2010). The UNFCCC EB, through the Nairobi Framework, has initiated some financial mechanisms to support DNA capacity building in the least developed countries and has also established an Adaptation Fund which takes 2% of all CER revenue generated to fund climate change adaptation in the least developed countries (Guijarro, Lumbreras & Habert 2008). Other suggestions for UNFCCC procedural reform include the immediate acceptance of additionality for small-scale projects in the least developed countries or through subsidising validation, verification and other administrative costs for these projects (Jürgen Stehr 2008). At the COP6, some changes were made to improve the participation of the LDCs with the introduction of loans, payable after the first issuance of CERs, towards the administrative costs for projects in countries with less than ten projects (United Nations Framework Convention on Climate Change 2010).

Other critics have suggested that the inclusion of LULUCF could generate a greater regional distribution of CDM projects, especially for countries in Africa (Murphy, Cosbey & Drexhage 2008). It has also been suggested that REDD (reducing emissions from deforestation and forest degradation) could play a role in rectifying the imbalance in projects between the North and Northeast and South and Southeast of Brazil due to the better condition of the forests in the North and Northeast (CDM Project Developer 3, 2011, pers. comm., 29 March), however the ability of REDD or LULUCF to benefit indigenous landowners or those residing in forested areas who often lack formal ownership of their lands must be questioned (Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 28 February), and at present, both the EU and Brazil opposes the inclusion of REDD or use of LULUCF projects.

4.1.2 Lack of Auditing and Monitoring of Sustainable Development

The structure, procedures and financial incentives of the CDM, including assessments undertaken for validation and monitoring verification, are focused only on the creation of
additional CERs, with methodological assessment and ongoing monitoring of projects focused only on the accurate calculation of CERs generated (Müller-Pelzer 2009). The only compulsory validation requirement related to the contribution of a project to sustainable development is checking that a LoA has been issued by the host country DNA, which is accepted as evidence of the project’s contribution to sustainable development without further quantification or qualification.

Prior to the submission of a project to the UNFCCC EB for registration, a project must undergo validation by an authorised DOE, or in the case of Brazil, a DOE that has an office in Brazil. Compared to the detailed descriptions required for proof of emission reductions methodology and monitoring, there are only two sections in the PDD with some relevance to the objective of contributing to sustainable development, namely Section D, Environmental Impacts and Section E, Stakeholder Consultation. These sections do not attract the attention or analysis applied by the validator to earlier sections of the document outlining project methodology and CER monitoring (CDM Project Developer 3, 2011, pers. comm., 29 March). Section D is limited to a description of the environmental impacts of the project and if the impacts are deemed significant by either the host party or project developer, to documentation showing the results of an EIA. Section E is limited to a description of how stakeholders have been contacted, a summary of the comments received and, if relevant, how comments were taken into account. Unless there is an explicit monitoring plan that requires substantiation of the potential sustainable development outcomes claimed in the PDD, which is rare, there is no way to prevent the issuance of CERs because the project is unable to demonstrate a contribution to sustainable development (IOB Evaluations 2008), unless the DNA decides to withdraw the LoA, which is an unlikely scenario. This undermines the integrity of the CDM (Rothballer no date; Brazilian Government Official 4, 2011, pers. comm., 16 March).

There is no explicit requirement within the procedures of the UNFCCC or within the approvals procedure for most DNAs for the provision of a sustainable development monitoring plan to be included as part of the PDD or validation report despite the publication of many criteria and evaluation (Müller-Pelzer 2009; Olsen & Fenhann 2006). Rarely, project developers do choose to include such a monitoring plan as part of their PDD and this enables the verification DOE to check claims made during the validation and stakeholder consultation phase with regard to sustainable development and requires the project developer to ensure that these obligations have been met before the project can complete the verification phase. However, without any monetary reward for sustainable development contribution, no requirement for monitoring of it to take place nor any evaluation or verification of it, the sustainable development objective of CDM projects is often disregarded (Watson & Fankhauser 2009; Boyd et al. 2009) and developers do not generally include such a section as it adds substantially to the time and cost of
projects proceeding through the validation and verification stages (Designated Operational Entity Regional Manager, 2011, pers. comm., 23 February; CDM Project Developer 2, 2011, pers. comm., 25 February).

Even for those projects with a sustainable development monitoring plan that the DOE is then required to validate and verify, there are concerns that the DOEs are compromised in their ability to act as the ‘extended arm’ of the UNFCCC and carry out validation and verification processes thoroughly and independently due to their client relationship with project developers (Friberg 2007; Jürgen Stehr 2008; Schneider 2007). Other factors that could compromise the ability of DOEs to act independently and thoroughly include the lack of adequate sanctions to ensure compliance by DOEs with UNFCCC EB procedures and standards (Schneider 2007; Schneider & Mohr 2010; United Nations Framework Convention on Climate Change 2010) and the existence of a competitive validation and verification market that has led to decreases in prices charged by DOEs and it has been argued that this may reduce the capacity of the DOE to thoroughly evaluate projects (Schneider 2007; Maosheng 2008; CDM Project Developer 2, 2011, pers. comm., 25 February). These concerns support the argument that structural weaknesses in the implementation of procedures and rules within the CDM inherently undermine the dual objectives of the mechanism. The DOE will only investigate the sustainable development contribution of a project when it is concerned by the potential risk to their reputation of a project with adverse social or environmental impacts is an assessment of this carried out (Designated Operational Entity Regional Manager, 2011, pers. comm., 23 February), or if there is a specified monitoring plan in the PDD for assessment regarding the contribution of the project to sustainable development (United Nations Framework Convention on Climate Change (no date)).

The capacity of the DOEs to assess sustainable development monitoring plans, if they were to become compulsory in the future, remains unclear (Nussbaumer 2006). While Brazil requires DOEs to have a presence in Brazil, most host countries do not have this requirement, and given that the location of the majority of DOEs is in Annex I countries, it must be asked whether these are the best organisations responsible for evaluating the monitoring of sustainable development contribution of projects, especially given that many of them have traditional roles as financial, rather than development, auditors. Suggestions have been made to strengthen the independence of DOEs by a number of scholars and CDM participants (Schneider 2007; Leguet & Elabed 2008; Jürgen Stehr 2008; CDM Project Developer 2, 2011, pers. comm., 25 February).

There is no obligation on behalf of the intermediaries who purchase on behalf of the Dutch government to monitor the contribution of sustainable development CDM projects. There is also no clear procedure of what should happen if ‘the performance in terms of sustainable
development is below the level promised in the contract...non-delivery of the sustainable development benefits could lead to breach of the contract, but that is unlikely to happen within the present international CDM policy context, because it would also jeopardise the future delivery of CERs’ (IOB Evaluations 2008, pp. 41-2). The monitoring of Dutch-purchased CERs must be questioned when the first Community Development Carbon Fund project, La Esperanza large-scale hydro project, was denied registration by the UNFCCC in 2004 due to lack of additionality. The project was able to gain LoAs and proceed to the registration phase without adhering to the procedures of the World Commission on Dams (WCD), a requirement of all EU CDM projects, and with the CDCF receiving support from both the Dutch and German governments (Pearson 2006). A number of inadequacies of the EU’s implementation of the WCD requirements on large hydro have been exposed, including the use of DOEs for auditing of reports, despite the WCD requirement for independent auditors; weak guidelines on stakeholder engagement that do not include free, prior and informed consent, which are requirements of the WCD; lack of access to compliance reports by all EU countries; and lastly the classification of large hydro projects, which the EU deems to be larger than 20 MW as opposed to the CDM cut-off of 15 MW (Haya & Parekh 2010). The UK does not have any monitoring obligations for projects that generate CERs that are purchased by UK companies.

Monitoring of contributions to sustainable development does not occur in most host countries due to resource or capacity constraints or due to a perception that this is not important, and Brazil is no exception (Brazilian Government Official 4, 2011, pers. comm., 16 March). The Brazilian DNA does not require a monitoring plan to be submitted as part of the approvals procedure for projects within that country, however there is a recognition that there may be a need for evaluation of the contribution of individual projects to sustainable development (Brazilian Government Official 4, 2011, pers. comm., 16 March). Brazil lacks the resources to monitor the outcomes of all CDM projects (Brazilian Government Official 4, 2011, pers. comm., 16 March). Should the project fail to comply with domestic environmental, labour or other laws, the Brazilian DNA is able to suspend or close the project operations, however this relies on the availability of information with regard to, and the strength of ex-ante monitoring of, environmental and other legislation within Brazil (Designated Operational Entity Regional Manager, 2011, pers. comm., 23 February). Suspending or closing a project based on the failure to employ the nominated number of local staff for instance, is not within the realm of Brazilian domestic law (Americano 2008) The Gold Standard Foundation, which is responsible for a value added accreditation of carbon projects, is considering approaching the Brazilian DNA to offer a joint program to evaluate the contribution of projects to sustainable development using the Gold Standard methodology, something that it is already discussing with the governments of Peru and Honduras (CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January).
The obvious suggestion to rectify this weakness is to require monitoring and verification of sustainable development contributions in accordance with a monitoring plan submitted during validation (Guijarro, Lumbreras & Habert 2008; Rothballer 2008). This would, however, increase verification costs for projects and threaten to make unviable the smaller projects and projects with smaller profit margins, which often include renewable energy projects (Designated Operational Entity Regional Manager, 2011, pers. comm., 23 February). It has been suggested that the use of financial incentives for projects with higher sustainable development could mitigate this impact (Curtius & Vorlaufer 2009). The impact of high transaction costs is discussed further in section 4.3 below. The capacity of project developers to adequately monitor contributions to sustainable development has been questioned, with some developers lacking the necessary expertise to undertake such monitoring operations (CDM Project Developer, 2011, pers. comm., 29 March) and others question the capacity of DOEs, with expertise in technical and financial auditing, to assess the contribution of a project to sustainable development (CDM Project Developer 2, 2011, pers. comm., 25 February).

There are others still who suggest that there is no agreed upon mechanism for monitoring sustainable development (CDM Project Developer 2, 2011, pers. comm., 25 February). Some of the benefits of CDM projects may not be realised for a number of years, or at the site of the project itself. Improvements such as capacity building, staff training and investment in health and education may all take considerable time to materialise and monitoring of sustainable development on a project by project basis may not be appropriate for some of the sustainable development outcomes forecast by project developers at the validation stage of the project (CDM Project Developer 2, 2011, pers. comm., 25 February). The limited finances available should perhaps be allocated to monitoring what is considered measurable (CDM Project Developer, 2011, pers. comm., 29 March). There is no doubt that sustainable development is difficult to measure and monitor, however it is necessary to at least attempt to undertake this to ensure that the sustainable development objective of the CDM is being met, and not disregarded in favour of a focus on calculating emission reductions. Not all benefits of CDM projects are measurable in the short-term, nor is it easy to measure the benefits of projects when the benefits are experienced across a wide geographical area, however there are indicators to measure and monitor the contribution of projects to these benefits. Training and education of staff for example can be measured and monitored, and an assumption can be made that this will contribute towards long-term employment and income benefits for the host community, even though these long-term benefits cannot be measured or monitored as part of the scope of most CDM projects.
4.1.3 Dominance of End of Pipe and Low Sustainable Development Projects

Some researchers assert that project type has a bigger impact on the contribution to the sustainable development of a project when compared with project size (Olsen & Fenhann 2006; Cosbey 2006). The two criteria however are linked, with certain projects such as industrial gas projects more likely to be large-scale due to the warming potential of industrial gases when compared to say run of river projects, which are unlikely to generate a large number of CERs. Project types, such as end of pipe industrial gas projects, which contribute little if anything to sustainable development, have made up the majority of CERs generated on the international CDM market. A study by Holm Olsen and Fenhann (2006) indicated that for HFC projects there were on average only 1.8 sustainable development benefits per project while for N₂O this figure was only one, although the potential for other benefits such as increased tax revenue from projects was identified. At present, CERs generated from only ten industrial gas projects account for two-thirds of all CERs surrendered to the EU ETS in 2009 and 84.3% of all CERs originate from HFC and N₂O projects (Elsworth & Worthington 2010). The EU has already stated that they will not accept CERs generated through these types of industrial gas projects into the EU ETS in the next accrediting period, due to concerns about the additionality, while Australia and New Zealand will follow this lead (Reuters 2011; Europa 2011). Lecoq and Ambrosie (2007) point out that indirect contributions such as the Chinese tax on CER revenue and other municipal-level rents must be taken into account as positive contributions and that not all contributions to sustainable development are direct, however it could be argued that this assumes that funds collected from taxes on these types of projects will be used towards sustainable development initiatives, something that is not guaranteed (Cosbey 2006).

Transaction costs have unfairly affected the financial feasibility of small-scale projects and this has exacerbated the dominance of large-scale projects in the CDM market. The problem with this is not that they do not contribute to a decrease in emission reductions, because they do, although the additionality of some projects is widely questioned. The problem is that through the generation of large numbers of cheap CERs, these projects are driving down CER prices in the international market and making community-scale or renewable energy projects less economically viable (Cosbey et al. 2005). The global warming potential of the industrial gases targeted by these types of projects is 11 700 times greater than for CO₂ reducing projects, and as such the implementation of these projects, with relatively simple and widely available end of pipe technology, is much cheaper than for other project types (Schneider 2007; Andrade unpublished; MacDonald 2010). The dominance of large-scale end of pipe technology has also brought about criticisms of the costs of the CDM, with the implementation of technology to reduce emissions for HFC projects
costing less than US$1/tonne (Schneider 2007), leading to massive profits for the project developers (Bakker et al. 2011), and the ability to pay off the pre-registration transaction and implementation costs within the first year, making this sector even more attractive for project developers and investors in a market with an uncertain future (Pearson 2006). The reduction in emissions from industrial gas projects could have taken place a lot cheaper through its inclusion in the Montreal Protocol through the escalation of processes to reduce the production of ozone depleting substances, however this process has been blocked by both China and India (MacDonald 2010; Elsworth & Worthington 2010). Despite these arguments, some investors reject the need to ban these projects outright, given that due to the lowest hanging fruit phenomenon, the market for these projects is likely to be saturated soon and the CDM will then be able to move towards other project sectors (Cosbey et al. 2005).

The behaviour of the CDM market, in its sourcing of CERs from lowest hanging fruit projects first, has concerned some who ask the question of how will this affect the developing countries when in the future they will be required to take on binding emission reduction targets (Kim, cited in Olsen 2005, p. 10). The ability of the CDM market to eliminate all cheap emission reduction sources whilst only the Annex I countries are bound to emission reduction targets, and the ability for buyers to bank CERs between compliance periods, could result in emission reduction targets for developing countries being more expensive to achieve than for developing countries (Kim, cited in Olsen 2005, p. 10).

The solutions offered to discourage industrial gas projects and encourage other CDM projects include exclusion of CERs sourced from industrial gas projects in the second commitment period, something the EU ETS has already implemented; provision of financial incentives such as tax incentives or higher prices for project sectors with greater contributions to sustainable development; implementation of a minimum quota for Annex I countries to acquire CERs from project sectors deemed to contribute to greater levels of sustainable development; or the introduction of a tax on revenue gained through the sale of industrial gas generated CERs in order to fund sustainable development projects, similar to the Chinese tax on income derived from the sale of industrial gas projects that is used for climate change mitigation and adaptation purposes (Murphy 2006; Schneider 2007).

4.1.4 Lack of Effective Stakeholder Consultation

As part of the registration process, project developers are required to consult with the relevant stakeholders of the proposed CDM project activity prior to the publication of the PDD on the UNFCCC website (CDM Watch 2010a; United Nations Framework Convention on Climate Change (no date)). This can be achieved through meetings or public advertisements explaining the project, its impacts and announcing where more information can be accessed. Within the
validation process is the requirement for the project documentation to be made available on the UNFCCC and DOE websites for stakeholders to view for a minimum or 30 days, and section E.1 of the PDD asks for details on how stakeholder comments have been invited and compiled, a summary of comments (E.2) and how they have been taken into account (E.3). The validating DOE is required to ensure that ‘[c]omments by local stakeholders that can reasonably be considered relevant for the proposed CDM project activity, have been invited’ and that environmental impact assessments, which may involve an element of community consultation, have been made in line with those required by host country law (United Nations Framework Convention on Climate Change (no date), p. 26). Schneider (2007) claims that one-quarter of all projects invite comment from only selected stakeholders via letter, interview or telephone call rather than public announcements, and that in the case of some projects, the PDDs did not document any negative comments received. Only 40% of PDDs clearly documented how stakeholders likely to be affected by the project were invited to comment (Schneider 2007).

For most countries, there is no specific list of potential stakeholders to be consulted prior to the registration process according to the DNA or the UNFCCC EB, and this leads to a concern that the stakeholder consultation requirements can only be achieved through targeting supportive stakeholders for specific invitations to comment rather than inviting comment from those likely to criticise aspects of the project, or under-representing the views of certain sections of the community (Boyd et al. 2009). As Burian (2006, p. 51) states, it is important to have an adequate stakeholder consultation process as different values lead to different conclusions as to what constitutes a contribution to sustainable development.

The Brazilian DNA does require some level of community consultation and a set list of federal and state government departments, community groups and non-governmental organisations must be contacted prior to the issuance of a LoA through Resolution 7, with information including the name and type of the project; the website address where copies of the PDD can be downloaded from in Portuguese; the description of the project’s contribution to sustainable development (Annex III); and a physical address for stakeholders who do not have access to the internet to request a written and timely copy of the relevant documents (Interministerial Commission on Global Climate Change 2008). The list of stakeholders that must be contacted for a project that does not exceed the boundaries of one state includes:

1. City hall and city council of each township involved, and in the case of the Federal District, respecting its cumulative competence established in the Federal Constitution;
2. State and township environmental bodies involved;
3. Brazilian Forum of NGOs and Social Movements for the Environment and Development;
4. Community associations whose purposes are directly or indirectly related to project activity;
5. State Attorney General of the state involved, or, depending on the case, the Attorney General of the Federal District and Territories; and

Should the project extend over the geographical boundary of one state, the list of stakeholders that the project developers are required to contact includes:

1. Government and legislative assembly of each state involved, or, in the case of the Federal District, the Legislative Chamber;
2. Federal and state environmental bodies involved;
3. Brazilian Forum of NGOs and Social Movements for the Environment and Development;
4. National entities whose purposes are directly or indirectly related to project activity;
5. State Attorney General of the states involved, and/or, depending on the case, the Attorney General of the Federal District and Territories; and

Despite the specific requirements for stakeholder consultation in Brazil, less than one in 20 projects will receive stakeholder comments from the above stakeholders consulted, and when received, most comments are limited to general positive statements welcoming development in the region rather than providing specific feedback about the project (Deutsche Gesellschaft fuer Technische Zusammenarbeit (GTZ) & GmbH (Postfach) 2008; Friberg 2009; Fuhr & Lederer 2009). The assumption that, because no comments are received, there are no problems with the project, is incorrect as the inability or incapacity of local stakeholders or NGOs to respond must be taken into account (CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January). The 500-member strong Brazilian Forum of NGOs and Social Movements for the Environment and Development (Brazilian Forum of NGOs and Social Movements for Environment and Development 2007), have raised an issue in their response to numerous CDM projects, in that they have not yet been advised as to how their analysis and comments would be taken into account during the final DNA decision, and as such, they do not comment on projects, but emphasise that this does not imply tacit approval. Another problem, namely evaluation fatigue,
should also be noted in that stakeholders and decision makers are often inundated with requests for comments or evaluation and they must prioritise limited resources and time towards only some of these requests (Müller-Pelzer 2009). NGOs and other stakeholders often claim that they lack the capacity, financial resources or technical knowledge to submit stakeholder responses to each of the CDM projects within their interest, particularly given the restrictive 30 day comment period (Boyd et al. 2009; Deutsche Gesellschaft fuer Technische Zusammenarbeit (GTZ) & GmbH (Postfach) 2008; Brazilian Government Official 4, 2011, pers. comm., 16 March).

It is of concern that obligatory stakeholder consultation is at present limited to the pre-registration processes, with stakeholders not invited to comment after the actual implementation of the project following registration, nor in most cases prior to the development of the final project design plans. Most projects continue through registration and implementation without any real influence from the local community (Andrade, Nascimento & Puppim de Oliveria 2010). The extra requirements for the Brazilian DNA add approximately two weeks onto the length of a project timeline pre-registration, due to the need for translation of documents and publication on a website, and between one and two months for the registered mailing of letters of invitation to comment to the nominated stakeholders and wait for responses (CDM Project Developer 4, 2011, pers. comm., 18 February). Whilst it is acknowledged that stakeholder consultation is in general a desirable process, in the case of the CDM in Brazil, it is often costly in terms of time taken, and does little to contribute any value to the overall process (CDM Project Developer 4, 2011, pers. comm., 18 February; Brazilian Government Official 4, 2011, pers. comm., 16 March).

A workshop declaration from a CDM Watch 2010 workshop in Brazil called for greater stakeholder consultation, with an extension of the public participation period, a call for follow up comments, the provision of translated copies of documents to local communities prior to the consultation period, the formulation of sanctions for DOEs who are shown to be ignoring or not acknowledging stakeholder comments, and the expansion of civil society participation in the CDM (CDM Watch 2010b). These sentiments have been echoed in a report by the High-Level Panel on the CDM Policy Dialogue (2012), where recommendations for improved and specific rules for stakeholder consultation are introduced, as are mechanisms for grievances to be held and acted on post-project registration.

Once the mandatory consultation period is over, there is no way that the UNFCCC EB can block registration of a project based on concerns about lack of consultation. The seriousness of this weakness was demonstrated in Honduras where a large number of community members opposed to a palm oil plantation that was undergoing the registration process for the CDM were allegedly murdered for their opposition to the project (EurActiv 2011). No account is taken of
occurrences after the mandatory consultation period or after the issuance of LoA by the host country government, and given the recent happenings in Honduras, this needs to be amended to protect those stakeholders most at risk from project developers who use force to quell opposition to CDM projects. Schneider and others suggest that all comments received should be made publicly available in their entirety (Schneider 2007; Guijarro, Lombreras & Habert 2008).

Local stakeholder concerns in Brazil have also been raised about one CDM project in particular, and this project has also been criticised internationally for its local social and environmental impacts. The ‘Mitigation of Methane Emissions in the Charcoal Production of Plantar, Brazil’ project in Minas Gerais was granted a LoA by the Brazilian DNA in 2004 and it was sponsored as part of the World Bank Prototype Carbon Fund. The project is based on the planting of large tracts of land with eucalypts to be converted to charcoal to power the pig-iron production facility at the site, as an alternative to coal (Articulação Mineira de Agroecologia et al. 2009; May et al. 2004). The project has reportedly led to the drying up of river systems around the plantation, the use of dangerous pesticides that are often administered without adequate personal protection equipment, questionable and often threatening tactics used to displace local landowners, both with and without official documentation or land ownership status, the destruction of native forest, and a threat to local food security, and it has also led to land disputes with the ‘quilombolo’ communities with ancestral land claims (Lohman 2006; Articulação Mineira de Agroecologia et al. 2009; Valentim et al. 2003; World Rainforest Movement 2012; Brazilian Non-Government Organisation Representative, 2011, pers. comm., 28 February). Despite pressure from international organisations and complaints made against the project from local landowners, the project continues to operate and generate CERs and the Brazilian DNA has not undertaken measures to revoke the LoA. Critics have questioned the capacity and resources of the Brazilian DNA to ensure that the CDM contributes effectively to sustainable development within Brazil based on this case (Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 28 February; CDM Project Developer 3, 2011, pers. comm., 29 March). Situations like these highlight the lack of ability for the UNFCCC EB to act on concerns raised post-registration.

4.1.5 Lack of Technology Transfer

One of the underlying aims of the CDM was to facilitate emission reductions in developing countries through the transfer of low carbon technology in order that developing countries do not have to follow the carbon intensive models of development that were undertaken by today’s developed countries in the past (Guillen 2010). The transfer of technology would ideally allow for continued economic development in the developing countries, just without the high carbon intensity of past development models.
Whether the CDM has facilitated technology transfer through its projects is debatable, with critics suggesting that, due to the increasing prevalence of unilateral CDM projects, where there is no nominated buyer or Annex I partner upon registration and implementation of the project, technology transfer is increasingly irrelevant for most of the projects currently registered or seeking registration (Watson & Fankhauser 2009; Lütken 2008). Another problem is the lack of exogenous transfer of technology and the persistence of projects using technology that is widely available in the host country (Guillen 2010). Technology transfer was claimed in only 39% of projects either registered or proposed in 2008 (Maosheng 2008). Another study suggests that any technology transfer through the CDM is best described as ‘minimal’ (Nifadkar & Dongre 2013). In some cases, such as in Brazil, endogenous technology transfer can still be seen as technology transfer as the vast differences in wealth and access to technology between the areas of the North and Northeast versus the South and Southeast, yet in most cases it can be argued that a lot of CDM projects are using technology readily available within the host country as there are not many projects hosted by the regions of the North and Northeast.

The dominance of end of pipe technologies in the CDM matrix has also fuelled the belief that the mechanism has not contributed to the transfer of clean, low carbon technologies to non-Annex I countries (Andrade unpublished; Nussbaumer 2009). Clean technology is defined as ‘the continuous application of a technical, economic and environmental strategy integrated into processes, products and services, for increasing efficiency in raw materials, water and energy use’ (Andrade unpublished; Andrade et al. 2009). Instead of the CDM promoting this type of technology, the structure of the CDM has made attractive the readily available, easy to implement and lower-risk end of pipe technologies, such as those used for industrial gas projects that are cheaper to implement and have faster financial returns over the transfer of clean technology (Andrade unpublished).

While the CDM does not define technology transfer, the IPCC definition sees it as a:

‘broad set of processes covering the flows of know-how, experience and equipment for the mitigating and adapting to climate change to amongst different stakeholders such as governments, private-sector entities, financial institutions, non-governmental organization (NGOs) and research/education institutions’ (Metz et al. 2001, p. vi).

Technology transfer can occur in a many ways and Andrade (unpublished) identifies a number of these. In a study of ten Brazilian CDM projects, it was found that only 4 had some level of exogenous technology transfer that the projects using clean technologies were more likely to have a widespread contribution to sustainable development than the projects using end of pipe technologies (Andrade unpublished). Half of the Brazilian CDM projects studied used new or innovative technologies and yet almost none led to the transfer of significant amounts of
technology (Andrade, Nascimento & Puppim de Oliveria 2010). One study found that Brazil had below average levels of technology transfer when compared to other CDM host countries (Serres 2008).

Approximately half of all Brazilian CDM projects are in renewable energy, in particular in the sectors of sugar cane bagasse and energy generation by natural gas, which is a high proportion compared to other host countries (Andrade et al. 2009). These projects are mainly located in the Southeast region of Brazil (Andrade et al. 2009). However only one percent of the sugar cane bagasse projects mentioned exogenous technology transfer and the technology, equipment and knowhow already exists in Brazil, in particular in that region of Brazil (Andrade et al. 2009). Only 3% of projects focused on a move from fossil to biofuels, that is, a move towards cleaner production, which does not indicate a successful promotion clean technology transfer within the CDM in Brazil (Andrade et al. 2009; Andrade, Nascimento & Puppim de Oliveria 2010).

Clearly there is a need for amendments to be made to the current structure of the CDM in order to better facilitate and promote the transfer of clean technology to host countries (Guijarro, Lumbreras & Habert 2008). This could be achieved through either financial incentives for clean technology use or mandatory requirements for reporting on exogenous and endogenous technology transfer. The issue of technological innovation has been used to question the basis of carbon trading in general. This is because the promotion of technological innovation in the host countries potentially eliminates the financial impetus or desire for technological innovation in the Annex I countries, and therefore the contribution of the CDM to global technological innovation has been questioned (Schneider 2007).

4.2 Sustainable Development as a Prerogative of Host Countries

Under the Marrakech Accord, negotiated at COP7, the responsibility for determining how sustainable development for CDM projects should be defined, implemented and monitored is allocated entirely to the host country government (Huang & Barker 2009). The host government can decide how to divide these responsibilities between itself and its DNA. As discussed in Chapters One and Two, this stipulation was included to protect the sovereignty of the developing countries, to encourage their participation in mitigating climate change and due to a lack of international guidance on the definition and assessment of sustainable development in the CDM (Figueres 2004).

Commentators have criticised this aspect of the CDM (Cosbey et al. 2005). Given that there is no formal international agreement, set of minimum standards, guidelines or other criteria with which to assess the contribution of CDM projects to sustainable development, some critics have predicted a ‘race to the bottom’ whereby in their desire to attract CDM projects and the
financial benefits that they bring with them, host countries would relax their definitions, assessments and monitoring of sustainable development in order to be more competitive with other non-Annex I countries (Sutter & Parrerio 2007; Müller-Pelzer 2009; Olsen & Fenhann 2008; Burian 2006). Although others have argued that there is no evidence of this occurring (Cosbey et al. 2005; Watson & Fankhauser 2009; United Nations Development Programme 2006; Fuhr & Lederer 2009), and it is difficult to argue that any relaxation of definitions and assessments could occur given that most host countries do not have such policies towards the CDM in the first place. As Macdonald suggests, ‘[i]t is not hard to imagine a government allowing a highly profitable project, issuing many CERs, without properly investigating sustainable development issues that are given no monetary value’ (2010, p. 8). Or put another way, ‘[n]either Annex I countries nor single non-Annex I parties have direct incentives to implement strict sustainable development criteria’ (Sutter & Parrerio 2007, p. 76). Whilst some may argue that Brazil has not succumbed to any ‘race to the bottom’, as evidenced by the additional documentation required on sustainable development contributions and public consultation compared to those required by the CDM registration process, it can be argued that due to the lack of monitoring of the former and the ineffectiveness of the latter, the Brazilian DNA requirements for CDM projects are, in effect, not much stronger than other host countries. Some developers and investors have complained that the lack of clear definition or information regarding sustainable development assessment in some countries has contributed to a lack of investor confidence in the CDM (Cosbey et al. 2005).

The two objectives of the CDM are treated very differently under its procedures. The reduction in emissions is monetised through the issuance of CERs for these reductions; the PDD requires a methodology used to calculate emission reductions and monitor emission reductions and this is scrutinised during the validation process and monitoring must be proven through verification at each CER issuance. In contrast, there is no financial incentive provided for promoting a contribution to sustainable development in the host country aside from ensuring that the LoA is received (Sutter & Parrerio 2007); the PDD does not require a detailed description of this contribution, nor, and this is vital, the monitoring of it; and this contribution is not scrutinised at any point in the validation, verification and issuance process other than through the issuance of the LoA. In fact the only way for a project to be withdrawn or denied the issuance of CERs after approval by the EB, requires the host country government to withdraw their LoA. For Brazil, this action has never been taken, nor is it likely to occur (Friberg 2009), with the DNA preferring to mediate with the project developers and to compromise on an additional contribution to sustainable development to mitigate harmful outcomes in the event of this occurring. ‘No single CDM project has failed due to lack of contribution to sustainable development. As the criteria are stated in such a general wording, it is quite easy to argue that a
project, short of being directly detrimental, would pass the sustainability test’ (Friberg 2009, p. 418).

Some have questioned the assumption that the national government is the best placed organisation to determine local scale sustainable development within their own country, doubting their ability due to issues with impartiality, availability of resources and capacity, and their ability to evaluate projects at a local scale when there might be a more locally based government or institution more capable of doing so. Some question not only the capacity of a host country to perform EIAs or stakeholder consultations (Cosbey et al. 2005; Begg et al. 2003), but the relevance of these types of assessments, which usually focus on mitigating potential negative impacts rather than assessing positive sustainable development contributions (Guijarro et al. 2009). Whilst Brazil’s EIA process appears to be more transparent, clearer and with more objectives than that of India or China, its assessment procedure for CDM projects is considered to be minimal, with a preference for simplified Preliminary Environmental Reports (Minegaki 2009), there have been many critics of these processes (European Commission 2007; Brazilian Non-Government Organisation Representative, 2011, pers. comm., 28 February; Designated Operational Entity Regional Manager, 2011, pers. comm., 29 March). Yet adhering to the Brazilian environmental legislation is considered more difficult than adhering to the requirements of the CDM for some project participants (CDM Project Developer 5, 2011, pers. comm., 18 February).

Some host countries do have detailed information on the sustainable development criteria for CDM projects (see Appendix B), however few prioritise the project submissions received in terms of sustainable development benefits and, in most cases, project developers must only say that they will contribute to one or some of the sustainable development criteria suggested by the DNA (Schneider 2007). Definitions of sustainable development within the CDM differ, with one end of the scale stating that CDM projects should lead to a reduction in emissions without causing any social, economic or environmental harm, whereas others determine that CDM projects should lead to social, economic and environmental improvements in addition to a reduction in emissions (United Nations Development Programme 2006).

The UNEP recommends that DNAs start by identifying national priorities for the broader development context within the host country, as documented in national or sectoral development plans followed by a selection of major sustainable development policy areas stemming from these major policy areas (Lee et al. 2004). One study showed that of 80 DNAs interviewed, 37 reported applying some sustainable development test to CDM projects (Müller-Pelzer 2009). However this does not say anything about the quality of such a test and most report basing their evaluation on a verbal description of the project’s contribution to sustainable
development, with only 3 applying an evaluation tool (Müller-Pelzer 2009). Soft definitions or evaluation of sustainable development are unlikely to lead to great contributions to by the CDM, as project developers have the monetary incentive to follow a compliance only pathway rather than ensure contribution beyond this which may adversely affect, however mildly, the number or cost of CERs produced (Müller-Pelzer 2009). Of the identified methods used to evaluate sustainable development, three types were identified including an operational approach, which uses specific check lists of criteria; a context specific approach which meets specific needs identified in energy or welfare provision for example; or a compliance approach which evaluates whether projects complied with national and local environmental legislation (IOB Evaluations 2008).

Brazil is one of only a few countries to formalise these sustainable development criteria in the form of the Annex III document (Interministerial Commission on Global Climate Change 2003). This document must be submitted to the Brazilian DNA in Portuguese alongside the PDD and validation report in order to receive the LoA and must be made public on the websites of the Brazilian DNA and project developer for the consultation period. Brazil is the only country that requires a draft copy of the validation report before granting the LoA and one of few countries that requires documents to be translated into the local language to be made available to the public during consultation. Due to the lack of monitoring mechanisms for the Brazilian DNA to ensure that the contributions outlined are met, the public nature of the document has been credited with enabling local populations to ensure that contributions listed are met by the project developers (Americano 2008). The Annex III document lists five criteria against which project developers can promote the sustainable development aspects of their projects (how these criteria were chosen is discussed in Chapter Five). These criteria are:

a) Contribution to local environmental sustainability
Assess the mitigation of local environmental impacts (solid wastes, liquid effluents, atmospheric pollutants, etc.) caused by the project in comparison with the estimated local environmental impacts for the reference scenario.

b) Contribution to improvement of labour conditions and net job creation
Assess the commitment of the project to social and labour responsibilities, health and education programs and defense of civil rights. Also assess the improvement in the qualitative and quantitative level of employment (direct and indirect) comparing the project scenario with the reference scenario.

c) Contribution to the distribution of income
Assess direct and indirect effects on the quality of life of low-income populations, noting the socio-economic benefits provided by the project in relation to the reference scenario.

d) Contribution to training and technological development
Assess the degree of technological innovation of the project in relation to the reference scenario and the technologies used in activities comparable to those called for in the project. Also assess the possibility of reproduction of the technologies used, taking account of their demonstration effect, and evaluating the origin of the equipment, the existence of royalties and technology licenses and the need for international technical assistance.

e) Contribution to regional integration and linkages with other sectors
The contribution to regional development can be measured in terms of the integration of the project with other socio-economic activities in the region where it is implemented. (Resolution 1 of September 11, 2003)

For approval and issuance of the LoA, the Brazilian DNA does not require the project to have positive sustainable development benefits in response to all the five criteria, just one (Brazilian Government Official 4, 2011, pers. comm., 16 March). Despite initial suggestions supporting a formal method of evaluating projects by some members of the CIMGC, there is no formal methodology or system for assessing the Annex III sustainable development criteria by the CIMGC (Guillen 2010; Brazilian Government Official 4, 2011, pers. comm., 16 March). The view of the Brazilian DNA is that the most important sustainable development contribution that the CDM can make is to reduce emissions in Brazil (Brazilian Government Official 4, 2011, pers. comm., 16 March; CDM Researcher 1, 2011, pers. comm., 24 March). Presumably then, the Brazilian DNA weighting of importance is based on technology transfer given its ability to reduce future emissions from Brazil, however as discussed in section 4.1.5 above, even this contribution for Brazil is questionable at times. Brazil’s definition and assessment of sustainable development, while more transparent and clearer than that of other countries, has led to a predominance of single bottom line sustainable development contributions for Brazilian CDM projects, focusing on economic considerations such as employment, tax revenue increases and income generation, rather than on environmental or social aspects of sustainable development in Brazil (Andrade unpublished). The findings of one particular study into the contribution of the CDM to sustainable development in Brazil found that the CDM alone could not lead to sustainable development for Brazil without political or institutional changes (Rothballer 2008).
The study noted that even with the additional criteria of needing to sign declarations of adhering to national labour laws and submit to environmental regulations, the Brazilian CDM market could still be criticised for a lack of emphasis on the social aspects of sustainable development, the lack of an exclusion criterion (whereby a particular negative impact of a project excludes the project from registration), the lack of verification and monitoring of the Annex III criteria and also the lack of involvement by local stakeholders in CDM projects (Rothballer 2008).

Despite the Annex III document, there has still been criticism of the lack of clarity in these guidelines, with Brazilian developers of the Social Carbon standard claiming that ‘[a]lthough broad in scope, Annex III is currently composed of documents that are informative but lack specifics regarding real project contributions to sustainable development’ (Rezende & Merlin 2010, p. 92). There is no matrix or checklist for the Brazilian DNA; rather decisions made by the CIMGC are subjective and autonomous and made largely by only three of the ministerial members of the committee (Rothballer 2008; Brazilian Government Official 1, 2 and 3, 2011, pers. comm., 16 March; Brazilian Government Official 1, 2011, pers. comm. 16 March). Quantification of contributions is largely not made in Annex III documents and the lack of baseline information or indicators against which the contribution to each of the five criteria can be judged, makes the Annex III requirements difficult to monitor, even if the resources were available to do so. There is no requirement for monitoring of the contribution to sustainable development claims made in Annex III documents, and as such, there is every incentive for developers to focus on and exaggerate the positive potential contributions of projects rather than presenting a more balanced assessment.

There have however been cases of the DNA returning the Annex III document to project developers and asking for clarification on either the structure or substance of parts of the document (CDM Project Developer 2, 2011, pers. comm., 25 February), although Brazilian developers and PDD consultants do not envisage the Brazilian DNA refusing to approve a project based solely on objections regarding its contribution to sustainable development (Rothballer no date; CDM Project Developer 3, 2011, pers. comm., 29 March). Some developers see the Annex III document as yet another time consuming requirement of the CDM that does not necessarily enhance the contribution to sustainable development of a project and deem it easier to nominate a percentage cut of CER revenue to be donated to local organisations rather than ensuring that the project itself leads to sustainable development outcomes (CDM Project Developer 2, 2011, pers. comm., 25 February). Approaches such as these do not build the capacity of local populations and, whilst one-off financial donations would most likely be welcomed in poorer communities, they do not contribute to development that is sustainable. The United Nations Development Programme (UNDP) has determined that despite initial concerns over the length of time and complexity in the Brazilian DNA review procedures, the current
stakeholder consultation and sustainable assessment initiatives set up in Brazil, compared to
other countries, ‘appear to be working quite effectively and have assisted in incorporating social
considerations and community benefits into CDM decision making’ (2006, p. 13).

The need for an international set of minimum standards or guidelines to guide the selection and
implementation of sustainable development assessment and monitoring criteria for CDM host
countries is considered by some commentators to be essential for achieving the dual objectives
of the CDM (MacDonald 2010; Huq 2002; Boyd et al. 2009). However negotiations on a
common set of standards or principles would generally lead to a lowest common denominator
level of findings, even if the resistance to an externally negotiated model by host countries is
overcome (MacDonald 2010). It is highly unlikely that an internationally negotiated set of
standards will emerge in the coming years (Cosbey et al. 2005; Müller-Pelzer 2009; Murphy,
Cosbey & Drexhage 2008) and as such, without the cooperation of host countries in increasing
the minimum standards for a contribution to sustainable development, the integrity of the CDM
in this regard will continue to be questioned.

There are also questions about the applicability of a universal definition of sustainable
development to all CDM host countries. The universal ‘one size fits all’ development approach
has had only limited success in the past and there is recognition amongst development
practitioners and policy makers that development definitions and solutions must be applicable to
the unique social, cultural, environmental, political and economic characteristics of the region in
question. Sustainable development evaluation and monitoring is complex, expensive and
fraught with challenges in weighing up the different criteria, time scales and geographical
scopes involved (Müller-Pelzer 2009). For this reason, those in favour of universal definitions
have suggested the use of sustainable development guidelines, which can be adapted to each
specific situation through either choice of relevant criteria and weighting of results so that the
relevant importance can be placed on each of the criteria, which Boyd (2009, p. 828) has
likened to ‘global norms with local flexibility’. Another suggestion has been proposed, whereby
a minimum quota for the number of projects which contribute to sustainable development for
poorer groups within the host country are set at an international level with internationally
accepted impact development assessment standards (Guijarro, Lumbreras & Habert 2008;
Schneider 2007). Another alternative would be to discount emission reductions from projects
sectors that do not contribute to sustainable development, as determined at an international level
(Schneider 2007; Boyd et al. 2009; Bakker et al. 2011). The broad nature of these suggestions is
likely to lead to rejection of them by host countries, who will argue for a recognition of the
diversities between non-Annex I countries and the sovereignty of each. The idea of taxing
income generated from the sale of CERs for development or adaptation purposes is already used
in China and Bolivia, and Rothballer (2008) suggests that a levy for climate change adaptation
in addition to minimum proportion of money to be dedicated to social causes would be suitable for Brazil (Rothballer 2008). The Columbian government policy uses tax incentives to promote wind power, biomass energy and agricultural residue projects, offering a 15 year tax exemption on income from electricity sales, provided that half of the income from CER sales is used towards local sustainable development projects (Cosbey et al. 2005). Further discussion of potential solutions to the lack of sustainable development from both the supply and demand-side of the carbon offset market is provided in Chapter Seven.

4.3 The Costs of CDM Projects and the Dominance of Large-Scale Projects

The high transaction costs and uncertain nature of the CDM market has resulted in the dominance of large-scale, end of pipe projects focused on the quick and cheap generation of emission reduction credits as the transaction costs have tended to detrimentally influence the viability of small-scale CDM projects (Guijarro et al. 2009; Begg et al. 2003; Cosbey et al. 2005; Ellis et al. 2007; Murphy 2006; CDM Project Developer 2011, pers. comm., 29 March). Many have argued that the transaction costs for small-scale projects are comparable to the transaction costs of large-scale projects (Pearson 2006). The incongruity between the transaction costs and predicted project returns through the CDM has deterred potential small-scale CDM developers from entering the CDM market and led them to focus on the voluntary carbon market, or abandon emission reduction projects altogether (CDM Project Developer 3, 2011, pers. comm., 29 March; CDM Project Developer 4, 2011, pers. comm., 18 February).

The transaction costs for CDM projects involve the pre-operational costs including validation and registration (and costs involving registering a new project methodology if relevant); the implementation costs of monitoring, certification and enforcement; and trading costs such as brokerage and national registry account holding fees (Lee 2004). Brazilian CDM participants identified the high cost of projects as the main factor in limiting the performance of the CDM in Brazil (PriceWaterhouseCoopers 2008). Transaction costs are highly dependent on the project type, existence of methodology and baseline, quality of the PDD and the length of time taken for the registration and issuance processes (United Nations Development Programme 2006). The UNDP (2006) estimated transaction costs to be between US$60 000 to US$200 000 per project from registration to issuance, with pre-registration costs around 20% to 40% lower for small-scale projects due to simplified procedures and modalities for establishing baselines. Of these, the initial registration costs are the most important to the viability of a project and carbon brokers suggest that projects need to recoup these initial transaction costs within one to two years of the project’s start or else the project is not deemed viable. Even though post-registration transaction costs are two to four times greater than pre-registration, some of these
costs can be met immediately by the sale of CERs generated (United Nations Development Programme 2006). Accessing funding for carbon projects in the first place can be extremely difficult as most financial institutions are reluctant to lend to renewable projects in developing countries, especially if they rely financially on the sale of credits in an unstable CDM market (Pearson 2006).

Projects generating less than 50 000 CERs, where CER prices are below US$15 to $20, are at risk of being infeasible due to the effect of high transaction costs on small-scale projects (United Nations Development Programme 2006). For projects 3 times this size in terms of CER generation, transaction costs are not as financially burdensome (United Nations Development Programme 2006). For projects producing under 5000 CERs annually, transaction costs are a major barrier, for example for small-scale solar photovoltaic (PV) projects which produce 500 CERs annually, CER prices would have to be at least US$15 just to recover initial transaction costs, not including issuance costs, and CER prices would have to exceed US$25 for this scale of project to meet pre and post-registration transaction costs (United Nations Development Programme 2006). Total transaction costs for large-scale projects are generally between 5% and 10% of CER revenue, between 10% to 20% for medium scale projects and between 20% to 40% for small-scale projects for 7 year crediting periods (United Nations Development Programme 2006).

Critics of the CDM highlight the lack of small-scale, community level and renewable projects as one cause of the mechanism’s failure to contribute to sustainable development. Small-scale and renewable projects are perceived by many as making greater contributions to sustainable development than large-scale projects (MacDonald 2010; Olsen 2005; Guijarro, Lumbreras & Habert 2008; Cosbey et al. 2005; Murphy 2006), although this is contested by others who cite examples of remote small-scale wind power projects which do not have noticeable sustainable development contributions outside that of renewable energy generation (Olsen & Fenhann 2006; Watson & Fankhauser 2009; Cosbey et al. 2005). There is a logical assumption made that through a reduction in transaction costs for small-scale projects, greater participation in the CDM by a larger number of smaller firms capable of implementing smaller scale projects would occur rather than the status quo situation of dominance of the market by a small number of large firms with large CDM projects (Andrade, Nascimento & Puppim de Oliveria 2010). This in turn should lead to greater civil society participation and social and economic benefits for the local communities hosting CDM projects (Andrade, Nascimento & Puppim de Oliveria 2010). Very few small-scale projects with the objective of benefiting poor communities are being developed around the world for the compliance market (Americano 2008) and this has again led to the suggestion that the contribution of projects to sustainable development must somehow be given more weight in the evaluation of CDM projects, comparable to that of reduction emissions.
In Brazil specifically, the implementation of the Proinfa scheme by the Brazilian government in order to encourage wind, biomass energy and small hydro projects in 2002 was driven by the recognition of the contribution to sustainable development and renewable energy technology by these projects (Americano 2008) and studies on farm based biomass energy projects in particular indicate that these projects have higher numbers of claimed sustainable development benefits compared to other project types (Lee & Lazarus 2011). Using just those projects registered by May 2011, Brazil has 57.8% large-scale projects compared to 42.2% small-scale in terms of project numbers compared to 69.8% of registered projects worldwide being large-scale and 30.2% small-scale (United Nations Environment Programme Risø Centre on Energy 2011).

Some solutions have been adopted, including UNFCCC EB amendments to the modalities and rules for small-scale CDM projects, such as the ability to use the same DOE for validation and verification, the setting of issuance fees at half the cost per CER for the first 15 000 CERs per year and simplified modalities for baseline and monitoring methodologies. Other solutions adopted include the removal of registration fees, a shorter review period before registration, the ability to bundle projects and simplified measures for demonstrating additionality for small-scale renewable energy projects (United Nations Development Programme 2006; Cosbey et al. 2005; CDM Watch 2010a; United Nations Framework Convention on Climate Change 2010). This has, according to EcoSecuritites, led to a reduction in costs of two-thirds for small-scale projects (Lee et al. 2004). Yet these procedures have failed to shift the balance of the CDM away from the current dominance of large-scale projects (MacDonald 2010). Other efficiency improvements have been adopted during the COP16, where procedures for registration, issuance and review were revised, setting timelines for each stage of the process (United Nations Framework Convention on Climate Change 2010). Another initiative is the establishment of the MDG Carbon Facility as part of the UNDP, which began in 2006 with the aim of supporting development of projects in countries or communities with low ability to attract CDM projects in order to contribute to progress towards the Millennium Development Goals (Guijarro et al. 2009; United Nations Development Programme 2007).

### Inconsistencies in CDM Rules and Procedures

Criticisms have been levelled at the UNFCCC EB due to the lack of clarity in rules and decisions with regard to CDM projects, clarity that is needed to attract investment in a difficult to finance sector, especially where finance is needed for transaction costs incurred prior to approval (Jürgen Stehr 2008; CDM Project Developer, 2011, pers. comm., 29 March). The lack of clarity is blamed for making projects ineligible or for delays, which see fewer credits issued than originally estimated (Jürgen Stehr 2008; Maosheng 2008). The increase in the number of
projects either rejected or reviewed by the UNFCCC EB has created uncertainty for current or potential CDM project developers (Jürgen Stehr 2008; CDM Project Developer, 2011, pers. comm., 29 March).

The impact of the lack of continuity for the CDM market after its first commitment period contributed to the lack of sustainable development, as the end of the first trading period in 2012 encouraged developers to invest in projects that generated a maximum number of low cost emission reductions, and discouraged investment in longer term project options (Pearson 2006; Cosbey et al. 2005). The second commitment period to 2020 has now been formalised, however an agreement on the post-2020 climate regime needs to be finalised as soon as possible to ensure the continuation, and improve the integrity, of the CDM (Cosbey 2006).

4.5 Questionable Additionality

Questionable additionality is the focus of much criticism integrity of the CDM. The requirement of additionality for CDM projects is designed to ensure that investment in projects that would have occurred regardless of the CDM, is not eligible to produce CERs, ensuring that an overall global reduction in emissions is achieved. However the definition of the concept of additionality in the CDM procedures is ambiguous at best (Liverman & Boyd 2008; CDM Watch 2010b). In order to assess the additionality and the number of CERs created, the UNFCCC EB is charged with the task of approving each and every CDM project before verified reductions can be converted to CERs issued. Many have argued that due to the subjective nature of the question of additionality, which is essentially an attempt to ascertain an accurate judgement from a hypothetical circumstance, the requirement for additionality needs to be amended or the CDM needs to move from a project by project basis evaluation to a sectoral mechanism (see Chapter Seven for more discussion of this) (Schneider 2007).

A Delphi survey quoted by Schneider (2007) showed that 71 percent of those survey participants involved in the CDM process thought that projects would have been implemented regardless of CDM registration, while 86 percent indicated that revenues from the sale of CERs are not decisive for financial decisions on project implementation and are only the ‘icing on the cake’ for investors. Another study has examined both the additionality of CDM projects and their contribution to sustainable development, with one quarter of all projects studied achieving neither objective (Sutter & Parrerio 2007). It was also found that, where a project could demonstrate a contribution to either one of these objectives, it was unlikely that it could demonstrate a contribution to the second objective (Sutter & Parrerio 2007). Large hydro projects in particular have been criticised for their lack of additionality, with these types of
projects common practice in all countries and the revenue from CERs deemed to be inconsequential to the viability of these projects (Haya & Parekh 2010; CDM Watch 2012c).

Rejection by the UNFCCC EB on additionality grounds is the most common reason for rejection or review and some have suggested the need for more specific guidelines to improve the process and deliver some level of confidence and certainty to the market (Schneider & Mohr 2010). The use of performance benchmarks, also known as ambitious benchmarks, could be set against companies operating in the top 20 percent of industry standards, with any other company reaching this threshold eligible to generate CERs (Schneider 2007). Most proposals for solutions to the problem of determining additionality focus on the establishment of either additionality factors or standardisation of particular sectors or project types, where assessment is unique for each host country, which could, for example eliminate the requirement for additionality testing for projects in the least developed countries (Jürgen Stehr 2008; Leguet & Elabed 2008; Ruthner et al. 2011; Murphy 2006; CDM Project Developer 2, 2011, pers. comm., 25 February).

**4.6 Conclusion**

The argument presented in this chapter is that the CDM is not achieving the dual objectives for which it was designed to the extent expected, and is instead skewed towards supporting the generation of low cost abatement options for Annex I countries at the expense of achieving sustainable development benefits for host countries. The main reason for this is the prioritising of emission reductions over sustainable development benefits through the monetisation of only the emission reductions component. This has led to a focus of the CDM on maximising emission reductions generated, often at the expense of potential sustainable development benefits of the mechanism.

The geographical spread of projects, internationally and within countries, is demonstrative of this, with CDM investment following traditional channels of FDI flows rather than being directed towards the LDCs or poorer areas of host countries. Weak CDM processes regarding verification and monitoring of sustainable development benefits are also representative of the focus on emission reductions. Technology transfer under the CDM, while not one of the dual objectives but a potential sustainable development benefit, has been weak, with a large reliance on end of pipe and commonly used technologies to generate the majority of the CERs in the market. This has subsequently resulted in a questionable level of additionality for some projects. The lack of guidelines and standards on stakeholder engagement has reduced the potential impact on sustainable development that CDM projects could achieve. CDM participants argue that the CDM is already an overly complex and expensive investment option and this has
contributed to the focus on project types that deliver high emission reductions but low sustainable development benefits.

The following chapter will critique a variety of methods used to assess the contribution of the CDM to sustainable development and also outline and justify the selection of assessment methods used in this thesis. These assessment methods will enable a discussion of the contribution of the CDM to sustainable development in Brazil in Chapter Six.
5 Assessing Sustainable Development

Introduction

The difficulty of achieving consensus on a definition for sustainable development is compounded by the difficulties in measuring and assessing it. The greatest concern for host countries with regard to a discussion of a universal assessment method to evaluate the contribution of CDM projects to sustainable development is that it will reduce the autonomy of host country DNAs and impose on the sovereignty of host countries to define what constitutes sustainable development within their borders (Thorne & La Rovere 1999).

The need for indicators through which sustainable development can be evaluated is based on the need to convert a large amount of complex information into smaller amounts of more meaningful information in order to assess progress and inform decision making (Singh et al. 2009). The method used to assess the sustainable development outcomes of a project can have a large impact on the results of any such assessment. The prioritising of certain indicators of sustainable development and rating methods used can affect the outcome of the results of the assessment. This chapter will assess the benefits of the CDM to Brazil at a country-wide level through the evaluation of a large number of project registration documents and using three different assessment methods. As noted earlier in this thesis, the use of three methods of assessment reduced the potential impact of any bias of one particular assessment method and also enabled a comparison between the results of the three methods.

Following the introduction, this chapter presents information on the sustainable development definitions and assessment methods used in Brazil. (For assessments used by other host countries see section B.1 in Appendix B and section B.2 for the sustainable development standards set by buyer countries). The chapter then provides a critical analysis of the sustainable development assessment methods developed throughout the past decade for both the voluntary and compliance (CDM) carbon markets and the justification for the sustainable development assessment method used in this research. The application of a combination of these assessment methods will allow for an analysis of the contribution of the CDM to the promotion of sustainable development in Brazil.

5.1 Sustainable Development Assessment Methods

Approaches for assessing the contribution of the CDM to the promotion of sustainable development in Brazil include assessment against pre-defined guidelines, such as the Brazilian Annex III document; checklists where specific requirements can be ticked for or against; or
negotiated targets whereby sustainable development contribution is negotiated between the host country or carbon fund and project developer. More commonly in the voluntary or value adding compliance market, multi-criteria assessments are used where the project is assessed against different criteria associated with the different pillars of sustainable development (Sutter 2003). Information on three standards used only in the voluntary market is presented in section B.5 of Appendix B. Negotiated targets are not commonly used in the CDM so will not be assessed in this research.

Other methods for assessment include the cost benefit analysis method or the cost effectiveness analysis method (Na, Nishiki & Ueta 2009; Qirui 2010; Olhoff et al. 2004). The cost benefit analysis involves the estimation of all project costs versus the estimation of all project benefits and a calculation of a net value, but this is less common due to its complexity, the difficulties in establishing baselines and the difficulties in converting non-economic values into economic terms (Olhoff et al. 2004).

A critical difference between sustainability assessments must be noted before detailing the differences between each of the assessment methods used for the CDM. Methods of ex-ante evaluation, such as those undertaken at the registration stage of projects, must be followed up with ongoing evaluation and, if possible, ex-post evaluation in order to assess the implementation and outcomes of the project to ensure that project developers are held accountable for implementing the project as per the original submission (Müller-Pelzer 2009; Warringa, Korteland & Doorn 2009). Ex-ante evaluation in the form of the validation and ongoing evaluation in the form of the verification of the CDM project is dedicated almost solely to the CDM objective of ensuring a reduction in emissions rather than a contribution to sustainable development (Müller-Pelzer 2009). There is no mandatory requirement for validation of sustainable development contributions and these contributions can only be assessed if the project developer has voluntarily included a monitoring plan in their registration documentation. As discussed in Chapter Seven, developers are unlikely to do this due to the additional financial and time costs associated with the verification and ongoing monitoring of sustainable development benefits (CDM Project Developer 1, 2011, pers. comm., 29 March; UK Government Representative, 2011, pers. comm., 11 January; CDM Project Developer 4, 2011, pers. comm., 18 February; CDM Researcher 3, 2011, pers. comm., 31 March; Brazilian Government Official 4, 2011, pers. comm., 16 March). It is also unlikely that a host country would enact the only other mechanism for addressing discrepancies between claimed and implemented sustainable development benefits by withdrawing their LoA. Given this, ex-ante assessment methods, including those used in this research, can demonstrate only the sustainable development benefits as claimed by project developers prior to the implementation of projects. Without ongoing evaluation, a more accurate picture of such benefits can not be obtained. The
claims made by project developers are at best, an estimate of future benefits, or at worst, a list of benefits claimed only to gain approval for a project. CDM participants suggest that the reality lies somewhere in between these two scenarios (CDM Project Developer 1, 2011, pers. comm., 29 March). For measuring technology transfer however, a desktop analysis is more robust and therefore findings related to this aspect of sustainable development should be considered as a accurate reflection of what has occurred through the CDM. Despite these limitations, a number of researchers have used methods of assessment where project documentation is the primary source of data (Nussbaumer 2006; United Nations Framework Convention on Climate Change 2011; Cosbey 2006; Lee & Lazarus 2011; Olsen & Fenhann 2006; Alexeew et al. 2010).

Pre-determined guidelines are a useful tool for assessment as they allow for innovation and new carbon reduction ideas to be generated from the CDM through different interpretations. Checklists and multi-criteria assessment rarely offer this flexibility, usually developed from ridged, predetermined factors. However, while flexibility can facilitate innovation, it can also result in uncertainty, which could lead to only minimum standards being met. Some guidelines can be obscure and give no guidance as to which technologies are preferred or to what types of sustainable development are preferred (Na, Nishiki & Ueta 2009). The Brazilian DNA uses guidelines to assess potential CDM projects in the form of the Annex III documentation required prior to the issuance of a LoA.

Checklists can provide the minimum criteria which CDM projects have to meet and the responses to these checklists can later be ranked based on sustainable development objectives that have been identified and prioritised by the DNA or through wider host country policy (Olhoff et al. 2004). Checklist criteria can be given neutral, positive or negative ratings based on the projected change from baseline after project implementation (Olhoff et al. 2004). This method is both simple and transparent and used widely by other host country DNAs in their assessments (Olhoff et al. 2004; Guillen 2010). Others argue that the narrow nature of a checklist does not help develop new sustainable development policies, so instead just matches existing policies with projects, which are unlikely to contribute to the decarbonisation of the economy through sectoral transformation (Figueres, cited in Olsen & Fenhann 2008, pp. 2821-2). The narrow scope is not conducive to the dynamics of innovation or interpretation (Na, Nishiki & Ueta 2009).

Multi-criteria assessments require a high level of stakeholder participation in both the identification of sustainable development criteria and their weighting and therefore most countries and project participants are unable to make use of these types of methods (Olsen & Fenhann 2006). Multi-criteria assessments are mostly used by research institutions and NGOs,
rather than by DNAs or project developers, due to their complexity and time consuming implementation (Guillen 2010; Cosbey 2006).

For each assessment method, except the negotiated targets, a set of assessment criteria based on the generally accepted triple pillars of sustainable development is created. Most assessment methods are framed around the commonly cited Bellagio Principles which focus on goal setting and practical application of goals through standardisation, baselines or targets; inclusiveness of the whole system; inclusion of future generations in calculations of equity and disparity; an adequate temporal scope for assessment of impacts; transparency of methods; clear communication; broad participation; and ongoing monitoring of assessment through designation of ongoing assessment responsibility (Hardi & Zdan 1997). From the assessment criteria, indicators can be identified which, when compared to the baseline, can return a measure of whether or not the project contributes to sustainable development for each criterion or if it would likely have an adverse effect.

Some early suggestions in discussions surrounding the establishing of a standardised sustainability assessment method applicable to the CDM included requirements for: a single set of sustainable development criteria (Anagnostopoulos et al, cited in Müller-Pelzer 2009, p. 58); global standards for fair trade CDM (Humphrey, cited in Müller-Pelzer 2009, p. 59); or the inclusion of a section in the PDD which requires a quantified discussion of the contribution to sustainable development of the project with quantified commitments (Burian 2006). Singh et al (2009) recommend the need for selection criteria and indicators to be chosen based on their validity, comparability, simplicity and data availability (pp. 195-6). Of course, the higher the number of criteria to be assessed, the greater the transaction costs and time taken for assessment (Lenzen, Schaeffer & Matsuhashi 2007). Olhoff et al suggests a number of guidelines for the selection of sustainable development indicators when evaluating CDM projects, proposing that indicators need to be:

- Complete – ‘indicators should be adequate to indicate the degree to which the overall objective of sustainability has been met’ (2004, p. 37);
- Operational – ‘indicators should be used in a meaningful way in the analysis’ (2004, pp. 37-8), provide balanced coverage of the area and be well defined, unambiguous and relevant to policy;
- Decomposable – the set of indicators can be broken down into parts consisting of a smaller number of indicators;
- Non-redundant – ‘indicators should be defined to avoid double counting of consequences’ (2004, p. 38); and
• Minimal – in order to minimise costs, time, effort and so that the set of indicators can be partly based on data already available that is regularly updated (2004, pp. 37-8).

This set of guidelines is directed towards the use of indicators to assess individual CDM projects by either host DNAs or DOE's. While this set of guidelines articulates the ideal list of indicators used to assess individual projects, for a desktop, country-wide analysis of the contribution of the CDM to the promotion of sustainable development within a country, this list is unworkable. An attempt has been made to incorporate aspects of this list, such as ensuring indicators are operational, into the three assessment methods used in this research, however it was not possible to use indicators that required regular updating due to the nature of the research methods.

Another important aspect when selecting indicators through which to measure a contribution to the promotion or the implementation of sustainable development benefits is that of weighting the indicators. While weighting of indicators can be used to tailor an assessment approach to a the specific situation of a host community, weighting requires a high reliance on the subjective opinions of people and weighting has been shown to have a significant influence on the final result of a project assessment (Müller-Pelzer 2009; Sun 2011; Lenzen, Schaeffer & Matsuhashi 2007). Weighting relies heavily on the availability of stakeholders, experts and resources to enable this process to take place for each project and, as previously stated, resources sufficient to conduct such a process are not always made available to host DNAs. Weighting is not used in the three methodologies for this research, as it is not appropriate for a country-wide assessment given that the opinions of the many different host communities is not available.

The Sustainability Management Approach was developed by Müller-Pelzer in 2009 and the purpose of the research was to establish a conceptual framework that would be suitable for the needs of both DNAs and project developers in assessing the contribution to sustainable development of a CDM project (Müller-Pelzer 2009). Müller-Pelzer suggests that despite the proliferation of sustainability assessment methods by other writers, most DNAs did not apply such methods to their assessment of CDM projects, largely due to the time consuming nature of these assessment methods (Müller-Pelzer 2009). Müller-Pelzer identifies 37 out of the 80 DNAs interviewed as using some sort of approach to assess contribution to sustainable development, however she questions the quality of these approaches (Müller-Pelzer 2009).

The Sustainability Management Approach offers 10 guidelines from which sustainable development projects should be evaluated, designed to ensure applicability and adaptability by different DNAs and for different types of projects, whilst still ensuring minimum thresholds so
that sustainable development is achieved (Müller-Pelzer 2009). The 10 guidelines include the need for a holistic approach of interactions between people and the environment, embeddedness and institutionalisation, whereby notions of sustainable development are embedded in the project developers’ organisation rather than focusing on financial donations; time and geographical scales appropriate to the boundaries of the project; broad stakeholder participation; transparency of goals and assumptions; continuity and flexibility to respond to changes; organisational learning to implement an understanding of sustainable development; proactive attitude rather than one of meeting minimum compliance standards; and minimising compensatory approaches to mitigating damages or lack of contribution to sustainable development (Müller-Pelzer 2009).

The Sustainability Management Approach tool itself consists of seven ‘elements’, each equally important, which were seen to provide valuable information on the sustainability strategy of project developers (Müller-Pelzer 2009).

Table 5-1Sustainability Management Approach tool elements (Müller-Pelzer 2009)

<table>
<thead>
<tr>
<th>Element 1:</th>
<th>Description of Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy Analysis</td>
<td>Takes relevant international, national and local legislation into account. Strengthened if DNA guidance given.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Element 2:</th>
<th>Description of Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholder Analysis</td>
<td>Analyses who is affected by, has an interest in, is in a position to affect the project, has expressed an opinion on or ought to care about the project. This was seen as useful by project developers and other people involved in the CDM process.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Element 3:</th>
<th>Description of Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources and Inputs</td>
<td>Assesses whether there are activities aside from the project itself that will help contribute to sustainable development such as quantified social plans for the area. This was seen as useful by project developers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Element 4:</th>
<th>Description of Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal Hierarchy</td>
<td>Establishes connections between the goals, sub-goals and preconditions of the project.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Element 5:</th>
<th>Description of Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of Activities</td>
<td>Definition of goals for each activity, such as job creation, culminating in the achievement of sustainable development for the project. This was seen as useful by project developers.</td>
</tr>
</tbody>
</table>
Element 6: Definition of SMART Indicators
SMART indicators being specific, measurable, action-oriented, realistic and timed, should be specified for each activity planned for the project. This element was seen as most useful by DNAs despite the need for increased capacity and technical skill to assess.

Element 7: Discussion of Underlying Assumptions
Discussion in order to engage groups in understanding the arguments of other groups and to achieve consensus. This element was seen as the least useful by DNAs with the assumption being that a skilled facilitator would be required.

The research findings suggested that this approach was acceptable for most DNAs and project developers, however it is not known whether this approach has been adopted by any DNAs in their current analysis of contribution to sustainable development for CDM projects.

5.2 Sustainable Development Assessment Methods for DNAs and Research Purposes
A sustainable development assessment framework for the evaluation of individual CDM projects by a DNA prior to registration must be applicable to the specific requirements of the CDM, DNAs and other interested parties and take into account the following factors:

- National policy priorities and identified sustainable development priorities of the country and host community must be taken into account when designing an assessment framework (Olhoff et al. 2004). ‘By including relevant criteria from existing plans and strategies in the selection of SD [sustainable development] criteria for CDM projects, the additional effort related to the SD assessment process is furthermore minimised and consistency between environmental and broader development considerations is enhanced’ (Lee et al. 2004);

- Assessments need to be applicable to all CDM project types. Given that not all project types will contribute equally to all pillars of sustainable development, or may in fact impact detrimentally on some areas, guidelines should, within some parameters, allow for positive contributions in some indicators to compensate for failures in other areas (Olhoff et al. 2004);

- The high transaction costs have already been identified as a problem in the CDM, in particular for smaller scale projects and so the assessment process needs to be performed in a timely manner in order to reduce delays in the DNA approvals process.
Despite this, CDM projects must still contribute to sustainable development and this needs to be evaluated and monitored pre- and post-implementation (Olhoff et al. 2004);

- DNAs in host countries are often resource or capacity constrained in their ability to undertake complex evaluations of potential CDM projects prior to their implementation. In addition to this, there is often a lack of evaluation of sustainable development contributions after the initial DNA appraisal prior to the issuance of the LoA and registration and there is a need for monitoring of post-implementation outcomes. Suggestions, however, for monitoring responsibilities, should take into account the fact that DNAs are often unable to undertake complex monitoring of projects after their implementation due to resource or capacity constraints. Therefore, monitoring may need to be undertaken by DOEs, or resources provided to DNAs to enable them to undertake this themselves; and

- Investors have cited uncertainty regarding the procedures, rules and future of the CDM as a large concern (CDM Project Developer 2, 2011, pers. comm., 25 February). As such, DNAs should attempt to reduce uncertainty by making guidelines for sustainable development criteria and decisions with regard to this as clear, simple and as transparent as possible to reduce uncertainty amongst participants and investors.

Müller-Pelzer (2009) found that just under half of the host country DNAs she interviewed had established definitions for sustainable development or methods to assess a project’s contribution to the specific sustainable development requirements of their country, including checklists of national priorities, matrices, environmental impact assessments or forms, and a small number of DNAs used an analytical tool. This study suggests that more than half of all DNAs approve or reject CDM projects without any set methods or approaches (Müller-Pelzer 2009). Other DNAs reportedly assessed the sustainable development contribution based on community acceptance of the project or reliance on authorisation of the project by the various regulatory bodies as sufficient evidence of the project’s contribution, whilst another DNA required a percentage of the CER revenue to be spent on social projects (Müller-Pelzer 2009).

As discussed in Chapter Four, Brazil, being one of the few host countries with a DNA that has outlined a set of guidelines to assist the DNA in evaluating the sustainable development contribution of CDM projects, is considered to have one of the more stringent DNAs (Brazilian Government Official 4, 2011, pers. comm., 16 March). The more thorough evaluation conducted by the Brazilian DNA leads to projects being much more likely to receive registration by the UNFCCC (Brazilian Government Official 4, 2011, pers. comm., 16 March) and to generate CERs of higher value, due to the reduced risk (Deutsche Gesellschaft fuer Technische Zusammenarbeit (GTZ) & GmbH (Postfach) 2008). The Brazilian DNA requires
project developers to complete a document entitled ‘Annex III’, which was compiled through a process of negotiation between the different ministries of the Interministerial Commission, in particular the Ministry of Science and Technology, Ministry for Environment and Ministry for Mines and Energy, and is based on existing development documents pertinent to each Ministry (Guillen 2010). This document is to be submitted in Brazilian Portuguese along with the PDD and the validation report to the Brazilian DNA in order to seek a LoA (Ministry of Science and Technology General Coordination Office on Global Climate Change and Interministerial Commission on Global Climate Change 2008). The five priorities of Annex III reflect some of those identified in the discussion on Brazil’s development priorities in Chapter Two. While there is no emphasis in the Annex III document on promoting regional or urban/rural equality for instance, employment creation, education and training, improving environmental sustainability and promoting technological transfer both into and within Brazil are sustainable development priorities for Brazil identified in the literature and outlined in Chapter Two.

Assessment frameworks are used for the purposes of ex-ante evaluation by researchers. Some examples of these frameworks include the UNFCCC approach (United Nations Framework Convention on Climate Change 2011); the Grupo de Pesquisa em MDL da UFBA framework for assessment using both a multi-criteria and a checklist approach; the assessment used by Alexeew et al (2010) to examine the sustainable development benefits of CDM projects in India; and the Development Dividend framework (Cosbey 2006). These four approaches are presented below.

In 2011, the UNFCCC released a report evaluating the sustainable development, technology transfer and cost of abatement of the CDM projects registered before July 2011 (United Nations Framework Convention on Climate Change 2011). From an analysis of the PDDs or PoAs of each project and from the results of a survey conducted of 409 project participants, the report compared the results to the research already conducted in this field (United Nations Framework Convention on Climate Change 2011). The study used a set of 15 indicators from which to assess the contribution to sustainable development of these projects based on the PDD documentation, and later reviewed through surveying project participants. The study states that these indicators incorporate most of the criteria and indicators used in other studies (see for example Alexeew et al. 2010; Huq 2002; Nussbaumer 2009; Olsen 2007; Sutter & Parrerio 2007; United Nations Framework Convention on Climate Change 2011). Table B.3-1 in Appendix B presents more the indicators and scoring system used for this framework.

A maximum of four indicators were assigned to each project, which according to the report, was sufficient to cover the claims in most PDDs, and although, the study acknowledged the potential for bias due to the subjectivity required by the nature of the data in the PDD and due to the
of different assessors assigned different indicators to any sustainable development outcome claimed in the PDD, it claimed that this bias would not be systematic due to the large sample size (United Nations Framework Convention on Climate Change 2011). These results were then analysed for each criterion, on a project type and category, host country and year of registration basis.

The contribution to technology transfer was identified through the use of data in section A.4.2 of the PDD which asks for a description of technology transfer if relevant, based on the use of a keyword search for relevant technology transfer descriptions (United Nations Framework Convention on Climate Change 2011). This was also evaluated on a project type and category, host country and year of registration basis.

Of particular significance for this research is the work of the Grupo de Pesquisa em MDL da UFBA. This inter-disciplinary research group is based at the Universidade Federal da Bahia (Federal University of Bahia) and conducts research to evaluate and recommend improvements to the CDM process in Brazil to enable greater technological development, technology transfer and sustainable development in Brazil (CDM Researcher 1, 2011, pers. comm., 24 March). For the purposes of their research, clean technologies are defined as those which ‘can be understood as the continuous application of a technical, economic and environmental strategy integrated into processes, products and services, for increasing efficiency in raw materials, water and energy usage’ (Andrade unpublished). All other projects, including biogas sourced from landfills or swine production, are classed as end of pipe technologies (Andrade unpublished).

Technology transfer is classified as either endogenous, where technology transfer occurs within the non-Annex I country, or exogenous, whereby the technology is transferred from an Annex I country to a non-Annex I country (Andrade unpublished). Technology transfer in the CDM can occur in six identified ways. First, through licenses and patents; technology transfer contracts; partnerships with universities, research centres, government agencies, strategic alliances or through joint ventures; or via subcontracting for development of local machinery and equipment. Secondly, it can occur through the incorporation of technologies into machinery, equipment and software that is imported. Thirdly, technology transfer can take place through the information contained in operations manuals, software applications, courses and training programs. Fourthly, it can occur through the transfer of knowledge during consultation, technical support and qualification procedures. Fifthly, through improvements on the technology transferred to the host country, and lastly, through technological self-development via research and innovation, reverse engineering and experimentation (Andrade unpublished). The sustainable development criteria and indicators chosen by this research group include those listed in Table B.3-2 of Appendix B.
Through gathering information from the PDDs, websites of project developers and semi-structured interviews on 75 Brazilian CDM projects granted CERs prior to 2007, the researchers were able to fill in a checklist based on the above indicators, compiling an aggregate figure of benefits for each pillar of sustainable development and from this they determined whether the individual projects contributed to a single, double or triple bottom line definition of sustainable development (Andrade unpublished). Any projects failing to achieve the three social indicators, at least three out of the four environmental indicators or at least three out of the four economic indicators were considered to contribute to only double or single bottom line sustainable development (Andrade unpublished). Projects with less than less than all three social criteria and less than two environmental criteria were considered to only achieve a single bottom line contribution status (all projects achieved a contribution to economic development) (Andrade unpublished), as shown in Table 5-2.

Table 5-2 Explanation of the single bottom, double bottom and triple bottom line approach (Andrade Celio Silveira (unpublished))

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Single Bottom Line Contribution</th>
<th>Double Bottom Line Contribution</th>
<th>Triple Bottom Line Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>Less than 3 indicators</td>
<td>Less than 3 indicators</td>
<td>3 indicators</td>
</tr>
<tr>
<td>Environmental</td>
<td>Less than 2 indicators</td>
<td>Less than 3 indicators</td>
<td>3-4 indicators</td>
</tr>
<tr>
<td>Economic</td>
<td>n/a</td>
<td>n/a</td>
<td>3-4 indicators</td>
</tr>
</tbody>
</table>

Projects were divided into end of pipe or clean technology categories and the relative contributions of each to triple bottom line sustainable development were determined (Andrade unpublished).

Another researcher from the Grupo de Pesquisa em MDL da UFBA used an adaptation of the MATA-CDM data set to make a multi-criteria assessment of a number of case study projects in Brazil, but without any weighting of indicators. The total score was not compiled as results were displayed on radar charts to demonstrate the contribution of each project to each of these facets of sustainable development (Guillen 2010). The criteria for assessment included those in Table 5-3.
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air quality</td>
<td>-2 to +2</td>
</tr>
<tr>
<td>Water quality and quantity</td>
<td>-2 to +2</td>
</tr>
<tr>
<td>Soil conditions</td>
<td>-2 to +2</td>
</tr>
<tr>
<td>Biodiversity protection</td>
<td>-2 to +2</td>
</tr>
<tr>
<td>Natural resource conservation impact</td>
<td>-2 to +2</td>
</tr>
<tr>
<td>Generation of direct employment</td>
<td>-2 to +2</td>
</tr>
<tr>
<td>Technology transfer and technological development</td>
<td>-2 to +2</td>
</tr>
<tr>
<td>Distributional return of CER revenue through taxes</td>
<td>-2 to +2</td>
</tr>
<tr>
<td>Regional integration</td>
<td>-2 to +2</td>
</tr>
<tr>
<td>Impact on livelihoods of local population</td>
<td>-2 to +2</td>
</tr>
<tr>
<td>Quality of employment generated</td>
<td>-2 to +2</td>
</tr>
<tr>
<td>Training and development opportunities</td>
<td>-2 to +2</td>
</tr>
<tr>
<td>Involvement of stakeholders in development of project</td>
<td>-2 to +2</td>
</tr>
</tbody>
</table>

Another assessment method, conducted by Alexeew et al (2010), was specifically designed to assess the sustainable development benefits claimed by CDM projects hosted by India, and had similar limitations to the methodology used in this research, focusing on the promotion of, rather than a measured implementation of, sustainable development benefits based on claims made in project registration documentation. The methodology for the MCA (multi-criteria assessment) approach in this thesis was based strongly on the methodology from the study conducted by Alexeew et al (2010). As part of an analysis in the pay offs between additionality and contribution to sustainable development of 40 Indian CDM projects, Alexeew et al (2010) developed a multi-criteria analysis based on Olsen and Fenhamn’s (2008) model. The MCA was designed to match India’s national sustainable development policies, addressed each of the three pillars of sustainable development and was developed to use in conjunction with information garnered in PDDs rather than through other methods of analysis (Alexeew et al. 2010). Each
indicator was evaluated on a scale from -1 to +1 with 0 representing a neutral impact, +1 positive and -1 negative on that particular indicator (Alexeew et al. 2010). At the conclusion of this analysis the values were added together to calculate an aggregate score, comparable between projects (Alexeew et al. 2010). Table B.3-3 in Appendix B summarises the criteria, indicators and method of calculation for this MCA.

As outlined in the research, the quality of data in this assessment is limited by the quality of information in the PDD, which is based on only the potential contribution of projects as determined in the early stages of project development, is written by project developers who are likely to promote only the positive benefits of their projects and is often presented in an unspecific way (Alexeew et al. 2010). However, Alexeew et al (2010) were able to find a number of patterns proving that CDM projects are often a trade-off between additionality and sustainability benefits and that particular project types have greater additionality and/or sustainability benefits compared to others (Alexeew et al. 2010).

The Development Dividend Framework was designed in 2006 in order to assess the contribution of registered projects to the development dividend, defined as ‘the benefits to developing countries beyond those strictly related to climate change, in the areas of economic growth through investment; technological evolution; poverty alleviation; environmental and human health improvements’ (Cosbey 2006, p. 1). Using the SouthSouthNorth scale of scoring, this framework was developed to enable comparability between projects, which was minimal in terms of information requirements as it was designed to use only the information included in the PDD and validation reports, based on an international rather than national level approach and producing an aggregate result (Cosbey 2006). The framework is based on the three pillars of sustainable development and includes the questions in Table B.3-4 in Appendix B. For each type of project, a scoring chart was set up to allocate points for each of the development benefits applicable to the project that are mentioned in the project documentation (Cosbey 2006). The scoring framework is presented in Table B.3-5 in Appendix B.

The authors of the Development Dividend Framework themselves recognise the limitations of the framework and acknowledge that the use of a simple, universal framework that is based on the analysis of documentation submitted prior to project implementation may exclude specific regional and national contexts and fail to take into account the implementation of development dividends claimed in the documentation (Cosbey 2006). While the framework is able to differentiate between projects based on their quality, it fails to differentiate based on quantity, that is, the development benefits delivered by a smaller project may fall across a number of categories and therefore rate higher than a larger project that delivers a larger quantity of development benefits across a smaller number of categories (Cosbey 2006). Despite these
weaknesses, the development dividend framework is suitable for a pre-implementation, desk-based analysis that aims to compare the contribution to sustainable development of various project types.

5.3 Sustainable Development Assessment Methods for DNAs and Project Developers

Other assessment frameworks used to inform the methodology used in this research include Sutter’s (Sutter 2003) MATA-CDM approach; the SouthSouthNorth matrix (SouthSouthNorth (no date)); the CD4CDM framework (Olhoff et al. 2004); and the Prototype Carbon Fund framework (Huq 2002). The Gold Standard, Social Carbon and Climate Community and Biodiversity standards are also examined as a source of information for the development of the methodology for this research.

All of these assessment frameworks are based on the three pillars of sustainable development and each framework emphasises different aspects of these pillars through their selection of indicators chosen. The MATA-CDM, SouthSouthNorth, Gold Standard and Social Carbon frameworks each calculate a final overall score while only the MATA-CDM framework uses weighting of indicators to tailor the framework to better suit host community requirements. Table 5-4 shows the most commonly used indicators from the assessment frameworks discussed in this chapter.

Table 5-4 Common indicators used to measure the three pillars of sustainable development

<table>
<thead>
<tr>
<th>Environmental</th>
<th>Social</th>
<th>Economic (and technological)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air quality</td>
<td>Employment generation**</td>
<td>Improvements to GDP or balance of payments</td>
</tr>
<tr>
<td>Water quality</td>
<td>Poverty alleviation</td>
<td>Technology transfer</td>
</tr>
<tr>
<td>Soil quality</td>
<td>Empowerment through capacity building</td>
<td>Technological self-reliance</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Stakeholder participation</td>
<td>Increases in tax revenue</td>
</tr>
<tr>
<td>Reduction in use of fossil fuels*</td>
<td>Improved service availability</td>
<td>Employment generation**</td>
</tr>
</tbody>
</table>
The selection of indicators for the comprehensive checklist assessment and MCA methodologies for this research was informed by the selection of indicators in each of these assessment methods, as well as the indicators used by the Grupo de Pesquisa em MDL da UFBA, Alexeew et al (2010), the UNFCCC (2011), Müller-Pelzer (2009) and the development needs identified in Chapter Two.

In 2003, Sutter (2003) published a multi-criteria or Multi Attributive Assessment of CDM (MATA-CDM), based on the assessment criteria produced by Heuberger (2003). The aim of the research was to help host countries to define their sustainability requirements and help reduce uncertainty for project developers through clarifying host country DNA sustainability criteria (Sutter 2003), something that for most DNAs is neither clear nor publicly available. MATA-CDM can also be used by carbon fund managers to rank the projects in their CDM portfolio (Sutter 2003). Since the publication of this research, the Government of Uruguay has adopted Sutter’s methods for CDM sustainability assessment and a number of other researchers have used Sutter’s methods to adapt to their own sustainability assessments (see Müller-Pelzer 2009; Nussbaumer 2009).

MATA-CDM proposes the use of 12 qualitative, quantitative or semi-quantitative measures to ascertain whether an individual CDM project meets the sustainability standards of the host country through a comparison to the baseline scenario (see section B.3.8, Appendix B) (Sutter & Parreiro 2007). These criteria can be adapted through weighting to reflect the relative importance of the particular criterion to the specific requirements or priorities of the host country. Weighting of criteria can be problematic however, and Sutter finds that smaller groups yield large influence over the results of weighting, opening the process up to potential misuse, whereas large scale weighting surveys that require a larger amount of effort are shown to produce equalised weighting results (Sutter 2003). Some criteria are deemed as non-critical for all of the project categories in the CDM and as such, the matrix can be simplified by the user for particular projects (Sutter 2003). The overall score of the project according to the MATA-CDM determines the suitability of the project for approval by the host country DNA. With an equal number of criteria within each pillar of sustainable development, the pillars overall are weighted equally and the numerical results awarded for each criterion and as an overall assessment allow for comparison between projects. Criteria considered irrelevant to the project are given a neutral result. Users of the MATA-CDM system can decide upon minimum standards for any of the

<table>
<thead>
<tr>
<th>Improved quality of life</th>
</tr>
</thead>
</table>

*This indicator is included in the MATA-CDM and CD4CDM frameworks

**Employment generation is classed as either a social or economic indicator in different frameworks
given criteria or require the mitigation of any negative results with additional positive results in other criteria (Sutter 2003).

While the MATA-CDM assessment method is comprehensive, comparable, relatively simple to apply (Nussbaumer 2009), scientifically sound, transparent (Jaynutapong 2010), and adaptable to the specific conditions of the host country, it has not been applied in many countries (Jaynutapong 2010), and it is unlikely many DNAs will adopt this system. MATA-CDM requires a high level of capacity to assess each criterion, the financial resources available to execute the required interviews and assessments and, in addition, the time taken to review each project makes this assessment a less attractive option. Any weighting procedure that would make the assessment more applicable to local requirements within the host community would require further interviews, surveys or research to enable community participation in the weighting of criteria, which critics suggest could be difficult to implement or may not take into account the views of all stakeholders (Burian 2006; Nussbaumer 2009). Some suggest that the MATA-CDM method is weakened by the fact that the selection of stakeholders can have undue influence on the results of the analysis, with this assessment method unable to include all potential stakeholders, including future generations, and that findings tend to reflect the views of stakeholders best able to express their interests (Müller-Pelzer 2009). While the Uruguayan DNA has adopted this assessment system, only one weighting stakeholder conference was conducted to determine the nation wide weighting of sustainability criteria and this may be unsatisfactory for countries with a diversity of economic, social and environmental priorities (Heuberger, Sutter & Santos 2003). Others argue that the use of weighting of criteria and the compilation of an aggregate score for projects enables weaknesses or negative outcomes in particular project areas to be mitigated in others, and while this may be acceptable for certain, non essential criteria, negative impacts should not be disguised by the compilation of a final aggregate score (Nussbaumer 2009)

The SouthSouthNorth (SSN) matrix tool was based upon research conducted for HELIO International in 1999 (Thorne & La Rovere 1999). (For the HELIO International criteria and scoring system, see section B.3.5 in Appendix B). Aside from suggesting which project types should and should not be eligible for the CDM, HELIO International’s research suggested that four pillars of sustainable development (social, economic, environmental and technological) should be upheld through the elevation of sustainable development to a high level of assessment and the assurance that CDM projects individually relate to national public policy priorities before projects become eligible under the CDM (Thorne & La Rovere 1999). The authors also suggested that monitoring of sustainable development should occur during the project cycle, not just monitoring of emission reductions (Thorne & La Rovere 1999). The SouthSouthNorth (SSN) Matrix Tool was also developed by Thorne and La Rovere based on four CDM projects
hosted by Brazil (SouthSouthNorth (no date)). This tool is used by the Gold Standard, a voluntary value-adding standard (The Gold Standard 2011b), discussed below. The tool can be applied to energy projects only and aims to ‘avoid the risks of a purely subjective assessment of projects which could then face opposition in the international arena’ (SouthSouthNorth (no date)). The tool ranks each criterion on a scale of -3 for a project with major negative impacts against that criterion to +3 for a project with major positive impacts (Lenzen, Schaeffer & Matsuhashi 2007). Minimum values apply to each sub-total for either local/regional/global environmental sustainability; social sustainability and development; and economic and technological development (SouthSouthNorth (no date)). The SSN matrix tool is shown in Tables B.3-7 and B.3-8 in Appendix B.

The Matrix Tool, while limited to projects in the energy sector, is considered simple to use, transparent and widely recognised (Olsen 2005). Some criticisms have been made against the Matrix Tool however for the large number and broad nature of criteria (Burian 2006) and the subjective nature of scoring applied to each indicator (Jaynutapong 2010).

An early publication that critiqued the contribution to sustainable development of CDM projects by Huq (2002) outlines the need for a uniform approach with which to assess sustainable development benefits of the CDM for all sectors and countries and especially for the World Bank’s Prototype Carbon Fund projects, a fund that the Netherlands is a member of (Huq 2002). Huq (2002) suggests the need for host countries to initiate mechanisms for CDM approval, capacity building for DNAs to attract and evaluate projects and for international fund managers to maintain diversified account portfolios in order to encourage the proper application of the CDM’s sustainable development criteria. It is suggested that the uniform approach needs to be simple and easily applied (see section B.3.7, Appendix B) (Huq 2002). Huq (2002) suggests that criteria can be divided into those that are desirable from a global, national and local project level and presents a ‘crude’ or ‘incomplete’ matrix which could be used as a starting point for later sustainable development evaluations.

The CD4CDM Sustainable Development Guidelines were introduced in 2004 and enable DNAs to determine sustainable development criteria upon which to evaluate CDM projects, based on existing national sustainable development strategies to reduce additional effort and to ensure consistency with national environmental and development priorities (Olhoff et al. 2004). The criteria used for this framework are shown in section B.3.9 of Appendix B.

The Gold Standard is a framework developed by a number of international NGOs including World Wide Fund for Nature (WWF) and an international monitoring agency, HELIO International, and is based on the SouthSouthNorth Matrix (The Gold Standard 2011b). It is an assessment designed to be a value-adding label through which developers of CDM projects can
claim that a particular project contributes a greater level to sustainable development; has greater 
stakeholder participation and can demonstrate higher levels of additionality compared to a 
project without this label (Nussbaumer 2009), and can therefore demand a higher purchase price 
on either the voluntary or compliance international markets. The Gold Standard is not just used 
for the CDM, but also for voluntary markets, which make up 60% of the Gold Standard registry 
(The Gold Standard 2011a). The Gold Standard excludes forestry, land use change and 
industrial gases project sectors, focusing on renewable energy and energy efficiency projects 
(Total Environment Centre 2011; Ecofys, TÜV-SÜD & FIELD 2008b) and will not accept 
projects for registration under their voluntary market accreditation if they have previously been 
rejected by the UNFCCC EB.

The main premise of the Gold Standard is to ensure that projects ‘do no harm’, emphasise the 
need for project developers to take into account the relevance of the eight MDGs for the host 
community, and attempt to safeguard human rights, labour standards and environmental 
protection (Ecofys, TÜV-SÜD & FIELD 2008b). The price for Gold Standard voluntary credits 
has recently exceeded prices for compliance credits given the uncertainties regarding the global 
carbon market and the need for offsets in the third phase of the EU ETS (McGarrity 2012). The 
Gold Standard had 570 projects registered before April 2012, with nine of these projects located 
in Brazil (The Gold Standard 2012). The Gold Standard scoring matrix, which is based on 12 
indicators, including the do no harm assessment, is presented in section B.4.1 of Appendix B. 
Monitoring of sustainable development outcomes is necessary to be eligible for the Gold 
Standard accreditation and all non-neutral indicators on the assessment matrix must be 
monitored (Ecofys, TÜV-SÜD & FIELD 2008b).

A study conducted in 2009 by the Ministry of Housing, Spatial Planning and the Environment 
(VROM) of the Netherlands assessed the quality of the range of voluntary and compliance 
standards with regard to their environmental integrity and contribution to sustainable 
development amongst other parameters (Warringa, Korteland & Doorn 2009). This study found 
that the Gold Standard was equal to the CDM in terms of validation report checks, selection of 
auditors, stakeholder consultation, validation of baseline, leakage, extension of crediting periods, 
checks of verification reports, ensuring validation and verification uses different auditors and 
registration (Warringa, Korteland & Doorn 2009). The study found that in terms of 
sustainability, the Gold Standard was better than the CDM, for additionality it was better than or 
equal, and for conducting spot checks of activities, it was worse than the CDM (Warringa, 
Korteland & Doorn 2009). Despite the last assessment, out of the voluntary and other standards 
listed, only the Gold Standard was found to have either equal to or stricter standards than the 
CDM in terms of additionality and checking on auditors (Warringa, Korteland & Doorn 2009). 
Another study of renewable and energy efficiency projects supported the claim that ‘[l]abelled
projects did not, however, drastically outperform non-labelled ones’ (Nussbaumer 2009, p. 99). The findings of this study are weakened however by the fact that value-added labels, unlike the CDM, provide ongoing monitoring and verification of claims made in the initial documentation, whereas the CDM does not provide this additional verification.

The Social Carbon methodology was the first carbon crediting sustainability assessment produced in the developing world and it was devised by the non-profit organisation, ‘Instituto Ecológica’ (Ecologica Institute) in order to integrate concepts of sustainability and social responsibility into carbon sequestration projects (Reis 2009; CDM Voluntary Accreditation Developer, 2011, pers. comm., 17 March). Social Carbon is used as a value-adding accreditation for both the voluntary and compliance markets. Using six measures derived from the sustainable livelihoods approach of Chambers and Conways (Rezende & Merlin 2003; Reis 2009), the ‘Social Carbon Standard is founded on the principle that transparent assessment and monitoring of the social and environmental performance of projects can improve their long-term effectiveness and thus add value to the voluntary [or compliance] emission reductions generated’ (Social Carbon 2011). Monitoring involves the use of interviews, field surveys, participatory meetings, site visits, satellite imagery and the collection of physical data in the analysis of results for natural resources (Rezende & Merlin 2003). Criteria and scoring for the Social Carbon Framework is shown in section B.4.2 of Appendix B.

Climate, Community and Biodiversity Project Design Standards, released in 2005, apply only to land based carbon projects such as sequestering and avoided deforestation and forest degradation, and call for a checklist of criteria developed within four pillars, namely general, climate, community and biodiversity (Müller-Pelzer 2009; Climate Community and Biodiversity Project 2008). The CCB checklist is presented in section B.4.3 of Appendix B. The CCB is designed to be used in conjunction with the CDM or voluntary markets as this standard does not issue reduction certificates, it only verifies the quality of such reductions (Climate Community and Biodiversity Project 2008). The Climate Community and Biodiversity Alliance (CCBA) recommends the use of methods or assessments from the Forest Stewardship Council, SouthSouthNorth, FAO, UNEP, IPCC, IETA (International Emissions Trading Association), the World Bank, BioCarbon Fund tool, sustainable livelihoods approaches, Social Carbon and the WWF amongst other methods (Climate Community and Biodiversity Project 2008). Sustainable development contributions are validated, monitored and verified on a regular basis and CCB accreditation can be revoked at any stage of the process should the project fail to deliver based on CCB standards (Climate Community and Biodiversity Alliance 2010).
5.4 Sustainable Development Assessment used in this Research

The sustainable development assessment frameworks that were adopted for use in this research include:

- A checklist approach based on the guideline priorities of the Brazilian DNA as outlined in Annex III;
- A qualitative and quantitative checklist approach based on the guideline priorities of the Brazilian DNA as outlined in Annex III, the stated sustainable development priorities for Brazil according to the research outlined in Chapter Two, and a combination of other criteria selected due to their relevance to Brazil and use amongst the range of CDM assessment frameworks that are critiqued in this chapter; and
- A scored multi-criteria analysis approach adapted from the framework used by Alexxew (2010) in their assessment of India’s CDM projects.

These frameworks were used to evaluate both the Annex III and the PDD documentation for all registered projects in Brazil prior to 1st May 2011, where both Annex III and PDD documentation was available, a total of 178 projects. The Annex III documents, accessed from the Brazilian DNA website, were translated using the Google Translate program from Brazilian Portuguese into English while the PDDs were accessed in English from the UNFCCC website.

Using a combination of assessment frameworks can complicate the assessment of a project’s promotion of sustainable development for those entities that need a simple, straightforward assessment such as DNAs, project developers or credit buyers. The purpose of this research is not to propose the development of a framework of assessment that can be used by these entities, as this has been done elsewhere (Sutter 2003; Thorne & La Rovere 1999; SouthSouthNorth (no date); Huq 2002) but to comprehensively assess the level of contribution to promoting sustainable development that the selected 178 Brazilian CDM projects have had. The use of a range of frameworks rather than just a singular framework allows for a more comprehensive assessment of this contribution, one that is less likely to be influenced by any inherent bias or weaknesses in a single assessment framework. The use of multiple frameworks is also an attempt to strengthen a document-only based analysis of these 178 projects in this part of the research, and to eliminate any potential bias arising from the use of a single framework method of assessment.

The use of the three assessment methods also allows for a comparison to be made between the assessment frameworks. The first framework, based on the Annex III documentation of the Brazilian DNA assessment, assesses the contribution of the CDM towards the promotion of
sustainable development as defined by the Brazilian DNA assessment. This is an important baseline for comparison between the assessment frameworks as this is the least stringent assessment, and is the framework that is based on the host country definition of sustainable development – the only definition and assessment that counts in the CDM process. The second method, the comprehensive checklist assessment allows for an analysis of the promotion of the CDM against both the more commonly identified indicators of sustainable development used in the wider literature on the CDM, such as those identified in Section 5.2, and against the development priorities of Brazil identified in Chapter Two. This assessment method attempts to match the benefits of CDM projects to the development priorities for Brazil identified by the Brazilian government and non-governmental organisations. The third method is a multi-criteria assessment (MCA), modelled closely on the assessment used by Alexeew et al (2010) to assess the contribution of the CDM to sustainable development in India. This last method was specifically designed to assess CDM projects using information garnered from PDD documentation, which makes this method well suited to this research. The scoring system of this last assessment also provides a quantitative framework by way of comparison to the first and second qualitative assessment frameworks. The commonality between the frameworks is their design around the three pillars of sustainable development and their inclusion of technological innovation or transfer as an indicator of economic development. Indicators selected for each differ based on their definition of sustainable development, and the methods of rating against each indicator are different for each assessment. The second method, the comprehensive checklist assessment, incorporates the need for quantification and monitoring of claims, while this is not a part of the Brazilian DNA assessment framework.

Each of the 178 projects in the sample was evaluated using these three frameworks to establish the contribution of these projects to promoting sustainable development. It is expected that there will be little difference between the projects with UK and Dutch credit buyers and those projects that were developed without nominated buyers or for buyers from different countries, because, as stated in Chapter Three, there are no real policy limitations on CER purchases or preferences for particular project types or sustainable development outcomes by the Dutch and UK, aside from those limitations implemented across the EU. Chapter Six will assess these findings with reference to the stated development priorities of Brazil, as discussed in Chapter Two. The statistical data gathered from the use of the three assessment frameworks has been presented in Appendix A.

5.4.1 Methodological Limitations

Due to the nature of a desk-based analysis of projects, a number of limitations need to be taken into account, and the selection of the above frameworks of assessment was made with these
limitations in mind. The foremost limitation was related to the need to rely on publicly available project documentation in order to make an assessment on each of the selected criteria in the above frameworks. As other researchers have found, the quality of data in the PDD is inadequate to make a thorough assessment of the contribution to, or promotion of sustainable development of CDM projects (Olsen & Fenhann 2008), although a number of researchers have used PDDs for this purpose (Nussbaumer 2006; United Nations Framework Convention on Climate Change 2011; Cosbey 2006; Lee & Lazarus 2011; Olsen & Fenhann 2006; Killick 2012). For this research, the problem was somewhat ameliorated due to the requirement for an Annex III statement by the Brazilian DNA that requires an outline of the sustainable development contributions of a project (discussed in Chapters Three and Four). Despite this, the amount and quality of documented data available on each Brazilian CDM project did not allow for an in-depth, continuing assessment of each project through ongoing interviews and field visits, so a detailed MCA assessment relying on either interviews or post-implementation analysis for each project complete with weightings was not considered appropriate. The foremost limitation was that of relying on the accuracy of documentation with regard to each project.

Other researchers have used text analysis software to measure the sustainable development benefits outlined in the PDDs (Olsen & Fenhann 2006; Lee & Lazarus 2011). The method used for this research however has involved the reading of both the Annex III documentation and the PDD for each project by the researcher, in order to prevent the decontextualisation of the data contained within these documents and to enable a broader understanding of how the projects could potentially contribute to sustainable development according to their stated contributions. No weighting was given to the checklist criteria in any of the frameworks, because it is considered that weighting is very contextual and project specific and would not be appropriate at a national level for this number of projects (Olsen & Fenhann 2008). As explored in section 5.1, weighting of indicators can have a significant influence on the final result of the assessment, and meaningful weighting relies on access to stakeholders (Müller-Pelzer 2009; Sun 2011; Lenzen, Schaeffer & Matsuhashi 2007). Given that host community consultation for each project assessed is not part of this research methodology, none of the frameworks will weight criteria.

The problems with using an analytical framework that relies on the stated contributions within the available documentation is that these contributions have not yet been achieved and are only projected at the early stages of project development. The claimed contributions outlined in the Annex III and PDD documentation are not required to be monitored or verified throughout the CDM process after the provision of the LoA by the host country, and so there is no incentive for the project participant to avoid overly optimistic or improbable projections of positive contributions.
contributions to sustainable development, or to avoid downplaying potentially negative impacts in cases where these impacts are not addressed through environmental legislation requiring mitigation (Olsen & Fenhann 2006). These limitations need to be taken into consideration when assessing projects using documentation as a primary data source, as there is no information available for each project on the realisation of claims made during the project implementation stages. Given this, the three methods of assessment used are enabling an analysis of the promotion of the CDM to sustainable development in Brazil rather than an assessment of the implementation and realisation of such development.

The availability of both PDDs and Annex III documentation and the relative consistency of information required by each document still represents the most available and reliable source of information available on each project in Brazil’s portfolio, despite these limitations. Olsen and Fenhann (2006) have likened the use of this type of documentation to that of a ‘crude, proxy measure of the maximum possible sustainability contribution of CDM projects’ (emphasis from original) (Olsen & Fenhann 2006, p. 9), however it remains the main source of information for most published assessments of the contribution of CDM projects to sustainable development. Documents may not reveal information about how the projects are implemented, however they do say ‘something about the mindset of project developers and the importance that they assign to SD [sustainable development]’ (Watson & Fankhauser 2009, p. 4). In accepting the limitations of the assessment methods and by triangulating these results with the results of interviews and other policy and literature reviews undertaken on the CDM, it is envisaged that it will be possible to present an indicative study of the contribution of CDM projects to promoting sustainable development in Brazil.

5.4.2 Checklist Approach Incorporating the Brazilian DNA Requirements

In order to develop an assessment framework based on the Brazilian DNA requirements listed in Annex III that would be comparable between projects and sectors, the guidelines were formatted into a checklist in order to clarify the contribution to sustainable development of each project. For each project, after reading the PDD and Annex III documentation, the researcher made an assessment as to whether the project contributed to promoting each criterion for sustainable development. Developers needed to explicitly mention the positive contributions in either piece of documentation for it to be marked as ‘yes’ on the checklist below. If it was not explicitly mentioned, was irrelevant or there was no positive impact, the checklist was be marked as ‘no’.

While in the Brazilian DNA, there is no requirement to detail or quantify the contributions made for this approach, some of the indicators for this analysis require a separation between those claims that are quantified and those that are not to show whether or not they are likely to be
overly optimistic claims of potential benefits, or more likely to be implemented due to their quantification in the project documentation. In addition to this, the origin of equipment indicator requires one of three answers as shown in the table below. Projects of a particular type or using a particular methodology were not automatically deemed to contribute to any of the criteria unless it was specifically mentioned in the documentation. There is a criterion included for stakeholder consultation, and while this is not explicitly required by the Annex III documentation, a level of stakeholder consultation is required according to the rules of the DNA (discussed in detail in Chapters Three and Four). Given that it is a legal requirement for project developers to abide by this requirement, it is assumed this consultation has occurred, and as such a simple ‘yes’ or ‘no’ assessment is superfluous. In place of this, the number of responses to this consultation process is recorded where this information is provided in the PDD. As part of criteria ‘b’, the Brazilian DNA highlighted the need for projects to incorporate a defence of civil rights (Interministerial Commission on Global Climate Change 2003), but this indicator was deemed to be too broad to measure on a project basis and therefore excluded from the assessment framework.

The criteria used for this assessment is shown in Table 5-5.

Table 5-5 Brazilian DNA checklist approach (adapted from Interministerial Commission on Global Climate Change 2003)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicator</th>
<th>Checklist</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a. Contribution to local environmental sustainability</strong></td>
<td>Solid waste reduction</td>
<td>☐ Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ No</td>
</tr>
<tr>
<td></td>
<td>Improvement in air quality</td>
<td>☐ Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ No</td>
</tr>
<tr>
<td></td>
<td>Improvement in water quality</td>
<td>☐ Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ No</td>
</tr>
<tr>
<td><strong>b. Contribution to improvement of labour conditions and net job creation</strong></td>
<td>Social and labour responsibilities (including adherence to health and safety legal requirements)</td>
<td>☐ Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ No</td>
</tr>
<tr>
<td></td>
<td>Health and education programs</td>
<td>☐ Yes</td>
</tr>
<tr>
<td></td>
<td>Quantitative employment</td>
<td>Qualitative employment</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td></td>
<td>(N.B. number of jobs is given if it is clear from the documentation as to whether the job is in the construction or operation phase of the project. For each stage, the number of direct and indirect jobs are totalled. For projects given in person-hours, the number of jobs is calculated presuming a construction period of four months).</td>
<td>Skilled labour employed</td>
</tr>
<tr>
<td></td>
<td>Construction employment (Divided into direct and indirect)</td>
<td>□ Yes</td>
</tr>
<tr>
<td></td>
<td>□ Yes and number</td>
<td>□ No</td>
</tr>
<tr>
<td></td>
<td>□ Yes but not quantified</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ongoing employment (Divided into direct and indirect)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Yes and number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Yes but not quantified</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ No</td>
<td></td>
</tr>
</tbody>
</table>
| d. Contribution to training and technological development | Ability for technology/project to be reproduced | ☐ Yes  
☐ No |
|------------------------------------------------------|-------------------------------------------------|--------|
| Technical innovation | ☐ Yes  
☐ No |
| Origin of equipment | ☐ Brazil  
☐ Overseas  
☐ Not specified |
| Need for international assistance | ☐ Yes  
☐ No |
| e. Contribution to regional integration and linkages with other sectors | Integration with other socio-economic activities in the region | ☐ Yes  
☐ No |
| Stakeholder consultation | In accordance with the requirements of the DNA | ☐ Number of responses received |

This approach is not scored, however it enables a comparison between projects to be made regarding contributions to each of the five individual indicators and the overall contributions to promoting sustainable development made by each project according to project credit buyer, project type and project scale in.
5.4.3 Comprehensive Checklist Approach

The qualitative and quantitative checklist approach was designed to incorporate the requirements of the Brazilian DNA and the sustainable development requirements of Brazil as discussed in Chapter Two in addition to the criteria and indicators deemed important for CDM projects by international researchers in the CDM field. In addition to the incorporation of the specific development priorities for Brazil, as discussed in Chapter Two, a range of CDM assessment methods were considered and aspects of each were incorporated into this assessment framework including:

- MATA-CDM (Sutter 2003);
- Gold Standard (Ecofys, TÜV-SÜD & FIELD 2009);
- Climate, Community and Biodiversity Project Design Standards (Climate Community and Biodiversity Project 2008);
- SouthSouthNorth Assessment (SouthSouthNorth (no date));
- Social Carbon (Social Carbon 2011);
- UNFCCC Assessment Method (United Nations Framework Convention on Climate Change 2011);
- Sustainability Management Approach (Müller-Pelzer 2009);
- Grupo de Pesquisa em MDL da UFBA (CDM Research Group of the University) Research Methods (Andrade unpublished; Guillen 2010);
- Alexeew et al Multi-Criteria Analysis for Indian CDM Projects (Alexeew et al. 2010); and
- Development Dividend (Cosbey et al. 2006).

Given the limitations of the document analysis method, no scoring was applied using this framework and all criteria were selected for their relevance to Brazil’s development requirements, as discussed in Chapter Two. Weighting was not applied, as there is no requirement for an aggregated score in this framework. Most indicators were marked as either ‘yes’ or ‘no’, however some indicators were given more appropriate and applicable response options, including quantitative options or multiple step options (see Table 5-6). Where relevant, the framework also assesses whether the documentation includes quantification or qualification of claims made, for example the land area of forestry conservation or the monetary value of social projects, as well as whether there is specific monitoring of that criteria. There is also scope for recording whether or not a sustainable development contribution was the direct result of the project or a response to mitigation or legislative requirements of the Brazilian national or state governments.
In addition to the standard pillars of sustainable development, provision has been made to assess the level of stakeholder consultation and engagement, technology transfer, the legal requirements for an environmental impact assessment and the existence of an overall sustainable development monitoring plan.

Table B.6-1 in Appendix B demonstrates which other framework analyses have used comparable criteria and indicators selected for the comprehensive checklist framework. Table 5-6 shows the indicators used for the comprehensive analysis, including the data source, the possible response options for this approach and the further qualifications of those responses where required.

**Table 5-6 Comprehensive checklist approach indicators**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicator</th>
<th>Data Source</th>
<th>Response Options</th>
<th>If yes,</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic</strong></td>
<td>Regional integration</td>
<td>Annex III and PDD documents</td>
<td>Product supplied domestically and/or integration with construction industry</td>
<td>Quantified</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>☐ Yes</td>
<td>Yes (if a description of either the financial benefits of regional integration or a list of organisations with which the project will be working with)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>☐ No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Monitored</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>☐ Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>☐ No</td>
<td>No</td>
</tr>
<tr>
<td>Increase in taxes received by municipal/ national government</td>
<td>Annex III and PDD documents</td>
<td>☐ Yes</td>
<td>Quantified</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>☐ No</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Increased in employment</td>
<td>Annex III and PDD documents (N.B. number of jobs is given if it is clear from the documentation as to whether the job is in the construction or operation phase of the project, or direct or indirect)</td>
<td>Operation – direct</td>
<td></td>
<td></td>
</tr>
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<td>-------------------------------------------------------------------------------------------------</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>□ Yes</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>□ No</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Operation – indirect</td>
<td>□ Yes</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>□ No</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Construction – direct</td>
<td>□ Yes</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>□ No</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Construction – indirect</td>
<td>□ Yes</td>
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<tr>
<td></td>
<td></td>
<td>□ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved income distribution</td>
<td>Annex III and PDD documents</td>
<td>From training</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>□ Yes</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>□ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>From employing unskilled labour</td>
<td>□ Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Monitored

☑ Yes

☑ No

Quantified

☑ Yes

(Where an estimated range is given, the average is taken. For AgCert projects, contributing to 50 new jobs across 76 projects, 1 job per project is attributed)

☑ No

Monitored

☑ Yes

☑ No

Monitored

☑ Yes
<table>
<thead>
<tr>
<th>Environmental Benefits</th>
<th>Description</th>
<th>Yes/No</th>
<th>Quantified</th>
<th>Monitored</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable electricity generation, including the benefits of reducing line losses or increase in reliability</td>
<td>Energy generation from renewable sources based on project type</td>
<td>☐ Yes ☐ No</td>
<td>Quantified</td>
<td>☐ Yes ☐ No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Monitored</td>
</tr>
<tr>
<td>Reduced consumption of fossil fuels</td>
<td>For project types resulting in energy efficiency, fossil fuel switch and renewable energy production</td>
<td>☐ Yes ☐ No</td>
<td>Quantified</td>
<td>☐ Yes ☐ No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Monitored</td>
</tr>
<tr>
<td>Improved air quality</td>
<td>Project type (Standardisation from PDD, Annex III documents and Development Dividend)</td>
<td>☐ Yes ☐ Yes – Environmental Legislation or Mitigation Requirement ☐ No</td>
<td>Quantified</td>
<td>☐ Yes ☐ No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Monitored</td>
</tr>
<tr>
<td>Improved soil quality</td>
<td>Project type (Standard-</td>
<td>☐ Yes ☐ Yes –</td>
<td>Quantified</td>
<td>☐ Yes</td>
</tr>
<tr>
<td>Project type</td>
<td>Environmental Legislation or Mitigation Requirement</td>
<td>Monitored</td>
<td></td>
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<tr>
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<td></td>
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<tr>
<td>Improved water quality and quantity</td>
<td>Yes, Yes – Environmental Legislation Requirement, No</td>
<td>Yes, Yes, No</td>
<td></td>
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</tr>
<tr>
<td>Reduced land area</td>
<td>Yes, Yes – Environmental Legislation Requirement, No</td>
<td>Yes, Yes, No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conservation of vegetation, including replanting, biodiversity or habitat protection</td>
<td>Yes, Yes – Environmental Legislation Requirement, No</td>
<td>Yes, Yes, No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
<td>Quantified</td>
<td>Monitored</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Development Dividend)</td>
<td>b) By individual project (from PDD and Annex III documents)</td>
<td>☐ Yes</td>
<td>☐ Yes</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>☐ No</td>
<td>☐ No</td>
<td></td>
</tr>
<tr>
<td>Reduced solid waste</td>
<td>Project type (Standardisation from PDD and Annex III claims)</td>
<td>☐ Yes</td>
<td>☐ Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ Yes – Environmental Legislation Requirement</td>
<td>☐ No</td>
<td>☐ No</td>
</tr>
<tr>
<td>Social</td>
<td>Training, worker education and capacity building Annex III and PDD documents</td>
<td>☐ Yes</td>
<td>☐ Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ No</td>
<td>☐ No</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Details</td>
<td>Yes</td>
<td>No</td>
<td></td>
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<tr>
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<td></td>
</tr>
<tr>
<td>Reduce rural area exodus</td>
<td>IPEA (Institute of Applied Economic Research) municipal urban population and rural population</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Occupational Health and Safety and staff health improvements</td>
<td>Annex III and PDD documents</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Improved health of general population</td>
<td>a) Project type (Standardisation from PDD, Annex III documents and Development Dividend)</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

- **Quantified**: Yes (if a description how working conditions or staff health will improve)
- **Monitored**: Yes
<table>
<thead>
<tr>
<th>Area</th>
<th>Annex III &amp; PDD documents</th>
<th>□ Yes</th>
<th>□ No</th>
<th>Quantified</th>
<th>□ Yes</th>
<th>□ No</th>
<th>Monitored</th>
<th>□ Yes</th>
<th>□ No</th>
<th>Improved environmental education of population</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) By individual project (health program support)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Monitored</td>
<td></td>
<td></td>
<td>Yes – Environmental Legislation Mitigation Requirement</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Improved service availability (other than reliable electricity provision)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Monitored</td>
<td></td>
<td></td>
<td>Yes</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Funding of</td>
<td>Annex III &amp; PDD documents</td>
<td>□ Yes</td>
<td>□ No</td>
<td>Quantified</td>
<td>□ Yes</td>
<td>□ No</td>
<td>Monitored</td>
<td>□ Yes</td>
<td>□ No</td>
<td>New Fund</td>
</tr>
<tr>
<td>Charity or community project (excluding reforestation/conservation – already accounted for)</td>
<td>PDD documents</td>
<td>☐ Yes</td>
<td>☐ Yes – mitigation requirement</td>
<td>☐ No</td>
<td>Existing Fund</td>
<td>☐ Yes</td>
<td>☐ No</td>
<td>☐ Yes</td>
<td>☐ No</td>
<td></td>
</tr>
<tr>
<td>Improved quality of life for population (including but not limited to improvements in levels of noise, odours or improvements in working conditions).</td>
<td>Annex III and PDD documents</td>
<td>☐ Yes</td>
<td>☐ No</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Improved quality of life for disadvantaged region</td>
<td>FIRJAM Index of Municipal Development</td>
<td>☐ High 0.81-1.0</td>
<td>☐ Moderate 0.61-0.8</td>
<td>☐ Regular 0.41-0.6</td>
<td>☐ Low 0.0-0.4</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Improved quality of life for those in IPEA municipal distance from</td>
<td>☐ Most remote</td>
<td>☐ Moderately</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Category</td>
<td>Details</td>
<td>Remote Locations</td>
<td>Capital City, Divided into Quartile Rankings</td>
<td>Reproducibility of Technology</td>
<td>Technology Transfer</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>☐ Not very remote ☐ Not remote</td>
<td>☐ Yes ☐ No</td>
<td>☐ Yes ☐ No</td>
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<tr>
<td>Domestic Equipment</td>
<td>Annex III and PDD Documents</td>
<td></td>
<td></td>
<td>☐ Yes ☐ No</td>
<td>☐ Yes ☐ No</td>
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</tr>
<tr>
<td>Reproducibility</td>
<td>Annex III and PDD Documents</td>
<td></td>
<td></td>
<td>☐ Yes ☐ No</td>
<td>☐ Yes ☐ No</td>
<td></td>
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</tr>
<tr>
<td>Technology Type</td>
<td>Project type (Grupo de Pesquisa em MDL da UFBA – CDM Research Group of the University); (Guillen 2011)</td>
<td>☐ End of Pipe (introduction of additional technology systems that capture pollutants to reduce negative environmental impacts)</td>
<td>☐ Clean Technology (seek to avoid or reduce such emissions in advance, dealing with causes, not consequences of environmental degradation)</td>
<td>☐ Exogenous ☐ Endogenous</td>
<td></td>
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</tr>
<tr>
<td>Source of Technology</td>
<td>Project type (Grupo de Pesquisa em MDL da UFBA – CDM Research Group of the University); (Guillen 2011)</td>
<td>☐ Exogenous ☐ Endogenous</td>
<td></td>
<td>☐ Yes ☐ No</td>
<td>☐ Yes ☐ No</td>
<td></td>
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</tr>
<tr>
<td>Stakeholder Consultation</td>
<td>PDD section ‘G’</td>
<td>☐ Just did required consultation (as per Brazilian legislation)</td>
<td></td>
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<td></td>
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<td>☐ Did more than required consultation</td>
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<td></td>
<td></td>
<td>☐ Invitation to comment will be sent out in validation stage</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>☐ No applicable (second crediting period)</td>
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<tr>
<td></td>
<td></td>
<td>If ‘Did more than required consultation’</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ Meeting during design</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>☐ Meeting after design</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>☐ Meeting after design and newspaper advertisement</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>☐ Newspaper advertisements</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>☐ Newspaper advertisements as required by environmental licencing</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
For each of the environmental criteria, it was still considered important to ascertain whether the criteria were monitored or quantified/qualified as part of this framework. How each criterion was assessed, whether that be according to sub-project type, individual project documentation, or otherwise, is shown Table 5-6.

The data showing an improved quality of life for disadvantaged regions is taken from the FIRJAN Index of Municipal Development (Índice FIRJAN de Desenvolvimento Municipal or IFDM) released by the Federation of Industries of the State of Rio de Janeiro (Federação das Indústrias do Estado do Rio de Janeiro or FIRJAN) (Federação das Indústrias do Estado do Rio de Janeiro 2011b; Federação das Indústrias do Estado do Rio de Janeiro 2011a). The IFDM is a ranking of life quality from zero to one, with one representing a high quality of life and is calculated using employment and income, education and health statistics at a municipal level in Brazil (Federação das Indústrias do Estado do Rio de Janeiro 2011b). In similarity to the HDI, the IFDM data can be divided into categories of low development (scores from zero to 0.40), regular (0.41-0.60), moderate (0.61-0.80) and high (0.8 to 1.0) (Federação das Indústrias do Estado do Rio de Janeiro 2011b). The data for this research is from the 2011 IFDM, based on 2009 data. For projects with multiple locations, the mean of the IFDM development scores is calculated in order to give an overall sense of the projects’ contribution to areas of lower development as defined by the IFDM.

The use of the IFDM data as opposed to data released by official Brazilian government agencies such as Institute of Applied Economic Research (Instituto de Pesquisa Econômica Aplicada or

<table>
<thead>
<tr>
<th>Overall Sustainable Development Monitoring Plan</th>
<th>Annex III &amp; PDD sections ‘D’, ‘F’ and relevant appendices</th>
<th>□ Yes □ No</th>
<th>□Project designed in consultation with stakeholders</th>
</tr>
</thead>
</table>

| Number of responses received to required consultation | _____ | | |

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IPEA) and IBGE can be justified in that the IFDM data is the most recent database of development available at a municipal level and is developed using official government data. Human Development Index data available at a municipal level is currently available from 2000, however an updated version is not due to be released until 2013, using data from the 2010 census (Programa das Nações Unidas para o Desenvolvimento 2012a; Marques 2012). Data available from the office of the United Nations Development Program in Brazil (Programa das Nações Unidas para o Desenvolvimento no Brasil or PNUD) has annual data available on HDI, however this is only available at a national level (Programa das Nações Unidas para o Desenvolvimento 2012b). Other data such as employment, education and health statistics are available at a municipal level from IBGE using data from the 2010 census (Instituto de Pesquisa Econômica Aplicada 2012), however as an overall assessment of development of a municipality, the IFDM data is more comparable to the HDI, seen internationally as a reliable measure of development (see for example its use by the International Bank for Reconstruction and Development (International Bank for Reconstruction and Development 2012).

The data needed to determine whether a project contributes to reducing rural exodus is taken from IPEA data reflecting urban and rural populations in 2010 (Instituto de Pesquisa Econômica Aplicada 2012). As rural and urban classifications are made at a municipal level and are not standardised across states or the country (Marques 2012), this data is just a proxy measure of whether or not a municipality is more of a rural or urban locality. A municipality is defined as rural if the rural population is larger than the urban population according to the IPEA data. The data measuring the improvement in quality of life for those living in remote regions uses IPEA data of the distance of the municipality from the capital city as a proxy measure of remoteness as there is not standardised definition for this in Brazil (Instituto de Pesquisa Econômica Aplicada 2012). These distances are divided into quartile rankings of all Brazilian municipalities that are then classified as most remote, moderately remote, not very remote or not remote. For projects with multiple locations, the mean of the IFDM ranking, the rural and urban locality classification and the quality of life data is used.

In order to reduce inconsistencies caused by the high variation in the quality and quantity of information provided in the PDD and Annex III documentation, it was decided to consider the environmental contributions to sustainable development and some of the economic and social contributions in a different manner to other contributions in this framework. Most of the responses to the social and economic criteria were considered to be predominantly determined by the unique characteristics of the project itself, rather than by project type. However given the differences in the amount and quality of information provided on the PDD and Annex III documentation, it was decided that all of the environmental and some of the economic and social criteria could be assessed according to the sub-project type in order to ensure consistency.
between projects. This is an approach that has been used by other researchers such as Cosbey et al. (2006), and Guillen (2010) used a standardised approach based on project type for determining the rating for a range of environmental and economic indicators. Tables B.6-2 and B.6-3 in Appendix B show the contributions made by each project sub-type to the environmental and other selected criterion, where the contribution is based on project sub-type rather than individual project documents, according to a range of sources including the PDD documents, Annex III documents and the Development Dividend approach (Cosbey 2006). Only those project sub-types represented in the sample of 178 projects are shown.

5.4.4 Multi-Criteria Analysis Approach

The multi-criteria assessment framework is an adapted version of the framework developed by Alexxew et al (2010) to assess the relationship between additionality and contribution to sustainable development based on a PDD-only analysis of 40 CDM projects hosted by India. However in order to adapt this assessment framework to the priorities of Brazil and to replace the criteria that were used by Alexxew et al to assess additionality, an aspect that is not investigated in this research, a few adaptations were made.

The measurement of stakeholder participation was removed as the Brazilian DNA regulates the stakeholder participation process, requiring a minimum level of consultation that was comparable to a score of +1 on the Alexxew et al original framework. In order to replace the economic criteria that Alexxew et al used to measure additionality, an indicator to measure the change in availability of renewable energy was included. This criterion is one of the development priorities for Brazil discussed in Chapter Two and has also been used by a number of CDM assessment frameworks including the SouthSouthNorth Assessment (SouthSouthNorth (no date)); UNFCCC Assessment Method (United Nations Framework Convention on Climate Change 2011); and the Development Dividend (Cosbey et al. 2006). By eliminating the stakeholder consultation criteria and including a single economic indicator to replace those used by Alexxew et al for additionality testing, the environmental, economic and social development aspects are equally weighted, allowing for an aggregate score that reflects this even weighting of the pillars of sustainable development. In keeping with the original assessment, equal weighting is applied to each of the criteria, with all scores normalised on a range from -1 to +1 (Alexeew et al. 2010).

The data for each of these categories comes from PDD and Annex III documents for each project, an evaluation of project type and the contribution of particular project types to each MCA sub-category, an assessment of sustainable and innovative technology (Andrade unpublished; Guillen 2010) and data on life quality based on the FIRJAN Index of Municipal Development (Federação das Indústrias do Estado do Rio de Janeiro 2011b; Federação das
Indústrias do Estado do Rio de Janeiro 2011a). As explained in the section on the comprehensive checklist assessment, the IFDM is a ranking of life quality and in used in lieu of the HDI, which was last updated in 2000 and for which higher resolution than national level is not available (Federação das Indústrias do Estado do Rio de Janeiro 2011b; Marques 2012). For projects with multiple locations, the mean of the IFDM development scores is calculated in order to give an overall sense of the projects’ contribution to areas of lower development as defined by the IFDM.

The adapted MCA framework is shown in Table 5-7.

Table 5-7 Multi-criteria assessment framework (adapted from Alexeew et al. 2010)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Development Social</td>
<td>Improved availability of services and infrastructure such as professional</td>
<td>Linear scale where at least 3 of these conditions improved receives +1, three of these conditions degraded receives -1.</td>
</tr>
<tr>
<td>Development for poorer parts of society</td>
<td>training of unskilled workers, supplementing other education opportunities (schools, kindergartens), creation of infrastructure (roads, bridges), improved service availability (health centres).</td>
<td>IFDM category of low receives a +1, regular +0.5, moderate -0.5 and high -1</td>
</tr>
<tr>
<td>Supporting the development of poorer municipalities</td>
<td>Life quality, as determined by the IFDM rating, taking into account employment and income, education and health, at municipal level.</td>
<td>Impact on life quality Degree of physical well-being experienced by people. Improvements could be decrease in level of noise, odours, or risk of accidents or improvements in working conditions.</td>
</tr>
<tr>
<td>Impact on life quality</td>
<td>Degree of physical well-being experienced by people. Improvements could be decrease in level of noise, odours, or risk of accidents or improvements in working conditions.</td>
<td>Linear scale where three of these conditions improved receives +1, three of these conditions degraded receives -1.</td>
</tr>
<tr>
<td>Environmental development</td>
<td>Impact on air</td>
<td>Does the project lead to a reduction in emissions of particulate matter, pulverised fuel ash, grime or gaseous air pollutants (SOx, NOx, CO etc.)?</td>
</tr>
<tr>
<td>---------------------------</td>
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<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Impact on soil</td>
<td>Does the project lead to improvements in soil fertility (e.g. avoided pollution through landfills), excavation of soil, erosion (through planting of trees) or biodiversity impacts?</td>
<td>Linear scale where three out of three conditions improved receives +1, three out of three conditions degraded receives -1.</td>
</tr>
<tr>
<td>Impact on water</td>
<td>Does the project have a positive impact on the quality of fresh or waste water, the availability or quality of fresh water and/or irrigation water or impact on biodiversity?</td>
<td>Linear scale where three out of three conditions improved receives +1, three out of three conditions degraded receives -1.</td>
</tr>
<tr>
<td>Economic development</td>
<td>Sustainable and innovative technology</td>
<td>Assesses level of international technology transfer, in-house technology development and ability for local workers to maintain technology long-term.</td>
</tr>
<tr>
<td>Employment generation</td>
<td>Whether and to what extent work is created in construction and operation phases. (Takes into account that most PDDs don’t specify</td>
<td>Projects with jobs in operation, construction and indirect jobs created receive score of +1. Negative scores</td>
</tr>
<tr>
<td></td>
<td>hours/number of jobs)</td>
<td>represent job losses.</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Renewable energy availability</td>
<td>Whether the project increases the availability of renewable energy through a reduction in the use of electricity, or reduction in line losses or increases in reliability from decentralising energy supply.</td>
<td>+1 for renewable energy generated for public use, +0.5 for generating renewable energy and 0 for no change to renewable energy availability.</td>
</tr>
</tbody>
</table>

Overall contribution

Overall contribution = Total sum of above values

5.5 Conclusion

This use of these three frameworks will enable an assessment of the contribution to sustainable development of CDM projects in Brazil to be made according to the parameters identified by the Brazilian DNA, the development priorities of Brazil as discussed in Chapter Two and those parameters identified by the international research community as important when assessing the sustainable development contribution of CDM projects. All three assessments are modelled on the three pillars of sustainable development – environmental, social and economic sustainable development, however the selection of indicators for each and the method of rating against each indicator reflect the sustainable development definition of the individual assessment method. The first method, based on the definition of sustainable development of the Brazilian DNA, emphasises those aspects of sustainable development outlined in the Annex III documentation. The second method, the Comprehensive Analysis, emphasises those indicators most commonly used by other CDM assessment frameworks identified in this chapter as well as those criteria to measure against the sustainable development priority areas for Brazil identified in Chapter Two. The third method, based on the Alexeew et al (2010) multi-criteria assessment, uses indicators commonly used across the assessment frameworks identified in this chapter. It is also a method that was designed for evaluation of the contribution of sustainable development to the CDM through the use of project documentation. The combination of these three methods of assessment will allow for a more robust analysis of the contribution of the CDM to the promotion of the CDM in Brazil than the use of a single assessment method, or even two assessment methods, where the potential for bias is higher.
Weighting of indicators was considered to be unsuitable given the need for in-depth stakeholder discussion and the tendency of weightings to dramatically impact upon assessment results. One aspect of these assessment methods that must be emphasised is that, due to their reliance on documentary evidence lodged prior to the implementation of projects, coupled with the lack of overall sustainable development monitoring within the CDM, claims made represent the best estimate of the developer and may not reflect the reality post-project implementation.

The results of the application of a combination of these assessment frameworks to the documentation of 178 of Brazil’s CDM projects are presented in Appendix A and a discussion of the relevance of these results to the priority development areas for Brazil is presented in Chapter Six.
6 Results of the Sustainable Development Analysis Compared to the Development Priorities of Brazil

**Introduction**

This chapter will compare the sustainable development contributions made by projects with the priority development areas in which the CDM can be expected to contribute, identified in Chapter Two. This will be achieved through the use of the three sustainable development assessments that have been outlined in Chapter Five, and also through the use of information gathered from interviews and other sources to discuss the contribution of the CDM to these priority areas. This chapter is organised according to the three pillars of sustainable development – environmental, social and economic. While not every priority area is important to all regions of Brazil, these priority areas are identified as development objectives by numerous Brazilian and international organisations.

The results of the overall analysis, as well as analysis based on project type and project size, is presented for each development priority listed below. An assessment based on credit buyer is not included in this analysis, because, given the lack of policies in the Netherlands and the UK towards the use of CDM credits, any differences in sustainable development contributions claimed by projects in Brazil can not be attributed to a demand-side motive. Neither country has expressed a larger demand for projects that generate greater sustainable development benefits than for any other projects, and therefore it can be concluded that in this case, the purchasing country has no impact on the sustainable development benefits of CDM projects from which they purchase CERs. For this reason, a comparison of results for the priority development areas of Brazil by credit purchasing country is not presented in this chapter.

For the assessment of contributions to sustainable development based on project type, one limitation should be taken into consideration. There were varying numbers of projects within each project type category, and for those project types with only a small number of projects, the evidence taken from the documentation was relatively more influential and this meant that the robustness of assessments results is proportional to the number of projects registered for each project type. Assessment by project scale is more robust than by project type given the larger number of projects in each category.
6.1 Priority Environmental Issues for Brazil Related to CDM Projects

6.1.1 Reducing Air Pollution in Urban Areas

Of the 178 projects, only seven were located in regions that were considered to be more rural than urban and of these rural projects, none returned scores for air quality improvements. Given this, the improvements in air quality found by the three assessment methods were all experienced in urban areas and therefore contributing to this particular priority area. The inclusion of air quality improvement in the Brazilian DNA requirements is indicative of the importance of this issue to environmentally sustainable development in Brazil. Of the three areas measured for contributions to environmental development, air quality improvements had the greatest number of ‘yes’ responses with over 61% of projects claiming this benefit and a further one percent of projects claiming a contribution to an existing air quality improvement project (see Appendix A.5.1.1). The DNA assessment by project type, shows that fossil fuel switch, methane avoidance and PFCs (perfluorocarbons) and SF$_6$ (sulphur hexafluoride) were the projects most likely to lead to improved air quality. Landfill gas and N$_2$O projects claimed higher than average improvements in air quality, while biomass energy projects were as likely to improve air quality as all other projects (see Appendix A A.5.2.1). Small-scale projects are more likely to claim this contribution compared to large-scale projects using the DNA assessment (see Appendix A A.5.3.1).

The overall MCA score for improvements to air quality was 0.38, which was the highest score for an environmental indicator (see Appendix A A.7.1). Some regional variation of results is shown by the MCA results and the Southeast, where air quality improvements are most needed (Marcilio & Gouveia 2007), scores second highest using the MCA analysis, indicating that air quality improvements are being experienced in the region where they are most needed (see Figure A.7-3 in Appendix A). These results were consistent with the regional analysis of air quality improvements provided by the comprehensive checklist assessment. By project type, the MCA analysis shows that biomass, fossil fuel switch, landfill gas and methane avoidance projects, and to a lesser extent, PFCs and SF$_6$ projects, are more likely to contribute to an improvement in air quality when compared to the mean of all projects. EE (energy efficiency) own generation showed improvements similar to that of the mean of all projects (see Appendix A A.7.2). Small and large-scale projects scored on average 0.38 and 0.39 respectively for this indicator, demonstrating that project scale is not significant in determining the contribution of a project to this indicator (see Appendix A A.7.3).
The method used by the comprehensive checklist assessment showed that 72 of the 178 projects (40%) of projects claimed to improve air quality, yet of these, only nine projects quantified this improvement and 10 outlined monitoring plans (including four projects that were required to monitor air quality as a mitigation of environmental legislation requirement) (see Appendix A A.6.1.1). The differences between these results and the ones achieved by the Brazilian DNA assessment, which showed that 61% of projects are contributing to improved air quality, are caused by the differences between the methods. The DNA assessment required only a mention of improved air quality in the project documentation, whereas the comprehensive checklist assessment required an improvement additional to that which is required to register as a CDM project, that is, a reduction over and above that counted as a reduction in GHG emissions. This eliminates the double-counting of this benefit as both a GHG emission reduction and as a sustainable development benefit, and as such, the comprehensive checklist assessment is a more reliable indicator of the contribution of the CDM to this sustainable development priority. The comprehensive checklist assessment by project type showed that landfill gas, EE own generation, fossil fuel switch and methane avoidance projects either always or nearly always claimed an improvement in air quality, either directly or in the case of EE own generation, through environmental mitigation or legislation requirements (see Appendix A A.6.2.1). This method shows different results to the DNA assessment, with only two percent of biomass energy projects claiming and improvement in air quality. CO$_2$ usage, fugitive, hydro, N$_2$O and PFCs and SF$_6$ projects were least likely to claim a contribution to improving air quality. The differences for N$_2$O and PFC and SF$_6$ projects can be explained through the differences in the methods between the DNA assessment and the comprehensive checklist assessment. By project scale, differences between small and large-scale projects were insignificant (see Appendix A A.6.3.1).

From this analysis, it can be asserted that overall, between 40 and 60% of projects claim to reduce air pollution, and that these improvements occur only in urban areas. Yet there is a large gap between the number of projects claiming improvements and the number of projects quantifying or monitoring these improvements. Only 13% of projects claiming an improvement actually quantified this improvement in the documentation and only 14% of projects monitored improvements claiming, including those required to do so by law. While there were some discrepancies in the results between assessments, fossil fuel switch, methane avoidance and landfill gas were the project types most likely to improve air quality. N$_2$O and PFCs and SF$_6$ projects were also helpful in improving air quality, although these improvements could be considered to be a direct result of what is required to be eligible for a CDM project and not additional to the core purpose of the project. Project scale does not have a large impact on the contribution of CDM projects to the reduction of air pollution.
6.1.2 Reducing Deforestation and Land Degradation

Under the Comprehensive Analysis, three components could be used to assess the success of the CDM towards achieving a reduction in deforestation and land degradation. These are ‘reduced land area’, ‘soil quality improvements’ and ‘conservation benefits’, the latter including both those achieved by project type and by individual project. Only 26% of projects claimed a contribution to reducing land area and of these 36 projects, only 13 quantified this contribution and just one project was monitoring it. For soil quality improvements, 42% of projects claimed an improvement in soil quality (60% of these due to mitigation or environmental legislation requirements). Of these 76 projects, only three projects quantified improvements and eight projects outlined monitoring plans for the improvements in soil quality. In terms of conservation not required by legislation or environmental mitigation, 16% of projects claimed a conservation benefit and all 16% of these projects quantified this, however only nine of these 29 projects monitored this contribution. For conservation required by environmental legislation or mitigation requirements, a further 17% of projects claimed a conservation benefit, with 16 of these 30 projects quantifying this benefit and the majority of them monitoring it, as required in most cases by legislation (see Appendix A A.6.1.1).

Assessing the contribution by project type, reduced land area was claimed by all landfill gas projects and a minority of biomass energy and hydro projects (see Appendix A A.6.2.1). Conservation benefits were claimed by biomass energy, EE own generation, fugitive and reforestation projects, with hydro and landfill gas projects claiming this benefit as either a direct contribution or one required by mitigation or environmental legislation. Soil quality improvements were claimed by all EE own generation, fossil fuel switch, reforestation and landfill gas projects, with hydro and wind projects claiming this due to mitigation or environmental legislation requirements.

By project scale, there was no significant difference in the contribution to reducing land area (see Appendix A A.6.3.1), although large-scale projects were more likely to claim a contribution to conservation with 24% of large-scale projects and five percent of small-scale projects directly contributing to conservation projects or a total of 40% compared to 23% including environmental legislation and mitigation requirements. Soil quality improvements were also more likely to be claimed by large-scale projects with 24% of large-scale and eight percent of small-scale projects claiming this contribution directly, or 46% and 38% when including environmental legislation or mitigation (see Appendix A A.6.3.1).

Using the MCA, the soil indicator shows an average score of 0.21 out of 1.0 for soil quality improvements. This score was lower than for all other MCA scores, except for the development of a poorer region and water quality improvements (see Appendix A A.7.1). Neither of the other
environmental indicators is of relevance to this priority area. By project type, landfill gas, and to a lesser extent biomass energy, fugitive and reforestation projects all contributed to soil quality improvements more than the mean of all projects, with CO$_2$ usage and N$_2$O projects scoring lowest on this indicator (see Appendix A A.7.2). Large-scale projects claimed a contribution to soil quality improvements at a greater rate than small-scale projects (see Appendix A.7.3).

The Brazilian DNA assessment did not include indicators relevant to this priority area, and as such, this approach can not be used for analysis on reducing deforestation and land degradation.

From this information, it can be said that, without mitigation and environmental legislation requirements, fewer than a quarter of projects would be contributing to the reduction of deforestation and land degradation through reducing land area, improving soil quality or through conservation projects. Including those projects where environmental mitigation or legislation requirements are included, a greater proportion of projects are potentially contributing towards reducing deforestation and land degradation through either conservation or soil quality improvement actions, however very few projects quantify these actions or monitor their progress. Without the monitoring of quantified aims, it is impossible to assess whether or not the actions claimed in the project documentation are being implemented and actually leading to a reduction in deforestation and land degradation.

From examining the contribution of particular project types to this priority area, it can be established that landfill gas projects, biomass energy, reforestation and EE own generation projects contribute more to reducing deforestation and reducing land degradation when compared to other project types, as either a direct result or due to environmental legislation and mitigation requirements. Assessing by project scale, these results show that large-scale projects are more likely than small-scale projects to contribute to the priority area of reducing deforestation and land degradation.

### 6.1.3 Protecting Biodiversity

Indicators used to measure the protection of biodiversity are similar to those for reducing deforestation and land degradation, omitting only indicators on soil quality improvements, and hence similar conclusions can be drawn. Overall, between one in four and one in six CDM projects claimed to contribute to a protection of biodiversity, either directly or indirectly (see Appendix A A.6.1.1). By project type, landfill gas projects, reforestation and to a lesser extent, biomass energy and hydro projects, contributed to this aim, when environmental legislation and mitigation requirements are taken into account (see Appendix A A.6.2.1). By project scale, large-scale projects were more likely to claim contributions to reduced land area and
conservation, when both including and excluding those projects where the contribution is due to environmental legislation or mitigation requirements (see Appendix A A.6.3.1).

6.1.4 Improving Water Quality

The inclusion of water quality and quantity improvements in the Brazilian DNA Annex III requirements is indicative of the importance of this to Brazil. Of the 178 projects analysed, 58% of projects claimed a contribution to this objective, with a further two percent claiming that the project was assisting in improvements already underway (see Appendix A A.5.1.1). By project type, this contribution was claimed by all fugitive and methane avoidance projects, and wind and landfill gas projects were more likely to claim this benefit compared to the mean of all projects. CO₂ usage, N₂O and PFC and SF₆ projects did not claim this benefit (see Appendix A A.5.2.1). Results based on project scale were not significantly different (see Appendix A A.5.3.1).

Using the MCA, the mean score for water quality and quantity improvements was 0.18, the lowest score apart from the indicator measuring the development of a poorer region (see Appendix A A.7.1). Assessment by project type shows that methane avoidance and landfill gas projects returned higher than average scores for this indicator. Fugitive and N₂O projects were less likely to claim water quality and quantity improvements compared to other projects (see Appendix A A.7.2). Similarly to the DNA assessment, there was no significant difference in scores based on project scale (see Appendix A A.7.3).

According to the method used by the comprehensive checklist assessment, 39 out of the 178 of projects claimed a contribution for water quality and quantity, however just seven of these projects quantified this contribution and only 11 were monitoring (four of these due to environmental mitigation or legislation requirements) (see Appendix A A.6.1.1). By project type, all fossil fuel switch, reforestation and landfill gas projects claimed a contribution to improved water quality and quantity, while all EE own generation projects claimed this as an environmental legislation or mitigation requirement. Half of the reforestation projects claimed this benefit (see Appendix A A.6.2.1). As for the other two methods, there was no significant difference in contribution based on project scale (see Appendix A A.6.3.1).

From these results, it can be stated that while between 22% and 58% of projects claimed a beneficial contribution to water quality and quantity, very few projects quantified or monitored this contribution. Projects were less likely to contribute towards water quality and quantity improvements than they were for nearly all other indicators according to the MCA analysis, while the Comprehensive Analysis put a contribution to water quality and quantity improvement at the second lowest out of six environmental indicators, just above ‘reducing land
The difference in claims across the methods is demonstrative of the differences in analysis, with the DNA assessment only requiring a mention of improved water quality, resulting in a higher proportion of projects contribution to this priority area compared to the comprehensive checklist assessment where water quality improvements were determined by project type. The MCA scored projects based on the availability of fresh water, impact of the project on aquatic diversity and biodiversity and the quality of wastewater, and because most projects did not score against each of these options, scores for improved water quality were generally lower compared to the other two assessment methods.

Assessing by project type, landfill gas projects were consistently able to claim water quality and quantity improvements across each of the methods, while methane avoidance projects was one of the types more likely to claim this benefit across two of the three assessment methods. N₂O and PFC and SF₆ projects were least likely a contribution to this priority area. Assessment by project scale shows that there are no significant differences in contribution to this indicator based on project scale.

6.1.5 Increasing Renewable Energy in the Energy Grid

The Brazilian DNA Annex III requirements do not include an indicator for renewable energy generation and as such, there are no indicators that can be used to measure progress towards this priority area using this analysis.

The MCA uses a measure of renewable energy generation and the mean score out of 1.0 was 0.5, representing the highest mean score out of all nine indicators used in the MCA (see Appendix A A.7.1). By project type using the MCA analysis, biomass energy, hydro and wind were more likely to generate renewable energy for use within the energy grid. Other project types to generate renewable energy for use within the grid or for use within the company producing the energy include CO₂ usage, EE own generation and fugitive projects (see Appendix A A.7.2). There was no significant difference in contributions to this priority area based on project scale (see Appendix A A.7.3).

The methods used by the comprehensive checklist assessment indicate that 97 out of the 178 projects claimed they contributed to the generation of renewable energy (see Appendix A A.6.1.1). The comprehensive checklist assessment showed that by project type, renewable energy generation was claimed in all cases for CO₂ usage, EE own generation, hydro and wind projects, by most of the biomass energy projects and for some fugitive and landfill gas projects (see Appendix A A.6.2.1). Consistent with the MCA, by project scale in the comprehensive checklist assessment, there was no significant difference in the contribution to this priority area based on project scale (see Appendix A A.6.3.1).
In terms of a regional variation in scores for renewable energy generation, the highest MCA scores were in the Northern and Southern regions, and lowest in the Northeast with a mean score in this region of 0.38. By comparing the MCA scores for renewable energy generation and a measurement of remoteness of location, it can be seen that the more remote locations were more likely to benefit from projects that contributed to renewable energy generation than projects in more central locations. This is illustrated in Figure 6-5. This is a good indication for the provision of renewable energy to remote regions, however the number of projects in remote and very remote areas remains low and the overall contribution is still low.

![Figure 6-5 Mean scores for renewable energy generation by remoteness of region](image)

The comprehensive checklist assessment showed that the South, Central West and North hosted projects that more likely to generate renewable energy, and the difference between these results and the MCA findings can be explained due to the fact that the MCA awards different scores for renewable energy generation used within the company operations and generation that connects to the energy grid, providing wider public use of energy generated.

Incorporating the results of all three methods of analysis, it can be seen that CDM projects in Brazil are more likely than not to generate renewable energy for the consumption of the company involved, and hence reducing the demand on publicly available electricity, or for the wider electricity grid. It can therefore be said that CDM projects are helping to fulfil the objective of increasing the proportion of renewable energy in the electricity grid. It can also be seen that renewable energy generation is more likely to occur in areas considered to be very remote or remote areas compared to not remote or centrally located areas, which contributes to the objective to provide universal electricity supply. Given that these projects generate their CERs through the production of renewable energy, this indicator is monitored through the verification process. Project types contributing to this priority area included CO₂ usage, EE own generation, hydro, wind, biomass energy projects and for some fugitive and landfill gas projects. Results of analysis by project scale indicate that there is no relationship between project scale
and a contribution to the generation of renewable energy. Aside from the differences in contributions across the regions, the MCA and comprehensive checklist assessment are largely consistent in their assessments of this priority area.

6.2 Priority Social Issues for Brazil Related to CDM Projects

6.2.1 Reducing Regional Inequality

In order to assess the contribution of projects to the priority area of reducing regional inequality, the location of projects and a number of the indicators used in the three methods can be used. Overall, the largest proportion of projects in terms of the number of projects, and the generation of CERs, were located in the Southeast, as shown in Figure 6-6. Projects located across multiple regions were divided up amongst the regions for these calculations.

![Figure 6-6 Percentage of projects and CERs generated in each macro-region of Brazil](image)

This spread of projects does not reflect a contribution towards the improvement of regional equality in Brazil, as the pattern of investment in the CDM reflects the existing uneven pattern of investment and development across Brazil, and shows that CDM projects have occurred in areas that are considered to be the ‘lowest hanging fruit’, where projects that maximise CERs are favoured over those that are located in regions where investment in CDM projects may be more costly or difficult. CDM projects in Brazil do not challenge, but reflect existing structures of inequality.

Even when taking into account the argument that cogeneration projects in the North and Northeast regions were historically more difficult to economically justify given the higher proportion of renewables in that electricity grid and therefore the lower number of CERs
generated compared to an equivalent project in the South or Southeast, the number of projects in
the North and Northeast has not noticeably improved since the change in policy where Brazilian
CER calculations were to be based on a single, national electricity grid in 2008 (Michaelowa
2011). Figure A.2-9, in Appendix A, shows the number of projects registered over time from
2004 until 2011 and while the number of projects in the Southeast, and to a lesser extent in
Central West and South has fluctuated over time, the number of projects registered in the North
and Northeast has remained low over this entire time period.

By project type, hydro had the largest spread of projects across all five macro-regions with 73% of projects located outside of the Southeast region. Biomass energy, landfill gas and methane avoidance were also located in all five macro-regions (see Figure A.2-11 in Appendix A). Fugitive, wind, N₂O and landfill gas project types had the proportion of projects in the North and Northeast (50%, 25%, 25% and 20% respectively) while landfill gas had the largest number of projects in these regions. By project scale, small-scale projects were more likely to be located in the South, Central West and North compared to large-scale projects, while large-scale projects were more likely to be located in the Southeast and Northeast. A total of 9% of both large and small-scale projects were located in the combined regions of the North and Northeast.

In terms of the contribution to regional equality from the sale of CERs and generation of revenue within the region, using the prices and formulas described in section 6.3.2, it can be seen in Figure 6-7 that the contribution to the more developed Southeast far outweighs the total contribution to the rest of the country. Any calculation based on the issuance of CERs rather than the number of projects is skewed by the single N₂O emission reduction project in São Paulo, which issued over 40 million CERs since 2007, however even without the contribution of this project, the GDP contribution from the issuance of CERs to the Southeast is over three times the amount from the rest of the regions of Brazil.
Figure 6-7 Financial contribution to each macro-region of the sale of CERs (CER quantities from Institute for Global Environmental Strategies 2013; CER prices from Intercontinental Exchange 2013)

The comprehensive checklist assessment provides a breakdown of what percentage of projects are located in regions of disadvantage compared to the percentage of municipalities in each of those categories of disadvantage, shown in Figure 6-8.

Figure 6-8 Percentage of municipalities and CDM projects in each IFDM development category

While it would not be expected that many projects would be located in municipalities of low development status considering only 0.4% of all Brazilian municipalities fall into this category, this analysis demonstrates that CDM projects were more likely to be located in regions of moderate to high development than regions of regular or low development. Therefore, the CDM can not be seen to be contributing to improving regional inequality at a municipal level. Of the
different project types, half of the fugitive projects and some of the hydro and biomass energy projects were located in municipalities considered to be of regular development status (see Figure A.6-31 in Appendix A). Projects types that were located in municipalities of high development status include 75% of N₂O projects, 50% of fossil fuel switch, 40% of landfill gas, 24% of biomass energy and 9% of methane avoidance projects. The remaining projects were all located in regions of moderate development status. Small-scale projects were more likely to be located in municipalities considered to be of regular and moderate development compared to large-scale projects, which were more likely than small-scale to be in municipalities of higher development status (see Figure A.6-43 in Appendix A).

The MCA has an indicator that assesses the development of a poorer region, with results based on municipal level regions rather than the macro-regions used for most of the analysis on Brazil. This gives an indication of how many projects are actually located in municipalities considered to be of lower development. The mean score of -0.51 for ‘development of a poorer region’ was the lowest out of the nine categories used for the MCA method (see Appendix A A.7.1). This indicates that the majority of projects were actually located in regions considered to be of moderate (therefore receiving a score of -0.5) to high (-1.0) development according to the IFDM categories rather than in the low and regular categories. No projects were located in regions of low development status. By project type, the MCA scored fugitive and hydro projects higher for contributing to the development of a poorer region, while N₂O projects scored the lowest for this indicator (see Appendix A A.7.2). By project scale, small-scale projects were more likely to be located in poorer regions compared to large-scale projects (see Appendix A A.7.3).

The comprehensive checklist assessment can also be used to measure the percentage of projects in each region in each of the IFDM categories of development. Across all regions, the greatest proportions of projects were located in regions of moderate development (see Figures A.6-11 to A.6-15 in Appendix A). This is despite between 75% and 78% of municipalities in the Northeast and North being of low to regular development status. If the CDM were contributing to regions of lower development status, it would be expected that three-quarters of the projects in the North and Northeast would be located in municipalities of low to moderate development status. The only region with projects in regions of high development was the Southeast, the region with the highest proportion of municipalities of high development status. The North and Northeast had the highest proportion of projects located in municipalities of regular development, which is to be expected given that the majority of municipalities for each of these regions fall in the category of regular development. All 29 projects located in regions of high development are located in the Southeast (see Figure A.6-15 in Appendix A). This analysis demonstrates the tendency of CDM projects to be located in areas of higher, rather than lower, development status across all macro-regions of Brazil.
In looking at the financial benefit to the municipalities of Brazil based on their development status through the issuance of CERs, using the method for calculating total contribution outlined in section 6.3.2, it can be seen in Figure 6-9 that the vast majority of funds from the issuance of CERs are directed towards municipalities of high development status. Again, this is skewed by the issuance of CERs from the single N₂O project in São Paulo, and without this single project, it can be seen that the funds from the sale of CERs are more evenly distributed between the high and moderate municipalities in terms of development status, but there is still only a small amount of funding going to regions of regular development status and none to those of low development status.

The MCA can also be used to measure the relationship between both the macro-region location and the IFDM development categories against employment generation scores. The mean employment generation scores for each macro-region indicate that both the Northeast and Central West have the highest scores (0.56 and 0.55), followed by the Southeast (0.52), the South (0.50) and the North (0.21). Despite this positive result for employment generation in the Northeast, in terms of the contribution to employment generation in municipalities by development status, those municipalities of regular status had a mean of 0.21 compared to moderate municipalities (0.49) and high municipalities (0.51). Compared to an overall mean of 0.47 for employment generation, this shows that employment was much less likely to be generated in municipalities considered to be of regular development status than it was in more developed municipalities. Where employment generation may be higher in the Northeast according to this analysis, it is not highest in the municipalities of lower development status in that region. In addition to this, the total number of projects in regions of low and regular development status was low, which suggests that employment is not being generated through the CDM where it is needed most.
In terms of employment generation according to the comprehensive checklist assessment method, contributions to all types of employment were greatest in the Northeast, with projects located in the Central West more likely to contribute to direct rather than indirect employment. This is similar to the results of the MCA, with employment generation by macro-region showing that amongst all states except the North, employment generation scores were relatively even, between 0.50 and 0.56. For the North however, mean scores were substantially lower at 0.21.

When comparing the contribution to socially sustainable development of projects for each region, it can be seen that projects located in the Northeast are more likely to claim a contribution to social sustainable benefits than those located in the other macro-regions of Brazil according to the comprehensive checklist assessment. Projects located across multiple regions were least likely to claim a range of social benefits, except for improving the health of the local population, which was claimed by the majority of these projects. Projects located in the North were less likely to claim a contribution to social benefits compared to the other macro-regions of Brazil. Improvements to quality of life were claimed at a greater level by projects located in the Northeast, followed by the Southeast and at the lowest percentage in the Central West, however projects located across multiple regions were most likely to claim a contribution to improving quality of life.

Looking at the rest of the MCA results, it is apparent that projects implemented in the Northeast region have the greatest return of social, environmental and overall benefits (see Figure A.7.2 in Appendix A). Higher social and overall benefits are likely due to the category of ‘development of a poorer region’, which contributed up to 1.0 to the social score, as the Northeast region ranks lowest on the IFDM index in term of regions in Brazil. Projects located in the other regions are more likely to return lower social scores, in particular, projects in the Southeast. Overall, projects in the Northeast contributed more to sustainable development when measured using this method, followed by projects in the South, Southeast, the Central West and the North. Yet the overall number of projects was low in the Northeast, so even though the projects that were located here were likely to return higher social scores, overall the benefit is low compared to in the Southeast.

Using the DNA assessment, in response to the second component of the Annex III requirements, social labour responsibilities were claimed at by 50% of projects in the Northeast and 41% in the Southeast compared to just 15% of projects in both the Central West and the South claiming this. Staff health and education improvements that were new and additional were low and claimed evenly across the macro-regions, ranging from 9% of projects in the Southeast to 15% of projects in the Central West and the South. Projects that claimed that the CDM was
contributing to pre-existing benefits (commonly the provision of staff training and education) were located mainly in the Southeast and Central West. Responses to the third section of the Annex III requirements include a measurement on quality of life improvements and contributions to socioeconomic benefits. New quality of life benefits were claimed mostly by projects located in the North and Northeast and least by projects located in multiple regions. The Northeast and Southeast claimed the greatest proportion of projects that contributed to existing quality of life benefits. New socioeconomic benefits were claimed mostly in the Northeast and Southeast, with projects located in multiple regions again claiming the least.

In terms of the contribution towards sustainable social development within each region, according to the comprehensive checklist assessment approach, projects located in the Northeast were most likely to contribute to social development, including charity funds, while projects located across multiple regions claimed less overall benefits but were most likely to claim a contribution towards the health of the population (see Figure A.6-17 in Appendix A). Environmental education, due to mitigation requirements or otherwise, was mostly claimed by projects in the Central West and Northeast. Projects in the North and those located across multiple regions were less likely to claim this benefit (see Figure A.6-18 in Appendix A). Quality of life improvements, such as a reduction in smells due to improvements in air quality or improved access to services such as reliable electricity, were claimed by more than half of all projects across all regions, although they were more likely for projects in the Northeast and those located across multiple regions (see Figure A.6-19 in Appendix A).

The sheer number of projects located in the Southeast and South compared to the poorer and less developed regions of Brazil shows that the CDM is not contributing towards a reduction in regional inequality across the country (see Figure A.2-7 in Appendix A). While it has been argued that this may change in the future given the changes to the national emissions factor (Brazilian Government Official 1, 2 and 3, 2011, pers. comm. 16 March), there is no evidence that there has been an improvement in the geographical spread of projects since this change was made in 2008. The proportion of projects located within less developed areas was very low and while projects located in Northeast were shown to be more likely to generate employment and contribute more to improved quality of life, the number of projects in this macro-region was substantially outweighed by projects located in the more developed South and Southeast, leading to the conclusion that the CDM is not contributing significantly to reducing regional inequality. By project type, hydro, fugitive and biomass energy project types were more likely to contribute to regional equality given their location in Brazil’s poorer macro-regions and municipalities of lower development status. While small-scale projects are marginally more likely to contribute to a reduction in regional inequality through a greater prevalence...
municipalities of lower development, differences in the contribution to regional inequality by scale of project are not large.

6.2.2 Reducing Income Inequality

All three assessment methods measured employment generation and are relevant to this section, but are presented in full in section 6.2.4 below. Other indicators that are relevant to this priority area include contribution towards income distribution, quality of life and socioeconomic benefits and the training and education of unskilled labour, employees and the wider population.

For the Brazilian DNA Annex III documentation, section III required projects to state their contribution towards income distribution, measured through contributions to the quality of life and also through socioeconomic benefits. Over half (52%) of projects claimed a contribution to neither category, while 14% claimed at least one of the indicators and 34% claimed a contribution to both (see Appendix A A.5.1.3). Quality of life improvements were claimed by 30% of projects, with a further 13% claiming a contribution to existing benefits and socioeconomic benefits were claimed by 20% of projects, while a further 19% claimed a contribution towards existing benefits. By project type, improvements to quality of life were claimed at a higher rate by fugitive, N₂O and wind projects while socioeconomic benefits were claimed at a higher rate by fugitive, N₂O, biomass energy and landfill gas (see Appendix A A.5.2.3). By counting both new and additional benefits, as well as those projects that claimed a contribution to pre-existing projects, large-scale projects were more likely to claim a contribution to this indicator of income distribution compared to small-scale projects (see Appendix A A.5.3.3).

Other indicators that could be used to measure the contribution of CDM projects towards this priority include the training of unskilled labour (comprehensive checklist assessment), the training and education of the general population (comprehensive checklist assessment) and the training or education of employees (comprehensive checklist assessment and Brazilian DNA assessment). These results are presented in section 6.2.5 below.

In terms of employment generation where it is most needed, the MCA shows that employment generation scores according to the human development of the region indicate that poorer regions scored much lower than the high and moderate human development regions, as demonstrated by Figure 6-10. This shows that employment generation in poorer regions is not being achieved through the CDM and given both this and the limited number of projects in the municipalities of lower development status, it can be concluded that the CDM is not contributing towards improving income inequality in Brazil.
The generation of formal employment remains the most effective way to reduce income inequality within Brazil, and while the majority of CDM projects claim to do this in either or both of the construction and ongoing operational phases of projects, and as discussed in detail in section 6.2.4, very few projects quantify this contribution and even fewer offer monitoring plans for projects. Quantification and monitoring of employment generation is higher than for other social, economic or environmental indicators as it is requested by the Brazilian DNA in the Annex III documentation, however it still remains low and monitoring, and hence the assurance that claims will be achieved, is not mandatory. Without higher rates or mandatory reporting and monitoring, it is difficult to establish whether the majority of CDM projects will lead to employment generation, although anecdotal evidence suggests that this can sometimes go the other way, with more employment generated than originally envisaged (CDM Project Developer 3, 2011, pers. comm., 29 March). Employment generation scores were relatively even across the regions of Brazil, however the number of projects is highly skewed in favour of the richer Southeastern and Southern regions of Brazil, and hence the majority of employment generation occurs in these regions. This does not improve regional equality across Brazil and can perpetuate the migration of Brazilians from the poorer Northern and Northeastern states to the cities of the South and Southeast. Contributions to income distribution through other measures or through the education and training of Brazilians were claimed by between one third and over half of projects, but the quantification and monitoring of such claims was rarely mentioned, eliminating the ability to ensure that the implementation of the outlined programs or projects was achieved. It is difficult to ascertain if a particular project type is more likely to contribute to reducing income inequality as most project types claim a contribution to this priority area. For project scale, both scales of projects claimed similar levels of employment opportunities, while training and education benefits were more likely to be claimed by large-scale projects.
6.2.3 Reducing Rural Inequality

Only indicators from the comprehensive checklist assessment and MCA can be used to measure a reduction in rural inequality. The comprehensive checklist assessment shows that of the 178 projects in the dataset, just seven were located in municipalities where the rural population was larger than the urban population, compared to the 29% of all Brazilian municipalities considered to be rural (see Appendix A A.6.1.2). According to this method of analysis, projects in the North, Northeast and South were more likely to be located in rural areas, with the Southeast hosting no CDM projects in rural areas. There were only three project types with one or more projects located in municipalities considered to be rural – fugitive, wind and hydro. Small-scale projects were more likely to be located in rural areas than large-scale projects.

Municipalities deemed to be remote or not remote (the middle two categories of remoteness) hosted higher than expected numbers of CDM projects. Very remote municipalities hosted the lowest number of projects (see Figure A.6-16 in Appendix A). In terms of project types that were more likely to be located in more remote areas, CO₂ usage, biomass energy, hydro and methane avoidance were more likely to be in municipalities considered to be very remote, while N₂O, landfill gas and fossil fuel switch were more likely to be located in central locations (see Figure A.6-30 in Appendix A). Fugitive, PFCs and SF₆, reforestation and methane avoidance projects were located equally across remote and note remote regions. Assessment by project scale indicates that small-scale projects were more likely to be located in very remote municipalities, remote and not remote compared to large-scale projects, which were more like to be located in municipalities considered central (see Figure A.6-42 in Appendix A).

The provision of reliable electricity from renewable resources is one of the outcomes of the CDM that could contribute to reducing inequality in rural and remote parts of Brazil. Using the MCA scores for the generation of renewable energy and comparing these to the categories of remoteness used, there is a pattern that shows that scores are higher for more remote locations and lower for more central locations (see Figure A.7.4 in Appendix A). This shows that the CDM may be contributing to renewable energy generation and provision in more remote areas and therefore be reducing rural and remote inequality. It must however be remembered that the total number of projects located in very remote municipalities was much less than in central municipalities, so while projects in more remote regions are scoring higher for this indicator, the overall contribution is still quite small and could be improved through the location of more projects in remote and very remote locations.

By comparing the MCA score on sustainable and innovative technology and remoteness, an indication of the contribution of the CDM to more remote areas of Brazil can be established (see Figure A.7.5 in Appendix A). The scores range from 0.36 in very remote municipalities to 0.47
in central municipalities. There does not appear to be any pattern to suggest that the CDM does contribute to reducing rural inequality when looking at the spread of sustainable and innovative technologies.

With 29% of all Brazilian municipalities being classified as rural for the purposes of this research, it would be expected that nearly one-third of funds from the sale of CERs would be directed to rural municipalities, however only 0.7% of funds from the sale of CERs, as calculated using the method in section 6.3.2 is made, were generated from by projects located in rural municipalities. Even when the single N₂O project, located in an urban area, is excluded, only 1.7% of the remaining funds are allocated to projects located in rural areas. In terms of remoteness, Figure 6-11 demonstrates that, when including the single N₂O project, the majority of funds can be attributed to projects located in the least remote 25% of Brazilian municipalities. However, when that project is excluded, there is still a skew in favour of the less remote areas of Brazil, but it is less pronounced.

![Figure 6-11 Financial contribution to municipalities by remoteness from the sale of CERs](image)

Overall it can be seen that investment in CDM projects across Brazil is not making a significant contribution towards reducing rural inequality, as most of the projects are located in municipalities considered to be more urban. Of those projects in rural areas, only wind, hydro and fugitive project types were represented. Small-scale projects are more likely than large-scale to be located in rural or remote municipalities.

### 6.2.4 Generating Formal Employment

All three assessment methods measured the contribution of a project to employment generation. Employment generation is also included as an indicator for reducing income inequality (see
section 6.2.2). The Brazilian DNA assessment measured the claimed contribution towards ongoing or operational employment and temporary or construction employment and also measured what proportion of projects quantified this contribution. These categories were also split into direct and indirect employment generated by the CDM project. The Brazilian DNA assessment showed over two-thirds of projects claimed a contribution to direct ongoing and temporary employment and over half of projects claimed a contribution to indirect employment, yet less than half of these projects quantified the claims (see Appendix A A.5.1.2). For projects where the contribution to ongoing employment was quantified, the mean was 20 jobs (with a range of two to 100). For direct temporary jobs, the mean number was 343 (with a range of five to 1500).

The MCA indicator for employment generation was 0.47 out of a possible 1.0 (see Appendix A A.7.1). Ongoing employment returned higher scores under this method compared to temporary employment and the comprehensive checklist assessment showed that employment generation was claimed by most projects.

The comprehensive checklist assessment showed that the majority of projects claimed employment generation. For ongoing direct employment, 123 of the 178 projects claimed this benefit, with 51 of these quantifying and five of projects monitoring this contribution. For ongoing indirect employment, 100 of projects claimed this benefit, 43 quantifying and one project monitoring this contribution (see Figure A.6-22 in Appendix A). Temporary direct employment was claimed by 149 of projects, with 49 quantifying the contribution and five monitoring it. Temporary indirect employment was claimed by 99 of projects, with 12 quantifying this contribution and one project outlining plans for monitoring.

According to the employment generation indicators used in each assessment method, it is difficult to ascertain whether one particular project type contributes more to employment generation than another as most projects claimed this benefit. There were differences between the assessment methods, such as the higher scores in the MCA for ongoing employment compared to temporary employment delivered different results to the comprehensive checklist assessment. Given these results, it can be concluded that there are no clear project types that contribute more to employment generation compared with others, however fugitive, reforestation and landfill gas projects rated highly in either two or three of the three assessment methods. For project scale, the proportion of projects that claimed a contribution to employment generation was similar for both small and large-scale according to the DNA assessment (see Appendix A A.5.3.2) and this similarity was confirmed by both the comprehensive checklist assessment (see Appendix A A.6.3.2) and the MCA (see Appendix A A.7.3). From these results,
it can be concluded that the CDM does contribute to the generation of formal employment within Brazil.

6.2.5 Promoting Education and Training

The comprehensive checklist assessment offers four indicators that are of relevance to this priority development area including training and education of employees or the wider population, training and education of unskilled labour and the provision of environmental education. Training and education of employees was claimed in 53 of the 178 projects, quantified by 32 of these and monitored in 5 of those projects claiming the benefit (see Figures A.6-7 and A.6-8 in Appendix A). Training and education of the wider population was claimed by more projects with 132 projects claiming either a new benefit or a contribution to an existing program with 37 projects quantifying claims and just five projects outlined a monitoring plan (see Figure A.6-21 in Appendix A). The training of unskilled labour was claimed in 68 of projects, however this was only quantified by three projects and only one project had a description of a monitoring arrangement. Environmental education, measured in the comprehensive checklist assessment can also be used to measure the contribution of the CDM to training and education (see Figures A.6-9 and A.6-10 in Appendix A). Of the 55 of projects that claimed a contribution to environmental education, the majority (56%) were the result of mitigation or environmental legislation requirements, and these projects also accounted for nearly all of the projects that outlined monitoring plans. A total of 18 projects quantified the contribution and 13 of projects outlined monitoring plans, 11 of which were required by environmental legislation.

For the Brazilian DNA assessment, contributions to health and staff education were combined into the one indicator and 11% of projects claimed a new contribution to this benefit with 26% claiming that the CDM project would assist in benefits already available (see Appendix A A.5.1.2). A majority of 63% of projects did not claim either a contribution to health or educational benefits for employees. By project type, training and education indicators show that biomass energy, CO₂ usage, fugitive, N₂O, PFCs and SF₆, methane avoidance and landfill gas projects were all likely to claim this contribution at high rates (see Appendix A A.5.2.2). Training of unskilled labour was claimed at a greater rate by hydro, landfill gas, N₂O, wind and biomass energy projects. Training of unskilled labour, another indicator of the ability of the project to reduce income inequality was greater for large-scale projects than small-scale projects, as was training and education for employees and the general population according to the comprehensive checklist assessment. Training and education for employees was also greater for large-scale projects according to the Brazilian DNA assessment (see Appendix A A.5.3.2).
The MCA did not include a specific indicator for education and training and is therefore not included in an analysis against this priority area.

Overall, between one third and three quarters of projects claimed the indicators used to measure a contribution towards education and training, and as such, it can be said that CDM projects are claiming to contribution an improvement within this priority area. However quantification and monitoring of these contributions remain very low and until quantification and monitoring are increased or made mandatory for CDM projects, it is difficult to ascertain as to whether these claims are being implemented. Training and education for the general population was claimed at a greater rate for biomass energy, CO$_2$ usage, fugitive, N$_2$O, PFCs and SF$_6$, methane avoidance and landfill gas projects. Training of unskilled labour was claimed at the greatest rates by hydro, landfill gas, N$_2$O, wind and biomass energy projects. Fugitive and biomass energy projects were the most likely to contribute to the training and education of employees. Environmental education was claimed as a mitigation requirement mostly by hydro projects, and by fugitive, PFCs and SF$_6$ and EE own generation as a voluntary measure. Large-scale projects are more likely to claim a contribution towards the development priority of promoting education and training.

### 6.3 Priority Economic Issues for Brazil Related to CDM Projects

#### 6.3.1 Promoting Technology Transfer, Clean Energy Innovation and Research and Development

Clean technology, rather than end of pipe technology, was used in 102 (57%) of projects according to the classifications set out by the Grupo de Pesquisa em MDL da UFBA (see Appendix A A.6.1.4). By the sale of CERs, projects classified as using clean technology comprised 39% of the total financial value of the CDM to Brazil, however when the single N$_2$O project was excluded from this calculation, projects using clean technology generated more than twice the financial return from the issuance of CERs compared to projects using end of pipe technology (see Figure 6-11). The comprehensive checklist assessment shows that biomass energy, CO$_2$ usage, fossil fuel switch, hydro, reforestation and wind are all classified as projects that use clean rather than end of pipe technology. Differences in clean technology were not significant between the different project scales (see Appendix A A.6.3.4).

Technological innovation according to the Brazilian DNA assessment was claimed by just 10% of projects, and was claimed mainly by EE own generation, fugitive, N$_2$O and PFCs and SF$_6$ projects (see Appendix A A.5.1.4). Using the MCA, the score for the use of sustainable and innovative technology was 0.4 out of 1.0 (see Appendix A A.7.1) and scores for sustainable or innovative technology were higher for CO$_2$ usage, N$_2$O, PFCs and SF$_6$ and wind compared to
the mean for all projects according to the MCA (see Appendix A.7.2). There was no significant difference between project scales in claiming technological innovation according to both methods (see Appendix A.6.3.4 and A.7.3). When assessing the introduction of innovative and sustainable technology into the different macro-regions, there is very little difference between the macro-regions of Brazil with scores ranging between 0.37 and 0.43 on the MCA scoring scale, in favour of the more developed regions of the South and Southeast. For sustainable and innovative technology scores using the MCA and the IFDM classifications of development, there is a relationship between scores and the development status. The higher developed a municipality, the higher the project scores for sustainable and innovative technology, as seen in Figure 6-12. In terms of remoteness, there appears to be no relationship between sustainable and innovative technology scores and the level of remoteness of a hosting municipality.

![Figure 6-12 Mean score for sustainable and innovative technology by the development classification of municipality (using IFDM classifications)](image)

According to the classifications set out by the Grupo de Pesquisa em MDL da UFBA, the technology source for 122 (69%) of projects was endogenous while 56 (31%) of projects sourced technology exogenously and therefore could claim an element of international technology transfer (see Appendix A.6.1.4). The need for international assistance was claimed by 15% of projects compared to 40% stating that it was not required (the remainder of projects did not comment on this) according to the Brazilian DNA assessment (see Appendix A.5.1.4). Projects located in the Northeast were more likely to claim the need for international assistance (29%) compared to 22% of projects in the Southeast, 11% in the Central West and 10% in both the Northeast and South. The need for international assistance was mainly claimed by PFCs and SF₆, wind and biomass energy project types according to the DNA assessment (see Appendix A.5.2.4), and the comprehensive checklist assessment showed that methane avoidance, N₂O, PFCs and SF₆ as well as wind projects were more likely to be classed as using exogenous technology types (see Appendix A.6.2.4). Small-scale projects were more likely to
use exogenous technology compared to large-scale projects (see Appendix A A.5.3.4 and A.6.3.4).

The origin of equipment for 58% of projects was domestic according to the Brazilian DNA and the comprehensive checklist assessment, while 7% claimed equipment was from an international source (see Appendix A A.5.1.4 and A.6.1.4). The remainder did not specify the origin of the majority of equipment for the project. The highest proportions of imported equipment were in the Northeast and Northern regions (20% and 14% respectively) according to the Brazilian DNA and comprehensive analyses, compared to 11% for projects in the Southeast and 3% for those in the South. The origin of equipment according to the DNA and comprehensive checklist assessment shows that fossil fuel switch, landfill gas, PFCs and SF₆, and to a lesser extent, wind projects were more likely to source equipment from overseas than other project types (see Appendix A A.5.2.4 and A.6.2.4). Technology transfer indicators showed that small-scale projects were less likely to use equipment imported from overseas and were also less likely to require international assistance than for large-scale projects (see Appendix A A.5.3.4 and A.6.3.4). These results indicate that there is a distinct lack of technology transfer occurring through the CDM in Brazil. This result is supported by the findings of other research, which suggests that less than one-third of projects in Brazil are the result of technological diffusion and no projects are genuinely the result of technological innovation (Nifadkar & Dongre 2013).

Technological reproducibility was claimed by 72% of projects in the Brazilian DNA and comprehensive checklist assessment (see Appendix A A.5.1.4 and A.6.1.4). According to the DNA and comprehensive methods of analyses, technical reproducibility was claimed at higher rates by projects in the Northeast (90%), South (80%) and Southeast (73%). Technological reproducibility was claimed by the majority of project types and by all CO₂ usage, EE own generation, fugitive, landfill gas, N₂O, PFCs and SF₆ and wind projects according to the DNA and the comprehensive checklist assessment (see Appendix A A.5.2.4 and A.6.2.4). The scale of projects made no difference to the reproducibility of technology (see Appendix A A.5.3.4 and A.6.3.4).

Regional integration was claimed by 84% of projects according to the Brazilian DNA method and quantification of this claim was rare, with none monitoring it (see Appendix A A.5.1.5). Regional integration was claimed to a greater extent by biomass energy, fugitive, hydro, landfill gas, methane avoidance, PFCs and SF₆, reforestation and wind according to both the DNA and comprehensive checklist assessment (see Appendix A A.5.2.5). Only CO₂ usage had no projects claiming this benefit. There was no significant difference in the claiming of regional integration between project scales (see Appendix A A.5.3.5).
While the results for assessing the contribution of CDM projects to technology transfer and clean energy innovation differed according to the method of analysis, clean technology was used for only just over half of the projects, and the majority of projects were using technology already available in Brazil, with little to no element of technology transfer, a key claimed objective of the CDM. Innovative technology was higher in municipalities of higher development status. Regional integration was claimed by the majority of projects, and as such, a benefit to the surrounding business and communities could be expected, however the dissemination of clean and innovative technology to the poorer municipalities and regions of Brazil was low, with the promotion of these types of technologies through the CDM focused mainly on the South and Southeastern regions.

While different project types contributed in different ways to sustainable economic development in Brazil, a few project types were able to claim a contribution towards both the broad categories of technological reproducibility, innovation and transfer, and the use of clean technology or generation of renewable energy, as seen in Table 6-1. Information for this table is taken from across all three assessment methods. Wind projects were most likely to claim across two indicators from each of the above broad categories, while landfill gas, fugitive, biomass, CO₂ usage and EE generation were able to claim from three of the indicators, covering both of the broad categories. PFCs and SF₆ and N₂O projects were only able to claim a contribution towards technological reproducibility, innovation or transfer while hydro projects only contributed to indicators to the clean technology and renewable energy generation broad category. The difference in contributions to sustainable economic development between small and large-scale projects was not noticeable. For most of the indicators used to measure the contribution of projects to the priority economic development areas, there was no discernible difference between the small and large-scale projects.

Table 6-1 Number of economic benefits claimed by project type

<table>
<thead>
<tr>
<th>Technological innovation, reproducibility or transfer only</th>
<th>Both categories (at least three indicators claimed)</th>
<th>Clean technology or renewable energy generation only</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFCs and SF₆</td>
<td>Landfill gas</td>
<td>Hydro</td>
</tr>
<tr>
<td>N₂O</td>
<td>Fugitive</td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomass energy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.3.2 Improved Balance of Trade – Value of CERs to Brazil’s GDP

The total financial contribution of the CDM to Brazil’s GDP is calculated based on the contribution of all registered CDM projects in Brazil where CERs were issued over the period between 2005 and 1 May 2011 (the timeframe for this research) rather than just those 178 for which all documentation is available. This is because this section assesses the overall contribution of the CDM to Brazil’s GDP over this time period and this is not reliant on having all documentation available. For all other sections in this chapter referencing the financial contribution to Brazil’s GDP in terms of macro-region, project type or credit buyer for example, only the financial contribution from the issuance of CERs from the 178 projects used in this research are included.

While a contribution to GDP is considered to be an appropriate indicator across a range of CDM assessment methods, it must be noted that not all GDP increases are necessarily indicative of improvements to sustainable development, especially if they result in social harm or unsustainable use of resources.

In order to assess the contribution of the CDM to Brazil’s GDP, a price for CERs from 2005, the coming into force of the Kyoto Protocol, to 1 May 2011 must be calculated. An average price for CERs calculated over this time period is not suitable given the huge fluctuations in CER market prices. It was deemed more suitable to calculate an annual average price for CERs and use this along with the number of CERs issued each year to calculate the overall contribution of the CDM to the Brazilian GDP.

There are three types of CER prices that could be used for this purpose, spot prices, forwards prices and futures prices. While spot prices are more consistent, they are more difficult to obtain and forwards prices do not cover the period of time covered in this research. Therefore it was decided that futures prices should be used. Futures prices only became reliable from 2008 onwards, as this was when the market began to mature, so it is from this period onwards that is displayed in Figure 6-13. The CER Dec-12 line in blue shows the futures price for CERs purchased for Phase II of the EU ETS, while the CER Dec-13 line in red shows futures prices for CERs purchased for Phase III.
These daily prices can be averaged to provide a mean annual CER price from 2008 onwards. The mean annual CER prices are shown in Table 6-2. Prices for 2005 through to 2007 are considered to be the same as those for 2008. Reliable prices for the years 2005 through to 2007 are not available using futures prices, so for the purposes of calculating the overall financial contribution of the CDM to the GDP of Brazil, this research has applied the 2008 mean futures price to 2005 through to 2007. This research has also used the prices for Dec-12 CERs as these CERs formed the majority of the sales volume for Brazil, and as Figure 6-13 demonstrates, the price difference between Dec-12 and Dec-13 CERs is small. Table 6-2 also shows the total number of CERs issued by Brazil in each year. From this, an annual contribution to the Brazilian GDP from the sale of CERs can be calculated, shown in the fourth column of Table 6-2. Taking into account the price assumptions identified above, the total contribution from 2005 until the 1 May 2011 to the Brazilian economy was €762 million.
Table 6-2 Number of CERs issued by Brazil, annual average CER prices and total value of CERs to Brazil by year (Issuance data from Institute for Global Environmental Strategies 2013; Price data from Intercontinental Exchange 2013)

<table>
<thead>
<tr>
<th>Year of Issuance</th>
<th>Issued CERs Total</th>
<th>CER DEC-12 (€)</th>
<th>Value of CERs (€)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>45 988</td>
<td>€18.83</td>
<td>€865 954</td>
</tr>
<tr>
<td>2006</td>
<td>3 582 155</td>
<td>€18.83</td>
<td>€67 451 979</td>
</tr>
<tr>
<td>2007</td>
<td>12 451 978</td>
<td>€18.83</td>
<td>€234 470 746</td>
</tr>
<tr>
<td>2008</td>
<td>12 293 106</td>
<td>€18.83</td>
<td>€231 479 186</td>
</tr>
<tr>
<td>2009</td>
<td>8 937 963</td>
<td>€12.09</td>
<td>€108 059 973</td>
</tr>
<tr>
<td>2010</td>
<td>8 781 962</td>
<td>€12.09</td>
<td>€106 173 921</td>
</tr>
<tr>
<td>2011</td>
<td>14 643 630</td>
<td>€9.84</td>
<td>€144 093 319</td>
</tr>
<tr>
<td>2012</td>
<td>17 565 656</td>
<td>€2.96</td>
<td>€51 994 342</td>
</tr>
</tbody>
</table>

Figure 6-14 Number of CERs issued by Brazil and value (Issuance data from Institute for Global Environmental Strategies 2013; Price data from Intercontinental Exchange 2013)

Figure 6-14 demonstrates the change in number of CERs issued by Brazil over time and the value of these CERs. The first peak from 2007 to 2008 is related to the issuance of CERs from the single N2O project located in São Paulo and the peak in 2012 is partially caused by a large issuance of over 4 million CERs to the Plantar project in Minas Gerais. The CER price was
highest from 2007 until 2008 and this is demonstrated by the figure, however from 2009 when the CER price began to fall, even the higher number of issued CERs was unable to continue the growth in the total value of CERs. The decline in prices from 2011 onwards was related to the EU debt crisis and oversupply in the Kyoto Protocol and EU-ETS post-2012 markets (Ecofys 2013).

Table 6-3 shows the total value of CERs as a percentage of Brazil’s GDP according to World Bank GDP figures (World Bank 2012a), which ends in 2011. Figure 6-15 shows the change in percentage of GDP compared to the total value of GDP from 2005 until 2011. This figure however does not show the impact of the fall in CER price from 2011 onwards due to the World Bank GDP figures ending in 2011.

Table 6-3 Value of CER issuance to the GDP of Brazil (GDP data from World Bank 2012b; Historical exchange rate data from OANDA 2013)

<table>
<thead>
<tr>
<th>Year of Issuance</th>
<th>Value of CERs (€)*</th>
<th>GDP (World Bank euro)</th>
<th>Proportion of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>€ 865 954</td>
<td>€ 709 541 960 559</td>
<td>0.000%</td>
</tr>
<tr>
<td>2006</td>
<td>€ 67 451 979</td>
<td>€ 867 648 922 059</td>
<td>0.008%</td>
</tr>
<tr>
<td>2007</td>
<td>€ 234 470 746</td>
<td>€ 997 986 550 223</td>
<td>0.023%</td>
</tr>
<tr>
<td>2008</td>
<td>€ 231 479 186</td>
<td>€ 1 129 204 956 375</td>
<td>0.020%</td>
</tr>
<tr>
<td>2009</td>
<td>€ 108 059 973</td>
<td>€ 1 165 974 624 004</td>
<td>0.009%</td>
</tr>
<tr>
<td>2010</td>
<td>€ 106 173 921</td>
<td>€ 1 617 134 462 477</td>
<td>0.007%</td>
</tr>
<tr>
<td>2011</td>
<td>€ 144 093 319</td>
<td>€ 1 780 217 594 086</td>
<td>0.008%</td>
</tr>
</tbody>
</table>
Interestingly, the contribution of the value of CERs to the GDP of Brazil is similar in scale to that of overseas development assistance (ODA) received by Brazil from 2006 to 2008 as a percentage of GDP. This is shown in Figure 6-16.

Figure 6-15 Comparison between the growth in value of CERs and the growth of the Brazilian GDP (GDP data from World Bank 2012b; Price data from Intercontinental Exchange 2013; Issuance data from Institute for Global Environmental Strategies 2013; Historical exchange rate data from OANDA 2013)

Figure 6-16 Comparison between value of CERs and ODA as percentage of GDP (GDP and ODA data from World Bank 2012b; Price data from Intercontinental Exchange 2013; Issuance data from Institute for Global Environmental Strategies 2013)
From 2005, the sale of CERs has contributed a small amount to the annual GDP of Brazil, peaking at 0.02% in 2007 and falling back to below 0.009% from 2009 onwards. The peak in the contribution to the GDP of Brazil was caused by the issuance of a large number of CERs from a single adipic acid project at a time when CER prices were at their peak, while falling CER prices since 2009 have contributed to the declining importance of the CDM to Brazil’s GDP. By way of comparison, Brazil has received significantly more in foreign ODA annually than from the sale of CERs for all years shown in Figure 6-16 except 2006 and 2007.

By project type, N₂O projects contributed more than 1.3 times more in GDP to Brazil than all other projects combined (see Figure 6-17). Excluding this project particular type, biomass energy contributed 34%, landfill gas 30% and hydro 24% of all GDP generated through the issuance of CERs.

As of 1 May 2011, no fugitive or reforestation project types had issued CERs (Institute for Global Environmental Strategies 2013).

By project type, large-scale CDM projects contributed to Brazil’s GDP much more than small-scale CDM projects. Large-scale projects contributed 6.6 times more to Brazil’s GDP than small-scale, related to their very nature as large-scale projects, and also due to their greater prevalence in Brazil’s CDM portfolio.

6.3.3 Increased Generation of Taxes

Using the comprehensive checklist assessment indicator for increased tax revenue, it can be seen that 62 (35%) of projects claimed this benefit with four projects quantifying this
contribution, however it is likely that more projects are generating increased tax revenue through payments received for the CDM and have just not specified it in documentation (see Appendix A A.6.1.3). Of the projects in the North and Central West, 57% and 52% of them were most likely to claim this contribution respectively, compared to 48% of those in the South, 30% in the Northeast and 2% in the Southeast. With an increase in GDP from the sale of CERs to 2012 as calculated in the above section, there is likely to be a tax revenue increase for the Brazilian national government, however this increase has not been quantified in any literature.

An increase in tax revenue was claimed by all CO₂ usage, PFCs and SF₆ projects, most hydro and wind projects, and some reforestation, landfill gas, fossil fuel switch and EE own generation project types (see Appendix A A.6.2.3). Similar proportions of both small and large-scale projects claimed increased generation of taxes as a benefit (see Appendix A A.6.3.3), however given that large-scale projects are by nature going to generate more CERs, it is likely that large-scale projects would contribute more to the increased generation of taxes.

6.4 Conclusion

This chapter has linked the results of the three different assessment methods to the sustainable development priority areas for Brazil outlined in Chapter Two, measuring the overall impact of the CDM to these development priority areas, and the impact based on project type and project scale. Overall, these findings indicate that the CDM has contributed to the areas of generating renewable energy, improvements in air quality, improvements in water quality and quantity and employment generation, and over half of the projects studied were using clean, rather than end-of-pipe, technology. Priority development areas in which the CDM was not contributing included regional inequality by project number and especially not through the sale of CERs, rural inequality, development of poorer regions of Brazil including municipalities of regular development status and technological innovation and transfer.

There is some indication that project type has an impact on the level and type of sustainable development benefits claimed, with fugitive, biomass energy, landfill gas, energy efficiency and fossil fuel switch consistently claiming higher levels of sustainable development benefits. The project types least likely to claim sustainable development benefits, particularly environment and social indicators, were the N₂O, PFCs and SF₆ projects types.

Project scale did not appear to affect the level of sustainable development benefits claimed by CDM projects, although small-scale projects were more likely to be located in areas of lower development status and in rural and remote regions of Brazil. There were few other differences between claims made to support the assumption that small-scale projects lead to greater development benefits under the CDM.
The key point that was apparent in this analysis is that very few projects included any quantification or plans for monitoring of sustainable development claims in their project documentation. Without adequate quantification and monitoring of projects, the integrity of the CDM is undermined, and this is discussed further in the following chapter. Chapter Eight will examine the place of the findings of this research with reference to the wider literature on the CDM and propose reasons as to why the CDM has not achieved the level of sustainable development that it was expected. It will also offer some suggestions for improvements to the CDM process.
7 The CDM in Brazil: limitations and opportunities for improvement

Introduction

The previous six chapters have outlined the history, complexities, policies towards and ultimately the various successes and failures of the CDM in contributing to the promotion of sustainable development in Brazil. This chapter will explain why the high expectations of the CDM as a win-win, dual mechanism for the world to tackle both climate change and the development needs of non-Annex I countries do not match the realities. This chapter will begin by recapping the expectations for the CDM stemming from the history of UNFCCC negotiations, as discussed in Chapter One. It will then assess these expectations against the realities of the CDM, focusing specifically on Brazil. Specifically it will assess concerns regarding the success of the CDM in contributing towards sustainable development within host countries; the implications of a lack of stakeholder engagement on delivering sustainable development; the highly concentrated nature of projects geographically, both internationally and within host countries; the low contribution of the CDM towards technology transfer and clean technology development; and address accusations levelled at the CDM for not achieving the goal of emission reductions. The differences between the expectations of the CDM and the realities experienced will be discussed for each of these themes. This discussion will draw on a number of explanatory factors, including the short-sighted nature of international climate negotiations; reliance on a tradable commodities market to deliver sustainable development outcomes; the emphasis on the sovereign rights of nations; and the various financial and other difficulties experienced with the CDM process. This chapter will also consider potential improvements that could be made to the CDM process in order to better facilitate sustainable development benefits for Brazil, and conclude with a discussion of the implications of the findings of this research for emissions trading.

7.1 High Expectations

The CDM developed out of the Brazilian suggestion that a financial penalty should be included in the Kyoto Protocol for Annex-I countries that failed to meet their binding emission reduction targets. The penalties were to contribute towards a Clean Development Fund, used to pay for development adaptation strategies for climate change in the developing world (Olsen 2005; Johnson 2001). The majority of Annex-I countries, and the US in particular, were against committing to pay penalties for exceeding their emission reduction targets (Olsen 2005). The
US however was supportive of the need for flexible mechanisms in order to reduce the financial burden of compliance for Annex-I countries, and as discussed in Chapter One, the CDM was included in the Kyoto Protocol at the ‘eleventh hour’ of the negotiations. The EU negotiating bloc at the UNFCCC was supportive of the CDM, despite initial concerns that the use of flexible mechanisms would be used in lieu of domestic emission reductions (Bodansky 2001; Werkman 1998). The EU hoped that the CDM would encourage investment in ‘emissions reductions in non-Annex I countries’, be an ‘incentive for capacity building’, and promote ‘development and transfer of environmentally sound technologies’ (Government of Austria 1998). Brazil has continued to express pride in its role in the development of the CDM as a mechanism to encourage the participation of developing countries in the climate change regime, despite concerns that this could lead to a lower urgency placed on domestic emission reductions in Annex-I countries (United Nations Industrial Development Organization 2003). In particular, Brazil has defended the cooperation between the Annex-I and non-Annex I countries in support of article 4.5 of the UNFCCC, which states that all parties to the UNFCCC should ‘take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention’ (United Nations Framework Convention on Climate Change 1992b; United Nations Industrial Development Organization 2003).

The role of the CDM, as negotiated at COP3, was multi-faceted, hence its description as a ‘win-win’ for the negotiating parties. The two official dual roles for the CDM were to a) assist non-Annex I countries to achieve sustainable development and b) assist Annex I countries to achieve their emission reduction commitments (Kyoto Protocol to the United Nations Framework Convention on Climate Change 1997). In other words, the mechanism was charged with both delivering sustainable development to non-Annex I countries and enabling Annex I countries to meet their emission reduction targets where financially cheaper to do so.

Non-Annex I countries in particular saw the mechanism as an opportunity for benefiting from technology transfer through the use and demonstration of clean technology within CDM projects; an opportunity to enable sustainable development benefits from projects; and as a way for Annex-I countries to be held financially accountable for their historical responsibilities for the levels of greenhouse gases in the atmosphere. The Annex I countries stood to gain from the reduced cost of compliance with emission reduction targets and through the continued participation of developing countries in the climate change negotiations, potentially keeping open the option for future binding emission reduction targets for the more developed of the non-Annex I countries. The CDM was a popular alternative for Annex I countries to the Brazilian suggestion for financial penalties for non-compliance. Both groups of countries stood to benefit
through climate change mitigation resulting in the investment in low greenhouse gas development trajectories for developing countries.

It has been argued that these multi-faceted expectations for the CDM have been at the root of the problems for it in succeeding in achieving either one of the two stated objectives, reducing greenhouse gas emissions and in enabling sustainable development amongst non-Annex I countries. Some involved in the CDM in Brazil claim that it is simply not possible for a project-level greenhouse gas reducing mechanism to also contribute to genuine sustainable development benefits (CDM Project Developer 2, 2011, pers. comm., 25 March).

The following sections will discuss the differences between these stated expectations and the realities experienced through an analysis of the CDM in Brazil and internationally. Possible explanations for these differences, based on the findings of this research, will also be developed and presented.

7.2 CDM Realities and Explanations

7.2.1 Less than Expected Sustainable Development Benefits

While envisaged as a win-win solution for both the Annex I and non-Annex I countries, the reality is that the CDM has received a large degree of criticism for the less than expected contribution to sustainable development, when assessed using a range of sustainable development assessments. The majority of the literature supports the argument that, according to widely used methods of sustainable development assessment, the CDM is not contributing to the degree, and in the way, originally envisaged (Shiva 2008; Burian 2006; Americano 2008; MacDonald 2010; Cosbey et al. 2005; Guijarro, Lumbreras & Habert 2008; Andrade, Nascimento & Puppim de Oliveria 2010; Guijarro et al. 2009; Sutter & Parreiro 2007; Murphy, Cosbey & Drexhage 2008; Boyd et al. 2009; Andrade et al. 2009; Olsen 2005; United Nations Development Programme 2006; United Nations Development Programme 2007; Figueres 2004; Huang & Barker 2009; Liverman & Boyd 2008; Ruthner et al. 2011). This research confirms and extends this analysis, finding that the CDM is not contributing to sustainable development in Brazil as originally envisaged. Brazil does have more stringent regulations regarding CDM projects in Brazil compared to other countries and Brazilian CDM projects do tend to have better stated claims to sustainable development in their PDD and registration paperwork. Whether or not these claims are implemented according to the PDD and Annex III documentation is not confirmed and should be a topic for further research, however at least the requirements for some level of stakeholder engagement, the translation of documents in Brazilian Portuguese, and the requirements to fill out the Annex III documentation, can be seen as at least some improvement on requirements for LoA issuance in for other host countries.
As demonstrated through the use of multiple sustainable development assessment approaches in this research, the choice of assessment approach, indicators and weighting of each indicator can dramatically alter the findings of the assessment. The Brazilian DNA method showed the greatest sustainable development contributions, the comprehensive analysis method showed contributions across some areas, due possibly to the large number of possible indicators included, while the MCA approach found that the sustainable development benefits of projects in general were very low. This demonstrates that it may be beneficial to use a range of assessment methods for analysis of the overall contribution to sustainable development in this type of research, however this is not a feasible approach for assessment within the CDM framework itself to the complexity and time involved. Each assessment method used in this research has developed in response to a different definition of sustainable development, depending on whether this definition encompasses the opinion of the Brazilian DNA, is in response to the development priorities of Brazil, or incorporates the views of academics who champion a more universal definition and therefore assessment method. Each assessment method will give differing results based on the selection of, and rating against, the indicators of the specific assessment method. None of these methods is necessarily more accurate; they are instead reflective of differing viewpoints on sustainable development so accuracy remains subjective. Through using a combination of the results of each of the assessment methods that have been presented in Chapter Six, it can be seen that some CDM projects have claimed a contribution to improvements in air quality in urban areas, improvements in land degradation and deforestation, improved water quality, generated electricity, promoted education and training and generated employment. Yet CDM projects were less likely to contribute to reducing rural inequality, regional inequality and promoting technology transfer and less than half of projects were using clean technology. The approval of projects by the DNA did not appear to be dependent on these claimed contributions, with over 7% of projects scoring one or less out of a possible score of nine using both the MCA method, and one project claiming no benefits against the DNA as assessment method, yet all were still approved for an LoA. While the Brazilian DNA specifies that projects do not have to contribute to all five areas outlined in the Annex III documentation (Brazilian Government Official 4, 2011, pers. comm., 16 March), a score of less than one indicates that, according to an MCA approach, favoured by many in the literature (Nussbaumer 2009; Sutter 2003; Sutter & Parrerio 2007; Alexeew et al. 2010; SouthSouthNorth (no date)), any contributions the projects are making to sustainable development are at best, very minor. As stated by one interviewee, ‘you couldn’t imagine the Brazilian DNA denying a project because they feel that there is something wrong with the sustainability aspects [of it]’ (CDM Project Developer 3, 2011, pers. comm., 29 March).
The CDM and the wider UNFCCC framework of which it is a part, are the result of compromises made in international negotiations on climate change, and given the nature of the climate change problem as a classic example of a ‘tragedy of the commons’ (see Chapter one, section 1.3), the compromises resulting from international negotiations in this field have made the CDM predictably weak. The designs of both the UNFCCC and CDM have weakened the ability of the mechanism to act in the way in which it was originally envisaged in its contribution towards technology transfer and sustainable development. First, demand, and subsequently the price, for CERs has been limited by the low emission reduction targets negotiated through the process for the Annex I countries. It is widely recognised that the emission reduction targets negotiated through the Kyoto Protocol are not low enough to prevent a rise in global temperatures considered to be acceptable to the parties to the Protocol (International Energy Agency 2013). However, due to the inherent nature of international agreements being reduced to the lowest common denominator, stronger emission reduction targets were not feasible and there is no effective mechanism for enforcement of these ‘binding’ targets. Participation in the process is voluntary and effective mechanisms to ensure compliance or participation do not exist, as demonstrated by the withdrawal of Canada from the Kyoto Protocol (Environment Canada 2011) and New Zealand’s refusal to sign up to the Second Commitment Period of the Kyoto Protocol (Ministry for the Environment 2013).

Secondly, similar to the voluntary nature of participation in the UNFCCC and Kyoto Protocol processes, participation in the CDM is voluntary and it would be politically unpopular amongst members to implement a mechanism for enforcement of the non-market objectives of the CDM, namely sustainable development. Alongside the argument that the CERs generated from CDM projects are a tradable commodity, rather than a form of aid, the UNFCCC and Kyoto Protocol participants, above all else, respect the sovereignty of participants and therefore there is no push for a mechanism for enforcement of the sustainable development requirements of the CDM on host countries. All evaluation, assessment and monitoring of the sustainable development benefits of the CDM are set by the host country itself, with no mechanism in the CDM rules to question this after registration. This is reflected in the lack of specific Dutch and UK policies favouring particular project types, however the EU is set to change that with the introduction of bans on certain project types deemed to be not additional, nor contributing to technology transfer (Official Journal of the European Union 2011).

The very nature of the CDM as a compliance or flexible mechanism, without monetisation of sustainable development benefits, sets the theme for how the ‘mandatory’ contribution to sustainable development of projects is viewed. The only financial reward in the CDM is for the generation and sale of CERs, not for the generation of sustainable development benefits. There is no demand side push for CERs that are generated from projects with high sustainable
and this lack of demand for ‘higher-quality’ CERs has obstructed the production of such CERs by project developers. Accreditation schemes such as the Gold Standard add time, complexity and expense to the development of projects and according to a lot of stakeholders in the process, the additional time, complexity and expenses are not justified due to a lack of economic incentives in the form of willingness to pay for such credits by the market (CDM Project Developer 2, 2011, pers. comm., 25 March; CDM Project Developer 3, 2011, pers. comm., 29 March; CDM Project Developer 4, 2011, pers. comm., 18 February). The small market for ‘high quality’ credits through these types of accreditation schemes is driven mostly by governments looking to voluntarily offset their operational emissions, rather than compliance under the Kyoto Protocol (UK Government Representative, 2011, pers. comm., 11 January; CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January). Of the projects studied for this research, just one was Gold Standard accredited and only four CDM projects have such accreditation in Brazil in total.

It is clear that the CDM is a financial mechanism, and the CERs generated from CDM projects are a tradable commodity above all else (UK Government Representative, 2011, pers. comm., 11 January). No interviewee viewed the CDM as a form of aid or a development tool. It is viewed purely as a compliance mechanism, a way to reduce the costs of compliance with binding emission reduction targets, with no inbuilt incentive to encourage any greater contribution to sustainable development than what is legally required as a minimum by either the UNFCCC or the host country.

The CERs generated through the CDM are a tradable commodity and are therefore subject to the nature of the marketplace. The nature of the marketplace is to maximise profit by minimising costs and the commoditised nature of the CDM has ensured that the mechanism has targeted and rewarded those project types that maximise the number of CERs for the lowest possible cost. In terms of CERs generated through the projects studied in Brazil, one single adipic acid project dominates, generating 27.7% of all CERs expected to 2012 for Brazil. This is despite research suggesting that these types of projects are neither additional nor contribute in any significant way to sustainable development or technology transfer. This is supported by parties such as the EU, who have outlawed the use of CERs generated from industrial gas projects in Phase II of the EU ETS (Europa 2011; Official Journal of the European Union 2011). The market drive for maximum CER profits has led to investment in lowest hanging fruit projects, those that are quick and easy to implement, yet have been shown to have questionable additionality and varying levels of sustainable development benefits. This claim in the literature
is supported by the research undertaken for this thesis. The high-risk nature of CDM investment, coupled with the nature of the market, has incentivised investment in projects with both high and quick returns and these projects are generally not the ones that have inspired technological innovation or transfer, or are located in less developed regions of the world. This argument is supported by this research, where projects are far less likely to be located in regions where development is needed the most such as the more rural and remote regions of Brazil or the poorer regions of the North and Northeast. Nor are projects likely to lead to the use of innovative or even exogenous technology. Exogenous technology, for example, was used in less than one-third of projects, and given the dominance of both project numbers and CERs generated from projects in the South and Southeast, it would be difficult to argue that the remaining two-thirds of projects were contributing to technology transfer within Brazil, from the South and Southeast to the North and Northeast for instance.

There are implications of the elimination of these lowest hanging fruit opportunities for host nations themselves. At some stage in the future, and for Brazil this has already occurred through a voluntary motion, host countries themselves are likely to adopt binding emission reduction targets and without the opportunities to gain these reductions through investment in lowest hanging fruit projects, host countries are likely to find it more difficult and expensive than the current Annex I countries to meet their emission reduction targets. Selling off all the cheap and easy opportunities for emission reductions through the CDM leaves only those sectors of the economy where emission reduction is more difficult, costly or requires greater investment in innovation and technology. Through using all the lowest hanging fruit opportunities for emission reductions first, Annex I countries will effectively be able to reduce their emissions for less cost. This of course only applies to the proportion of emission reductions that are permitted to be taken using international offsetting, and not the proportion of emission reductions that must be taken domestically, but it is a substantial advantage for them.

Given the market nature of the CDM, investment flow has unsurprisingly followed that of FDI. Whilst the credit buying countries do not directly target investment towards these particular regions, they do create a demand for a product that is most easily satisfied through CERs generated by projects from these same regions. FDI and CDM investment both tend to follow the rule of ‘success attracts success’, and follow well-worn paths towards host regions that are easier to invest in, such as those with adequate infrastructure, stable governance, low-risk and good opportunities to maximise profits through investment in projects that will generate a high number of CERs in the shortest possible time. This has occurred on both an international level and domestically within Brazil. Within Brazil, this research demonstrates that investment within Brazil is focused on the Southeast and South, regions where infrastructure is well developed and opportunities for easy investment in CER generating projects are more common than in the less
developed North and Northeast. Arguments that claim that this dominance has been caused by the previous calculations on Brazil’s regional emissions factors fail to explain the lack of investment in the North and Northeast regions since the emission factors were nationalised in 2008 (Michaelowa 2011). As shown in Figure A.2-9 in Appendix A, the number of projects registered in the North and Northeast did not noticeably increase following the 2008 change in emissions factor calculations, with most CDM investment there occurring around 2005.

As has been demonstrated by this research and by numerous other pieces of research, relying solely on the market for the promotion of emission reductions and of development is an inherently flawed concept. The market in the CDM has continued to do what it does best. It has found the cheapest, quickest and easiest abatement options, and enabled the production of the cheapest offsetting options possible for the Annex I countries. Without adequate regulation from the UNFCCC or the supply or demand sides (options for which are discussed in section 7.3), the CDM market will continue to operate as a market. It will not promote development in the countries or regions where it is needed most, and it will not promote the development projects that have high sustainable development benefits for communities, unless these types of projects are cheap to implement and are likely to generate large numbers of CERs quickly. As has been demonstrated by this research, sustainable development requirements in Brazil as a result of the CDM are greater than for other host countries and this is the result of stricter legislation and regulation by the Brazilian DNA on the validation process. This is not to say that the CDM has been a great success story for sustainable development in Brazil and that improvements are not necessary, only that the greater regulation of the CDM in the country by the Brazilian DNA has directly contributed to a higher level of sustainable development claimed, and possibly achieved through the implementation of projects. Initial expectations that the CDM market would be the ‘silver bullet’ for achieving cheap abatement options, technology transfer and sustainable development have not been met. It is not the misbehaviour of the market that has caused this to occur, it is more the case that the unregulated market is not the right mechanism to achieve these goals.

One of the most cited essential weaknesses of the CDM in contributing to sustainable development is the sovereignty awarded to host countries over the definition and assessment of sustainable development. For the period of time studied, apart from large-scale hydro where there were additional requirements for assessment (Europa 2009c), neither the UK nor the Netherlands insisted upon any additional sustainable development checks to those conducted by the host country. There was no policy or program put in place to encourage the purchase of projects from particular project types. This is despite the actions of the UK government to only purchase Gold Standard equivalent carbon credits for government offsetting, which infers a rating of these projects as being of a higher quality, and by the Netherlands who originally paid
more for CERs generated from ‘high sustainable development’ projects under the AIJ, that particular project types are more likely to lead to sustainable development.

A behavioural norm of international relations is reflected in the agreement under the CDM to respect the sovereign rights of the host country to determine their own definition and assessment of sustainable development. While this decision is criticised in much of the literature (Sutter & Parrerio 2007; Olsen & Fenhann 2008; Burian 2006) and blamed in part for the low contributions to sustainable development of the CDM, the debate over host country sovereignty is more complex. While the complexities of the decision towards host country sovereignty over the definition and assessment of sustainable development may blur the answer to this dilemma, the lack of monitoring of sustainable development objectives for individual projects is difficult to dispute. While many CDM participants may argue that sustainable development can not and therefore should not be monitored on a project by project basis (CDM Project Developer 2, 2011, pers. comm., 25 February), it is difficult to persuasively argue that claims made in the Annex III documentation in the case of Brazil, or those claims made in the PDD for other host countries, should not be checked for implementation in the years following the registration of projects. Without some form of monitoring of claims, it is not possible to evaluate the success of CDM projects at either a national, regional or individual project level, nor is it possible to assess the quality of CERs purchased by buyers. Some aspects of sustainable development may not be apparent at a project level, such as long-term benefits resulting from investment in staff training or education, however monitoring of the implementation of promised programs in these areas can and should still be undertaken at a project level during verification.

Without any monitoring or continuing assessment of CDM projects, claims made at the validation stage are considered to be implemented without any changes, however this is not always the case (see for example (Martinez & Bowen 2012)). Projects accepted as leading to sustainable development by the host country, may in fact change their contribution over time for financial, logistic or other reasons, and may upon implementation end up resembling a project that would not have been accepted as leading to sustainable development by the host country. While it is agreed unanimously amongst those interviewed for this research and in the literature that compulsory monitoring of CDM projects is financially unviable given the high costs, risks and time delays already inherent in the CDM process (UK Government Representative, 2011, pers. comm., 11 January; CDM Project Developer 4, 2011, pers. comm., 18 February; CDM Project Developer 2, 2011, pers. comm., 25 February; CDM Researcher 3, 2011, pers. comm., 27 March; CDM Project Developer 1, 2011, pers. comm., 29 March; Brazilian Government Official 4, 2011, pers. comm., 16 February), it is difficult to claim that some form of monitoring is not essential to ensure the integrity of sustainable development claims made at validation. Potential improvements to the high costs, risks and time delays of the CDM in its current form
are addressed in Section 7.3, and these improvements to the CER generation component of the CDM may allow for more time, money and attention to be paid to the sustainable development generation aspects of projects. The only monitoring of the integrity of projects currently relates to the number of CERs generated, which is the only component of the CDM that is monetised. The integrity of the sustainable development component of the CDM contribution is not ensured in most countries at the point of validation, although Brazil has higher standards in this field than most, and no host country ensures this at any point past validation. The host country reserves the right to withdraw approval and the LoA for any CDM project at any point during the life of the project (Brazilian Government Official 4, 2011, pers. comm., 16 March), however this right has never been acted upon in Brazil, not even for projects where there has been a large number of stakeholder complaints and wider concerns about environmental integrity and additionality (see for example the Plantar project – Section 7.1.1.4).

Potential monitoring techniques do not have to be overly time consuming or financially expensive in order to provide a verification that sustainable development benefits outlined in the initial project documentation have been implemented. Monitoring and evaluation techniques such as focus group meetings, group discussions and the use of the participatory most significant change monitoring methodology (a program evaluation that searches for the project impact using stakeholder experiences rather than focusing on scoring against predetermined indicators), can also present the additional benefit of highlighting unexpected outcomes, whether they be positive or negative, and allow for participants to consider the contribution of the project based on overall merit (see for example (Davies & Dart 2005)), rather than being limited to a small number of pre-set indicators that may skew results, as seen in the application of three different assessment methodologies in this research. This method may be more subjective than current CDM assessment methods and may not be suitable for comparison with other projects, but it is less restrictive and serves the purpose of a thorough assessment at a project level.

The UNFCCC has also been blamed by some for their lack of enforcement of claims made in the PDD and other registration documentation, and also for their lack of response to complaints regarding particular CDM projects. Some stakeholders in the CDM process have suggested that complaints or concerns lodged at a sub-national level are not heard or responded to by the UNFCCC and this lack of communication makes it difficult to claim that the CDM is really of benefit to host communities as opposed to nations as a whole (Carbon Market Watch 2012b; CDM Watch 2011; Carbon Market Watch 2011b; CDM Watch 2010; Carbon Trade Watch 2013; Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 28 February). The lack of adequate stakeholder engagement and the difficulties in directly
communicating with the UNFCCC call into question the success of the CDM in its claims to contribute towards sustainable development.

The overarching nature of the CDM process itself has limited the ability of the CDM to adequately contribute towards sustainable development. The CDM is already viewed as a high-cost and high-risk investment by project developers, investors and buyers, and this reduces the ability or desire of developers to improve the sustainable development outcomes of their projects through monitoring or additional funding. Through quantifying sustainable development outcomes and through including a monitoring plan for these in the PDD, this means that the regular verification process will be more time consuming, costly and potentially more risky for the project developer, potentially reducing profits that could be made through investment in a CDM project (UK Government Representative, 2011, pers. comm., 11 January; CDM Project Developer 2, 2011, pers. comm., 25 February; CDM Project Developer 1, 2011, pers. comm., 29 March; Brazilian Government Official 1, 2 and 3, 2011, pers. comm., 16 March; Brazilian Government Official 4, 2011, pers. comm., 16 March). The successful registration of a CDM project is already considered to be a highly complex undertaking and the Brazilian Government, amongst other stakeholders in the Brazilian CDM market, does not wish to see the process become any more complex through compulsory sustainable development assessment or monitoring (Brazilian Government Official 4, 2011, pers. comm., 16 March). Small-scale projects in particular are limited in their ability to validate or verify their contributions to sustainable development above the contribution that is legally required. This is due to the already high costs for project development, registration and verification when compared to the smaller potential for financial return from the sale of CERs compared to large-scale projects (CDM Project Developer 3, 2011, pers. comm., 29 March; CDM Project Developer 4, 2011, pers. comm., 18 February). The lack of monetisation of sustainable development benefits of projects does nothing towards incentivising greater emphasis from project developers and investors in this field.

In another way, the set up of the CDM indirectly favours Annex I countries through the use of approved DOEs. Validation and verification in the CDM can only be undertaken by approved UNFCCC DOEs. The vast majority of these DOEs are located in or have their headquarters in the countries of the developed world, and thus the fees accrued through the validation or verification processes does not necessarily benefit the host country. Again, the Brazilian Government has an additional requirement for DOEs above that of the UNFCCC, and for DOEs to assess a Brazilian CDM project, they must at least have a presence in Brazil in the form of an office (Designated Operational Entity Regional Manager, 2011, pers. comm., 23 February). This at least means that some of the fees accrued through this process are likely to stay in Brazil, however for other host countries, this additional requirement is not made. For all 178 Brazilian
CDM projects that were the subject of this research, DOEs for both validation and verification all had headquarters in Europe.

As stated, the additional requirements of the Brazilian DNA regarding CDM projects, namely the requirement for the completion of the Annex III documentation, the requirements surrounding the translation of project documents, the greater emphasis on assessment of additionality and methodology by the Brazilian DNA at the LoA stage, the requirement to see the draft validation assessment prior to project approval, the need for DOEs to have an in-country presence and to a small extent, the additional stakeholder consultation requirements, all lead to a perception that Brazilian CDM projects contribute to a larger degree to sustainable development when compared to projects in other host countries, namely China and India (CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January; CDM Project Developer 4, 2011, pers. comm., 18 February). These same requirements also contribute to the perception that Brazil is a safer and less-risky investment option for CDM when compared with other host countries (Designated Operational Entity Regional Manager, 2011, pers. comm., 23 February; CDM Project Developer 3, 2011, pers. comm., 29 March; CDM Project Developer 4, 2011, pers. comm., 18 February; Brazilian Government Official 4, 2011, pers. comm., 16 March).

7.1.1.1 Related to the Nature of Sustainable Development as a Concept
The perceived inability of the CDM to generate sustainable development within host countries can be related back to the lack of a consensus on the very definition of sustainable development (CDM Voluntary Accreditation Developer, 2011, pers. comm., 17 March). In order to measure the progress of the CDM towards achieving it, surely a definition is needed. As discussed in Chapter Two, no such definition is unanimously accepted internationally, nor is there a definition unanimously accepted within Brazil. In Brazil, there are very different definitions and opinions on what exactly sustainable development is and what constitutes an acceptable level of sustainable development benefits to be achieved through the CDM. These definitions range from those of the Brazilian DNA, where their objective for the CDM in Brazil is to achieve greenhouse gas emission reductions and the generation of clean, renewable energy (Brazilian Government Official 1, 2 and 3, 2011, 16 March; Brazilian Government Official 4, 2011, pers. comm., 16 March), to those who think that more stringent additionality requirements, high levels of stakeholder engagement and do-no-harm levels of achievement should be adopted at a minimum (CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January; Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 28 February).

Despite these disagreements over the definition of sustainable development, most will accept that it is a long-term and wide ranging goal, and this is why some CDM participants argue that any attempts to measure or monitor it on a project-by-project basis are inherently flawed. Not
only are the criteria surrounding the measurement of it subjective (Brazilian Government Official 1, 2 and 3, 2011, 16 March) and likely to further complicate and increase the time and expense of projects (CDM Project Developer 4, 2011, pers. comm., 25 February; Brazilian Government Official 4, 2011, pers. comm., 16 March; CDM Project Developer, 2011, pers. comm., 29 March), but also some of the benefits such as contributions towards education and training, can not be measured on a project-by-project basis. Measurement on a project-by-project basis, where the assessment of benefits is restricted by the focus on the annual performance of the project itself, and will likely ignore any wider benefits beyond the geographical and time scope of the project assessment. Sustainable development assessment can only be achieved by taking in the whole regional picture through longitudinal studies and this is beyond the scope of what can be achieved through assessments made in validation and verification evaluations (CDM Project Developer 2, 2011, pers. comm., 25 February).

Other participants however argue that there needs to be a better balance between the technical and sustainable development aspects of the CDM and this can be achieved through more standardised procedures and provision of information to project developers by the host countries to enable a better assessment of the sustainable development benefits to be made through the LoA process (CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January). These participants argue that the awarding of the LoA should be based on the sustainable development benefits rather than the opportunity for FDI in the country (CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January). As already stated, there are ways and means to better assess and monitor sustainable development, and to not monitor this, exposes the CDM to a major point of weakness.

Another component to this argument relates to the complexities in the argument as to who is best placed to define and assess sustainable development in the context of the CDM. This component is discussed in more detail in Section 7.2.2 below.

7.1.1.2 Specifically Related to CDM in Brazil

Some CDM participants in Brazil argue that the CDM is less likely to contribute to sustainable development within the country, compared to other less developed host countries, because the mechanism is less likely to greatly benefit the governmental institutions with experience and knowledge in the fields of social and environmental protection. It has been argued that the Brazilian social labour laws and environmental protection legislation are already well developed and applied, and therefore the use of the CDM to transfer knowledge and skills regarding these aspects, regarded by some as a major potential benefit, is not going to be of benefit for Brazil (CDM Project Developer 4, 2011, pers. comm., 18 February; Brazilian Government Official 4, 2011, pers. comm., 16 March). Whether or not Brazil’s environmental protection legislation and
social labour laws are well enforced or could be improved are issues for further research and
debate (Herbertson 2012; European Commission 2007; Brazilian Non-Governmental
Organisation Representative, 2011, pers. comm., 28 February; Designated Operational Entity
Regional Manager, 2011, pers. comm., 23 February), however relative to the legislation and
enforcement in the least developed countries, Brazil is less likely to experience a great
improvement in these areas compared with that experienced by the least developed countries.

7.2.2 Weak Stakeholder Engagement and its Implications

The ineffectual nature of stakeholder engagement for CDM projects hosted by Brazil and by
other non-Annex I countries has been a strong point of criticism in the literature (CDM Watch
2010a; Schneider 2007; Boyd et al. 2009; Burian 2006; Ruthner et al. 2011). While the
Brazilian stakeholder engagement requirements are more stringent than those for other host
countries, stakeholder engagement is mostly limited to consultation after the design of the
project is finalised, as part of the validation process. Criticism has also been made that some
Brazilian project developers only contact those stakeholders from whom they could expect a
positive response and not all stakeholders affected by the project (CDM Project Developer 2,
2011, pers. comm., 25 February; Brazilian Non-Governmental Organisation Representative, 28
February). The CDM stakeholder participation and engagement process in Brazil is at the level
of informing or at best, consulting on the IAP2 Public Participation Spectrum (International
Association for Public Participation 2013). The lack of meaningful stakeholder engagement
during the design process of projects limits local community ownership of projects, limits the
ability to define, measure or achieve local level sustainable development co-benefits, and even
limits the ability of stakeholders to support or oppose proposed CDM projects. While
empowerment, the ‘ability to negotiate and influence outcomes in a particular environment’
(Rennie & Singh 1995), is seen as the holy grail of development (Titi & Singh 1995), it is
recognised that this is not always achievable through CDM projects due to their nature, however
to improve the sustainable development benefits resulting from the implementation of these
projects, stakeholder participation can and should be improved, through inclusion as a
UNFCCC requirement for registration or through more stringent processes determined by the
host DNA.

Another reason to promote greater levels of stakeholder participation and engagement in the
CDM process relates to the ability to measure and monitor sustainable development. The ability
to meaningfully evaluate sustainable development benefits is determined by the definition of
sustainable development and, if local community members are not consulted on their definition
or preferences for sustainable development benefits of CDM projects, it is unlikely that projects
will be deemed successful in this regard by their host communities.
7.1.1.3 Difficulties with Stakeholder Engagement

As discussed in Chapter Four, the requirement for some stakeholder consultation is part of the CDM process, however the consultation requirements are at best very weak and do not, as a whole, lead to meaningful stakeholder participation in either the design of CDM projects or their implementation. Project developers are obliged to consult with relevant stakeholders prior to the publication of the PDD on the UNFCCC website, however in practice, this process is more of an informing mechanism rather than a meaningful dialogue with stakeholders on the development of the project. This process can also be skewed by the project developer in order to gather favourable comments in support of the project, and on an international scale, Schneider (2007, pp. 51-2), states that one-quarter of projects only invite comment from selected stakeholders rather than making public announcements, and only 40% of PDDs documented how stakeholder consultation was undertaken. Project developers are obliged to document how they have integrated any comments or concerns by stakeholders into the design of the project, however they are not obliged to publish actual comments made in part or in full (Schneider 2007; Guijarro, Lumberras & Habert 2008). As noted by Boyd (2009, p. 826), there are concerns that project developers are stacking the consultation process through inviting comments only from those most likely to support their project. Brazilian CDM stakeholders have also raised this concern, stating that stakeholder engagement in the CDM is neither complete nor transparent (Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 29 February; CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January).

While the Brazilian stakeholder engagement process is more thorough than for other countries, due to the additional requirements made by the Brazilian DNA, in practice it still operates as more of an informing, rather than consultation function. As documented in Chapter Four, the Brazilian DNA’s additional requirements extend to the translation of PDD documents into Brazilian Portuguese and also requesting consultation from a range of federal and state government offices, the Brazilian Forum of NGOs and Social Movements for the Environment and Development (FBOMS) as well as any community groups who are affected by the project activity (the latter is only the case where projects do not exceed the boundaries of one Brazilian state) (Interministerial Commission on Global Climate Change 2008). In practice however, the limited ability of the community and NGO stakeholders to meaningfully respond to a request for comments within a 30-day period, diminishes the effectiveness of the consultation that takes place and it becomes more of an informing process. FBOMS for instance, is a group representing 500 members and they have already raised concerns that they have not been informed as to how any comments raised by them through the CDM consultation process will be used by the Brazilian DNA, nor do they have the capacity to meaningfully respond to project proposals, so therefore they will not participate in the written consultation process (Brazilian...
As demonstrated in this research, 100 of the 178 projects received no responses through the stakeholder consultation process, only 78 projects received one or more response and the mean number of responses was just 1.1 per project. Just 37% (66) of projects undertook stakeholder consultation that was more than what was required by the Brazilian DNA, with the majority of these holding meetings and or taking out newspaper advertisements to inform stakeholders about the planned project. Only two projects undertook stakeholder consultation during the design phase of the project, indicating that most stakeholder consultation is for the purposes of providing information to the stakeholders rather than integrating their thoughts and ideas into the actual design of the project. According to the comprehensive analysis, projects located in the North and Northeast were more likely to just undertake the consultation required by the Brazilian DNA, while projects located across multiple regions (mainly the manure projects) and those located in the Central West were more likely to undertake additional stakeholder consultation. Projects in the Northeast were more likely to receive comments through the Brazilian DNA stakeholder process (mean of 1.7 comments per project) while those located across multiple regions were least likely to receive comments (0.9 comments per project).

Stakeholder opinions on what sort of project co-benefits could be considered as contributions to sustainable development are usually not solicited. Stakeholder engagement with, and sense of community ownership over, projects is not encouraged through this process, and the process represents one of informing stakeholders, or at best consulting with them, rather than any other more meaningful participation (International Association for Public Participation 2013). Stakeholders are generally viewed as being inactive participants in the CDM process, people from whom project developers hope to avoid receiving objections to the project, rather than...
being actively involved in the development and implementation or projects or the setting of sustainable development co-benefits standards or targets.

Project developers and other CDM participants argue that the current additional requirements for stakeholder consultation in Brazil are pointless, with no additional benefits due to the lack of comments received from the stakeholders contacted (CDM Project Developer 2, 2011, pers. comm., 25 February; CDM Project Developer 4, 2011, pers. comm., 18 February; Brazilian Government Official 4, 2011, pers. comm., 16 March; CDM Voluntary Accreditation Developer, 2011, pers. comm., 17 March). As shown in this research, most projects do not receive any comments from stakeholders in the process, and when a comment is received, it is often a generic statement of support or a statement claiming that adequate capacity is not available to provide a substantial comment on the project (CDM Project Developer 4, 2011, pers. comm., 18 February). Most participants argue that it is important to engage with stakeholders in order to minimise project risk (Designated Operational Entity Regional Manager, 2011, pers. comm., 23 February; CDM Project Developer 3, 2011, pers. comm., 29 March), however the Brazilian DNA stakeholder consultation processes are viewed as not benefiting projects and only contributing to the complexity and time-consuming nature of project registration (CDM Project Developer 4, 2011, pers. comm., 18 February; CDM Project Developer 2, 2011, pers. comm., 25 February). The Brazilian DNA has recognised this weakness and has been looking at changing to an online consultation process, however due to changes in governments over the past few years, these plans have not come to fruition (Brazilian Government Official 4, 2011, pers. comm., 16 March).

Project developers and other CDM participants argue that it is difficult to undertake adequate levels of stakeholder consultation outside of that required by the Brazilian DNA for a number of reasons. These include the additional time delays and costs of seeking additional consultation through community meetings and interviews (Brazilian Government Official 4, 2011, pers. comm., 16 March). Brazil is a large country with many remote regions and transportation is often problematic for those seeking to travel to these regions (CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January). This can raise both the cost of consultation and also the time taken to complete it (CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January), however as most projects in the portfolio are located in the Southeastern and Southern regions of Brazil that have more developed transportation infrastructure, this argument is not as strong for projects located in these regions. Another problem that can affect the stakeholder consultation process is the lack of access to technology such as the Internet or the lack of knowledge on how comments regarding CDM projects can be lodged. For comments to be included in the validation process, they must be lodged within a 30-day period, after which the UNFCCC itself is powerless to block registration based on the concerns of stakeholders.
Communities where Internet access is sparse or where knowledge of these formal processes is not widespread, opportunities to comment on the implementation of CDM projects are very limited. Brazilian DNA movements towards an online consultation system may in fact alienate those without access to this process even further, even if it does reduce the costs of the stakeholder consultation process for project developers.

The quality of stakeholder consultation through the DOE validation process varies, with some DOEs calling local communities prior to providing validation to ask whether or not they have been involved in the process, however there is a ‘very significant difference between procedures between DOEs’ (Designated Operational Entity Regional Manager, 2011, pers. comm., 23 February) and not all undertake this process with as much rigour.

7.1.1.4 Fundamental Differences in Definitions

The definition and assessment of sustainable development in the CDM is more complex than that which is often recognised. Through attempting to define, assess or promote the use of a standardised assessment tool for sustainable development through the CDM, this limits the right of the host country and/or host community itself to define and assess sustainable development contributions for themselves. Discussion of the imposition of developed world sustainable development definitions on the developing world is widespread (Guimarães 1991) and most attempts in the literature to improve the contribution of the CDM to sustainable development have focused on the development of tools, standardised enough to allow for meaningful comparison, but flexible enough to account for the individual and unique characteristics of host countries or communities. However standardisation of this process risks being accused of imposing foreign values, and in some cases the values of the developed countries, on CDM host countries. The development objectives of the Brazilian Government for the CDM are demonstrated in the focus on the Brazilian DNA on the production of emission reductions and the generation of renewable energy through the CDM (Brazilian Government Official 4, 2011, pers. comm., 16 March; Brazilian Government Official 1, 2 and 3, 2011, pers. comm., 16 March). This clear, albeit simple, definition of success for sustainable development under the CDM, is one which is made by a sovereign nation, who as some participants in the process point out, is in the best placed position in which to evaluate sustainable development contributions to their country (CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January). The use of the Annex III document to further evaluate the contribution of projects to the sustainable development of the country appears to be used to stimulate project developers into articulating the sustainable development co-benefits of their projects, yet as communicated by the DNA, not all projects have to contribute to all areas specified in the Annex III document, and as demonstrated by this research, there is a significant proportion of projects which fail to contribute meaningfully to any of these areas.
So the question remains, who has the right to determine how sustainable development should be evaluated in the context of the CDM? Surely the majority of this right should rest within the host country itself? The imposition of values regarding sustainable development from the international community, and in particular the developed world, is problematic and is articulated by Shiva with reference to international forest conventions between the developed and the developing world below:

‘The G7 can demand a forest convention that imposes international obligations on the Third World to plant trees. But the Third World cannot demand that the industrialized countries reduce the use of fossil fuels and energy. All demands are externally dictated – one way – from North to South. The ‘global’ has been so structured, that the North (as the globalized local) has all rights and no responsibility, and the South has no rights, but all responsibility’ (Shiva, cited in McNeill 2000, p. 21).

So in answering the question as to who should have the right to define and assess the contribution of CDM projects to sustainable development, rather than being at an international level, this is best set at the host country level at a minimum, and preferably at the host community level. As it currently stands, the definition and assessment of sustainable development lies with the host country DNA, and due to a lack of demand for ‘high quality’ CERs, the evaluation of sustainable development through the demand side is limited to the EU restrictions on certain project types. No ranking or rating from the demand side exists and all CERs generated are in practice renumerated equally. Despite this, most of the literature on the contribution of the CDM to sustainable development focuses on the use of standardised evaluation criteria, or evaluation criteria that are based on the UN definition of sustainable development (see for example (Sutter 2003; Olhoff et al. 2004; Na, Nishiki & Ueta 2009; Müller-Pelzer 2009; Singh et al. 2009; Thorne & La Rovere 1999; SouthSouthNorth (no date); The Gold Standard 2011b; Huq 2002; Nussbaumer 2009; Ecofys, TÜV-SÜD & FIELD 2008b; Rezende & Merlin 2003; Reis 2009; Social Carbon 2011; Climate Community and Biodiversity Project 2008; Andrade unpublished; Alexeew et al. 2010; United Nations Framework Convention on Climate Change 2011; Cosbey et al. 2006). Even in this research, the definition and assessment of sustainable development for the comprehensive and MCA approaches is derived not from the stated objectives of the Brazilian DNA, but is derived from research into the development needs of Brazil according to a range of domestic and international sources and from interviews. This focus is problematic, as it diminishes or, at worst, ignores the right of the host country to define sustainable development in their country. The Brazilian DNA has stated that the main objectives of the CDM for the country are to enable Brazil to reduce their GHG emissions and to encourage the generation of renewable energy to enable Brazil to maintain high levels of clean and renewable energy in their energy matrix and these views are supported...
by many participants in the Brazilian CDM industry (CDM Project Developer 1, 2011, pers. comm., 29 March; CDM Project Developer 3, 2011, pers. comm., 29 March; CDM Researcher 1, 2011, pers. comm., 24 March; Brazilian Government Official 1, 2011, pers. comm., 16 March; Brazilian Government Official 1, 2 and 3, pers. comm., 16 March). Many argue that the expectations for the mechanism are too high and that, if the CDM leads to a redistribution of resources from the developed world to the developing world while reducing GHG emissions, then surely this is enough to justify its continued existence (CDM Project Developer 2, 2011, pers. comm., 25 March; CDM Project Developer 3, 2011, pers. comm., 29 March).

As demonstrated by this research, the choice of evaluation criteria and tool for evaluating the sustainable development contributions of the CDM can have a huge impact on the outcome of the evaluation. By focusing on the sustainable development definition and objectives of the Brazilian DNA, the evaluation performed in this research found that the CDM was highly successful in achieving sustainable development as defined by the Brazilian DNA, using the Brazilian DNA definitions of sustainable development, where reductions in GHG emissions and the generation of renewable energy constitutes sustainable development. There are many criticisms about the additionality of Brazilian CDM projects, specifically related to industrial gas and other project types (Schneider 2007; Sutter & Parrerio 2007; Haya & Parekh 2010; Europa 2011; Reuters 2011; Elsworth, Worthington & Morris 2012), and this uncertainty about the additionality of particular project types undermines the claim that the CDM in Brazil is meeting both the objectives of the Brazilian DNA. Despite these uncertainties, it must be asked how and why we as researchers have the right to impose international definitions and assessment criteria to the evaluation of the CDM in Brazil? Yet this is not the end of the matter, as even an assessment based on the performance definitions of the Brazilian DNA can ignore the rights of other stakeholders to participate in the defining and evaluation of sustainable development under the CDM. The key issue is whether the definition of sustainable development by the Brazilian DNA reflects the different view towards sustainable development within Brazilian society. The limited assessment of a reduction in GHG emissions and a contribution to renewable energy generation fails to incorporate the aspects of sustainable development identified in governmental and non-governmental research into development in Brazil, explored in Chapter Two. The expanded definition, published as the Annex III document, incorporates some of these aspects, but ignores issues of inequality – regional, rural, remote, gender and racial inequality in income, access to services and access to employment options. While not all of these issues are easily addressed through the hosting of CDM projects, for example gender and racial inequality, the other forms of inequality, in particular those based on geography, are able to be addressed through policies that direct or incentivise investment in regions where investment and development is needed the most.
While the host DNA is currently granted the right to define and assess the contribution of CDM projects through the power over the LoA, the weaknesses in the current stakeholder engagement process in Brazil have implications for the definition and assessment of sustainable development outcomes of the CDM. At present, the definition and assessment of sustainable development for particular CDM projects is undertaken at a national governmental level only. The host communities largely do not contribute to the discussion on what would be considered to be positive sustainable development benefits of a particular CDM project and as demonstrated in this research, very few communities ever get the opportunity to enter this discussion during the design phase of the project. Community engagement in practice is limited to informing, or at best, post-design consultation (International Association for Public Participation 2013). It may not be practicable for all potential host communities to sit down and agree on definitions and assessment criteria for CDM projects in order that they can be designed to maximise contributions to sustainable development, however the ability of the sovereign host country to define and assess the sustainable development objectives for the CDM in their country is surely improved through the practise of more meaningful stakeholder engagement and consultation in the design and implementation of CDM projects throughout Brazil.

Participation does not have to be overly time consuming or financially expensive. Techniques and methodologies used to evaluate and monitor sustainable development can also be used to help define it in the first place and to consult meaningfully with communities during the planning stages of CDM projects. Focus group meetings, group discussions and ensuring that input from local government and community organisations is received can help tailor the sustainable development co-benefits of projects to those areas most valued or deemed in need by the local community. Additional assistance from the DNA may be necessary for local communities or members of the DNA stakeholder contact list, to ensure an adequate and meaningful response can be submitted when project developers ask for submissions. Provision of an online forum in which to submit comments, something which the Brazilian DNA has considered in the past (Brazilian Government Official 4, 2011, pers. comm., 16 March), may allow for the more timely submission of responses, however other channels of communication must remain open to ensure that those without access to adequate Internet services can also participate in the process. In practice, sovereign national and governmental definitions and assessments of sustainable development override those held at a state or local community level as stakeholder consultation for projects neither meaningful nor a widespread practice.

Examples of CDM projects where a lack of stakeholder consultation has led to violence and human rights abuses are thankfully rare, however incidents where stakeholder anguish over elements of CDM projects has led to violence have occurred, including accusations of extra-judicial killings (Carbon Market Watch 2011b; Carbon Market Watch 2011a; Carbon Trade
Watch 2013). Stakeholder suppression over a CDM project in Honduras has been blamed for an outbreak of violence amongst the host community and an outbreak of protest from non-governmental organisations (Directorate-General for External Policies of the Union 2012; Human Rights and Climate Change Working Group 2012; Wong 2012; Carbon Market Watch 2012b; CDM Watch 2011; Carbon Market Watch 2011b) while Brazil’s Plantar project (Mitigation of Methane Emissions in the Charcoal Production of Plantar) has been linked with allegations from stakeholders of suppression, threatening behaviour, coercion, environmental destruction and loss of access to water (CDM Watch 2010; Carbon Trade Watch 2013; Valentim et al. 2003; Articulação Mineira de Agroecologia et al. 2009; Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 29 February). Members of the host community of this project in Minas Gerais have complained that concerns over the project lodged with the UNFCCC have been largely ignored and that the company who owns the project have actively tried to suppress their views and concerns (Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 29 February). Other local stakeholders have voiced concerns about the damage to local buildings, lack of local employment opportunities and blocked access to fishing sites, caused by the construction of CDM wind farms in Ceará (Brown 2011), or the social and environmental impacts on local communities hosting hydro projects (Fearnside 2012a; Fearnside 2012b; Fearnside 2013). Hydro projects in Panama have also come under investigation for human rights violations (Human Rights and Climate Change Working Group 2012). Even when violence or threatening behaviour is not the outcome of CDM projects, projects where the livelihoods and lifestyles of host communities are adversely affected should still be cause for concern for the UNFCCC and all participants in the CDM.

7.2.3 High Geographical Concentration of Projects

The geographical spread of investment for the CDM has, unsurprisingly, followed that of other forms of foreign direct investment into Brazil. Without adequate incentive to invest in projects in less developed regions of Brazil, or the least developed countries of the world, investment has concentrated in those areas where the maximum number of CERs can be generated for the lowest cost (Brazilian Government Official 4, 2011, pers. comm., 16 March). These so-called lowest-hanging fruit projects are found in regions with high concentrations of industry and higher standards of infrastructure, allowing for ease of investment in infrastructure-intensive projects or for projects reducing emission through changes to industrial processes (CDM Researcher 1, 2011, pers. comm., 24 March; CDM Project Developer 4, 2011, pers. comm., 18 February).

This is evident in the geographical spread of projects across Brazil as discussed in Chapter Six. Most projects are located in the richer regions of the Southeast and South of Brazil, where the
majority of industry is located and where infrastructure is greater and it is therefore easier to
develop CDM projects in these regions. While there is some hope that the future potential
inclusion of forestry credits could resolve these regional inequalities of CDM investment across
Brazil (CDM Project Developer 3, 2011, pers. comm., 29 March), there is little hope of this
occurring without improved confidence in the future of the CDM itself. Forestry projects are
characterised for their long investment periods and slow return on investment, and are therefore
unattractive to current investors in CDM projects in Brazil and internationally. There are also
ongoing problems with acceptance of credits from this project type in international markets,
with the EU ETS continuing to ban CERs generated from LULUCF project types (Europa
2013d).

The replication of the well-worn paths of foreign direct investment to the richer regions of the
developing world is also evident in the geographical spread of CDM projects across the world,
with China, India, Brazil and South Korea hosting over 74% of CDM projects to May 2011 and
generating 80% of CERs expected to 2012 for projects registered prior to May 2011 (United
Nations Environment Programme Risø Centre on Energy 2011). These countries offer the
largest number of lowest-hanging fruit projects, where maximum CERs can be generated for
minimum financial outlay, and with quick financial return on investment.

The geographical concentration is also driven by a lack of certainty in the future of the carbon
market overall (CDM Project Developer 3, 2011, pers. comm., 29 March; CDM Project
Developer 4, 2011, pers. comm., 18 February). The uncertainties in the future of the market, as
well as the uncertainties and complexities of the CDM process, considered to be risky, costly
and lengthy, have deterred investors from investing in long-term projects without guaranteed
high and quick return on investment (CDM Project Developer 1, pers. comm., 29 March).
Projects that may be more difficult to construct due to their remoteness, a lack of appropriate
infrastructure, their use of new methodologies or their use of innovative technology, which tend
to be those projects that are located outside of the industrial and population centres of countries,
are not seen as safe investments by project developers. A lack of certainty in the future of the
carbon market due to a lack of international agreement on a successor to Kyoto, just one of the
causes of the recent price crash in the price of carbon on the international market (Watson 2012),
is concentrating investment in quick-return projects. It has also been argued that these are the
sorts of projects where additionality can be questioned the most (this theme is considered in
more detail in a following section).
7.2.4 Lower than Expected Technology Transfer and Promotion of Clean Technology

While it is recognised that additionality is stronger for Brazilian projects than for projects hosted by other non-Annex I countries (CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January; CDM Project Developer 3, 2011, pers. comm., 29 March; Brazilian Government Official 4, 2011, pers. comm., 16 March), this does not necessarily equate to the importation of new and clean technology from the developed countries. Due to the nature of the CDM as a financial mechanism it has an inherent predisposition to fund projects that maximise CERs at a minimum of cost, the lowest-hanging fruit projects, rather than encourage investment in either the development of new and clean technology, or the importation of exogenous technology.

The projects that have shown to deliver the largest number of CERs expected to 2012 tend to be those that use end-of-pipe (69% of CERs) rather than clean technology (31% of CERs), despite clean technology projects making up 57% of the total number of projects to projects registered in Brazil up to May 2011 (United Nations Environment Programme Risø Centre on Energy 2011). This distinction in technology types differentiates between those projects where clean technology refers to those projects that seek to avoid or reduce emissions in advance while end-of-pipe projects introduce technology that capture pollutants to reduce the negative environmental impacts and is therefore a reactive rather than proactive technology type (Guillen 2011). Investment in, and diffusion of, clean rather than end-of-pipe technology is seen as the only solution to reduce greenhouse gas emissions to the levels that are required to avoid catastrophic temperature increases (de Sépibus 2009). Many questions have also been raised about the use of end-of-pipe technology such as that used for industrial gas projects in terms of additionality, when the costs of installing the widely-used and well-known technologies are so low, especially in the more developed of the non-Annex I countries.

True technological innovation, developed within Brazil and made possible due to CDM investment, was claimed by just 10% of projects according to the more generous DNA method of analysis, while exogenous sources of technology were used for just 31% of projects according to the classifications set out by the Brazilian Grupo de Pesquisa em MDL da UFBA. The remaining 69% of projects used technology considered to be endogenous, and given that the majority of projects are located in the Southeast and South, it is the endogenous technologies are being used in internal technology transfer from these more developed regions to the lesser developed regions of the North and Northeast. It should also be noted that technology transfer can be most accurately determined through the use of a desktop analysis compared to other sustainable development indicators as the methodology has to be explicitly stated in the registration documentation.
The perpetuation of a limited set of technologies is explained by both the drive to generate maximum CERs at minimum cost, and also the difficulties in the process of the CDM itself, where innovation that requires changes or additions to the accepted methodologies is avoided. Being a financial mechanism, investors in the CDM want a high and quick return on investment, so are likely to invest in tried and true technologies and methodologies, concentrating on encompassing as many investment opportunities as possible using these same technologies in order to maximise CERs generated through economies of scale. A lack of faith in the future of the market perpetuates investment in tried and true technologies rather than encouraging innovation or the importation of genuinely exogenous technology into Brazil or other host countries. Any innovation or development of a new technology is considered to be discouraged by the complexity of the CDM rules on new methodologies, which can lead to costly delays and risk due to uncertainty in the consistency of CDM Executive Board decisions on the registration of new methodologies (CDM Project Developer 1, pers. comm., 29 March). The lack of true technology transfer will have implications for the need to reduce emissions in the future for Brazil’s increasingly affluent society (Lenzen et al 2013).

7.2.5 Questionable Additionality and Contribution to Emission Reductions

Additionality is one component of the CDM that has been widely criticised, in both the literature and by Annex-I countries, in particular for those project types where the warming potential of the GHG destroyed results in the generation of vast numbers of CERs for the use of cheap, end-of-pipe technology (Schneider 2007; Sutter & Parreirio 2007; Haya & Parekh 2010; Europa 2011; Reuters 2011; Elsworth, Worthington & Morris 2012). While additionality was not the focus of this research, improvements in additionality through the banning of certain project types in the CDM and the removal of their CERs from the market could improve sustainable development by increasing the price for CERs through limiting supply.

As stated by one interviewee, that even for an energy generation project, it is difficult to accept the idea that without CDM revenue, the project would not have gone ahead – that the CDM revenue is the make or break factor, and thereby the most important factor in the additionality of a project (CDM Voluntary Accreditation Developer, 2011, pers. comm., 17 March). Another interviewee stated that micro-economic changes were more likely to affect the economic feasibility of a project rather than access to CDM revenue (CDM Project Developer 1, pers. comm., 29 March). It is also difficult to argue that the CDM is not just a green-washing process, allowing countries of the developed world to continue to increase their emissions, if additionality is not guaranteed (Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 29 February).
One of the other factors that has been raised when questioning the additionality of CDM projects is that reliance on CERs by Annex I countries is discouraging investment in research and development of new emission reducing technologies by reducing the cost of compliance for governments and industries within Annex I countries. It has been argued that this is perpetuating the status quo, with an over-reliance on high emitting technologies in Annex I countries that are being compensated for through investment in widely-used and well-known technologies in non-Annex I countries. As noted above, only 10% of projects in Brazil, which is known for its higher than average standards on additionality and methodological compliance, claimed that technological innovation were being driven by the CDM process. In 69% of cases, technologies already used and trusted in the developed world were being used to generate CERs in the Brazil.

7.3 Suggestions for Improvement

A number of suggestions for improving the sustainable development benefits of the CDM for host countries have been made. These include changes to the supply or demand-side, as well as systematic alternatives for improvement throughout the CDM process. The CDM is set to continue following a decision at the COP18 in Doha (the Doha Platform) to extend the Kyoto Protocol into a second commitment period. At present, future developments or improvements to the CDM are being delayed by the lack of decision on the development of new international emission reduction targets. New international targets and new market mechanisms will not be developed prior to 2015, nor implemented before 2020 (Ecofys 2013). The following suggestions for supply-side, demand-side and systematic improvements assume a continuation of the CDM through to at least the implementation of new emission reduction targets in 2020.

7.3.1 Supply-Side Improvements

The EU solution for the lack of additionality, and to improve the sustainable development outcomes of the CDM through reducing the over-supply of non-additional CERs, is to see sectoral, rather than project based crediting in more developed CDM host countries to improve the environmental integrity and additionality of the CDM (de Sépibus 2009; Europa 2013c; Schneider 2007; Murphy, Cosbey & Drexhage 2008; Elsworth & Worthington 2010). Where technology for certain project types within a country is genuinely additional, this will be recognised on a sectoral basis, eliminating subjective, project based, decisions regarding additionality by the UN Executive Board and reducing uncertainty for project developers. It would also be easier and more accurate to determine the additionality of projects on a sectoral level rather than on a project level. This concept also has support amongst CDM participants in Brazil (CDM Project Developer 1, pers. comm., 29 March; CDM Project Developer 2, 2011,
pers. comm., 25 February). By setting a business as usual threshold, all emission reductions achieved below that threshold can be sold as CERs, to the host country directly rather than through project developers (de Sépibus 2009). Sectoral crediting can also focus on technological objectives, such as the promotion of sustainable transport or energy efficient appliances for instance (de Sépibus 2009; Cosbey et al. 2005; Bakker et al. 2011). Sustainable transport is an objective under Brazil’s Agenda 21 (Ministério do Meio Ambiente 2012), however to date there are no transportation CDM projects hosted by Brazil. Others have suggested that if the UNFCCC or Brazil would submit new methodologies in areas where there is limited investment, then this would make the process easier and cheaper, promoting innovative and diverse project technologies in Brazil (Brazilian Government Official 1, 2 and 3, 2011, 16 March).

Actions that host countries, and Brazil in particular, could take to incentivise projects with higher sustainable development benefits could be to offer tax incentives for projects deemed to have higher contributions to sustainable development, or to tax CERs generated through projects that are deemed to have a lesser contribution to sustainable development, similar to China’s CDM tax. If sustainable development contributions based on project type are not considered to be appropriate, a minimum proportion of the funds generated from CER sales to be used for social projects, such as the policy adopted by Bolivia, could be an alternative (Rothballer 2008). The difficulty with these improvements is that an assessment for sustainable development contributions would have to be decided upon and project types or particular projects ranked to determine whether they would be eligible for tax incentives, or if they would come under policies requiring them to be taxed at a greater rate due to their lower contribution to sustainable development. Given the difficulties already outlined with assessment and monitoring within Brazil, instigating this on a project-by-project basis may not be a feasible alternative until host country assessment and monitoring is improved.

The willingness of the Brazilian DNA to come up with a more comprehensive assessment method for CDM projects is limited by the desire to make the DNA approval process as easy as possible, given that the rest of the process is inherently complex (Brazilian Government Official 4, 2011, pers. comm., 16 March). The original intention of the DNA was to have a team to monitor and evaluate CDM projects for their contribution to sustainable development, however resource capacity restrictions has so far prevented this from occurring (Brazilian Government Official 4, 2011, pers. comm., 16 March). The idea that the host country DNA can influence the sustainable development benefit outcomes of a CDM project is supported by research by Killick (2012), who suggests that host country can be more influential than project type or scale on sustainable development claims of projects.
7.3.2 Demand-Side Improvements

Two options on the demand-side is to introduce a minimum quota of projects deemed to have a greater contribution to sustainable development, or to discount CERs from certain project types where these project types have demonstrated that they have a lesser contribution to sustainable development benefits for the host community. As an example, under the AIJ, the Dutch prioritised CERs from certain project types through the payment of higher prices for CERs from those project types. The difficulty for both of these potential improvements lies in the definition and assessment of which projects are deemed to contribute to greater levels of sustainable development, and whether that assessment can be made on the basis of project type. Any such action would also be seen as removing the power over the definition and assessment of sustainable development from the host country, and this is unlikely to be met with approval by the non-Annex I countries. Any action to escalate the price of CERs for buyers would also likely make this change unpopular amongst Annex I countries.

The necessity to introduce such demand-side changes is somewhat mitigated by the fact that the EU has stated that they will no longer allow CERs generated from industrial gas projects into the EU ETS. Another factor is that given the lack of a successor agreement to the Kyoto Protocol, and therefore the lack of categories such as Annex I and non-Annex I for 2013 onwards, the EU has decided that for CERs generated during 2013 and after, they will only accept into the EU ETS CERs generated in the least developed countries (LDCs) as defined by the UN (European Commission 2013; Nederlands Emissieautoriteit 2013b). This reflects the stated objective of the EU to target the CDM towards investment in GHG reducing projects in the least developed countries of the world (Europa 2013c).

While the lack of certainty in the supply side of the market has contributed to a large drop in the demand and price for CERs, this action by the EU may enable investment in the CDM to increase its regional spread, despite the fact that this investment is likely to be much smaller than in the past. It is unclear whether this policy would change should a new international agreement be negotiated in 2020 (Glowacki Law Firm 2013).

7.3.3 Systemic Alternatives for Improvement

The use of a market mechanism to promote sustainable development without adequate regulation or incentive is the major flaw in the CDM. It is therefore imperative that projects with better sustainable development benefits are rewarded financially through demand-side incentives, or that improvements are made to the CDM process itself that ensure that minimum standards of sustainable development are mandatory.
Standardising the sustainable development assessment system for host country DNAs or for DOE to follow is neither financially or politically feasible given the already complex and costly nature of the CDM. Standardising the assessment method for DNAs could also be seen as overriding the right of host countries to determine the definition and assessment of sustainable development. As stated by one interviewee, even if it would be more beneficial to the sustainable development outcomes of the CDM if the UNFCCC led to drive to improve the process, given the costs and delays already involved in the process, this may not be a good initiative anyway (UK Government Representative, 2011, pers. comm., 11 January). Perhaps though at the UNFCCC level, through helping to develop the capacity of DNAs to adopt at least one assessment method, the UNFCCC could then request the submission of a report outlining how a particular project contributes the sustainable development priorities of the host country in much the same was as the Annex III documentation in Brazil. The public submission of this document as part of the registration process could provide greater scrutiny and transparency of the contributions made at the registration stage and throughout project implementation. An assessment of the Dutch AIJ experience suggests that the Dutch Government should continue to assess the sustainable development contribution of projects in addition to the assessment done by the host country to ensure additional scrutiny of the compliance of projects with host country standards (IOB Evaluations 2008). The UNFCCC EB has recognised the need to address the need for a sustainable development tool and the suggestion to develop a voluntary measure to highlight the co-benefits of CDM projects and PoA was made at the seventh CMP (Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol 2011). The assessment is currently a five-step questionnaire focusing on co-benefits, no-harm safeguards and stakeholder engagement (United Nations Framework Convention on Climate Change 2012b). As CDM Watch (2012a) points out, the filling out of the questionnaire by project developers only, not stakeholders, weakens the proposition, as does the voluntary nature of the questionnaire and the lack of verification and monitoring of claimed benefits. In response to invitations by the UNFCCC EB to comment on possible changes to CDM modalities and procedures, Carbon Market Watch suggested that the UNFCCC develop minimum global standards of sustainable development, including the monitoring and verification of such standards throughout the project cycle, and ensure that procedures are in place to address situations where projects do not meet minimum standards (Kollmuss 2012; CDM Watch 2012b). These objectives were supported by the submission of a letter signed by 84 civil society organisations (Carbon Market Watch 2012a).

It is difficult to conclude that some element of ongoing monitoring of sustainable development benefits is not required within the CDM. Emission reductions are monitored and verified on a regular basis and the same stringency needs to be applied to the other objective of the CDM to
ensure that what has been claimed in the registration phase is implemented. This was one recommendation of the 2011 High Level Panel of the CDM Policy Dialogue (2012).

There is a real need to improve the depth of stakeholder engagement in the CDM process, specifically during the design phase of a project, and given that this has not occurred without regulation under the CDM for the period of time studied, there is a need for the UNFCCC to regulate this process (Kollmuss 2012; Carbon Market Watch 2012a; CDM Watch 2011; CDM Watch 2012b; Climate Action Network International 2011). The establishment of guidelines for stakeholder consultation is a key recommendation of the High Level Panel on the CDM Policy Dialogue (High Level Panel on the CDM Policy Dialogue 2012), and a key recommendation of CDM stakeholders (Kollmuss 2012; CDM Watch 2012b).

Even with the additional regulation of the Brazilian DNA, stakeholder consultation in Brazil has been limited to more of an informing, rather than a more substantial and engaging process. Meaningful stakeholder consultation is important in helping to define priorities for sustainable development and enabling CDM projects to contribute to those areas defined by local host communities as sustainable development priorities. It is important to engage stakeholders in the CDM process to avoid the type of conflicts that have occurred in CDM host countries where human rights abuses and civil unrest have been the result of poorly designed or badly implemented CDM projects. The continued participation of stakeholders in the implementation process of projects can also improve monitoring of the benefits claimed by project developers during the registration process. This could occur through the development of a community steering committee that could respond to the queries of the DOE regarding the implementation of sustainable development benefits claimed at the registration stage. Should consultation with stakeholders be mandatory at each verification stage, the DOEs would be able to better report on progress towards the sustainable development outcomes of CDM projects. This would require making monitoring of sustainable development claims mandatory within the CDM process.

It is recognised that any additional requirements for stakeholder engagement in the CDM process will add complexity and cost to an already difficult and expensive process. However, without stakeholder engagement and participation by local host communities, it is difficult to see how the contribution to sustainable development can be improved within the CDM. It might be argued that stakeholder engagement in the design phase of complex industrial gas projects, for example, could be worth less given the likelihood that local communities may not fully comprehend the nature of the project, yet the benefits accruing from such a project through employment, training and education could be better directed with proper stakeholder engagement.
There is also a need for improved responses to stakeholder concerns post-project implementation (High Level Panel on the CDM Policy Dialogue 2012; CDM Watch 2012b; Carbon Market Watch 2012a). At present, the UNFCCC is restricted to investigating or cancelling projects prior to registration, with only the host country able to take action in the form of the withdrawal of the LoA should there be concerns with a project post-implementation. This has led to the concerns of host communities throughout the world being left without representation outside of their own governments, who are often unwilling to act on concerns and complaints. The UNFCCC needs to alter their processes so that they can investigate, respond to and act on substantiate claims of human rights violations and claims of environmental destruction.

Attempts to improve the international geographical concentration of projects in the CDM have been made by the UNFCCC in the form of establishing regional collaboration centres in Uganda, the West Indies, Columbia and Togo in an attempt to improve participation in the CDM (United Nations Framework Convention on Climate Change 2013). Interest-free loans have also been made available for potential projects in LDCs (United Nations Environment Programme 2012). This sort of capacity building, coupled with the decision by the EU to only allow CERs from LDCs in Phase III of the EU ETS will help contribute to the goal of improving the geographical spread of the CDM.

Suggestions for improvement on sustainable development assessment, stakeholder engagement and monitoring will all require increases in both CDM complexity and cost implement. Increasing the complexity or cost of the CDM is not something that is supported by any participants in the process, and as such, any improvements that do this need to be implemented in conjunction with other processes that simplify or reduce the cost of participation. An example of where costs could be reduced includes changes to the way additionality is calculated. As stated by one interviewee, if you have a nice sustainable project in a low-income community, it probably would not generate enough CERs to pay the CDM costs for validation as they are simply too costly, even for medium-sized projects (CDM Project Developer 4, 2011, pers. comm., 18 February). Her suggestion was to instead make the process of demonstrating additionality cheaper by incorporating an error factor rather than insisting on methodologies that calculate the exact emission reductions achieved (CDM Project Developer 4, 2011, pers. comm., 18 February). Other interviewees suggest that costs and complexities of the CDM could be dramatically reduced through the introduction of broad additionality factors based on sectoral or regionally based assessments of additionality (CDM Project Developer 2, 2011, pers. comm., 25 March), an approach that is also being considered by the UNFCCC through the introduction of new market mechanisms. This would not only reduce the costs of demonstrating additionality for project developers, it would also reduce the risk and uncertainty attached to investment in
CDM projects (CDM Project Developer 2, 2011, pers. comm., 25 March). The UNFCCC has begun revising the rules surrounding automatic additionality rules for micro-scale projects in underdeveloped zones that use approved technologies, a move that will reduce costs and time delays for a wider range of projects in the CDM (CDM Executive Board 2012). Standardised baselines have also been considered (High Level Panel on the CDM Policy Dialogue 2012), although there are concerns about the additionality implications of this option (Schneider et al. 2012; CDM Watch 2012d).

Oversupply of credits generated through the CDM, due in part to decreased demand from the EU, led to a near-collapse of the CDM market in 2012 (Watson 2012; ICIS 2012b). This collapse was also caused by a rush to register projects prior to the change in EU ETS rules banning the use of CERs from industrial gas projects and also the use of CERs from non-LDC host countries (Ecofys 2013). The cap in the EU ETS on how many CERs can be used also limits demand for the credits, depressing their market price. In contrast to this, a positive outlook has been reported for the post-2012 market for CERs (Kossoy & Guigon 2012). Relative to the pre-2013 market for CERs, the post 2012 market has shown strong growth, supported by private-sector buyers, rather than by governments who are still uncertain about the future of international agreements (Kossoy & Guigon 2012). Demand could be further increased by the recent decisions at COP19 at Warsaw to allow CERs to be used towards voluntary emission reduction targets prior to 2020 (Twidale 2013). Mexico and South Korea have made moves towards allowing the use of CERs generated from within their own countries to count towards domestic emission reduction targets (Twidale 2013). Another dilemma faced by the CDM market involves the carry-over of AAU from the first to the second Kyoto periods. The number of these units that could be carried over, or banked, into the second commitment period under the current Kyoto rules is 13 billion (CDM Watch & CCAP-Europe 2012), and this oversupply of credits not only discourages domestic action, but contributes to low prices for CERs. One suggestion is for stabilising the market is to cancel a large number of credits through the establishment of a new fund (High Level Panel on the CDM Policy Dialogue 2012).

Not allowing the use of CERs generated from particular project types may undermine the technologically neutral status of the CDM, however the exclusion of industrial gases from registration under the CDM has been called for by not only civil society organisations, but also the Alliance of Small Island States (AOSIS) (Allan 2012). One solution to the oversupply of CERs in the current market involves the surrendering of CERs from particular project types. The estimated oversupply is 1.25 billion CERs and researchers and the CDM Policy Dialogue High Level Panel have proposed that should credits from large power supply projects (coal, gas, wind or hydro) be surrendered, it would go some way to resolving the market crisis (ICIS 2012a). The EU have also proposed that they could ban the inclusion of CERs generated from
large-scale hydro projects, further assisting to reduce the oversupply, due to concerns about their additionality (ICIS 2012a; Stockholm Environment Institute 2012). The UK has taken the action of purchasing and surrendering £50 million of CERs through the Carbon Market Finance initiative in an effort to lend support to the CDM market (Garside 2013).

In addition to these measures, increased certainty in international negotiations and the future of binding emission targets would also encourage investment in the CDM and in particular, in more long-term projects, rather than in projects that maximise emission reductions in the shortest amount of time possible. The fall in carbon price, linked largely to the drop in demand resulting from the collapse of international climate negotiations, has deterred investment in projects that are costlier to implement due to their greater sustainable development benefits, such as community-scale projects in low income or remote communities. Greater certainty in the future of binding emission reduction targets could increase the price of CERs and make investment in these types of projects more feasible in the future.

An alternative to the CDM was proposed during the COP13 in Bali. Nationally Appropriate Mitigation Strategies (NAMAS) have been identified as an alternative investment destination for funding from developed countries to reduce emissions in developing countries. NAMAS are the mitigation policies or actions that developing countries wish to voluntarily undertake to reduce their GHG emissions (Kossoy & Guigon 2012). Supported NAMAS are those that are financially supported by international aid, while credited NAMAS are funded through the sale of carbon credits generated by the strategies (Kossoy & Guigon 2012). For Brazil, areas identified for emission reduction include reducing deforestation in the Amazon and Cerrado, improved agricultural techniques, energy efficiency, increasing the use of biofuels and alternative energy sources, as well as using charcoal from reforestation for iron and steel production (Odenbreit Carvalho & Santhiago de Oliveira 2012). Brazil presented these NAMAS at the COP15 in Copenhagen, while the UK and Germany have set aside €70 million to help developing countries establish NAMAS (Kruppa 2013). The use of sectoral CDM or NAMAS in Brazil is examined by Sarmiento Gutierrez (Sarmiento Gutierrez 2011). New market mechanisms, such as those based on NAMAS, could encourage the decarbonisation of the wider economy, particularly in the more advanced developing countries, (Europa 2013c), and allow for other, less developed countries to enter the CDM market.

7.4 Conclusion

The high expectations for the CDM stand in contrast to its lower than expected sustainable development benefits both internationally and within Brazil, as demonstrated by this research. The nature of international climate negotiations makes setting minimum standards for
sustainable development under the CDM difficult and unpopular with both Annex I and non-Annex I countries. Essentially, the CDM is a financial mechanism that has been very successful in producing low-cost abatement options for Annex I countries internationally and within Brazil, and by monetising only emission reductions and not sustainable development benefits of projects, the mechanism has targeted investment towards lowest hanging fruit opportunities.

The lack of monitoring and assessment of CDM projects in the CDM has damaged the integrity of the mechanism. Claims made at project registration phase are not monitored or verified at any stage in the CDM process, unless the project developer specifically includes a sustainable development monitoring plan with the registration documentation. There are cost disincentives to taking this voluntary action, with project developers already claiming that the CDM is a high risk, high cost and difficult mechanism to operate within. Despite this, verification and continued monitoring of sustainable development benefits claimed by project developers is essential to restoring the integrity of the market.

Weak stakeholder engagement guidelines and processes, both internationally and within Brazil, lead to a lack of responses to mandatory requests by DOEs and very limited involvement of host communities during the design or planning stage of a CDM project. Grievance procedures for stakeholders adversely affected by CDM projects are also in need of review, with the UNFCCC EB procedurally unable to override the authority of host countries that have granted approval for projects to be implemented. Technological innovation is very low internationally and within Brazil, and while Brazil has a higher proportion of projects using clean technology in the CDM, only 31% of CERs in Brazil are generated using clean technology. The nature of the CDM as a market mechanism influences the geographical distribution of CDM projects, both internationally and within Brazil. The tendency of CDM investment is to follow the channels of FDI to those regions where investment is easier, cheaper and returns on investment are quicker, and in Brazil, this means investment is skewed towards the Southeast and South of the country, rather than to the North and Northeast, or rural and remote regions where development is needed the most. This pattern reflects the international tendency for projects to be concentrated in China, India and Brazil. Opportunities for improvement have been outlined in this chapter, including supply-side, demand-side and options, as well as suggestions for improving the CDM system itself.
8 Conclusion

Introduction

The CDM was heralded as the ‘surprise double win’ of the Kyoto climate negotiations (Werkman 1998). Non-Annex I countries could benefit from new funding for sustainable development and access to new and clean technologies and Annex I countries could benefit through cheaper abatement options in order to fulfil their Kyoto commitment targets. This second benefit encouraged Annex-I countries to adopt stricter targets than they would have otherwise been willing to adopt, strengthening the level of commitments made under the Kyoto Protocol. The CDM was seen as a way to facilitate the involvement of the non-Annex I countries in international climate negotiations and the international carbon market, without them having to adopt binding emission reduction targets (Matsuo 2003).

In the eight years after the coming into force of the Kyoto Protocol in 2005, the success of the CDM in meeting these objectives has been widely questioned. Concerns have been raised regarding the additionality of certain projects, and especially certain project types, and their success in reducing greenhouse gas emissions widely disputed (Elsworth, Worthington & Morris 2012; Haya & Parekh 2010; Schneider 2007; Schneider 2011). The dominance of industrial gas projects in terms of CERs generated has been questioned and criticism regarding the levels of sustainable development and technology transfer that occur through the CDM is widespread (Andrade et al. 2009; Andrade, Nascimento & Puppim de Oliveria 2010; Boyd et al. 2009; Brown et al. 2004; Cosbey et al. 2005; Cosbey 2006; Ellis et al. 2007; Friberg 2009; Haya & Parekh 2010; Olsen & Fenhann 2006; IOB Evaluations 2008; Lohman 2006; MacDonald 2010; Olsen & Fenhann 2006 Pearson 2006; Schneider 2007; Sutter & Parrerio 2007; Watson & Fankhauser 2009). In Brazil for example, 54% of the total number of CERs generated were from a single adipic acid project. Lack of stakeholder consultation throughout the CDM process is another area of the CDM subject to criticism (CDM Watch 2010a; Schneider 2007; Boyd et al. 2009; Burian 2006; Deutsche Gesellschaft fuer Technische Zusammenarbeit (GTZ) & GmbH (Postfach) 2008; Friberg 2009; Fuhr & Lederer 2009; Müller-Pelzer 2009; CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January). Early hopes that the CDM would encourage investment in community-scale, participatory emission reduction projects in the regions most in need of technology transfer and the income generated from the sale of CERs have not been realised, either internationally or in Brazil (Cosbey et al. 2005). This thesis has contributed to the research undertaken on this latter concern, by assessing the level of achievement of the sustainable development and technology transfer objectives of the CDM for Brazil. Brazil was chosen as the country was one of the key participants in the CDM
negotiations at Kyoto and is an active proponent of action against climate change and promoting renewable energy generation. Brazil is the third largest host of CDM projects by project number and by generation of CERs, has a well-developed DNA and has participated in the CDM since the beginning of the mechanism, hosting the first ever CDM project. The requirement for projects hosted by Brazil to complete the Annex III documentation allows for more specific analysis of the sustainable development contributions of projects at a country-wide level, beyond the information that is provided in the UNFCCC registration documents.

The two credit buying case study countries for this research, the UK and the Netherlands, were selected based upon their dominance in both the overall CDM market as credit buyers, and their dominance as credit buyers from Brazilian CDM projects. Both the UK and the Netherlands are members of the EU, and therefore participants in the EU ETS. The EU purchases credits from 63% of all projects in the CDM, and of this, the UK purchases credits from the most projects out of the EU countries, buying from 30% of all registered CDM projects to 1 May 2011, and the Netherlands is next, purchasing from 9%. For credits purchased from Brazilian projects, combined the UK and the Netherlands represent 53% of credit buyers for registered projects to 1 May 2011. The choice of the Netherlands as a case study was strengthened by its involvement in the AIJ pilot phase prior to the CDM, giving it a long history of involvement in the international carbon market. The purpose behind choosing credit-buying countries as case studies for this research was to analyse how the policies within these countries towards the CDM and policies regarding the use of carbon credits affect the contribution to sustainable development of CDM projects.

The significance of this research is that it contributes to the wider body of literature on the sustainable development benefits of the CDM and in particular, the benefits experienced by Brazil as the third largest host country. The international carbon market value during the period of this research peaked at US$33 billion in 2008 (United Nations Framework Convention on Climate Change 2012c), which is a significant amount, and CERs are still the most commonly traded carbon credit in the world. Despite a successor to Kyoto not being negotiated as yet, the market for carbon offset permits continues (Coelho 2012). It is important to assess the success of the CDM in meeting its dual objectives, because if it does not meet the objective of sustainable development within the host country, it is really just a cheap mechanism for Annex-I countries to offset their emissions, without any real benefit to the host country. The ongoing concern about the additionality of particular projects and project types is very significant, despite not being the topic of this research. This is because without demonstrated additionality, the CDM may not even be achieving the goals of greenhouse gas emission reductions, jeopardising the success of the entire international climate negotiation process.
The overall question that this thesis aimed to answer is whether the CDM has promoted sustainable development in a widespread and substantial way in Brazil. Specifically, this thesis set out to explore the following issues related to the success of the CDM in achieving this objective:

1. Assess the impact of UK and Dutch policy towards the CDM on the success of Brazilian CDM projects in achieving sustainable development;
2. Assess the impact of Brazilian policy towards CDM projects and development priorities on the success of Brazilian CDM projects in promoting sustainable development;
3. Examine the sustainable development assessment methodologies used in compliance carbon markets, and use three of these methods to assess the sustainable development benefits of projects registered in Brazil prior to 1st May 2011. This assessment will be conducted for all registered projects, project type and project scale;
4. Compare the development objectives of CDM projects registered in Brazil with development priorities identified for Brazil by the Brazilian Government, the UN, non-governmental organisations and researchers; and
5. Examine why the CDM has been limited in achieving its dual objectives in Brazil.

Each of these issues has been explored in depth throughout this thesis. This conclusion will summarise the main findings of this research, reiterating how they relate to the original research aims, starting with a discussion of the impact of the definition of sustainable development and method of assessment used. Then the findings of whether the CDM has facilitated sustainable development in Brazil in a widespread and meaningful way will be reviewed. Lastly, the factors that limit the ability of the CDM to contribute to sustainable development in Brazil will be outlined.

8.1 What is the impact of the sustainable development assessment method?

The definition of sustainable development and the subsequent assessment method used can have a major impact on the measurement of sustainable development benefits for the host country resulting from the CDM. As explored in Chapter Five, a range of assessment methods can be used for measuring the sustainable development benefits of the CDM. Depending on which method is used and which aspects of sustainable development are prioritised through the selection of indicators and rating methods, sustainable development assessments can deliver different results for the same project. The assessment method is linked to the definition of sustainable development, and while most assessments use the three-pillar environmental, social and economic development categories, the indicators chosen within these and the methods
attributing ratings can be quite subjective. The choice of assessment method can also depend largely on the purpose of the assessment, whether that be for assessment at a country-wide level for academic research or individual project level for academic research or for evaluation by the host country prior to registration.

This research set out to assess the benefits of the CDM to Brazil through the evaluation of a large number of project registration documents, supplemented with interviews with CDM participants. Many researchers have undertaken this type of desktop evaluation process using project documentation as the primary source of information (Nussbaumer 2006; United Nations Framework Convention on Climate Change 2011; Cosbey 2006; Lee & Lazarus 2011; Olsen & Fenhann 2006; Spalding-Fecher et al. 2013). For the purposes of this research, three assessment methods were selected in order to increase the reliability of findings into the level of sustainable development achieved through the CDM in Brazil, and to compare the findings of each assessment method. The benefit of using multiple assessment methods is that any bias in one particular assessment method can be minimised through the cross-comparison of results from each assessment method. For the purposes of this research, which differentiated between sustainable development as defined by the Brazilian DNA and sustainable development as defined by the wider academic and CDM research community, multiple assessment methods also allowed for a comparison of findings. While the findings of this research indicate that the CDM has contributed to sustainable development as defined by the Brazilian DNA (GHG emission reduction and generation of renewable energy) and as defined by the Brazilian DNA through the Annex III documentation, this contribution is found to be much less when measured using alternative assessment methods.

When the results of all three assessment methods are used to assess the level of sustainable development achieved by the CDM in Brazil, similarities between the results of the three approaches for particular indicators were common enough for the combined results of these assessments to give a clear and robust indication of success in each of the three pillars of sustainable development. Many project types rated either consistently well or consistently poorly across the different methodologies. All three methodologies indicated that project scale did not have a significant impact on the sustainable development outcomes of projects and all three methodologies returned similar findings for contributions to economic indicators, relative to those for environmental or social indicators in each assessment method. However when the results of the approaches were used as stand-alone assessments of sustainable development achieved through the CDM in Brazil, different findings were produced, with a range of sustainable development outcomes achieved from the more positive results of the DNA approach to the low scores of the MCA approach.
The differences between these three assessment methods related more to the overall level of sustainable development claimed, not to the relative strengths and weaknesses of claims in the three sustainable development pillars of environmental, social and economic. The DNA approach, with the more simplistic format, returned the result that most projects were contributing to sustainable development in one or more fields. The CA approach found that while there were claims for sustainable development contribution across a range of indicators for all projects, there was only a weak level of quantification of such claims and an even weaker level of monitoring. For CDM registration and the Brazilian DNA assessment of projects, no quantification or monitoring is required and therefore any assessment that emphasises the need for this to take place will inevitably result in lower results than the DNA assessment method. Project developers are not obliged to include any information on quantification and monitoring of sustainable development benefits within the framework of the CDM (Olsen & Fenhann 2006), and they are reluctant to do so voluntarily due to the increased time and cost of the registration process, which is already seen as being overly complex. By including quantification and monitoring of sustainable development benefits, project developers are then obligated to pay for validation and verification of these claims at registration, and at every issuance of CERs from the project during verification (CDM Project Developer 2, 2011, pers. comm., 25 February). The high cost of participation in the CDM discourages the inclusion of any non-mandatory reporting. Yet without any mandatory quantification and monitoring of claims made during project registration, and such low levels of voluntary quantification and monitoring by project developers, the validity of these claims are assumed to be the best-case scenario in any analysis focused on project documentation as a major source of information, and these scenarios may not be reflected in post-project implementation.

The scores from the MCA approach were very low, especially for environmental and social sustainable development indicators. Modelled on the Alexeew et al MCA approach (Alexeew et al. 2010), there were fewer indicators used in order to try and simplify the assessment and this resulted in fewer claims in the project documentation being matched against indicators in the approach. Not all projects were able to score full points for some indicators like they would have under the other approaches. For example, scores for indicators such as renewable energy generation and employment were differentiated based on whether the renewable energy was being returned to the grid or whether employment generated was ongoing. The aggregated nature of scores, a step completed to enable comparison between projects, can also hide information about very high or very low scores by effectively cancelling such scores out in the aggregation. Development of a poorer region for example was an indicator that scored very poorly in the MCA approach, however the generation of renewable energy was one indicator that scored quite well. By aggregating the scores, the benefits of renewable energy generation
are effectively cancelled out by the fact most projects were located in regions of higher development status, and vice versa, and the overall score presented then suggests that there is no net benefit of the CDM project. As the Brazilian DNA stresses, it does not expect every project to contribute to every area of sustainable development, and a sufficient benefit could be a claim against just one indicator, yet one project claimed no benefits using the Brazilian DNA assessment. The MCA approach is not able to evaluate to this DNA standard if the scores are aggregated and indicator scores offset.

The difference in the overall results of the three assessment methods justifies the choice to use three methods as opposed to just one. Using just one of the above three methods, the assessment as to whether the CDM leads to sustainable development in Brazil relies on a limited and subjective selection of indicators and methods for rating. Where there were similarities across the assessment methods, more confidence could be placed in the results, and conversely, where there were contradictions between the assessment methods, there was a need to look for the reasons behind these contradictions. Often, the reason was that the design of the assessment method created a bias either in favouring or undervaluing certain benefits in the selection of indicators used, or in the way in which they were rated by the assessment method. The use of multiple assessment tools delivers more robust findings, and allows for a comparison between sustainable development achievement as defined by the Brazilian DNA and achievement as defined in the academic literature on the CDM. The differences in results are related to the difference in indicators chosen for the assessment method and the differences in how information from the project documentation is assessed. Clean technology for example was assessed for the CA and MCA assessments by project type, while for the DNA assessment method, which stuck to the method used by the Brazilian DNA, it was based on the project documentation having stated it as one of the benefits. The use of multiple assessment methods for the purposes of assessing projects in order to register them by the UNFCCC, for the issuance of the LoA by the DNA, or for the issuance of a positive validation report by DOE is not feasible given the time and resource capacity restraints. This is only really feasible for academic analysis of the CDM.

If there is to be a reliance on one specific assessment method to evaluate the overall contribution of the CDM to a host country, a careful selection of indicators and methods for how information from the project documentation is to be evaluated must be made and consistently applied. The reliability of an assessment method is contingent on the careful selection of indicators and methods for evaluation. While the MCA method is a less complex and easily comparable assessment method, as noted, the aggregation of scores can tend to disguise some contributions, whether they be positive or negative, and the selection of indicators has a big impact on the overall result. The DNA assessment based on the Annex III
documentation can give a basic overall assessment of the contribution of a project, however this approach may not be appropriate if the assessment relies on the need for quantification of the actual implementation of benefits, given the lack of mandatory quantification and monitoring in the CDM process. The comprehensive checklist assessment addresses both of these weaknesses in the MCA and DNA approaches, however it is complex and comparability between individual projects, project types or project scale is difficult. For the evaluation of the contribution of a single project, or an evaluation based on anything other than a country-wide assessment, an evaluation based on more than just project registration documentation would be necessary. Interviews with stakeholders and project developers both before and after project implementation would be required. Even for country-wide evaluations in other host countries without the benefit of access to an Annex III document or equivalent, a desktop analysis of project documentation may not reveal the full story.

The argument as to who is entitled to define sustainable development and decide on the assessment of it is related to this issue of the impact of assessment methods. This argument is explored in detail in Chapter Seven. Should the Brazilian DNA sustainable development aims for the CDM be used as a measure for success, the only indicators to assess success would be the ability of a project to reduce GHG emissions and to generate renewable energy (Brazilian Government Official 1, 2 and 3, 2011, pers. comm., 16 March; Brazilian Government Official 4, 2011, pers. comm., 16 March). These are the indicators that some interviewees for this research also considered to be sufficient to evaluate the success of the CDM (CDM Project Developer 2, 2011, pers. comm., 25 February). Some interviewees suggested that the incorporation of any other role for the CDM, such as addressing social issues or redistributing wealth, would not be a good thing as it would be one more barrier, in a long line of barriers, that projects would need to overcome (CDM Project Developer 2, 2011, pers. comm., 25 February). As one interviewee stated, it is simply ‘too much to ask of one mechanism’ (CDM Project Developer 2, 2011, pers. comm., 25 February). Ignoring issues of the additionality of some project types, it can be taken as given that all projects registered in Brazil succeed in meeting the first objective, a reduction in GHG emissions. According to a project type analysis of renewable energy generation, 55% of projects also contribute to the second objective, renewable energy generation to the grid or to the internal electricity supply of companies undertaking the CDM projects. From this measure of success, most projects may be able to meet the first objective (although not all projects given the concerns about the additionality of certain project types) and 55% meet the second, and therefore the CDM overall can be considered a success for Brazil. In terms of quantifying the first objective, CER sales from Brazilian CDM projects show that, as a proportion of Brazilian total GHG emissions from 2005 to 2010, the CDM reduced the total GHG emissions by up to
1.1% in 2007 for emissions excluding LUCF, or 0.58% when this sector is included (Institute for Global Environmental Strategies 2013; World Resources Institute 2013).

Yet use of the assessment methods to evaluate a single project as they are proposed in this research, or by using just the DNA evaluation outlined above, undercuts the right of local host communities to define what constitutes sustainable development and how that contribution can be measured. The lack of meaningful stakeholder participation in the CDM, even in Brazil where there are more stringent standards for consultation, undermines the ability of the CDM to claim a real contribution to sustainable development. Local level participation is considered to be paramount in achieving sustainable development (Rennie & Singh 1995; Titi & Singh 1995; United Nations 2011a), even if the process of ensuring that adequate stakeholder participation takes places can be difficult, given the already high costs of the CDM and the limitations imposed by large distances, lack of access to the internet in some areas and the limited capacity of non-governmental organisations in the case of Brazil. For the CDM to truly claim it is contributing to sustainable development, the importance of stakeholder engagement can not be overlooked in the process of defining and assessing sustainable development.

8.2 How has the CDM promoted sustainable development in Brazil?

In summary, the contribution of the CDM to Brazil’s sustainable development priority areas is as follows: the CDM has led to the use and promotion of clean technology for a majority of projects; it has improved employment rates and education and training opportunities (albeit in regions of higher development); it has enabled the generation of a small amount of renewable energy; and it has led to reductions in air pollution in urban areas and in deforestation. As would be expected, the CDM has contributed a small amount to Brazil’s GDP through the sale of CERs. Areas where the CDM does not contribute to sustainable development in Brazil include addressing regional inequality, income inequality, rural inequality, improved water quality and promoting technology transfer. In terms of stakeholder engagement, most projects took only the minimum level of engagement required by the Brazilian DNA and consultation was limited to only informing rather than involving host communities.

The method of assessment used to generate these findings is based on an assessment of claims made by project developers prior to registration, not based on an assessment of projects post-implementation and therefore, these claims represent best-case scenarios rather than accurate depictions of sustainable development benefits. It is not that these claims should be viewed with scepticism in every circumstance, it is just that without any mechanism for verification of these claims, they can not be tested and there is no disincentive against project developers overstating benefits claimed during the registration stage.
According to the DNA method of analysis, 93% of projects claimed 4 or more benefits out of the 12 available through this assessment method, and 73% of projects claimed 6 or more benefits.

The comprehensive checklist assessment used 27 indicators and while most projects claimed benefits for at least 6 of these indicators, quantification and monitoring of claims across nearly all indicators was very low. Overall monitoring plans were set for 13 (or 7%) of the 178 projects. The overall lack of quantification of claims and their subsequent monitoring is a key point of criticism of the CDM in Brazil in terms of its contribution to sustainable development and this weakens the argument that the CDM does lead to sustainable development in Brazil. Without a measure against which these claims can be assessed in the future, or without a way in which these claims can actually be assessed, it is difficult to say with any degree of confidence how many of these claims would be fulfilled with the implementation of projects. At best, these claims represent an estimate of future benefits, or at worst, a list of benefits claimed only to gain approval for a project with no intention of fulfilling them. Most interviewees for this research would agree that the reality lies somewhere in between these two scenarios. Without mandatory and ongoing validation of claims, initial and continued approval of the project by the host country is not based on any real assessment of the sustainable development benefit of a project. Of the 97% of projects that needed to comply with the Brazilian DNAs stakeholder engagement process, 60% undertook met the minimum requirements. While 37% of projects undertook greater levels of engagement than required, only 1% of projects met with communities during the design phase of projects.

The MCA approach provided the least favourable assessment of sustainable development benefits from the CDM in Brazil. The average total score out of 9 was 2.34. From this analysis, the MCA indicates that Brazil is not benefiting as greatly from the CDM as it could be. In particular, the CDM is not improving issues of regional inequality, as projects are mainly located in the areas of higher development status. Consistent with the other two approaches, renewable energy generation rated highly in this approach, as did employment generation, however the other 7 indicators generally scored quite poorly.

Renewable energy generation was one area where the CDM made a substantial benefit to sustainable development objectives for Brazil with over half of projects claiming this contribution. There was also a strong positive relationship between remoteness and renewable energy generation – the more remote a municipality, the more likely it was that the project generated renewable energy, which would more likely increase benefits to communities off the main electricity grid, formerly reliant on other fuel sources. The percentage of projects located in very remote areas and generating renewable energy was 16% and 17% for those in remote
areas, generating a total of 13% of all CERs expected to 2012 (United Nations Environment Programme Risø Centre on Energy 2011).

Around one-half of projects claimed reductions in urban air pollution, while one-third of projects claimed reductions in deforestation and land degradation, although these figures varied between assessment methods. These results indicate a good contribution to these objectives, however quantification and monitoring were low, and these claims were generally made only as a response to environmental legislation requirements. Actions that would protect biodiversity were claimed by around one-fifth of projects, again with low levels of quantification and monitoring. Improving water quality was the environmental benefit least likely to be claimed by projects, with less than one-quarter of projects claiming this benefit and less than one-fifth of those projects quantifying their contributions.

Regional inequality in Brazil was one form of inequality perpetuated, rather than reduced by the CDM. Project locations were found to be skewed towards the higher developed regions, and even where projects were located in regions of lower development status, projects were located in the more developed municipalities within these regions. In situations where projects were located in regions of lower development status, the social benefits of projects were found to be greater than for projects overall, demonstrating that when located in regions of lower development status, CDM projects can have a larger impact on social sustainable development.

Rural to urban inequality rates were not improved by the CDM. While 29% of all municipalities could be reasonably referred to as rural, only 4% of projects were located in, and only 0.7% of CER sales to 2012 were accrued by projects located in rural municipalities. These findings indicate that the CDM is not contributing to reducing rural inequality and may in fact be exacerbating it through the concentration of projects, and their benefits, in urban areas.

Contribution to reducing income inequality was determined using indicators of education, training and the generation of employment. Training or education of employees or the wider population and contributions to employment generation were claimed by most projects, while training of unskilled labour was claimed by 40% of projects. Project documentation on the training of employees was more likely to include specific details about the nature of benefits available compared to other indicators. This is a positive indication for the impact of the CDM in Brazil, however most of the projects were located in municipalities of higher development status, and therefore these benefits were most likely experienced by those areas already benefiting from these types of opportunities.

Employment generation was the most highly claimed, quantified and monitored indicator and this is likely due to the Annex III document specifically suggesting that employment
contributions be quantified in the Annex III response. Projects were more likely to claim temporary employment generation over ongoing, and for those projects that quantified these employment generation claims, the mean number of direct ongoing jobs was 20 compared to 343 for direct temporary. This indicates that most employment is being generated in the construction and other industries required at the establishment of projects, rather than in those roles where there are ongoing employment opportunities.

The promotion of clean technology innovation and technology transfer by the CDM was mixed across the indicators. Only a small proportion of projects claimed innovation and international technology transfer, with few claims of exogenous technology transfer for most projects and even fewer projects claimed any sort of innovation. On the other hand, the use of clean technology (as defined by the Grupo de Pesquisa em MDL da UFBA Research Methods (Andrade unpublished; Guillen 2010) was claimed by 57% of projects and accounted for 39% of the financial value of the CDM to Brazil overall. If the single large adipic acid project was excluded from this calculation, CERs generated from clean technology projects were twice that from projects using end of pipe technology. The higher scores for sustainable and innovative technology were more prevalent in the municipalities of higher development status, which shows the CDM was not really beneficial in promoting technology transfer to the less developed regions.

The total amount that the CDM contributed to Brazil’s GDP between 2005 and 1 May 2011 was approximately €762 million (in 2011 euros), ranging between 0.023% of GDP in 2008 and 0.008% in 2011. The drop in contribution of the CDM to Brazil’s GDP since 2007-2008 can be linked in part to a decline in demand for CERs due to the impacts of the global financial crisis on the EU and the decline in demand due to the uncertainty over the future of international climate change negotiations (Watson 2012; CDM Project Developer 3, 2011, pers. comms., 29 March). This drop in demand resulted in a substantial drop in prices for CERs in the international market.

8.2.1 What impact does the credit buyer have?

Aside from the EU policies on the use of CERs within the EU ETS (Europa 2011), neither the UK nor the Netherlands restrict or place conditions on the use of credits from CDM projects, and neither differentiates between projects with low or high sustainable development benefits (Dutch Government Official, 2011, pers. comm., 4 January; UK Government Representative, 2011, pers. comm., 11 January). There is no greater demand within either country for projects generating greater sustainable development benefits, for public relations or other such purposes, and therefore, any such finding related to a difference in contribution cannot be attributed to a demand-side motive (UK Government Representative, 2011, pers. comm., 11 January). For the
Netherlands, this is a change from the ranking system that was used in the AIJ to discriminate in favour of projects with perceived higher contributions to sustainable development.

Both the UK and the Netherlands purchased CERs from projects that had similar sustainable development benefits, suggesting that the purchasing country, in the case of EU countries, makes no difference to the promotion of sustainable development through the CDM. The policies of the credit buying countries are shaped by the fact the CDM is viewed within the UK and the Netherlands as a mechanism for reducing the costs of meeting emission reduction targets, rather than a mechanism for aid delivery or for fulfilling development objectives, resulting in a lack of demand for higher quality CERs. The CERs generated are a tradable commodity to credit buyers – nothing more, nothing less. As stated by one interviewee, ‘if you talk to the traders and financial people, they are less concerned about it [sustainable development]. Yes it’s carbon and yes it’s creating sustainable development benefits, but at the end of the day it’s a tradable commodity’ (UK Government Representative, 2011, pers. comm., 11 January).

The findings of this research indicate that during the first phase of the Kyoto Protocol, the CDM has not initiated a change in the nature of the relationship between the host and buyer countries, in this case between Brazil and the countries of the European Union. The relationship of these countries through the CDM is determined by the classification of the CER as a tradable commodity that is cheaper to produce in Brazil compared to in the countries of the European Union. The relationship is not complicated by any notions of aid or of the promotion of sustainable development, including technology transfer as evident through the analysis of the policies of the Dutch and UK governments towards the CDM presented in this research. This is also demonstrated by the assessment of Brazil’s CDM portfolio in this research, which indicates that the CDM does not contribute to sustainable development in Brazil to the extent that it could, or was expected to do during the international climate negotiations that led to the formation of the mechanism. The relationship of these countries through the CDM perpetuates rather than alters the long-standing trading relationship between Brazil and members of the European Union, whereby the trade in commodities produced by Brazil does not necessarily lead to sustainable development within Brazil.

8.2.2 What impact does the project type have?

The literature on the CDM and sustainable development points to a number of project types as being questionable in terms of their additionality, and in terms of their contribution to sustainable development within the host country. Project types such as industrial gas projects have come under scrutiny for their lack of additionality and technology transfer in the EU and are set to be excluded from the EU ETS for the third trading period from 2013 (Europa 2013b;
Elsworth, Worthington & Morris 2012). Without exploring these issues of additionality of particular project types in Brazil, just in terms of a contribution to sustainable development within Brazil, it does appear that project type does influence the sustainable development benefits of projects to a degree. While there were differences between the results of the assessment methods, fugitive, biomass energy, landfill gas, energy efficiency and fossil fuel switch were the project types to consistently claim higher levels of sustainable development benefits. The N<sub>2</sub>O, PFCs and SF<sub>6</sub> projects were least likely to claim sustainable development benefits, particularly against environmental and social indicators. The fact that fugitive project types were deemed to be one of the better types for contribution to sustainable development demonstrates a weakness in an assessment method using pre-registration documentation as a main source of information. The highly criticised Plantar project is one of just two fugitive, charcoal producing projects in Brazil. The findings from this research reflect only those claims made by project developers in the registration paperwork and not the post-implementation reality for projects. The registration documentation for the Plantar project identifies a large number of environmental, social and economic benefits, and hence it scored quite well according to all three assessment methods used in this research. This type of assessment excludes any stakeholder concerns raised, or negative impacts identified, after project implementation, and for the Plantar project, stakeholder concerns have been significant (Lohman 2006; Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 28 February; Articulação Mineira de Agroecologia et al. 2009; Valentim et al. 2003; World Rainforest Movement 2012). This weakness could potentially be mitigated by the use of more examples from each type of project for assessment, however this is not possible in this research as only two fugitive projects were registered prior to May 2011.

In terms of a contribution to environmental sustainable development, the project types with the most claims against these indicators were landfill gas and biomass energy, followed by fugitive, methane avoidance, hydro and wind project types. The project types least likely to claim a contribution towards environmental sustainable development were CO<sub>2</sub> usage and N<sub>2</sub>O.

For contributions to social sustainable development, fugitive, hydro, biomass energy and wind were more likely to claim a contribution to improving regional, income or rural inequality. Fugitive, reforestation, fossil fuel switch, landfill gas and biomass energy projects were more likely to claim employment and education benefits. The project types consistently least likely to claim a contribution to sustainable social development were PFCs and SF<sub>6</sub>.

Contributions to economic sustainable development in terms of use of innovative or sustainable technology, high levels of technology transfer, and renewable energy generation were claimed at a greater rate for CO<sub>2</sub>, biomass energy, energy efficiency, landfill gas and fugitive project
types. In terms of a contribution to Brazil’s GDP and balance of trade, the five N₂O projects contributed more than 1.3 times the value of all CERs generated by all other project types. After N₂O came biomass energy, landfill gas and hydro. It would be expected that increases in tax revenue generated would repeat this ranking, however based on claims made in the project documentation, CO₂ usage, PFCs and SF₆ as well as hydro and wind projects were most likely to claim a contribution to this indicator.

While no project type failed to claim some contribution to sustainable development, the industrial gas projects tended to be least likely to contribute to environmental and social sustainable development, yet were more likely to lead to economic sustainable development. The change in EU policy towards excluding industrial gas projects in the third trading period of the EU ETS will remove CERs generated from industrial gas projects from the EU ETS (Elsworth, Worthington & Morris 2012). This could potentially improve the overall sustainable development benefits of the CDM as the huge supply of CERs from industrial gas projects are removed from the market, and these CERs are replaced by CERs generated from other project types.

Depending on which aspects of development are considered to be a priority for Brazil and therefore which indicators of sustainable development, the findings of this research regarding the sustainable development benefits of particular project types could be read as a failure of the industrial gas projects to lead to sustainable development in Brazil. Yet as reiterated throughout this thesis, the weighting attributed to the different development priorities for Brazil can determine the results of the overall assessment as to whether a particular project type leads to sustainable development in Brazil or not, and the differences between the assessment methods regarding project types demonstrated this. Despite this, this research suggests that there is some evidence to support the exclusion of certain project types for their lack of contribution to wider sustainable development benefits, and in particular the social and environmental development priorities of the host country, even when taking into account the revenue generated from the sale of CERs to the GDP of the host country. This is especially so when additionality, technology transfer and innovation claims of these project types are widely questioned in the literature and by Annex-I countries (Elsworth, Worthington & Morris 2012; Schneider 2007; Schneider 2011; Sutter & Parrerio 2007; Haya & Parekh 2010; Europa 2011; Reuters 2011).

8.2.3 What impact does the project scale have?

Much of the literature discusses the difference in contribution to sustainable development of projects based on their scale (see MacDonald 2010; Olsen 2005; Guijarro, Lumbreras & Habert 2008; Cosbey et al. 2005; Murphy 2006), however not all authors agree that project scale can affect the sustainable development outcomes of a CDM project (Olsen & Fenhann 2006;
Watson & Fankhauser 2009; Cosbey et al. 2005). The findings of this research indicate that project scale does not have a significant impact on the sustainable development benefits of CDM projects.

All three assessment methods found that project scale did not lead to an overall significant difference in claims for sustainable development benefits in Brazil. There were some differences between the assessment methods, with the DNA and MCA assessments producing contradictory results. This is due to the differences in how the projects were assessed between the different approaches. The MCA approach for example emphasised those indicators for which small-scale projects scored highly in all approaches (for example their location in areas of lower development status, for which large-scale projects scored very poorly), yet the differences in overall sustainable development contributions between the project scales across all approaches were not significant.

The indicators for environmental sustainable development priorities for Brazil showed that on aggregate, there was no significant difference between large-scale and small-scale projects. For social sustainability indicators, overall contributions did not favour either project scale, however small-scale projects were more likely to be located in areas of lower development status, or remote and rural areas, and contribute more to reducing income inequality. Indicators for economic sustainability on aggregate again showed no significant difference based on project scale, despite the obvious difference of large-scale projects contributing more to Brazil’s GDP through the sale of CERs.

This finding adds weight to the literature that the scale of the CDM project does not necessarily translate into a difference in sustainable development benefits for the host country (Olsen & Fenhann 2006; Watson & Fankhauser 2009; Cosbey et al. 2005). Small-scale projects may be more likely to be located in areas of lower development status, and in more remote or rural areas, however unless this is the specific objective of the CDM for the host country and the method upon which sustainable development is assessed, there is no significant difference between the contributions of projects based on their scale. There is a push in the UNFCCC towards simplifying the CDM process for small-scale projects, as the current CER prices do not encourage the profitable implementation of small-scale projects within the CDM. Should this push be based on the need for simplification of the process in order to encourage small-scale projects, where profitability due to the reduced number of CERs generated is an insurmountable impediment to their implementation, then this aim would be of benefit in increasing the number of projects in the CDM. If the push is based on the belief that small-scale projects are more likely than large-scale projects to lead to sustainable development as defined and assessed in a lot of the literature, then the basis for this push for change may be flawed. There is an
alternative way of measuring the contribution of small-scale projects that may support the UNFCCC initiatives regarding encouraging small-scale projects. If the benefits of small-scale projects are viewed on a per-CER generated, rather than per-project basis, the benefits accrued by small-scale projects would be higher than for large-scale ones. This way of measuring the benefits of small-scale projects would support the push by the UNFCCC to encourage more small-scale projects through simplified CDM procedures.

8.3 What limits the CDM in contributing to sustainable development in Brazil?

The findings of this thesis echo those made by other researchers in terms of what aspects of the CDM limit its potential to deliver sustainable development outcomes, in particular the overall design of the CDM process and the focus on it as a market through which to reduce the cost of compliance with emission reduction targets, exemplified by the monetisation of emission reductions only, not the co-benefits (Sutter & Parrerio 2007; Guijarro, Lumbreras & Habert 2008; Cosbey et al. 2005; MacDonald 2010; Boyd et al. 2009; Olsen & Fenhann 2008; Ellis et al. 2007; Pearson 2006). The limitations identified in the literature were reviewed in Chapter Four with reference to the wider CDM. These limitations are discussed in more detail in Chapter Seven with reference to the case of Brazil as a host country, supported by the findings of this thesis. The limitations outlined in the wider literature that are supported by the findings of this research are: the perception of the CDM as a high-risk investment due to the uncertain nature of international climate negotiations; the emphasis on the CDM as a tradable commodity, without monetary or other incentives to encourage the implementation of high quality CDM projects; the lack of subsequent quantification and monitoring of sustainable development claims made by projects at registration stage; the market dominance of large industrial gas projects; and the lack of stakeholder engagement within the CDM process.

The nature of the type of projects invested in in Brazil is indicative of the wider problems of the CDM being seen as a high risk investment due to the failure of international negotiations on a future for the international CDM market. This has led to investors developing projects that can generate a quick return on investment, and not necessarily those longer-term projects that have added benefits of technological transfer and innovation and wider stakeholder consultation processes for example. The high risk nature of the market, and the high cost of investing due to the falling price for CERs (itself perpetuated by a lack of demand and lack of future certainty of the market), have also incentivised investment in regions where infrastructure is already developed, the labour market is already skilled and where the types of industry where high and quick returns on investment can be generated. Investment is skewed towards those host
countries, and within those host countries, to areas of higher development status, which are likely to be less in need of the sustainable development benefits of CDM investment.

The nature of CERs as a tradable commodity as a way in which emission reductions can be made for the lowest financial cost by credit buyer countries limits the ability of the CDM to generate greater levels of sustainable development benefits (Sutter & Parrerio 2007; Guijarro, Lumbrares & Habert 2008; Cosbey et al. 2005; MacDonald 2010; Boyd et al. 2009; Olsen & Fenmann 2008; Ellis et al. 2007; Pearson 2006). The lack of willingness to mandate on minimum levels of sustainable development and the lack of demand-side incentive for high-quality CERs, do not facilitate investment in projects where greater sustainable development outcomes can be achieved. Investment is directed to where it is cheapest to generate CERs (CDM Researcher, 2011, pers. comm., 24 March). Policy initiatives from the credit buying countries regarding minimum sustainable development requirements are lacking, due to the perception of the CDM as a mechanism for generating and trading CERs rather than as a mechanism through which to promote sustainable development. Both the UK and the Netherlands prefer to leave the definition and assessment of sustainable development to the host country itself and are unlikely to promote minimum requirements for projects in the future (Brown et al. 2004; British Government Representative, 2011, pers. comms., 11 January). Therefore one major avenue through which to implement minimum standards or to promote high quality CERs, is no longer open. There is the option for Brazil to improve sustainable development benefits from CDM projects on the supply-side through encouraging investment in regions of lower development status or encouraging project types linked to higher sustainable development benefits. Encouragement could take the form of tax incentives, like those used in China, Bolivia and Columbia (Rothballer 2008; Dutch Government Official, 2011, pers. comm., 4 January). However, unless the Brazilian DNA is willing to expand its definition of sustainable development success through the CDM beyond GHG emission reductions and renewable energy generation, such incentive based encouragement towards greater sustainable development benefits from the CDM is unlikely. In addition to this, the lack of demand for credits generated in lesser-developed regions or from particular project types from countries such as the UK and the Netherlands does not encourage Brazil to make these changes (CDM Project Developer 3, 2011, pers. comm., 29 March).

The expectation that the CDM could lead to a proliferation of small, community-scale, participatory projects in regions where sustainable development is needed most (Cosbey et al. 2005), is not reflected in the realities of the current market, both worldwide and within Brazil. As mentioned by a number of interviewees (CDM Project Developer 1, 2011, pers. comm., 29 March; CDM Project Developer 4, 2011, pers. comm., 18 February; CDM Project Developer 3, 2011, pers. comm., 29 March; CDM Project Developer 4, 2011, pers. comm., 18 February;
CDM Voluntary Accreditation Developer, 2011, pers. comm., 17 March), the CDM is not the mechanism to facilitate investment in small-scale, community level projects, such as solar power for remote Brazilian schools, due to registration costs and complexity. The only opportunities for such an investment would be through the voluntary carbon market, where there is an incentive for high quality offset credits. The complexities, high costs and high risks of the CDM market mean that it does not encourage these types of investment and instead benefits the largest companies in Brazil who have the capacity to navigate the complexities of the CDM process (CDM Voluntary Accreditation Developer, 2011, pers. comm., 17 March; Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 28 February). As one interviewee pointed out, it is contradictory that those companies who can afford to participate in the CDM are those same companies that are responsible for high emission levels in the first place Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 28 February).

The lack of a requirement for the quantification and monitoring of sustainable development claims as part of the validation and verification process undermines the integrity of the claims made by project developers in the initial project registration documents (Olsen & Fenhann 2006; Watson & Fankhauser 2009; Killick 2012; Müller-Pelzer 2009; CDM Project Developer 2, 2011, pers. comm., 25 February). While some developers argue that the claims can actually underestimate the benefits achieved once projects are implemented (CDM Project Developer 1, 2011, pers. comm., 29 March), without the same level of quantification and monitoring applied to the sustainable development aspects of the claims as that which is applied to the calculation of emission reductions, the sustainable development side of the ‘win-win’ arrangement will always be considered to be of a lesser importance to developers.

There is a concern expressed that if host countries make sustainable development contributions more regulated, then they could discourage potential investment through the CDM and project developers would move to countries with less regulations (and cost) surrounding sustainable development benefits (CDM Project Developer 1, 2011, pers. comm., 29 March). This is unlikely to be the case for Brazil given that it has been identified as one of the countries most conducive to investment CDM projects (Thomas Reuters Point Carbon 2009; CDM Project Developer 4, 2011, pers. comm., 18 February; CDM Project Developer 5, 2011, pers. comm., 18 February).

Additionality was an aspect of the CDM not specifically included for analysis as part of this research, however the literature clearly finds that certain project types within the more developed host countries are simply not additional (Thomas Reuters Point Carbon 2009; Schneider 2007; Sutter & Parrerio 2007; K. Olsen & J. Fenhann 2008), and therefore the GHG
emission reductions generated are not actually meeting the other objective of the CDM, to reduce GHG emissions and reduce the impact of climate change. The push towards investment in the lower risk, quick return investment options perpetuates the dominance of project types in the CDM where additionality is questioned the most. The dominance of the single adipic acid project in the Brazilian case, where 54% of CERs sold to 2013 were generated from this single project (Institute for Global Environmental Strategies 2013), brings into question the integrity of the ability of the CDM to lead to GHG emission reductions when many argue that these project types are simply not additional (Elsworth, Worthington & Morris 2012; Schneider 2007; Sutter & Parrerio 2007; Europa 2011; Reuters 2011). Without these projects, more demand is available for more additional alternative project types, and this would increase the returns on investment in these alternative project types and the overall sustainable development output of the CDM. This is because through reducing the supply of CERs in the market through the banning of industrial gas projects, this would increase the demand and therefore the price for other CDM projects.

The essential aspect that is stressed throughout this research and in the literature, and largely ignored throughout the CDM process, is the need for improved stakeholder participation from the local host community (CDM Watch 2010b; Schneider 2007; Boyd et al. 2009; Streck 2004; Deutsche Gesellschaft fuer Technische Zusammenarbeit (GTZ) & GmbH (Postfach) 2008; Friberg 2009; Fuhr & Lederer 2009; CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January; Brazilian Government Official 4, 2011, pers. comm., 16 March; CDM Voluntary Accreditation Developer, 2011, pers. comm., 17 March; Lövbrand, Nordqvist & Rindefjäll 2007). As stated by one interviewee, ‘most [project developers] don’t take into account comments from stakeholders. They organise meetings and invite, but it is not a transparent and complete process’ (CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 January). Another interviewee stated that the stakeholder process ‘doesn’t allow the stakeholders to really comment or understand the process – it is inadequate’ (CDM Voluntary Accreditation Developer, 2011, pers. comm., 17 March). Attempts to define, assess and measure sustainable development are intrinsically flawed unless they take into account the expertise of the local population in the process. Sustainable development aims in projects and assessments made by those without access to the expertise of the local host populations can at best try to contribute, or in the case of assessment, give an indication of the benefit or otherwise of projects on a large-scale, for example at a country-wide scale. They can not adequately define or evaluate projects at an individual scale.

While Brazil has a higher level of requirements for stakeholder engagement than all other host countries, the process is still considered by most of the interview participants to be inadequate and unhelpful (Brazilian Government Official 4, 2011, pers. comm., 16 March; Brazilian Non-
Governmental Organisation Representative, 2011, pers. comm., 28 February; CDM Voluntary Accreditation Manager, 2011, pers. comm., 13 March). Organisations contacted have limited capacity to respond meaningfully and responses are often undertaken as an afterthought, rather than as a mechanism to involve host communities in the design of projects (Deutsche Gesellschaft fuer Technische Zusammenarbeit (GTZ) & GmbH (Postfach) 2008). Responses received from state and municipal governments or local community organisations through the compulsory stakeholder engagement process in Brazil were not common and often involved only a generic statement of support. In the case of the Brazilian Forum of NGOs and Social Movements for the Environment and Development, comments were limited to a statement claiming that limited capacity precludes the ability to respond to requests for stakeholder engagement. Obviously thorough stakeholder participation in the planning process is not always possible for certain project types, however greater participation by stakeholders in defining the benefits most suitable for their communities as a result of investment within their communities would surely enable the better targeting of community and other programs towards those areas where the need is greatest.

At a minimum, mandatory levels of stakeholder participation and involvement, as well as improved methods for complaints regarding CDM projects to be made, would limit the number of incidents where civil unrest, claims of environmental and social damage and in the worst cases, violence, has developed as a result of CDM projects (Directorate-General for External Policies of the Union 2012). Human rights abuses have been linked to a number of CDM projects (High Level Panel on the CDM Policy Dialogue 2012; Böhm & Dabhi 2009; Directorate-General for External Policies of the Union 2012). Cases such as those in Honduras and Panama in particular have been criticised for links to human rights abuses and the CDM Executive Board has responded to these cases by saying that it has no mandate to investigate and that the power to react lies with the host country itself (Directorate-General for External Policies of the Union 2012). Within Brazil itself, the Plantar project (Mitigation of Methane Emissions in the Charcoal Production of Plantar, Brazil) has been widely criticised for the treatment of stakeholders and the environment in the project planning and implementation process (Lohman 2006; Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 28 February; Articulação Mineira de Agroecologia et al. 2009; Valentim et al. 2003; World Rainforest Movement 2012). Better processes that ensure mandatory investigation and responses to stakeholders concerns that are delivered to the UNFCCC would improve the situation in Brazil and throughout the other CDM host countries (Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 28 February). At present, participants or stakeholders in the CDM have complained about the lack of response to complaints made to the UNFCCC regarding specific CDM projects (Articulação Mineira de Agroecologia et al. 2009;
Responses to complaints made to the EU regarding human rights abuses have reiterated that it is the host country and the CDM EB that have the only say in approving or rejecting a project on these grounds (Carbon Market Watch 2011a). Yet when an organisation of landless people in Brazil attempted to lobby the CDM EB regarding their concerns about the Plantar project, the response they received was a short written statement saying that the Brazilian government is the only one with the power to sign off on sustainable development concerns (Brazilian Non-Governmental Organisation Representative, 2011, pers. comm., 28 February).

8.4 Conclusion

To conclude the discussion of whether or not the CDM contributes to promoting sustainable development in Brazil, this research indicates that yes, while projects claimed some contribution according to most methods of assessment, these contributions, are less than originally expected from the CDM, and its original dual aims could be greatly increased through improved stakeholder engagement and mandatory quantification and monitoring of claimed sustainable development benefits. It is recognised that the current CDM processes and marketplace do not facilitate a move towards these recommended improvements. The high cost and high risk of CDM investment, as well as the lack of demand-side incentive to push for greater sustainable development benefits from CDM projects, do nothing to incentivise a push at either host country, or UNFCCC, level towards greater adoption of necessary improvements to the CDM process. Numerous researchers and non-governmental institutions, in both host and credit buying countries, have recommended these changes be made, at a minimum, to ensure the integrity of the CDM marketplace.

Some improvements have been made since the inception of the CDM in response to these criticisms and suggestions, such as the move by the EU to ban CERs from certain project types (Elsworth, Worthington & Morris 2012; Europa 2011); attempts by the UNFCCC to simplify the registration costs and risks for small-scale projects (United Nations Framework Convention on Climate Change 2010); attempts to speed up the time taken for registration processes (Brazilian Government Official 4, 2011, pers. comm., 16 March); and moves to encourage a greater regional spread of projects internationally (United Nations Framework Convention on Climate Change 2010). Yet no changes have been made to improve the level of sustainable development benefits achieved through individual CDM projects. Monitoring of the implementation of benefits claimed during the registration process would add both time and...
cost to the process, thereby increasing the price of CERs in the international market and increasing the cost of compliance for the Annex I countries. In practice, the dominant objective of the CDM is as a mechanism to ensure reduced costs of compliance with emission reduction targets for Annex I countries, as exemplified by the lack of monetisation of the other objective of the mechanism. The dominance of this first objective continues to limit the success of the CDM in achieving its other ‘double-win’ objective, a contribution to sustainable development. Should revisions to the CDM not be made, the mechanism will continue to be criticised for its sole focus on just one of its dual objectives.
Afionis, S & Stringer, LC 2012, *The environment as a strategic priority in the European Union - Brazil partnership: is the EU behaving as a normative power or soft imperialist?*, Sustainability Research Institute, University of Leeds, Leeds [31 January 2012].


Allan, A 2012, 'Island nations signal end for Kyoto cash cow', *Thomas Reuters*, 31 August [5 November 2013].


Andrade, C unpublished, *Cleaner Technology and Sustainable Development in Brazil: contribution of CDM*, Federal University of Bahia, Salvador.


Bodansky, D 2001, 'The history of the global climate change regime', in International Relations and Global Climate Change, eds U Luterbacher & DF Sprinz, Massachusetts Institute of Technology, Massachusetts, pp. 23-40.


Brazilian Forum of NGOs and Social Movements for Environment and Development 2007, Climate Change and Brazil. Contributions and Guidelines for Incorporating Climate Change Issues in Public Policy, Brazilian Forum of NGOs and Social Movements for Environment and Development., [10 April 2011].


Brown, KB 2011, 'Wind power in northeastern Brazil: Local burdens, regional benefits and growing opposition', Climate and Development, vol. 3, no. 4, pp. 344-360. [2013/06/05].


Carbon Market Watch 2012b, Letter to Dr Rigoberto Cuellar, Brussels [15 May 2013].


Carbon Trade Watch 2013, Protecting Carbon to Destroy Forests: Land Enclosures and REDD+, Carbon Trade Watch, Barcelona [1 June 2013].


de Sépibus, J 2009, *Reforming the Clean Development Mechanism to Accelerate Technology Transfer*, NCCR Trade Regulation. Swiss National Centre of Competence in Research, Bern [10 October 2013].


Department for Environment, Food and Rural Affairs, *UK Guidance on Approval and Authorisation to Participate in Clean Development Mechanism Project Activities*. [15 September].

Department of Climate Change and Energy Efficiency 2013, *Registry Arrangements to Facilitate Linking with the EU Emissions Trading System*, DoCCaE Efficiency, Department of Climate Change and Energy Efficiency, Canberra, [20 April 2013].

Department of Energy and Climate Change 2010a, Beyond Copenhagen: The UK Government's International Climate Change Action Plan, Department of Energy and Climate Change, [31 August 2010].


Department of Energy and Climate Change, Charging Scheme and the Fees that have been Introduced, Department of Energy and Climate Change. Available from: <http://www.decc.gov.uk/assets/decc/What we do/Global climate change and energy/Tackling Climate Change/intl_strategy/1689-faqs-dna-dfp-charging-transferral.pdf%3E. [15 March].


Desai, V & Potter, R 2002, 'The nature of development and of development studies', in Desai, V.


Garside, B 2013, UK to buy 50 mln stg of UN carbon credits to help poor countries in Reuters, Reuters, London.


Guillen, CMB, Chana Michelli Bram Guillen personal communications.


Haya, B & Parekh, P 2010, *Hydropower in the CDM: Examining Additionality and Criteria for Sustainability*, University of California, Berkeley [31 January 2012].


Kasa, S 2013, 'The second-image reversed and climate policy: how international influences helped changing Brazil's positions on climate change', *Sustainability*, no. 6, p. 17. [20 November 2013].


Kollmuss, A 2012, *Subject: Call for Public Input on "Issues Included in the Annotated Agenda of the 72st Meeting of the CDM Executive Board and its Annexes"*, Carbon Market Watch, Brussels [5 June 2013].


Lenzen, M 1997, 'Individual responsibility and climate change', *International Academic Conference on Environmental Justice* [20 February 2012].


Ministry of Science and Technology General Coordination Office on Global Climate Change and Interministerial Commission on Global Climate Change 2008, *Manual for Submitting CDM Project Activities to the Interministerial Commission on Global Climate Change, aimed at obtaining a Letter of Approval from the Brazilian Government*, Ministry of Science and Technology General Coordination Office on
Global Climate Change and Interministerial Commission on Global Climate Change, Brasilia [20 February 2011].


Plan Vivo (no date), Summary of Plan Vivo Registration and Continued Review Procedures, Plan Vivo, Edinburgh [20 April 2012].


Poelhekke, FGMN 1996, Brazil. NGO Country Profile, Gemeenschappelijk Overleg Medefinanciering, Oegstgeest.


Rothballer, C no date, *The Green Zeitgeist. The Primary Valorisation of the Atmosphere and the Impact of Brazil's Clean Development Mechanism on Sustainable Development. Summary and Fact Sheet of a Brazilian Case Study*, University of Vienna, Vienna [10 November 2010].


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Schneider, L & Mohr, L 2010, 2010 Rating of Designated Operational Entities (DOEs) Accredited under the Clean Development Mechanism (CDM), Öko-Institut Berlin [10 January 2011].


Seres, S 2008, Analysis of Technology Transfer in CDM Projects, UNFCCC Registration and Issuance Unit CDM/SDM, Montreal [10 October 2013].


Stockholm Environment Institute 2012, Transitioning Away from Large-Scale Power Projects: a Simple and Effective Fix for the CDM?, Stockholm Environment Institute, Somerville [15 November 2013].


Sun, Q 2011, Understanding the Clean Development Mechanism and its Dual Aims – The Case of China’s Projects, Doctoral thesis, Royal Institute of Technology. [10 February 2012].


Turkowski, A 2012, 'Russia's international climate policy', The Polish Institute of International Affairs no. 27. [20 November 2013].


United Nations 2012b, 'Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its eighth session, held in Doha from 26 November to 8 December 2012. Addendum. Part Two: Action taken by the Conference of Parties
serving as the meeting of the Parties to the Kyoto Protocol at its eighth session’, in
Conference of Parties, Doha. [15 September 2013].

United Nations Department of Economic and Social Affairs Division for Sustainable
Development, Agenda 21, United Nations Department of Economic and Social Affairs

Assessment of Progress, United Nations Development Programme, New York [5 May
2010].

Finance for Sustainable Development, United Nations Development Programme, New
York, [10 September 2010].

United Nations Development Programme, Human Development Reports, United Nations

United Nations Development Programme, Millennium Development Goals Indicators. Official
List of MDG Indicators., United Nations Development Programme. Available from:
November].

United Nations Environment Programme 1989, Global Climate Change, United Nations
Environment Programme, New York [20 February 2012].

United Nations Environment Programme Collaborating Centre on Energy and Environment
Risø National Laboratory (no date), Introduction to the CDM United Nations
Environment Programme Collaborating Centre on Energy and Environment Risø
National Laboratory, Roskilde [10 August 2010].

United Nations Environment Programme Risø Centre on Energy, CaSD, CERs, United Nations
Environment Programme Risø Centre on Energy, Climate and Sustainable
November].

United Nations Environment Programme Risø Centre on Energy, Climate and Sustainable
Development, 2011, UNEP Risø CDM/II Pipeline Analysis and Database, United
Nations Environment Programme Risø Centre on Energy, Climate and Sustainable
Development, Roskilde.

United Nations Environment Programme, First Round of Loan Scheme Reveals Great Interest
for CDM Projects, United Nations Environment Programme. Available from:
l=en3E>. [12 July].

United Nations Framework Convention on Climate Change (no date), Clean Development
Mechanism Validation and Verification Manual, United Nations Framework
Convention on Climate Change, Bonn.

United Nations Framework Convention on Climate Change 1992a, United Nations Framework
Convention on Climate Change, United Nations Framework Convention on Climate
Change, Bonn, [20 February 2012].

United Nations Framework Convention on Climate Change 1992b, United Nations Framework
Convention on Climate Change, in United Nations Conference on Environment and
Development, United Nations Framework Convention on Climate Change, Rio de
Janeiro. [11 September 2010].

United Nations Framework Convention on Climate Change 2010, 'UNFCCC 2010 Annual
Report. Conference of the Parties 6th Session', in Conference of the Parties 6, United
Nations Framework Convention on Climate Change, Cancun. [10 July 2011].

United Nations Framework Convention on Climate Change 2011, Benefits of the Clean
Development Mechanism, United Nations Framework Convention on Climate Change,
Bonn[15 April 2012].

Tool for Highlighting Sustainable Development Co-Benefits of CDM Project Activities
and Programmes of Activities’, in Executive Board Meeting 68, UNFCCC, Bonn. [1 November 2013].


Valentim, R, Calazans, M, Meirelles, D, Gilbertson, T, Laschefski, K & Overbeek, W 2003, Where the Trees are a Desert: Stories from the Ground, Carbon Trade Watch, FASE, Vitória; Amsterdam [13 July 2011].


Winkler, H 2013, A Carbon Tax in South Africa. Perspectives from an Academic, CIfCEa Policy, Centre for Climate Economics and Policy, Canberra.


World Bank 2011c, Data by Country, World Bank, Washington D.C.

World Bank 2012a, Data, World Bank, Washington D.C.


Yale Center for Environmental Law & Policy 2011, Climate Policy & Emissions Data Sheet: Brazil, Yale Center for Environmental Law & Policy, New Haven [5 October 2013].

Appendix A – Results of the Assessment Methods

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A.1 Current Status of the International CDM Market

The following sections (Current Status of the International CDM Market and Current Status of the Brazilian CDM Market) present information regarding current projects according to the version of the UNEP Risø CDM/JI Pipeline Analysis and Database published on May 1, 2011 (United Nations Environment Programme Risø Centre on Energy 2011). The number of projects registered in Brazil that are used for the analysis in this section is 190, as opposed to the 178 projects that are used for the sustainable development assessment frameworks. The reason for this is that 12 projects did not have all documentation regarding their registration publicly available. Where references are made to kCERs, this refers to the kCERs expected to be generated to 2012 rather than 2020, as the 2012 figures rely less on future extrapolation of data, therefore reducing uncertainty. In terms of the number of registered CDM projects, Brazil is third on the list of host countries, behind China and India.

Figure A.1-1 shows the number of registered projects and kCERs generated by 10 of the top host countries in the world. China accounts for 45% of projects and 64% of kCERs to 2012, with India next at 21% of projects and 11% of kCERs, followed by Brazil with 6% of projects and 5% of kCERs (United Nations Environment Programme Risø Centre on Energy 2011). Together, China, India and Brazil host 83% of all registered CDM projects and 77% of all kCERs generated in the CDM to 2012.

Figure A.1-1 Percentage of registered projects and kCERs expected to 2012 as at 1 May 2011 by host country

In terms of the countries who are buying CERs, the UK, Switzerland, Japan and the Netherlands make up the top four buyers, with the UK and the Netherlands listed as buyers for 30.8% of all projects worldwide, sourcing from a total of 2162 projects. The dominance of the EU credit buyers can be seen in Figure A.1-2. The information in Figure A.1-2 includes those projects at
validation and requesting registration, as this is not categorised by status on the UN Risø CDM/JI Pipeline Analysis and Database.

![Bar chart showing number of projects sourced by credit buyers from Brazil](image)

**Figure A.1-2 Number of projects that credit buyers are sourcing from**

### A.2 Current Status of the Brazilian CDM Market

#### A.2.1 By Credit Buyer

Figure A.2-1 and Figure A.2-2 illustrate the major credit buying countries from CDM projects hosted by Brazil, by number of projects, and kCERs expected to be generated to 2012. As there are often multiple credit buyers for each project, the total number of projects displayed in Figure A.2-1 and the total number of kCERs expected to be generated to 2012 in Figure A.2-2 do not equal the total number of projects or kCERs hosted by Brazil. For each project where there are multiple credit buyers, the kCERs expected to be generated for each project are divided equally by the number of project credit buyers, as the data does not allocate the number of credits purchased to each buyer. By number of projects, the UK and Switzerland are credit buyers for the largest number of projects. For kCERs to 2012, the UK and the Netherlands purchase the largest number of credits, assuming the equal division of credits between each purchasing country for projects with multiple credit buyers.
A.2.2 By Project Type

Given the discussion surrounding the links between project type and contributions to sustainable development, it is important to analyse the breakdown of project types by both number of projects and generation of CERs. Figure A.2-3 shows the number of projects as well as the expected kCERs to 2012 for registered projects for each project type.

In terms of total project numbers, the project types that were best represented in Brazil included methane avoidance, mostly from manure at 26%, biomass energy projects, mostly from bagasse power with 24% and hydro at 23%, mostly from run of river projects. Figure A.2-3 also shows that projects that generated the highest proportion of kCERs for Brazil included landfill gas with...
36% of all CERs, and these CERs are split evenly between landfill flaring and landfill power. Landfill gas is followed by N\textsubscript{2}O projects with 29% of all CERs generated, mostly from a single adipic acid project, and also from hydro projects, which are expected to generate 10% of all CERs to 2012 from registered projects. The single adipic acid project is expected to generate 27% of all kCERs to 2012 for registered projects.

![Graph showing the breakdown of projects into scale by project number and by kCERs expected to 2012 for Brazil.](image)

**Figure A.2-3 Number of projects and kCERs to 2012 by project type**

### A.2.3 By Project Scale

The scale of projects is often assumed to be a determinant of the contribution of a project to sustainable development (see Chapter Four). Thus an analysis of project scale will be undertaken both here and in the sustainable development assessment frameworks.

Figure A.2-4 shows the breakdown of projects into scale by project number and by kCERs expected to 2012 for Brazil. In terms of project number, large-scale projects make up 56% of projects while small-scale projects make up 41%. In comparison, 26% of projects hosted by China, 65% by India and 60% by Mexico are small-scale.

In terms of kCERs however, large-scale projects constitute 85% compared to just 15% for small-scale projects. This is to be expected given that by definition, large-scale projects will produce more kCERs, however these figures show that the vast majority of income being generated through the sale of CERs is by large-scale project developers. In comparison to other host countries, small-scale Chinese projects are expected to generate 3% of the kCERs to 2012, Indian projects 17% and Mexican 1%.
Figure A.2-4 Number of projects and kCERs to 2012 for each project scale

Figure A.2-5 shows the proportion of projects that are either large or small-scale for each project type. These figures show the proportion of large and small-scale projects that have been registered in Brazil. Projects at validation are excluded from this figure, as project size is not recorded on the UNEP Risø CDM/JI Pipeline Analysis and Database for projects at validation. The asterisk denotes project types where the scale of one project is not specified.

Biomass energy projects for all sub-types, aside from bagasse power, are more likely to be small-scale. CO₂ usage, energy distribution, N₂O, PFCs and SF₆ and reforestation projects in this dataset were all large-scale. Three out of the four wind projects were small-scale whereas for EE own generation, fossil fuel switch, hydro and methane avoidance, there was a more even divide between small and large-scale.
A.2.4 Over Time

The number of projects sent to validation and the number of projects registered for each quarter from 2004 to 2011 has varied considerably in response to a number of variables including fluctuating prices for CERs, the change in Brazilian laws regarding the energy grid calculations in 2008 (Michaelowa 2011), changing confidence in the future of carbon markets and changes in UNFCCC methodology rules and registration requirements. Figure A.2-6 below shows the number of projects sent to validation (according to the date when the comment period started) and the number of projects registered per quartile of each year since 2004 until the first quartile of 2011.

The spikes in registration in 2005 show the approval of a backlog of projects that were sent to validation in 2004-5. The decline in registration despite continued high levels of projects sent to validation in 2008-9 coincide with the tightening of UNFCCC additionality rules and procedures.

![Figure A.2-6 Number of Brazilian projects sent to validation and registered over time (quartile and year)](image)

A.2.5 By Macro-Region

As shown in Figure A.2-7, the majority of registered projects are located, and kCERs sourced, from the Southeast region of Brazil. For registered projects, the total percentage of project numbers sourced from the Southeast was 48%. For kCERs expected to 2012, this bias towards the Southeast is even more pronounced, with a total of 67% of kCERs generated in this region.
In order to assess the geographic spread of projects on a smaller scale, Figure A.2-8 shows the spread of projects across the different Brazilian states in terms of percentage of both project numbers and kCERs expected to 2012 for registered projects. The dominance of the Southeastern states is clearly shown, however there is also internal macro-regional dominance of some states.

For the Southeast, all states are participants in the CDM. São Paulo is by far the most dominant state, hosting 27% of all projects and generating 54% of all kCERs for the entire country, and this surpasses the next largest CDM state in the Southeast and in the country, Minas Gerais, which hosts nearly 16% of all projects and generates 7% of kCERs for Brazil. In the South, all states are again represented with an approximately even spread across the three states, ranging from six to 8.5% for number of projects and nearly four to five percent for kCERs generated as a percentage for all of Brazil.

Six out of the nine states of the Northeast host at least one CDM project and the state of Bahia, home to the capital of the Northeast, Salvador, hosts the majority of these projects. Bahia hosts 3% of all Brazilian CDM projects and generates 6.5% of all CERs expected to 2012, compared to just 0.5% of all projects for the other CDM host states and between 0.008 to 0.8% of all CERs expected to 2012.

For the Northern region, three out of the seven states host CDM projects with no obvious dominance of any one state in this region, with Rondônia hosting a higher proportion of projects (2.4%) and Pará generating a slightly higher proportion of CERs to 2012 (1.8%). In the Central West, all states except the Federal District are represented. There is an relatively even share of project numbers and a range from 1.3% of CERs generated in Mato Grosso do Sul compared to 3.1% of CERs in Mato Grosso.
States that have so far failed to attract CDM investment include the Federal District in the Central West; Acre, Amapá, Roraima and Tocantins in the North; and Ceará, Piauí and Sergipe in the Northeast. Amapá and Tocantins (Northern region) are both represented amongst projects at validation, with a single project each at this stage.

Figure A.2-8 Percentage of projects and kCERs expected to 2012 by state and macro-region

Figure A.2-9 demonstrates the rate of investment in the different macro-regions of Brazil by using the registration dates of projects and categorising these into quartiles from 2004 to 2011. This figure demonstrates the overall dominance of projects in the Southeastern region of Brazil over the entire time period given, however there is has been a consistent trend of registration of projects in the Central West throughout this same time period. Projects in the Northern region, whilst greater in numbers between 2006 and early 2009, have not been as prominent since then. Projects in the Northeastern region experienced the highest number of registrations between 2005 and 2007, yet have had fewer registrations since 2008.

Given the changes in Brazilian legislation regarding the electricity grid in 2008 and the adoption of the national emission factor rather than having different emission factors for the north and south of Brazil as occurred in the past (Fernando Badanhan & Augusto Trein 2011), it was expected that cogeneration projects in the North and Northeast of Brazil would experience an increase post-2008, however there is little evidence to support this assumption.
Figure A.2-9 Number of projects registered over time (year and quartile) for each macro-region of Brazil

Figure A.2-10 demonstrates the total kCERs expected to 2012 from projects registered from 2004 until 2011, by date of registration. This table clearly shows that the number of kCERs from registered projects has steadily decreased since a high in late 2005 (the registration of the single adipic acid project). The majority of kCERs from the Northeast were with projects registered during 2005, and the majority of kCERs from the South and North were with projects registered from 2006 to 2007.

Figure A.2-10 Number of kCERs generated to 2012 over time by date of registration and macro-region
As shown in Figure A.2-11, the majority of projects in the Southeast and Southern regions are biomass energy, hydro, landfill gas and methane avoidance projects. For the Central West, projects are mainly hydro or methane avoidance. In the Northeast, projects are mainly landfill gas while other projects are spread across a range of categories including biomass energy, hydro and methane avoidance. Projects in the Northern region of Brazil are mainly hydro, with some biomass energy, energy efficiency, landfill gas, methane avoidance and PFCs and SF$_6$ projects. The dominance of the Southeast and South in most categories can be clearly seen, with the Central West region hosting a large proportion of hydro and methane avoidance projects. Wind projects are the only project type that the Northeast region has more of relative to the other macro-regions.

The majority of both landfill gas and N$_2$O project types are hosted in Brazil’s Southeast region. Hydro projects are represented in each region of Brazil, with the Southern region hosting the largest number of these projects. Biomass energy projects are located across all regions of Brazil.

In terms of kCERs expected to be generated to 2012, Figure A.2-12 shows a clear dominance of N$_2$O and landfill gas project types, followed by biomass energy and hydro. Despite the fact that there are only five N$_2$O projects in Brazil, these projects, four of which are located in the Southeast, are expected to generate the most kCERs compared to all other project types.

For the Southeastern region, the majority of kCERs expected will be from N$_2$O and landfill gas projects and for the South, this will be from biomass energy and hydro projects. The Central West expects most kCERs to come from methane avoidance and hydro. The Northeastern
region expects most kCERs to be generated from landfill gas projects and for the Northern region, this will be from landfill gas, hydro and biomass energy. Wind projects located in the South are expected to produce more kCERs than those in the Northeast, despite the Northeast hosting a larger number of projects.

Figure A.2-12 kCERs expected to 2012 by project type and macro-region

### A.2.6 Renewable or Fixed

Of the registered projects in Brazil, 70% or 132 of them are renewable projects as opposed to 29% or 55 of fixed projects, with one project not specifying this. For those project developers who have selected renewable, this means that they can renew their projects for another crediting period after seven years while those who chose fixed have a non-renewable 10-year crediting period. The proportion of renewable projects gives an indication of the future of the CDM market in Brazil and as there are a large proportion of renewable projects, this indicates that project investors intend to continue to generate kCERs past the seven-year mark.

### A.2.7 By PDD Consultant

There were 42 PDD consultants with registered projects in Brazil and their market share is shown in Figure A.2-13 below. Ecoinvest, AgCert and Econergy have the largest single market shares from 16 to 19%, while 20% of PDD consultants have less than three projects in the pipeline. Out of these top three PDD consultants, Ecoinvest focuses on projects in biomass energy, hydro and EE service; AgCert in methane avoidance; and Econergy in biomass energy, landfill gas and wind. AgCert also has the largest number of projects that have achieved DOE...
validation to be later terminated by the UNFCCC out of all of the PDD consultants in the UNEP Risø CDM/JI Pipeline Analysis and Database. For the purposes of this evaluation, projects with multiple consultants are divided equally between consultants.

![Pie chart showing the share of registered projects and projects at validation by PDD consultant.]

**Figure A.2-13 Share of registered projects and projects at validation by PDD consultant**

Figure A.2-14 shows the location of headquarters for the PDD consultants with registered projects in Brazil. Brazilian based PDD consultants account for the majority of projects with 56%, and Ireland and the UK following with 18 and 10% respectively. Econergy and Ecoinvest are both Brazilian based, while AgCert has headquarters in Ireland and Ecoscurities, with 9% market share, is from the UK. Projects with World Bank PDD consultants are considered to be based in the US and projects with multiple PDD consultants are divided equally between the PDD consultant headquarters.
A.2.8 By Designated Operational Entity

For a project to be registered in Brazil, the Brazilian government has determined that the validator and verifier for the project must have representation within Brazil to ensure that there is a level of local knowledge within the organisation regarding the Brazilian CDM market and regulatory requirements. Figure A.2-15 and Figure A.2-17 show the market share of validators for registered and projects at validation in Brazil and for verifiers for registered projects respectively. Figure A.2-16 and Figure A.2-18 show the market share by country of origin of validator and verifier respectively.

The UK based company DNV Climate Change Services AS (DNV) has the largest market share for validation for Brazilian projects at 42%, with TÜV-SÜD next at 33% and SGS, BV Cert, TÜV-Nord and RINA sharing between three and 17% of the market. The remaining 1% of the market belongs to RINA as shown in Figure A.2-15. Figure A.2-16 shows the market share of the home country of validators as listed in the UNEP Risø CDM/JI Pipeline Analysis and Database. European Union nations are home to validators for 82% of the Brazilian registered projects, with Switzerland home to the remaining 18% of validations.
Figure A.2-15 Market share of registered projects by validator

Figure A.2-16 Validator country headquarters for Brazilian CDM projects

Figure A.2-17 demonstrates the market share of the Brazilian projects that have undergone verification. Again, the UK based DNV retains the largest share, with SGS, BV Cert, TÜV-SÜD and TÜV-Nord sharing between eight and 24% of the market and the remaining 2% shared between Lloyd’s Register Quality Assurance Ltd and RINA S.p.A. Figure A.2-18 shows the country headquarter location of the verification companies and their market share in Brazil. Again, the UK dominates, with Switzerland, Germany and Italy also hosting the headquarters of Brazilian CDM project verifiers.
A.3 Future Projections for the International CDM Market

The following section presents the information regarding current and future projects according to the version of the UNEP Risø CDM/JI Pipeline Analysis and Database published on May 1, 2011 (United Nations Environment Programme Risø Centre on Energy 2011).

A.3.1 Future Projections for the International CDM Market by Host Country

Figure A.3-1 below shows the number of projects either registered or at validation (including projects requesting registration) for the top 10 host countries by number of projects at validation.
stage. As can be seen, China will continue to dominate the CDM market for the foreseeable future, while India’s share of projects is set to decline according to this data. Brazil’s share of 7% of the global market remains steady with Brazil hosting 6% of projects at validation. Declines in the share of projects at validation in Vietnam and Thailand have been offset by increases in those of Mexico, Indonesia and Malaysia.

Out of the projects either registered or at validation, 45% of the projects hosted by Brazil are at the validation stage. This indicates that there are still a large number of CDM projects in Brazil yet to commence and suggest that CDM projects are considered a worthwhile investment, despite the lack of international consensus regarding a successor to the Kyoto Protocol.

![Graph showing top 10 countries by number of projects registered and at validation for each host country.](attachment:figureA3-1.png)

Figure A.3-1 Top 10 countries by number of projects registered and at validation for each host country

As seen in Figure A.3-2, the percentage share of CERs from projects at registration and projects at validation stages decreases for China and Brazil, while countries such as India and those in the ‘other countries’ category, the smaller players in the CDM market, are projected to experience growth in their market share of CERs from CDM projects. The dominance of the three largest players in the CDM market is set to continue despite this decline.
A.3.2 Future Projections for the International CDM Market by Credit Buyer

In terms of the number of countries buying CERs from CDM projects, Figure A.1-2 includes projects that are registered and at validation, so future projections of the continued dominance of the countries of the EU, the UK in particular, and Switzerland and Japan remains unlikely to change. The data in Figure A.1-2 includes those projects at validation and requesting registration, as the project status is not specified in the UN Risø CDM/JI Pipeline Analysis and Database.

A.4 Future Projections for the Brazilian CDM Market

A.4.1 By Project Type

Given the discussion surrounding the links between project type and contributions to sustainable development, it is important to analyse the breakdown of project types by both number of projects and generation of CERs. Figure A.4-1 shows the proportion of projects either registered or at validation for each project type and Figure A.4-2 shows the proportion of kCERs generated from projects either registered or at validation (including those projects requesting registration) for each project type. The percentages indicate the percentage of projects or kCERs generated for each project type.
Figure A.4-1 Comparison showing the proportion of projects for each project type by status

Changes that can be expected in the proportion of project types in the future in terms of project numbers are increases in the proportion hydro projects, in particular run of river hydro projects and also wind projects. The proportion of methane avoidance and landfill gas projects on the other hand look set to decline in dominance. Hydro projects increased from 23% to 30% of the proportion of registered to at validation projects and wind increased from just 2% to 9% of projects at validation, while landfill gas projects more than halved from 14% to 6% and methane avoidance projects reduced from 27% to 18%. Biomass energy projects are still expected to retain around a quarter of the market in terms of projects numbers (24%).
In terms of kCERs generated, there is a dominance of a single N₂O project (adipic acid), in the proportion of kCERs from registered projects and as there are no such projects at the validation stage, this is the largest single change likely in the proportion of kCERs from future projects in Brazil, from 29% of all kCERs to 0%. Given the EU legislation on the banning of industrial gas projects for use within the EU ETS (Europa 2011; Official Journal of the European Union 2011), demand for industrial gas projects will not increase. As a result of this decline and increases in kCERs generated from projects in other sectors, the proportion of projects from methane avoidance are expected to increase from just 2% to 37%, in EE own generation from 1% to 15% and hydro from 10% to 16%. Decreases in landfill gas from 36% of all kCERs to just 12% are expected. Biomass energy projects retain 15% of market share while reforestation projects decrease from 4% to 0%.

A.4.2 By Project Scale

Only registered projects are identified as either small or large-scale in the UN Risø CDM/JI Pipeline and Analysis Dataset, and as such, no evaluation of the future projections based on the scale of projects can be made.

A.4.3 By Macro-Region

As shown by Figure A.4-3 and Figure A.4-4 below, there is a slight increase in regional spread for the number of projects at validation compared to the regional spread for those already registered (including those requesting registration). In particular there is a fall in the proportion
of projects in the Southeast of 7% compared to 1-2% increases in projects in the South and Northeast. For kCERs to 2012, there are increases of 6% to 14% for the Central West, 4% to 15% for the North and 14% to 17% for the South. While the Northeast is expected to see a small increase in the share of projects in the future according to the projects listed as at validation, it may experience a decrease in the share of kCERs expected to 2012 from 8% to 4% if the projects at validation are registered in similar proportions to those that are demonstrated by these figures.

![Figure A.4-3 Proportion of projects by macro-region and status](image)

![Figure A.4-4 Proportion of kCERs generated to 2012 by macro-region and status](image)

### A.4.4 By PDD Consultant

Figure A.4-5 shows that the number of PDD consultants for projects at validation has greatly increased compare to the number of consultants for registered projects. The market share for AgCert, Ecoinvest, Econergy and Ecosecurities, the market leaders for registered projects, has declined and a number of smaller and new consultants in the Brazilian market have taken this share.
Figure A.4-5 Proportion of projects by PDD consultant and by status

Figure A.4-6 shows the location of the headquarters of the PDD consultants for registered projects and those at validation. Brazil continues to host headquarters for just over 60% of the PDD consultants, while there have been large declines in the share of Ireland, the UK and Argentina in PDD consultants with projects at validation in Brazil.

Figure A.4-6 Proportion of projects by the location of headquarters of PDD consultant and status

A.4.5 By Designated Operational Entity

In terms of the DOEs used for project validation, Figure A.4-7 shows the future changes in market share of validators. The three largest validators in market share of registered projects
show a decline in the share of projects at validation, while a number of smaller and newer validators are increasing their share of projects validated.

Figure A.4-7 Proportion of projects by DOE by status

In terms of the headquarters of the DOEs used for validation purposes in Brazil, Figure A.4-8 demonstrates that while the UK market share of validations by DOEs remains steady, the decline in the share of German and Swiss DOEs for registered projects to projects at validation has been shared between Italy, China, Columbia and Spain for projects at validation.

Figure A.4-8 Proportion of projects by the location of headquarters of DOE and by status

A.5 Brazilian DNA Checklist Methodology

This section will present the results of the analysis of the 178 CDM projects with all documentation publicly available that were hosted by Brazil to 1st May 2011, according to the Brazilian DNA Checklist methodology set out in Chapter Five. These results are divided into
sections on the overall contribution of the CDM projects to sustainable development, the contribution of particular project types and the contribution according to project scale.

**A.5.1 Overall Brazilian DNA Methodology Sustainable Development Contribution**

According to this method of analysis, which incorporates the Brazilian DNA CDM requirements for contribution to sustainable development, overall results indicate that there is some level of contribution to sustainable development from CDM projects and the results below show the overall contribution on a national scale. It is important to note that only projects where a contribution was explicitly mentioned in either the Annex III or PDD documentation were given a score for these and all the other criteria for this analysis (see Chapter Five for details). There was no measurement recorded of whether projects provided further details or quantification of claims made in these documents. When a CDM project claimed to help or assist a pre-existing social, environmental or economic project in the community or company, this was recorded as either ‘helping existing benefit’ or ‘available already’.

Overall, the number of categories of sustainable development contributions claimed are shown in Figure A.5.1. This figure is calculated from adding up the number of contributions claimed for each of the following 11 categories used for the five sections of the Annex III requirements, including: solid waste reduction; improvement in air quality; improvement in water quality and quantity; adherence to social and labour responsibilities; staff health and educational benefits; improvement in quality of life; socioeconomic benefits; generation of employment; technological reproducibility; technological innovation and socioeconomic regional integration. Information on the origin of equipment and the need for international assistance is omitted given that claims in the PDDs have been made to argue that both Brazilian and internationally available equipment and know-how both contribute to sustainable development for Brazil.
No projects claimed a contribution across all 11 categories, however 41% of projects claimed benefits across half or more of the categories and 18% of projects claimed less than four categories of benefits, with one project claiming no benefits across the indicators.

A.5.1.1 Brazilian DNA Overall Contribution to Local Environmental Sustainability

To measure the contribution to environmental improvement, claims for solid waste reduction, and improvements to air quality and water quality and quantity were assessed. In terms of a contribution to environmental sustainability, on a national-scale, 37% of projects contributed to reducing solid waste in the form of new projects, with nearly 3% claiming that they were assisting projects already in existence. Nearly 60% of projects did not contribute to this criterion. There were 61% of projects claiming to contribute to an improvement in air quality, with a further 1% assisting projects already occurring. The remaining 38% of projects did not contribute to this criterion. Water quality and quantity was included in sustainable development claims for 58% of projects, with a further 2% assisting existing improvements. Figure A.5-2 demonstrates the contribution to environmental development of all Brazilian CDM projects in the dataset.
The proportion of all projects contributing to at least one category of environmental sustainability was 81%, with 53% contributing to at least two and 28% to all three. A total of 19% of projects made no claims of contribution towards environmental sustainability. This calculation included projects where a contribution to a pre-existing benefit was claimed.

A.5.1.2 Brazilian DNA Overall Contribution to Development of Working Conditions and Net Generation of Jobs

Section B of the Annex III documentation asks project developers to outline the contribution of the project to the development of working conditions and the net generation of jobs. Assessment of the contribution of projects to upholding social labour responsibilities, contributing to staff health and educational benefits and the net contribution to ongoing and temporary employment and skilled and unskilled employment is presented below.

The project documentation was assessed for a specific mention of upholding the social labour responsibilities towards employees and of the projects in the dataset, 28% of projects mentioned this. For an assessment of the contribution of a project towards staff health and educational benefits, 11% of projects claimed a contribution to a new project, 26% claimed that the CDM projects were assisting with existing benefits and 63% of projects had no mention of this benefit.

In terms of employment generated by CDM projects, this analysis has divided this into a number of categories based on the requirements for details on the Annex III documentation. Employment figures are divided into temporary and ongoing employment, with temporary employment related to employment needed for construction and ongoing employment linked to operational employee requirements. These two fields are also divided into direct and indirect employment generated, as requested by the Annex III documentation.
Temporary employment directly linked to CDM projects was claimed for 84% of projects. 56% of projects claimed indirect temporary employment as a result of CDM projects, illustrated in Figure A.5.3. For ongoing employment directly linked to CDM projects, 69% of projects claimed this contribution to sustainable development while 56% claimed indirect ongoing employment as a result of CDM projects. While the majority of projects claimed ongoing and temporary employment, both direct and indirect, not many projects quantified these figures in either the PDD or Annex III documentation. Figure A.5-3 shows the percentage of all projects that claimed employment generation and quantified their claims.

Figure A.5-3 Employment generation and quantification for each employment category

For those projects where employment generation was quantified, the mean number of jobs for temporary direct jobs was 343, while the minimum and maximum was five and 1500 respectively. For temporary indirect jobs, the mean number was 375 and the minimum and maximum 35 and 1000. Ongoing direct employment generation had a mean number of 20 jobs while the range was from two to 100. For ongoing indirect jobs, the mean number was nine while the number ranged from one to 160.

The proportion of projects that contributed to at least one category in section B was 86%, at least two categories 32% and all three categories including employment generation was 17%. A total of 14% of projects did not contribute to a category in this section of the Annex III requirements. Where relevant, this calculation included projects where a contribution to a pre-existing benefit or project was claimed.

A.5.1.3 Brazilian DNA Overall Contribution to Income Distribution

For Section C of the Annex III requirements, projects must state their contribution towards income distribution and to measure this, specific contributions to the quality of life of local
residents and socioeconomic benefits were assessed, as shown in Figure A.5-4. Quality of life improvements were claimed in 30% of projects, while a further 13% claimed that CDM projects were contributing to existing quality of life improvements. Contributions to pre-existing socioeconomic benefits were claimed by 20% of projects while 19% claimed that the CDM projects were contributing to new socio-economic improvements. A total of 57% and 61% of projects did not contribute to improvements in quality of life or socio-economic benefits respectively.

Figure A.5-4 Improvements to quality of life and socioeconomic benefits claimed

Of the projects in this dataset, 52% claimed no contribution to either of the categories, while 14% of projects claimed one benefit and 34% of projects claimed both benefits. Where relevant, this calculation included projects where a contribution to a pre-existing benefit was claimed.

A.5.1.4 Brazilian DNA Overall Contribution to Capacity Development and Technological Development

Section D of the Annex III documentation requires project developers to outline the contribution of the project to technological development and capacity building. This analysis counted the number of projects that claimed technological reproducibility, the level of technical innovation, the origin of the equipment needed and the need for international technological assistance.

Reproducibility of the CDM projects was claimed for 72% of projects while only 10% of projects claimed a contribution to technical innovation.

Equipment was largely claimed to be domestically produced, which while good for domestic industries, may weaken claims of technological transfer and innovation. A total of 58% of projects claimed that most equipment was sourced in Brazil, while 7% claimed that most equipment was sourced from overseas. The remaining 35% did not specify. The need for
international assistance was claimed in just 15% of projects, with 40% stating that international assistance was not required and the remainder did not specify.

When assessing just the categories for technological reproducibility and innovation, it was found that 27% of projects made no contribution to this section of the Annex III requirements, while 64% of projects claimed a contribution to one category and 9% claimed a contribution to both technological reproducibility and innovation.

A.5.1.5 Brazilian DNA Overall Contribution to Regional Integration

Section E in the Annex III documentation requires project developers to state whether or not the CDM project contributes to regional integration and to other economic activities in the region. The majority, 84% of projects claimed that regional integration was taking place as a result of the CDM projects.

A.5.1.6 Brazilian DNA Overall Type of Stakeholder Participation

As part of the compulsory stakeholder communication, project developers must contact a certain number and range of stakeholders prior to and during validation. As part of this assessment, the number of stakeholder responses as itemised on the PDD documentation was counted. The total number of responses received for the 178 projects was just 204, with a mean of 1.1 responses per project. Only 78 projects received more than one response, with 100 projects receiving no responses from stakeholders contacted. A total of 63 projects received between one and three responses, eight projects received between four and six responses and five projects received seven or more responses.

A.5.2 Brazilian DNA Results Relative to Project Type

The following section assesses the contribution to sustainable development of each different project type in the dataset. As explored in Chapter Four, the contribution to sustainable development of different project types in the CDM has been discussed at depth and it is necessary to see whether or not there is some correlation between project type and the contribution to sustainable development using this method of assessment.

The total number of claims per project type is shown in the Figure A.5-5 below. A total of 11 categories were used to measure this, excluding information on the origin of equipment and need for international assistance and the mean number of categories claimed per project was 5.4. Fugitive projects claimed the highest overall number of benefits, with biomass energy next and EE own generation, landfill gas and PFCs and SF₆ projects all claiming an average of 6.5 benefits per project. The lowest number of benefits claimed was for the CO₂ usage projects (1.0), followed by hydro (3.5).
Figure A.5.5 Mean number of contributions claimed for Annex III by project type

A.5.2.1 Brazilian DNA Project Type Contribution to Local Environmental Sustainability

Figure A.5-6, Figure A.5-7 and Figure A.5-8 demonstrate the contribution to the reduction of solid waste, the improvement of air quality and the improvement of water quality or quantity respectively. The figures show proportions of projects contributing to new and additional benefits for environmental sustainability, shown in blue, and also the proportion of projects that claim that they are assisting existing environmental sustainability benefits, shown in red. A reduction in solid waste was claimed by both fugitive projects, while methane avoidance, reforestation and biomass energy claimed higher than average reductions in solid waste.
Air quality improvements were claimed by 61% of all projects, with fossil fuel switch, methane avoidance, landfill gas and biomass energy projects all claiming more than the mean level of air quality improvements. Both N₂O and PFCs and SF₆ projects claimed that the CDM projects were supplementing existing air quality improvement benefits.

![Figure A.5-7 Improvements in air quality by project type](image)

Water quality and quantity improvements were claimed by over half of all projects (58%) with fugitive, methane avoidance, landfill gas and wind projects claiming more than the average level of water quality and quantity benefits.

![Figure A.5-8 Improvements in water quality and quantity by project type](image)
Figure A.5-9 summarises the mean number of contributions claimed in the documentation for section A of Annex III. A mean of 1.6 of the three categories were claimed by project developers, with the methane avoidance, fugitive and landfill gas project types claiming the most contributions to environmental sustainability.

Figure A.5-9 Mean number of contributions claimed for section A of Annex III by project type

A.5.2.2 Brazilian DNA Project Type Contribution to Development of Working Conditions and Net Generation of Jobs

With reference to section B of the Annex III requirements, only 28% of projects made a specific mention of adhering to social and labour responsibilities, and of the different project types, EE own generation, fugitive, reforestation, N₂O and biomass energy had the highest proportion of projects claiming this contribution.

More projects claimed that CDM projects contributed to existing staff health and education benefits than those that claimed that CDM projects enabled new and additional benefits, as shown in Figure A.5-10. Those project types with the highest proportions of new and additional benefits include reforestation, landfill gas, fossil fuel switch and hydro. For projects claiming that CDM projects were assisting with benefits already available, fugitive, biomass energy, PFCs and SF₆ and hydro claimed this the most.
Figure A.5-10 Contribution to staff health and education by project type

Figure A.5-11 and Figure A.5-12 demonstrate the proportion of projects that claimed a contribution to employment generation by employment category and project type. As can be seen, the majority of projects, except for fossil fuel switch, claimed high contributions to employment generation. Fugitive, reforestation, EE own generation and landfill gas projects were amongst the highest claiming projects for employment generation. Of these project types, only fugitive and wind projects were likely to quantify the contribution to the net generation of jobs.

Figure A.5-11 Generation of ongoing employment and project type
Figure A.5-12 Generation of temporary employment and project type

Figure A.5-13 illustrates the mean number of contributions claimed in the documentation for section B of the Annex III documentation, measuring the development of working conditions and next generation of jobs had a mean number of categories claimed of 1.3 out of a possible 3. Fugitive, biomass energy and reforestation projects claimed the greatest number of benefits in this section.

Figure A.5-13 Mean number of contributions claimed for section B of Annex III by project type

A.5.2.3 Brazilian DNA Project Type Contribution to Income Distribution

With reference to the third section of the Annex III documentation, Figure A.5-14 and Figure A.5-15 demonstrate the contribution of each project type to both improving quality of life and
providing socioeconomic benefits. New and additional quality of life improvements were claimed by 30% of projects and contributions to existing benefits by 13% of projects. N₂O, wind, landfill gas, reforestation, PFCs and SF₆ and hydro projects all claimed higher than average benefits while fugitive, fossil fuel switch, EE own generation and biomass energy projects claimed higher than average contributions to benefiting existing projects.

Figure A.5-14 Improvements to quality of life by project type

New and additional socioeconomic benefits were claimed by just 20% of projects, with N₂O, landfill gas, reforestation and hydro claiming the greatest contributions. Contributions to existing socioeconomic benefits were made by 19% of projects, with fugitive, EE own generation, fossil fuel switch, PFCs and SF₆, biomass energy and N₂O projects making the highest proportion of claims.
Figure A.5-15 Contribution to socioeconomic benefits by project type

Figure A.5-16 summarises the mean number of contributions claimed in the documentation for section D of the Annex III documentation, measuring the income distribution of projects shows that a mean of 0.8 out of a possible two categories was claimed by all projects. Fugitive, N$_2$O, biomass energy and landfill gas claimed the highest number of benefits in this category.

![Graph showing mean number of contributions claimed for section C of Annex III by project type]

Figure A.5-16 Mean number of contributions claimed for section C of Annex III by project type

A.5.2.4 Brazilian DNA Project Type Contribution to Capacity Development and Technological Development

A large proportion (72%) of projects claimed that technology could be reproduced. All CO$_2$ usage, EE own generation, fugitive, landfill gas, N$_2$O, PFCs and SF$_6$ and wind projects claimed this contribution to sustainable development, as shown in Figure A.5-17.
Technological innovation was claimed by only 10% of projects, with EE own generation, fugitive, PFCs and SF$_6$ and landfill gas projects claiming the greatest contribution, as seen in Figure A.5-18. A large proportion of projects did not specify the origin of the equipment used for the CDM projects (Figure A.5-19), however of those that did, most claimed that the equipment was sourced in Brazil. While this has implications for the achievement of technology transfer under the CDM, most projects argued that the domestic supply of equipment was actually an economic benefit for Brazil. Projects with the highest proportion of imported equipment include PFCs and SF$_6$, landfill gas and fossil fuel switch projects. Projects with the highest proportion of domestically sourced equipment include methane avoidance, hydro, fugitive and fossil fuel switch.
Few projects specified whether or not there was a need for international assistance, as demonstrated in Figure A.5-20, however those that did need assistance mainly included PFCs and SF6, wind and biomass energy projects while those that specified a lack of need for continued international assistance included methane avoidance, fossil fuel switch projects, hydro and biomass energy projects.
Figure A.5-21 summarises the mean number of contributions claimed for section D of the Annex III documentation. The mean number of benefits claimed was 0.8 out of a possible two. Information on the origin of equipment and the need for international assistance is omitted from this total given that claims in the PDDs have been made to argue that both Brazilian and internationally available equipment and know-how both contribute to sustainable development for Brazil. Of the different project types, EE efficiency, fugitive and PFCs and SF\textsubscript{6} projects claimed both of the possible benefit categories while N\textsubscript{2}O projects on average claimed 1.8 benefits.

![Figure A.5-21 Mean number of contributions claimed for section D of Annex III by project type](image)

**A.5.2.5 Brazilian DNA Project Type Contribution to Regional Integration**

Figure A.5-22 summarises the mean number of contributions claimed in the documentation for the final section of the Annex III documentation, which requires developers to describe how their projects will lead to regional integration. There was only one category used to measure the regional integration and a total of 84\% of projects claimed a contribution to this and fugitive, PFC and SF\textsubscript{6} and reforestation projects claimed this benefit in all cases. Biomass energy, hydro and landfill gas projects also claimed this benefit for most projects. The mean number of claims was high, at 0.8 out of a possible 1.
The following section assesses the contribution to sustainable development of large and small-scale projects. As examined in Chapter Four, the difference in contribution to sustainable development of small and large-scale projects in the CDM has been discussed in depth and it is necessary to see whether or not there is some correlation between scale and the contribution to sustainable development using this method of assessment. For this section of the analysis, the single project with an undefined scale has been included in the proportional calculations, but is not displayed in the figures below due to its irrelevance.

**A.5.3 Brazilian DNA Methodology Results Relative to Project Scale**

Figure A.5.22 demonstrates the contribution to environmental sustainability, the first component of the Brazilian Annex III requirements. According to benefits claimed by project developers in the PDD and Annex III documentation, there was only a minor advantage in terms of solid waste reduction and improvements in air quality for small-scale projects compared to large-scale projects. Water quality and quantity improvements were the same, with 58% of projects claiming some new and additional improvement in this aspect of environmental development. Only a few projects claimed that CDM projects were assisting with pre-existing environmental improvements and there was no discernible difference between large and small-scale projects for this.
A.5.3.2 Brazilian DNA Project Size Contribution to Development of Working Conditions and Net Generation of Jobs

In terms of the contribution of the projects in the dataset to the development of working conditions and the generation of jobs, Figure A.5-24 below demonstrates the differences between large and small-scale projects. For a stated commitment to social and labour responsibilities, 35% of large-scale projects claimed this benefit compared to 18% for small-scale projects. The percentage of projects that claimed new and additional benefits for staff health and education for large-scale projects was 11% compared to 10% for small while for those projects where the CDM was assisting existing staff health and education benefits, there was a larger gap with 30% of large-scale projects compared to 20% of small claiming this contribution to sustainable development.

Figure A.5-24 Contribution to staff health and education benefits (new and pre-existing combined) and adherence to social and labour responsibilities
The generation of jobs for each project scale was assessed for direct and indirect temporary and direct and indirect ongoing employment types. For both types of ongoing employment, a higher proportion of large-scale projects claimed this benefit compared to small-scale projects, specifically 10% more large-scale projects claimed ongoing direct employment than small-scale projects and this figure was 12% for ongoing indirect employment, as seen in Figure A.5-25. For temporary employment, there was no difference for direct employment, however 4% more large than small-scale projects claimed the generation of temporary indirect employment.

Project documentation where these employment benefits were quantified is demonstrated in Figure A.5-26. As shown, a much smaller proportion of both large and small-scale projects generate employment and quantify these claims, although figures for both large and small-scale projects do not differ substantially, with the largest difference being for ongoing indirect employment of 27% for small and 22% for large-scale projects.
A.5.3.3 Brazilian DNA Project Size Contribution to Income Distribution

The contribution to income distribution of projects, the third component of the Brazilian Annex III requirements is demonstrated in Figure A.5-27 below. For the categories of improvements in quality of life and socioeconomic benefits, both those claimed to be new and additional as well as those where projects assist existing benefits, large-scale projects rated higher than small-scale. For new and additional benefits to quality of life, 39% of large-scale projects claimed this compared to 18% of small-scale, and for new and additional socioeconomic benefits, 30% of large compared to 8% of small-scale projects claimed this.

![Figure A.5-27 Contribution to improved quality of life and socioeconomic benefits by project scale for new and pre-existing benefits](image)

A.5.3.4 Brazilian DNA Project Size Contribution to Capacity Development and Technological Development

The fourth component of the Annex III requirements covers the contribution of the CDM project to capacity building and technological development in Brazil. Figure A.5-28 demonstrates this through an assessment of the technological reproducibility of projects, the origin of the equipment and the need for international assistance. In terms of technological reproducibility, there was no real difference between the project scales. For the origin of equipment, more small-scale projects claimed that equipment was sourced from Brazil than large-scale projects, while more large-scale projects claimed the need for international assistance than small-scale projects.
Figure A.5-28 Contribution to capacity development and technological development by project scale

A.5.3.5 Brazilian DNA Project Size Contribution to Regional Integration

Section E of the Annex III documentation requires project developers to discuss the contribution to regional integration of their projects and with both 85% of small and large-scale projects claiming this benefit there was no difference between the two.

A.6 Comprehensive Checklist Methodology

This section will present the results of the analysis of the 178 CDM projects according to the comprehensive checklist methodology discussed in Chapter Five. These results are divided into sections on the overall contribution of the CDM projects to sustainable development, the contribution of particular project types and the contribution according to project scale.

A.6.1 Comprehensive Checklist Overall Results

The comprehensive checklist method of analysis incorporates a number of indicators from both the MCA and the DNA analysis as well as including indicators used in other studies of the contribution to sustainable development of CDM projects, as explained in Chapter Five. As there is no aggregated result through this method of analysis. The number of indicators from each pillar of sustainable development, being environmental, social and economic, are not standardised, nor are the indicators weighted. The results in this first section below show the overall contribution of CDM projects to sustainable development in Brazil. Where relevant, the results for projects located across multiple states and municipalities were evenly divided amongst the number of states and municipalities listed in the documentation to reflect as accurate a geographical spread of projects as possible.
Overall, Figure A.6-1 shows that most projects claimed between six and 13 benefits or contributions to sustainable development out of the 27 indicators used in this method of analysis. While this may seem high, the lack of quantification or monitoring of these contributions, which is discussed further in the following sections, weakens the argument that the CDM does promote sustainable development in Brazil.

Figure A.6-1 Total number of sustainable development contributions claimed out of the 27 indicators by proportion of projects

A.6.1.1 Comprehensive Checklist Sustainable Environmental Development Contribution

The contribution of the CDM to sustainable environmental development in Brazil is demonstrated through Figure A.6-2 and Figure A.6-3. The general trend shows that while a number of projects contributed to air, soil or water quality improvements, reductions in solid waste or land area, or had conservation benefits, only a very small number of these projects quantified these benefits or had plans in place to monitor these benefits. The percentages of projects quantifying and monitoring their claims in these figures are a percentage of the total number of projects claiming the benefit. Of the new and additional environmental benefits claimed, improvements in air quality followed by reduced solid waste were the most common, whereas when including for a contribution to benefits already occurring, soil, followed by air quality improvements, reduced solid waste and conservation benefits were the most common. Of those environmental benefits, both new and additional and pre-existing that were claimed, only 30% of them were quantified and just 16% of claimed benefits were monitored and this includes monitoring that was required by environmental mitigation or legislation. Figure A.6-4 illustrates the proportion of projects claiming zero through to seven environmental benefits, including only those benefits attributable to the project itself, not due to additional environmental legislative or mitigation requirements.
Figure A.6-2 Percentage of projects claiming a contribution to environmental indicators

Figure A.6-3 Percentage of projects claiming a contribution to environmental indicators, the percentage of these projects that quantified the contribution and the percentage of projects that claimed a benefit that also set monitoring plans for the contribution
Out of the projects, 38% had either undertaken an environmental impact assessment, a simplified or preliminary environmental assessment or had an environmental control plan, as demonstrated in Figure A.6-5. A total of 33% of projects did not require, or project developers considered that the projects would not require, an environmental impact assessment. The remaining projects did not specify whether or not an assessment was required.

**Figure A.6-5 Whether an environmental impact assessment was required and if so, what type**

**A.6.1.2 Comprehensive Checklist Sustainable Social Development Contribution**

In terms of a contribution to sustainable social development, benefits related to staff training, education and health, the health of the population, improvements in service availability, establishment of charity funds, improvements in quality of life and the location of projects in
disadvantaged or remote regions and a reduction in rural exodus were included as indicators. Figure A.6-6 shows the total number of social contributions claimed by projects out of the 10 indicators.

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**Figure A.6-6 Percentage of projects claiming between zero and 10 social benefits**

Figure A.6-7 demonstrates the contribution of CDM projects in Brazil overall to staff training and education, staff health, the health of the population and service availability (excluding provision of electricity as this is counted elsewhere). In similarity to the contribution of projects to sustainable environmental development, there were many claims made to social sustainable development, however most of these claims were neither quantified nor monitored according to the documentation, as demonstrated in Figure A.6-8. The most common claim here was for improvements in the health of the population by both the activities of the individual projects and based on the type of project implemented. Only 10% of new and additional benefits and contributions to pre-existing benefits claimed were quantified and only 2% of claims were monitored. The percentages of projects quantifying and monitoring their claims in these figures are a percentage of the total number of projects claiming the benefit.
Figure A.6-8 Percentage of projects claiming a contribution to social indicators, the percentage of these projects that quantified the contribution and the percentage of projects that claimed a benefit that also set monitoring plans for the contribution

Figure A.6-9 and Figure A.6-10 below demonstrate the contribution to environmental education projects resulting from actions taken by project developers and mitigation requirements, and claims of contributions towards charitable funds. More environmental education projects were the result of mitigation requirements made under environmental legislation (17% of all projects) than as a result of voluntary contributions by project developers (13% of all projects) and of these, 33% of projects were quantified and 5% were monitored. Contributions to new and additional charity funds were made in 13% of projects while an additional 26% of projects claimed that revenue from the CDM was assisting existing charity funds. Of the new and
additional and the existing charity funds, the contributions were quantified for 70% of these projects and monitored for 11% of them.

![Figure A.6-9 Percentage of projects claiming a contribution to environmental education and the percentage of projects quantifying and monitoring this contribution](image)

In terms of a contribution to the quality of life of the population overall, which could include but not be limited to improvements in noise levels, odours or working conditions, 71% of projects made this claim.

![Figure A.6-10 Percentage of projects claiming a contribution to a charity fund and the percentage of projects quantifying and monitoring this contribution](image)

Figure 6-8 in Chapter Six demonstrates the percentage of projects located in each region, categorised by the level of disadvantage as determined by the IFDM. This is to determine the number of projects located in regions considered to be disadvantaged. The red line on the figure shows the percentage of municipalities in Brazil falling into each category from low to high disadvantage.
levels of development. This figure shows that CDM projects in Brazil favour municipalities with higher than average levels of development according to the IFDM, as 92% of projects are located in municipalities deemed to have moderate to high levels of development, compared with just 63% of Brazilian municipalities falling into these two categories.

The following figures (Figure A.6-11 to Figure A.6-15) show the location of projects in Brazil’s macro-regions according to the development status of municipalities. Even in the less developed North and Northeast regions, projects tend to be located in the moderate regions in terms of level of disadvantage.

Figure A.6-11 Percentage of projects and municipalities located the Central-West categorised by IFDM development status

![Figure A.6-11](image1)

Figure A.6-12 Percentage of projects and municipalities located the North categorised by IFDM development status

![Figure A.6-12](image2)
Figure A.6-13 Percentage of projects and municipalities located the Northeast categorised by IFDM development status

Figure A.6-14 Percentage of projects and municipalities located the South categorised by IFDM development status
For the location of projects to achieve an even regional spread across the regions of Brazil as defined by their remoteness, there would have been an average of 44.5 projects (or 25% of projects) for each category of remoteness. Figure A.6-16 demonstrates that there were less than an expected number of projects located in regions classified as ‘very remote’ compared to the other areas. There were however, a higher proportion of projects in regions classified as ‘remote’ compared to all other categories.

The contribution of CDM projects to reducing the rural exodus and the range of problems associated with increased urbanisation in Brazilian cities can be measured by the number of projects that are located in areas defined as rural in Brazil. This measurement was made using data from the IDFM, and municipalities where there was a larger rural population than urban population were classified as rural and for municipalities where there was a larger urban
population than rural population, they were classified as urban. As described in Chapter Five, municipalities within Brazil are the entities that determine rural and urban classifications and there is no national or state level standardised way of defining this. The data shows that 171 (96%) projects were located in areas defined as urban and only seven (4%) in rural areas.

Figure A.6-17 below shows the spread of social sustainable development claims by projects across the macro-regions of Brazil. Figure A.6-18 shows the claims made against for providing environmental education by macro-region and Figure A.6-19 shows the claims against improving quality of life and the proportion of projects in rural areas by macro-region.
Figure A.6.17: Social sustainable development claims by macro-region

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<th>Staff Health Improvements</th>
<th>Improved Health of Population</th>
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Yes

Contributing to Existing Benefit

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<th>Staff Health Improvements</th>
<th>Improved Health of Population</th>
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A.6.1.3 Comprehensive Checklist Sustainable Economic Development Contribution

The contribution of CDM projects to economic sustainable development has been measured by the increase in taxes revenue paid, in renewable energy generation, the reduced consumption of fossil fuels, regional integration, improved income distribution (measured through training of the general public and of unskilled labour) and the generation of employment generated. Figure A.6-20 illustrates the number of contributions claimed from these indicators by projects.
An increase in tax revenue paid was claimed by 35% of projects and quantified by 2%, while 55% of projects claimed renewable energy generation and 54% a reduction in the use of fossil fuels. Renewable energy generation and reduced use of fossil fuels are quantified and monitored through CDM verification processes. The majority of projects claimed a contribution to regional integration (86%), with 46% of these projects quantifying this claim and one project monitoring it. A combined total of 92% of projects claimed either one, or both, of training or education for the wider population and the training of unskilled labour. Figure A.6-21 shows the quantification and monitoring of training and education of the wider population. The training of unskilled labour was claimed by 38% of projects, with 4% of these quantifying and 1% monitoring these claims. As was the case for contributions to environmental and social development, economic development indicators, aside from regional integration were rarely quantified or monitored. On average, only 8% of project benefits were quantified and less than only 0.3% of these benefits were monitored.
Employment generation was measured in terms of the contribution to ongoing and temporary employment, both directly and indirectly generated by each CDM project. Figure A.6-22 shows that a total of 69% of projects claimed a contribution to ongoing direct employment, 56% to ongoing indirect employment, 84% to temporary direct employment and 56% to temporary indirect employment. Of these claims, an average of 32% of these claims were quantified and 8% of them monitored. Direct employment benefits claims were more likely to be quantified and monitored than indirect employment claims. The quantified and monitored employment percentages in this figure, are percentages of those projects that quantified or monitored their employment generation claim, not percentages of the full dataset.

Figure A.6-22 Contribution to and quantification and monitoring of employment generation by category

A.6.1.4 Comprehensive Checklist Technological Transfer Contribution

Technology transfer in this analysis is measured by the origin of equipment, the reproducibility of technology, the technology type and the technology source, contributions to which are illustrated in Figure A.6-23. Of those projects that specified the origin of equipment required for the CDM projects, 103 projects claimed that equipment was sourced domestically while 13 projects imported the majority of equipment, with the remainder not specifying this.

Technological reproducibility was claimed by 72% of project developers and according to the categories outlined by Grupo de Pesquisa em MDL da UFBA, 57% of projects were using clean, rather than end of pipe technology. The source of technology was also determined using classifications from Grupo de Pesquisa em MDL da UFBA and 56 of the projects claimed that technology was exogenous to Brazil.
Figure A.6-23 Contribution to type of technology used and source of technology

A.6.1.5 Comprehensive Checklist Stakeholder Participation

Stakeholder participation was also measured for each project and these results are shown in the figures below. Figure A.6-24 shows the level of stakeholder consultation undertaken by project developers for all CDM projects. Nearly 60% of projects undertook just the level of consultation required by the Brazilian DNA and where relevant, the consultation required by environmental legislation. A total of 37% of projects undertook a greater level of consultation than was required. Figure A.6-25 below shows the type of additional consultation undertaken by project developers, which mostly included public meetings after the design of the project and newspaper advertisements. Only two of the 178 projects claimed consultation with the public during the design of the project.

Figure A.6-24 Stakeholder participation undertaken
A.6.1.6 Comprehensive Checklist Sustainable Development Monitoring

Out of the 178 projects in the dataset, only 13 or 7.3% of projects had a sustainable development monitoring plan included in the PDD and Annex III documentation. As discussed in Chapter Four, without a sustainable development monitoring plan, any sustainable development benefits claimed in the Annex III and PDD documentation can not be monitored or verified and no action can be taken if these benefits are not realised, aside from the cancellation of the LoA by the DNA, something that has not yet occurred on sustainable development grounds.

A.6.2 Comprehensive Checklist Relative to Project Type

A.6.2.1 Comprehensive Checklist Project Type Sustainable Environmental Development Contribution

Figure A.6-26 demonstrates the contribution to sustainable environmental development for each project type. The contributions are divided into contributions resulting either from the nature of the project itself or a benefit claimed in addition to those from the nature of the project, and those contributions that are required by mitigation or environmental legislation. Contributions made to sustainable environmental development that are included as part of the CER calculation methodology, for example, the contribution to air quality of PFCs and SF\textsubscript{6} or biomass energy projects, is not included in this analysis as these such contributions were required in order to qualify as a CDM project and are therefore not additional to this necessary requirement for registration.

The project types with the lowest contributions, as shown by Figure A.6-26, include fugitive projects, with benefits only for conservation in some projects, methane avoidance, with
contributions to air quality and only minor contributions to water quality and quantity, and CO₂ usage, N₂O and PFCs and SF₆ projects, where no sustainable environmental development benefits were claimed, aside from those required as part of their contribution to a reduction in greenhouse gases. Landfill gas projects showed the highest overall contribution to sustainable environmental development, while biomass energy, reforestation and fossil fuel switch projects also claiming a high contribution of benefits. EE own generation, wind and hydro claimed most benefits as a result of mitigation or environmental legislation requirements.
Figure A.6-26 Contribution to sustainable environmental development by project type
An environmental impact assessment was required for around half of the EE own generation, fugitive, hydro and reforestation projects, while preliminary or simplified plans were required for nearly half of the biomass energy and wind projects. While there were large proportions of projects that did not specify whether an EIA was required, all or most of the CO$_2$ usage, fossil fuel switch, N$_2$O and PFCs and SF$_6$ projects did not required one, as demonstrated by Figure A.6-27.

![Figure A.6-27 Environmental Impact Assessment undertaken by project type](image)

**A.6.2.2 Comprehensive Checklist Project Type Sustainable Social Development Contribution**

Figure A.6-28 demonstrates the contribution to various facets of sustainable social development depending on project type. These contributions are divided into those that are new and those that claim that the CDM is benefiting existing benefits.

Only CO$_2$ usage failed to claim any social benefits in these categories while benefits to staff health was the biggest claim made across most project types. Methane avoidance, reforestation and wind projects had the lowest contributions aside from CO$_2$ usage, whereas biomass energy, EE own generation, fossil fuel switch, fugitive, landfill gas and N$_2$O projects had more than 50% of projects contributing to most of the social sustainable development categories in these figures.
Figure A.6-28 Contribution to sustainable social development by project type
In terms of a contribution towards improved environmental education, Figure A.6-29 shows that hydro projects were more likely to claim this benefit, including as a result of mitigation requirements, while EE own generation, fugitive and PFCs and SF₆ projects were also more likely to claim this contribution.

![Chart showing contribution to environmental education by project type](chart.png)

**Figure A.6-29 Contribution to environmental education by project type**

Improvement to quality of life was the largest claimed social benefit and the differences between the project types are shown in Figure A.6-30. In terms of project types that contributed to a reduction in rural exodus, fugitive and wind projects, followed by hydro, were the project types more likely to be located in rural areas, and therefore contributing to this objective.
Figure A.6-30 Contribution to quality of life and reducing rural exodus by project type

There were only three project types that were located in regions of regular development according to the IFDM, being biomass energy, fugitive and hydro, as shown in Figure A.6-31. No projects were located in regions of low development, while N₂O, fossil fuel switch, landfill gas, biomass energy and methane avoidance were more likely to be located in areas of high development compared to other project types.

Figure A.6-31 Contribution to municipalities of lower development status by project type

When looking at which project types were located in remote areas, the only CO₂ usage project was located in a very remote area, and 37% of the biomass energy projects, 29% of the hydro
and 6% of methane avoidance projects were also located in very remote areas. The spread of each project type across categories of remoteness are shown in Figure A.6-32. Apart from CO$_2$ usage, N$_2$O and fossil fuel switch, most projects had a proportion of projects in remote areas, ranging from 10% to 50%. All four N$_2$O projects, 85% of landfill gas projects and 67% of fossil fuel switch projects were located in areas considered central.

![Figure A.6-32 Contribution to the development or remote regions by project type](image)

**A.6.2.3 Comprehensive Checklist Project Type Sustainable Economic Development Contribution**

Sustainable economic development for each project type is shown in Figure A.6-33. A contribution to regional integration was the most common benefit claimed across all project types, with biomass energy, CO$_2$ usage, EE own generation, hydro and wind claiming the greatest proportion and range of economic benefits. This is likely due to the indicators demonstrating a contribution to renewable energy generation and reduction in fossil fuels, however other benefits such as training of unskilled labour, increased tax revenue and training of the general population were also widely claimed by these project types.
Figure A.6-33 Contribution to sustainable economic development by project type
In terms of employment generation, ongoing employment, both direct and indirect, was claimed across most project types, except for fossil fuel switch projects. N₂O, PFCs and SF₆ projects were less likely to claim employment generation benefits compared to other project types. Fugitive and reforestation projects were mostly likely to claim benefits across all categories as seen in Figure A.6-34.

![Figure A.6-34 Contribution to employment generation by employment category and project type](image)

**A.6.2.4 Comprehensive Checklist Project Type Technological Transfer Contribution**

The source of equipment based on the type of project is shown in Figure A.6-35. Methane avoidance, hydro, biomass energy, fossil fuel switch, hydro and N₂O projects were more likely to have equipment sourced domestically. Landfill gas projects were more likely to have imported equipment while wind and PFCs and SF₆ projects were just as likely to have imported as domestically available equipment.
Apart from reforestation and methane avoidance projects, most project types were likely to claim a high level of technological reproducibility as shown in Figure A.6.36. Biomass energy, CO$_2$ usage, fossil fuel switch, fugitive, hydro, reforestation and wind were more likely to use clean technology rather than end of pipe. Exogenous projects, according to the Grupo de Pesquisa em MDL da UFBA classifications, were methane avoidance, N$_2$O, PFC and SF$_6$ and wind projects.

The level of stakeholder participation is shown in Figure A.6.37. Most projects just did the required level of participation, except for methane avoidance, where projects were more likely...
to undertake a higher level of consultation than what was required. EE own generation and wind projects were just as likely to do the required level of consultation, as they were to do more than what was required.

![Graph showing stakeholder consultation undertaken by project type]

**Figure A.6-37 Stakeholder consultation undertaken by project type**

Of those projects where more was done than required, as shown in Figure A.6-38, the most common consultation was to conduct a meeting after the design of the project, with a meeting and newspaper advertisements the next most common initiative. Landfill gas projects were the only ones that had a proportion of projects where a meeting was held during the design of the project, and hence a greater level of stakeholder consultation than the other methods shown, with stakeholders able to influence the design and implementation of the project from the beginning.
The mean number of responses received from stakeholders was highest for the reforestation projects with 11 responses received on average, followed by fugitive and PFC and SF₆ projects with a mean of four responses received for both. The most responses received were 12 and this was received by both a biomass energy project and a hydro project.

**A.6.2.6 Comprehensive Checklist Project Type Sustainable Development Monitoring Plan**

Of those projects that included an overall sustainable development monitoring plan, there were eight landfill gas projects, three hydro projects, one fugitive project and one reforestation project.

**A.6.3 Comprehensive Checklist Relative to Project Scale**

This section demonstrates the contribution to sustainable development according to the comprehensive analysis with reference to project size. Of the 178 projects, 98 were large-scale and 79 were small-scale. The one project where size was not specified in any of the documentation is excluded from this analysis.

**A.6.3.1 Comprehensive Checklist Scale Sustainable Environmental Development Contribution**

Figure A.6-39 demonstrates the differences in contributions to environmental sustainability between large and small-scale projects. Including mitigation and environmental legislation
requirements, these figures demonstrates that apart from the air quality improvement indicator, large-scale projects out-rated small-scale projects across all other indicators of environmental sustainability, with substantial differences for soil quality improvements, conservation benefits and reducing solid waste. When including measures taken for mitigation or environmental legislation, the percentage of projects claiming benefits of soil improvements increased 22% for large-scale and 30% for small-scale and for conservation, these figures increased 16% for large-scale and 18% for small-scale, thus not affecting the results of the comparison by project scale.
Figure A.6-39 Contribution to sustainable environmental development by project scale
Regarding the need for an environmental impact assessment, as would be expected, a higher proportion of large-scale projects required either an environmental impact assessment or a preliminary environmental assessment compared to small-scale projects as shown in Figure A.6-40.

![Environmental impact assessment undertaken by project scale](image)

**Figure A.6-40 Environmental impact assessment undertaken by project scale**

**A.6.3.2 Comprehensive Checklist Scale Sustainable Social Development Contribution**

Social sustainable development as measured by this method of analysis is shown in Figure A.6-41. The percentage of large-scale projects contributing to training and education for employees, population health, service availability and to charity funds was greater than for small-scale projects. For staff health improvements, small-scale projects had a greater percentage overall for large-scale projects, as well as for new and additional benefits.
Regarding a contribution towards environmental education, large-scale projects out-rated small-scale projects for both benefits, with and without mitigation or environmental legislation requirements. A total of 37% of large-scale projects contributed to this indicator (16 of the 27% due to environmental legislation requirements) compared to 23% for small-scale projects (19 of the 23% due to environmental legislation requirements).

Quality of life improvements were claimed by nearly the same percentage of small and large-scale projects (71% to 70%), and while small-scale projects were three times as likely to be situated in a rural area compared to large-scale projects, overall only 6% of small-scale projects were located in areas defined as rural compared to 2% for large-scale as seen in Figure A.6-42.

The proportion of projects located in disadvantaged regions was greater for small-scale than for large-scale projects (see Figure A.6-43). A greater proportion of small-scale projects were
located in regions defined as either regular or moderate in terms of development, while a greater percentage of large-scale projects were located in regions of high development. Neither scale of project had any examples in regions classified as being of low development.

Figure A.6-43 Prevalence of projects in municipalities of low development by project scale

With reference to the location of projects in areas considered remote, demonstrated in Figure A.6-44, small-scale projects were more likely to be located in more remote areas compared to large-scale projects which were more likely to be located in areas considered to be central rather than remote.

Figure A.6-44 Prevalence of projects located in municipalities considered to be remote by project scale
A.6.3.3 Comprehensive Checklist Scale Sustainable Economic Development Contribution

The contribution to sustainable economic development as measured by this method of analysis is shown in this section.

For the increase in tax revenue, renewable energy generation, reduced consumption of fossil fuels, regional integration and contribution to income distribution (through the training of the population and of unskilled labour) the scale of project did not have that great an effect. The only indicator with a noticeable difference was regarding the training of unskilled labour, where large-scale projects were more likely to claim this benefit compared to small-scale projects, as illustrated in Figure A.6-45.

![Figure A.6-45 Contribution to sustainable economic development by project scale](image)

In terms of employment generated by projects, Figure A.6-46 demonstrates this. Large-scale projects are more likely to claim ongoing direct employment benefits and temporary indirect benefits, while small-scale projects are more likely to claim ongoing indirect employment benefits. However, the percentages of projects claiming a contribution to each type of employment are similar between the project scales.
A.6.3.4 Comprehensive Checklist Scale Technological Transfer Contribution

In terms of the origin of equipment used for the projects, a higher proportion of domestic equipment was used for small-scale projects compared to large-scale, as seen in Figure A.6-47.

As shown in Figure A.6-48, technological reproducibility was not dependent on project size. With reference to the use of clean rather than end of pipe technology and the source of technology, small-scale projects were more likely to use clean technology and also use technology sourced exogenously compared to large-scale projects.
A.6.3.5 Comprehensive Checklist Scale Stakeholder Participation

Consultation of stakeholders by project developer appears to be relatively similar between the two different project sizes as seen in Figure A.6-49 and Figure A.6-50. For small-scale project developers, 58% undertook the minimum required stakeholder consultation, while this figure was 60% for large scale projects. Small projects were more likely to have a meeting after the design of the project was developed and also more likely to combine this with newspaper advertisements, however large-scale projects were more likely to just use newspaper advertisements as a method of additional stakeholder consultation. The mean number of responses received for large-scale projects was 1.4, while it was 1.0 for small-scale projects. The minimum number of responses for both scales of project was zero, while the maximum was 11 for large and 12 for small-scale.
A.6.3.6 Comprehensive Checklist Scale Sustainable Development Monitoring Plan

Of those projects that had an overall sustainable development monitoring plan, all 13 of them were large-scale projects.

A.7 Multi-Criteria Assessment Approach

A.7.1 MCA Overall Contribution to Sustainable Development

The results from the MCA analysis show that the mean total score for projects was 2.36 out of a possible nine and scores ranged from a minimum of 0.17 to a maximum of 5.17. The mean scores for each component of the MCA analysis and the total social, environmental and economic scores are shown in Table A.7-1. These results are represented in Figure A.7-2. This figure demonstrates that while renewable energy, employment generation and sustainable innovative technology have the highest means of all the scores, they are still below half of the highest possible score according to this rating. The mean score given to projects across the environmental indicators was lower than economic scores but higher than social in this method of analysis.
Table A.7-1 Mean project scores for each indicator

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<th>Sustainable/innovative technology</th>
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<td>Employment generation</td>
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<td>Water</td>
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<tr>
<td>Total</td>
<td>Total</td>
<td>Total</td>
<td>1.36</td>
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Figure A.7-1 Radar chart of mean scores for each indicator
For a contribution to environmental benefits, the MCA shows that all three indicators were scored similarly, but relatively low compared to other indicators in the MCA. For a contribution to reducing air pollution, Figure A.7-3 demonstrates that air improvements were targeted towards the macro-regions hosting some of Brazil’s larger cities where urban air pollution worst. Figure A.7-4 presents the comparison between scores for renewable energy generation by macro-region.

In terms of contribution to social benefits, a score of 0.24 for social benefits for the poorer part of society indicates that projects on average contributed less than one social benefit that improved the availability of services and infrastructure, such as training of unskilled labour, educational programs or the construction of infrastructure. The score of 0.47 for life quality indicates that projects were likely to contribute to the physical well-being of people in the project region in one to two ways (three ways correlating to the maximum score of one for this
indicator). The score of -0.51 for the development of a poorer region as determined by IFDM ratings indicates that on average, projects were located in regions of moderate to high development status rather than being in regions of low to regular development status.

Three indicators were used to measure the contribution towards economic sustainable development in the MCA approach. Overall, the score for renewable energy generation was 0.5 out of a possible 1.0. This was the highest score for all indicators in the MCA and this shows that the CDM is contributing towards achieving the aim of increasing renewable energy in the Brazilian grid. Sustainable and innovative technology achieved a score of 0.4 out of a possible 1.0 and this demonstrates that the technology being used in CDM projects is not generally being developed in-house nor using technology from overseas. The score for employment generation was 0.47 out of one, the same as a contribution to quality of life for the social indicators. Scores for employment generation were dependant on whether the project was contributing to temporary or ongoing employment generation. Scores for renewable energy generation and use of sustainable and innovative technology by remoteness are shown in Figure A.7-4 and Figure A.7-5.

![Figure A.7-4 Scores for renewable energy generation by remoteness](image-url)
A.7.2 MCA and Project Type

Figure A.7-6 shows the total MCA score for each project type represented in the dataset out of a possible score of 9. The numbers in brackets next to the project type indicate the number of projects from this project type in the dataset.

Figure A.7-7 shows the total MCA score for each of the three categories of criteria. The project types are in order of total MCA score from highest to lowest.
The following radar charts show the MCA score for each category for each project type, compared to the mean score for all project types. To eliminate the bias from project types with large numbers represented in the dataset and to focus the analysis on a direct comparison of project types, the mean score is calculated by adding the mean scores from each project type and dividing these by the number of project types, rather than using the overall mean for the dataset.

Biomass energy projects delivered higher MCA scores than average in terms of renewable energy generation and improvements in soil condition. They scored lower in sustainable/innovative technology and similar to the mean in all other categories (see Figure A.7-8).
The CO₂ usage project delivered higher MCA scores in the category of sustainable/innovative technology and renewable energy generation, but was lower than the mean for all environmental and social categories and employment generation (see Figure A.7-9). The fact that there was only one CO₂ usage project in the dataset means that this analysis may not be as robust as project types were multiple projects were represented in the dataset.

The MCA scores from EE own generation projects were very similar to the mean for all projects and there were no notable differences (see Figure A.7-10). As there were only two EE own generation projects in the dataset, these scores may be less robust than scores from project types with many projects.
The MCA scores for employment generation in the economic categories, life quality in the social and air quality in the environmental categories were higher than the average for fossil fuel switch projects (see Figure A.7-11). Fossil fuel switch projects however tended to be in more developed areas, as shown by the MCA score, and contributed less to sustainable/innovative technology than average.

The two fugitive projects delivered MCA scores higher than average for social benefits and development of a poorer region in the social categories and for soil in the environmental categories. Fugitive projects scored lower than the mean for both water and air, and similar to the mean in all other categories (see Figure A.7-12).
Figure A.7-12 Radar chart scores for fugitive (2 projects)

Hydro projects delivered scores higher than the mean in the categories of renewable energy generation and slightly higher scores for development of poorer regions, but for all other categories, hydro projects scored equal to or lower than the mean (see Figure A.7-13).

Figure A.7-13 Radar chart scores for hydro (42 projects)

MCA scores for landfill gas projects were higher than the mean for all environmental categories, life quality and employment generation. As only one project delivered renewable energy generation, landfill gas projects scored lower than average for this category. They also scored lower than the mean for development of a poorer region. For sustainable/innovative technology and social benefits scores, landfill gas projects were similar to the mean scores (see Figure A.7-14).
Methane avoidance projects delivered higher than average scores for employment generation, life quality improvements and air and water improvements. The higher than average employment generation score was due to the fact that despite there only being a small number of jobs created overall in each manure sub-type project, each project did in fact contribute to ongoing employment and therefore scored highly using this method of analysis. Renewable energy generation and social scores from methane avoidance projects were lower than the mean scores, while scores were similar to the mean for other categories (see Figure A.7-15).

N₂O projects delivered greater sustainable/innovative technology benefits than the mean and marginally higher social benefits, however they scored lower in all other categories, especially
in the development of poorer regions where N₂O projects scored an average of -0.9 (see Figure A.7-16).

![Radar chart for N₂O projects](image)

**Figure A.7-16 Radar chart scores for N₂O (4 projects)**

Industrial gas projects delivered greater benefits than the mean in the category of sustainable/innovative technology and marginally higher for air quality, however for all other categories, these scores were similar to or below the mean (see Figure A.7-17). As there were only two industrial gas projects in the dataset, these scores may not be reflective of the project type as a whole compared to project types with many projects represented in the dataset.

![Radar chart for PFCs and SF₆ projects](image)

**Figure A.7-17 Radar chart scores for PFCs and SF₆ (2 projects)**
Reforestation projects delivered lower scores than average for employment generation, sustainable/innovative technology, air quality and obviously for renewable energy generation (see Figure A.7-18). Scores for soil quality and social benefits were marginally higher than the mean and all other scores, including development of a poorer region, were similar to the mean.

Figure A.7-18 Radar chart scores for reforestation (2 projects)

MCA scores delivered for wind projects showed that in terms of renewable energy generation, the very purpose of these types of projects, they scored well above the mean. Wind projects scored marginally higher than the mean in terms of sustainable/innovative technology. For all other categories however, wind projects scored similar to or lower than average (see Figure A.7-19).

Figure A.7-19 Radar chart scores for wind (4 projects)
A.7.3 MCA and Project Scale

As can be seen in Figure A.7-20, there is not a large degree of difference between the mean MCA scores for large and small-scale projects. Small-scale projects do score higher on life quality improvements, employment generation and development of a poorer region, and large-scale projects score higher on social benefits and soil improvements.

Figure A.7-20 Radar chart scores comparing small and large-scale projects

Overall, small-scale projects were likely to score higher than large-scale projects (2.44 to 2.27). For environmental benefits specifically, the MCA approach indicates that small-scale projects are more likely to score higher in terms of water quality and quantity for small-scale projects (0.22 to 0.16), while large-scale projects are more likely to score higher for soil quality (0.27 to 0.15 for small-scale). Air quality improvements were nearly equal with small-scale scores averaging 0.38 compared to large-scale with 0.39.

The results from the MCA method of analysis indicate that there are some differences between the project scales in terms of overall scores for contribution to social sustainable development, with small-scale projects scoring a total of 0.26 compared to 0.14 for large-scale projects. Social benefits were more likely for large-scale projects (0.16 to 0.29) while life quality scored higher for small-scale projects (0.54 to 0.42). Development of a poorer region scores were low for both small and large projects, with -0.57 for large and -0.44 for small, indicating that while small projects were more likely to be located in poorer regions, both scales of projects were generally located in regions of moderate to high development.

The MCA approach supported the findings of the other approaches, in that there were only very small differences in contributions to economic sustainable development between the project
scales. The mean economic and technology score for small projects was 1.43 out of 3, while for large-scale projects it was 1.34. Small-scale projects were marginally more likely to use sustainable or innovative technology and contribute to employment generation, while large-scale projects were marginally more likely to lead to renewable energy generation.
# Appendix B – CDM Sustainable Development Assessments

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B.1 Sustainable Development Assessment Criteria Used by Non-Annex I Countries

China, the largest host country of CDM projects in the world, discriminates between projects based on the project type, and prioritises energy efficiency improvement, development and utilisation of new and renewable energy sources and methane recovery and utilisation (Olsen & Fenham 2008, p. 2820; Institute for Global Environmental Strategies & Ministry of the Environment of Japan 2005). Priority is granted to projects that reduce methane and carbon dioxide, on the basis that these projects are linked to energy conservation, and renewable energy development, unlike projects that reduce N₂O, HFCs, PFCs and SF₆. In order to encourage projects that are considered to be priorities, China taxes CER revenue at a rate of 65% for projects involving HFC and PFC emission reductions, 30% for projects reducing N₂O emissions and just 2% for all other CDM projects (Institute for Global Environmental Strategies & Ministry of the Environment of Japan 2005).

India, the second largest host of CDM projects, defines sustainable development for CDM projects through the use of guidelines against the three pillars of sustainable development – social development, environmental development and economic development. Social development is determined through the contribution of a project towards social benefits for poorer parts of society, supporting the development of poorer regions and impact on life quality, as well as on the level of stakeholder participation. Environmental development is determined through improvements to air, soil and water, while economic development is determined through indicators on sustainable and innovative technology, contribution to employment generation, the financial benefits of the project and the cost-efficiency of the GHG abatement (Treiber 2011).

Other countries that use a guideline approach include Malaysia, the Philippines, Morocco and South Africa (Na, Nishiki & Ueta 2009, p. 8; Olsen & Fenham 2008, p. 2820). Peru requires project developers to outline how the planned project will achieve sustainable development as part of the PDD (Müller-Pelzer 2009, p. 150). Egypt uses a multi-criteria assessment approach in their assessment of sustainable development (Olhoff et al. 2004), Bolivia imposes a 15-35% tax on revenue generated from CERs for large scale projects (Rothballer 2008), while Thailand uses a scoring method to assess projects against a predetermined list of sustainable development priorities (Na, Nishiki & Ueta 2009). Columbia offers an income tax incentive for projects, which contributes more than 50% of the revenue gained from CERs into activities showing to have social benefits (Figueres 2004, p. 14). Costa Rica states that projects must be compatible with the country’s priorities for the environment and development, while improving quality of life, income earning opportunities, technological knowledge and capacity building (Huq 2002).
The Government of Uruguay has adopted a highly complex mechanism for multi-criteria assessment designed by Sutter in 2003 (Sutter 2003), however the complexity, high need for capacity and demanding requirements for stakeholders of this assessment has deterred a more widespread adoption of it in DNA assessments (Olsen & Fenham 2006; Murphy 2006).

B.2 Sustainable Development Assessment Criteria Used by Annex I Countries

Annex I countries differ in their standards set for CDM project approval, although most leave the definition and evaluation of sustainable development to the host country. The Government of Belgium, for example, requires a letter by project participants stating that a project will meet basic international labour convention standards and that information on number and quality of jobs created is also specified before issuing a LoA (Nussbaumer 2006, p. 45). The standards used by the EU, and by the British and Dutch DNAs are outlined in Chapter Four.
### B.3 CDM Sustainable Development Assessment Methods

#### B.3.1 United Nations Framework Convention on Climate Change Assessment Method

Table B.3-1 UNFCCC assessment criteria (United Nations Framework Convention on Climate Change 2011)

<table>
<thead>
<tr>
<th>Dimension (Criteria)</th>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Economic**         | Direct/indirect financial benefit for the local and/or regional economy   | • Domestic or community cost savings  
                       |                                                                                  | • Poverty reduction and support for entrepreneurial activity  
                       |                                                                                  | • Financial benefits of project for national economy  
                       |                                                                                  | • Enhancement of local investment and tourism  
                       |                                                                                  | • Improvement of trade balance  
                       |                                                                                  | • Reinvestment of CER proceeds into community  
                       |                                                                                  | • Creation of tax revenue for community  
| Local/regional jobs generated directly/indirectly |                                                          | • Economic improvements through in/direct job creation and retention during operation and construction phases  
                       |                                                                                  | • (Poverty alleviation often cited as indirect benefit of this)  
| Development/diffusions of local/imported technology |                                                          | • Development, use, improvement and/or diffusion of a new local or international technology, technology transfer, or in-house innovation for others to follow  
| Investment in the local/regional infrastructure |                                                          | • Creation of infrastructure (e.g. roads and bridges) and improved service availability (e.g. health centres and water availability)  
| **Environment**      | Efficient utilisation of natural resources | • Promoting comprehensive use of natural resources  
                       |                                                                                  | • Promoting efficiency, recycling, creating positive by-products  

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| **Reduction in noise, odours, dust or pollutants** | • Reducing gaseous emissions other than GHG, effluents, odour and noise pollution and enhancing indoor air quality |
| **Improvement and/or protection of natural resources** | • Improving and/or protection of natural resources including non-renewables such as fossil fuels or of renewables such as soil and soil fertility, biodiversity, water • Availability of water and water quality |
| **Available utilities** | • Supply more or reducing use of energy • Stabilising energy supply for promotion of local businesses • Diversifying sources of electricity generation |
| **Promotion of renewable energy** | • Converting or adding to country’s energy capacity of renewable energy • Reducing dependence on fossil fuels • Stimulating growth of renewable power industries |
| **Social** | **Labour conditions and/or human rights** • Project will improve working and/or living conditions |
| **Promotion of education** | • Improved accessibility of educational resources or time to study • Donating resources for local education |
| **Health and safety** | • Improvements to health, safety and welfare of local people in reduction to harmful exposure • Changes that improve lifestyles, especially poor and most vulnerable |
| **Poverty alleviation** | • Emphasis on country’s core development priorities |
| **Engagement of local population** | • Community or local/regional involvement in decision-making • Respect and consideration of rights of local/indigenous people |
- Promotion of social harmony, education and awareness of local environmental issues
- Professional training of unskilled workers
- Reduction of urban migration

| Empowerment of women, care of children and frail | Providing of and improvements in access to education and training for youth and women, enhancement of position of women and children in society |

### B.3.2 Grupo de Pesquisa em MDL da UFBA Assessment Approach

Table B.3-2 Grupo de Pesquisa em MDL da UFBA (Andrade Celio Silveira (unpublished))

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social</strong></td>
<td>Professional training and improvement of working conditions</td>
</tr>
<tr>
<td></td>
<td>Philanthropic and social projects for local communities and other stakeholders</td>
</tr>
<tr>
<td></td>
<td>Increasing the quality of life of low-income population in rural areas to reduce rural exodus</td>
</tr>
<tr>
<td><strong>Environmental</strong></td>
<td>GHG emission reduction and environmental impacts mitigation</td>
</tr>
<tr>
<td></td>
<td>Sustainable reforestation and native riparian vegetation conservation</td>
</tr>
<tr>
<td></td>
<td>Use of raw material from renewable sources</td>
</tr>
<tr>
<td></td>
<td>Waste selective collection for recycling, reusing and reducing</td>
</tr>
<tr>
<td><strong>Economic</strong></td>
<td>Local and regional market development and integration</td>
</tr>
<tr>
<td></td>
<td>Employment and income generation and distribution</td>
</tr>
<tr>
<td></td>
<td>Increased competitiveness, cost reduction and improvement in company image</td>
</tr>
</tbody>
</table>
### B.3.3 Multi-Criteria Analysis

Table B.3-3 Multi-Criteria Analysis used by Alexxew et al (2010)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Development</td>
<td>Stakeholder participation</td>
<td>+1 rating for projects where stakeholders are invited to a meeting or survey and comments are explicitly discussed in the PDD. + value if indicates some measure of stakeholder engagement, -1 if stakeholders informed about implementation but not given chance to participate in survey or meeting.</td>
</tr>
<tr>
<td>Social benefits for poorer parts of society</td>
<td>Improved availability of services and infrastructure such as professional training of unskilled workers, supplementing other education opportunities (schools, kindergartens), creation of infrastructure (roads, bridges), improved service availability (health centres).</td>
<td>Linear scale where at least 3 of these conditions improved receives +1, 3 of these conditions degraded receives -1.</td>
</tr>
<tr>
<td>Supporting the development of poorer regions</td>
<td>Proportion of a population below the poverty line living in the region where the project is located.</td>
<td>Normalised on flexible scale between -1 and +1. 0 being India’s mean poverty</td>
</tr>
<tr>
<td><strong>Impact on life quality</strong></td>
<td>Degree of physical well-being experienced by people. Improvements could be decrease in level of noise, odours, or risk of accidents or improvements in working conditions.</td>
<td>Linear scale where 3 of these conditions improved receives +1, 3 of these conditions degraded receives -1.</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Environmental development</strong> Impact on air</td>
<td>Does the project lead to a reduction in emissions of particulate matter, pulverised fuel ash, grime or gaseous air pollutants (SOx, NOx, CO (carbon monoxide) etc.)?</td>
<td>Linear scale where 3 out of 3 conditions improved receives +1, 3 out of 3 conditions degraded receives -1.</td>
</tr>
<tr>
<td>Impact on soil</td>
<td>Does the project lead to improvements in soil fertility (e.g. avoided pollution through landfills), excavation of soil, erosion (through planting of trees) or biodiversity impacts?</td>
<td>Linear scale where 3 out of 3 conditions improved receives +1, 3 out of 3 conditions degraded receives -1.</td>
</tr>
<tr>
<td>Impact on water</td>
<td>Does the project have a positive impact on the quality of fresh or waste water, the availability or quality of fresh water and/or irrigation water or impact on biodiversity?</td>
<td>Linear scale where 3 out of 3 conditions improved receives +1, 3 out of 3 conditions degraded receives -1.</td>
</tr>
<tr>
<td><strong>Economic development</strong> Sustainable and innovative technology</td>
<td>Assesses level of international technology transfer, in-house technology development and ability for local workers to maintain technology long-term.</td>
<td>Projects with international technological transfer or in-house development documented transparently in PDD receive +1,</td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
<td>Scoring</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Employment generation</td>
<td>Whether and to what extent work is created in construction and operation phases. (Takes into account that most PDDs do not specify hours/number of jobs).</td>
<td>Projects with jobs in operation, construction and indirect jobs created receive score of +1. Negative scores represent job losses.</td>
</tr>
<tr>
<td>Financial benefits of the project</td>
<td>Evaluates benefits for national economy based on IRR (internal rate of return) including CER revenues based on IRR being typically 10% for viable investments.</td>
<td>Linear extrapolated scale where projects with IRR above 10% assumed to have positive impact + value, projects with IRR below 10% receive negative value.</td>
</tr>
<tr>
<td>Cost-efficiency of the GHG abatement</td>
<td>Calculates the average GHG abatement costs of projects based on information in PDD on levelised cash flow and annual emissions rebatement.</td>
<td>Project with highest cost receives -1, lowest cost project receives +1 and remaining projects are derived through a linear function.</td>
</tr>
</tbody>
</table>

Overall contribution = Total sum of above values
### B.3.4 Development Dividend Framework Approach

Table B.3-4 Development Dividend Framework approach (Cosbey 2006)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Question/Indicator</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic</td>
<td>1.a. Does it generate employment in significant amounts? Here the focus is not on construction employment (though such employment is not completely discounted), but on long-term opportunities.</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>1.b. Does it have a balance of payments/foreign exchange benefits? Does the project reduce the need for significant imports, for example, of fossil fuels? Does it significantly boost the prospects for exports (by creating transportation infrastructure, reliable energy supply, etc.)?</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>1.c. Does it involve technology transfer/capacity building? Does the project use local supplies, or otherwise build up the capacity of local manufacturers, local users, to adapt and utilise new technologies?</td>
<td>3.9</td>
</tr>
<tr>
<td>Social</td>
<td>2.a. Does it benefit marginalised populations economically (e.g. employment creation, income supplement)? Construction employment is heavily discounted here in favour of ongoing employment opportunities.</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>2.b. Does it benefit marginalised populations environmentally (e.g. reduced resource degradation, reduced health-damaging pollution)? Here the question is whether those improvements (e.g. reduction in polluting emissions or prevention of natural resource degradation) resulted in a significant portion of benefits going to marginalised populations.</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>2.c. Does it provide energy to energy-poor populations? Does any energy generated go to satisfying the needs of energy poor populations? Alternatively, do a significant number of energy-poor benefit, even if their numbers as a percentage of total</td>
<td>3.9</td>
</tr>
</tbody>
</table>
beneficiaries are low?

2.d. Does it increase adaptive ability, resilience of communities, regions? The project might do this by allowing the community to take ownership of the project or the technology. Or it might involve capacity building to help the community use or replicate the technology. Or the project might have inherent adaptation benefits.

<table>
<thead>
<tr>
<th>Environmental</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.a. Does the project reduce polluting emissions (air, water, soil)? GHG emission reductions are not counted. They are assumed to be reduced, and that reduction does not constitute part of the development dividend.</td>
<td>4.1</td>
</tr>
<tr>
<td>3.b. Does the project prevent and/or reduce natural resource degradation? It might do this by, for example, reducing the use of fuel wood, protecting biodiversity. Reducing the drawdown of non-living resource stocks (such as fossil fuels) does not count toward this criterion.</td>
<td>4.2</td>
</tr>
<tr>
<td>3.c. Does the project ‘green’ the process of energy production? Does it involve deriving energy from renewable sources, or from sources that are less polluting than the baseline? Does it increase the efficiency of energy use? (Bonus: actually displaces dirty energy).</td>
<td>4.0</td>
</tr>
<tr>
<td>3.d. Does it foster development, dissemination of new energy technologies/sources? Does the project contribute to a fundamental restructuring of energy regimes by using new ‘green’ technologies for energy production? They key here is that the technology should be relatively new. Green and traditional is not sufficient, this is already captured in another criterion.</td>
<td>4.0</td>
</tr>
</tbody>
</table>
Table B.3-5 Development Dividend Framework scoring framework (Cosbey et al. 2006)

<table>
<thead>
<tr>
<th>Economic</th>
<th>1.a.</th>
<th>1.b.</th>
<th>1.c.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>0.5 for construction, ongoing employment</td>
<td>If project scores under 3.c. then divide score by 2 and multiply by BOP score</td>
<td>0.5 for introduction of new technology</td>
</tr>
<tr>
<td>Biogas</td>
<td>0.5 for construction, ongoing employment</td>
<td>Country’s BOP score</td>
<td></td>
</tr>
<tr>
<td>Biomass Energy</td>
<td>0.5 for construction, ongoing employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cement</td>
<td>If a fuel switch, no credit for construction employment. If energy efficiency (use of excess heat), then 0.5</td>
<td>Country’s BOP score</td>
<td></td>
</tr>
<tr>
<td>EE Households</td>
<td></td>
<td>Country’s BOP score</td>
<td></td>
</tr>
<tr>
<td>EE Industry</td>
<td>0.5 for construction, ongoing employment unless simple fix with no ongoing employment</td>
<td>Country’s BOP score</td>
<td></td>
</tr>
<tr>
<td>EE Service</td>
<td></td>
<td>Country’s BOP score</td>
<td></td>
</tr>
<tr>
<td>Fossil Fuel Switch</td>
<td>No credit for construction</td>
<td>Country’s BOP score</td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>0.5 for construction, ongoing employment</td>
<td>Country’s BOP score</td>
<td>0.5 if low penetration in country – demonstration effect</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------------------------------</td>
<td>---------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>Fugitives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geothermal</td>
<td>0.5 for construction, ongoing employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HFCs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydro</td>
<td>0.5 for construction, ongoing employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landfill Gas</td>
<td>0.5 for construction, ongoing employment</td>
<td>If project scores under 3.c. then divide the score in 3.c. by 2 and multiply by country’s BOP score</td>
<td>0.5 for introduction of new technology</td>
</tr>
<tr>
<td>N₂O</td>
<td>0.5 for construction, ongoing employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar</td>
<td></td>
<td>Country’s BOP score</td>
<td>0.5 if technology new in country, 0.5</td>
</tr>
<tr>
<td><strong>Wind</strong></td>
<td>0.5 for construction, ongoing employment</td>
<td>Country’s BOP score</td>
<td>0.5 if first use of technology in country</td>
</tr>
<tr>
<td>----------</td>
<td>----------------------------------</td>
<td>-------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td>2.a.</td>
<td>2.b.</td>
<td>2.c.</td>
</tr>
<tr>
<td><strong>Agriculture</strong></td>
<td></td>
<td>0.5 for odour and non-GHG emission reductions, risk reduction if in populated area</td>
<td></td>
</tr>
<tr>
<td><strong>Biogas</strong></td>
<td></td>
<td></td>
<td>If gas used in community</td>
</tr>
<tr>
<td><strong>Biomass Energy</strong></td>
<td>If fuel is sourced as by-product from local producers score 1, or 0.5 if displaces commercial use of by-product</td>
<td>0.5 for odour reduction if avoids methane producing rotting of biomass, 0.5 if avoids open-air burning of biomass</td>
<td>If it frees up grid power, score Energy Poverty index for country</td>
</tr>
<tr>
<td><strong>Cement</strong></td>
<td>If fuel is sourced as by-product from local producers score 1, or 0.5 if displaces commercial use of by-product</td>
<td>0.5 for odour reduction if avoids methane producing rotting of biomass, 0.5 if avoids open-air burning of biomass</td>
<td></td>
</tr>
<tr>
<td><strong>EE Households</strong></td>
<td></td>
<td></td>
<td>Energy Poverty</td>
</tr>
<tr>
<td>Sector</td>
<td>Calculation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE Industry</td>
<td>If it frees up grid power, score Energy Poverty index for country</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE Service</td>
<td>Country’s Energy Poverty Index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fossil Fuel Switch</td>
<td>If fugitive gas converted to energy and sold into grid, then Energy Poverty Index for country</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fugitives</td>
<td>Country’s Energy Poverty Index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geothermal</td>
<td>Country’s Energy Poverty Index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HFCs</td>
<td>Country’s Energy Poverty Index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydro</td>
<td>If power being sold onto grid then score country’s Energy Poverty Index. If it is retained in community, score 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landfill Gas</td>
<td>If project scores</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significant portion of operating profits goes to municipality</td>
<td>Reducing odours under 3.c., then divide the score in 3.c. by 2 and multiply by country’s Energy Poverty Index</td>
<td>Solar</td>
<td>Country’s Energy Poverty Index</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Wind</td>
<td>If it is sold into the grid, score is country’s Energy Poverty Index</td>
<td>Environmental Environmental 3.a.</td>
<td>3.b.</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.5 for odour and non-GHG emission reductions, risk reduction if in populated area</td>
<td>1 for gas-to-energy, 1.5 if small scale, 2 if large scale</td>
<td></td>
</tr>
<tr>
<td>Biogas</td>
<td>0.5 for odour and non-GHG emission reductions if large scale aerobic digestion replaced with anaerobic. No points for fuel wood to biogas</td>
<td>1.5 points if fuel wood replaced with biogas</td>
<td>If primary aim to replace traditional fuel with biogas, score 2. If biogas is a used by-product of a project with another aim then 0.5 for gas to energy, if no claim for GHG reduced. If</td>
</tr>
</tbody>
</table>
### Biomass Energy
- 2 for 2 times the baseline emission factor.
- If biomass diverted from landfill or methane producing compost then additional 0.5 unless claimed as GHG emission reduction credits. If fly ash blended with clinker 0.5
- Automatic 2 points

### Cement
- If fuel switch, score is pollution score.
- If energy efficiency and displaces grid power then score is 2 times baseline emissions factor
- Automatic 2 points

### EE Households
- 2 times the baseline emissions factor

### EE Industry
- 2 times the baseline emissions factor
- Automatic 2 points
- Unless the technology penetration is
<p>| <strong>EE Service</strong> | 2 times the baseline emissions factor |  | high, score 0.5 |
| <strong>Fossil Fuel Switch</strong> | 1.8 points if replacing polluting fuels (more than 75% fossil fuel in existing mix) with renewables. 1.3 if more than 62%. 1 if more than 50%. 0.5 points automatically. If replacing fossil fuel with less polluting fuel then 1 point |  | Automatic 2 points |
| <strong>Fugitives</strong> | 2 points if fugitive gas converted to energy |  |  |
| <strong>Geothermal</strong> | 1 if displaces fossil fuel |  | Automatic 2 points |
| <strong>HFCs</strong> |  |  |  |
| <strong>Hydro</strong> | 2 times the baseline emissions factor Negative 0.5 points if involves a reservoir over 75 000m³ even if run of river or diversion type. Negative 1 points if over |  | Automatic 2 points |</p>
<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Description</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Landfill Gas</strong></td>
<td>1 point for containing leachate if not done previously, automatic 0.5 for odour and risk reduction</td>
<td>1 point for gas-to-energy, 1.5 points if small scale, 2 points if large scale (no credit for potential future gas-to-energy)</td>
</tr>
<tr>
<td><strong>N₂O</strong></td>
<td>0.5 points for reducing NOₓ emissions</td>
<td></td>
</tr>
<tr>
<td><strong>Solar</strong></td>
<td>No points for displacing fuel wood</td>
<td>1.5 points for providing energy, 2 points if displaces more polluting energy source</td>
</tr>
<tr>
<td><strong>Wind</strong></td>
<td>1.8 points if replacing polluting fuels (more than 75% fossil fuel in existing mix) with renewables, 1.3 if more than 62%, 1 if more than 50%, 0.5 points automatically</td>
<td>Automatic 2 points</td>
</tr>
</tbody>
</table>
### B.3.5 HELIO International

Table B.3-6 HELIO International criteria (Thorne & La Rovere 1999)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicator</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environmental sustainability</strong></td>
<td>Contribution to the mitigation of global climate change</td>
<td>0% being no change in GHG level</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100% being total avoidance of GHG emissions</td>
</tr>
<tr>
<td></td>
<td>Contribution to local environmental sustainability</td>
<td>0% being no change in emission level of pollutant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+100% being total avoidance of emissions of local pollutant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-100% being doubling of emission of local pollutant</td>
</tr>
<tr>
<td><strong>Social sustainability</strong></td>
<td>Contribution to net employment generation</td>
<td>0% being no change in employment level</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+100% being doubled number of jobs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-100% being elimination of all jobs predicted in the baseline</td>
</tr>
<tr>
<td><strong>Economic sustainability</strong></td>
<td>Contribution to sustainability of the balance of payments</td>
<td>0% being no change in foreign currency expenditure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+100% being total avoidance of foreign currency expenditure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-100% being doubling of net foreign currency expenditure</td>
</tr>
<tr>
<td></td>
<td>Contribution to macroeconomic</td>
<td>0% being no change in public investments</td>
</tr>
</tbody>
</table>
| sustainability | +100% being total avoidance in use of public investments  
-100% being doubling in use of public investments |
|---------------|--------------------------------------------------------------------------------------------------|
| Cost effectiveness | 0% being no change in costs  
+100% being total avoidance of costs  
-100% being doubling of costs |
| **Technological sustainability** | **Contribution to technological self-reliance**  
0% being no change in foreign currency expenditure with technology  
+100% being total avoidance of foreign currency expenditure  
-100% being doubling of foreign currency expenditure with technology |
| **Contribution to sustainable use of natural resources** | 0% no being change in non-renewable natural resource use  
+100% being avoidance of all non-renewable natural resources  
-100% being doubling of use of non-renewable natural resources |
### B.3.6 SouthSouthNorth Matrix Tool

Table B.3-7 SouthSouthNorth matrix tool scoring (Lenzen, Schaeffer & Matsuhashi 2007; SouthSouthNorth (no date))

<table>
<thead>
<tr>
<th>Rating</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>Major negative impacts – significant damage can not be mitigated through preventative means</td>
</tr>
<tr>
<td>-2</td>
<td>Medium level negative impact (between very minor and major)</td>
</tr>
<tr>
<td>-1</td>
<td>Very minor negative impacts</td>
</tr>
<tr>
<td>0</td>
<td>No or neutral impacts</td>
</tr>
<tr>
<td>1</td>
<td>Minor positive impacts</td>
</tr>
<tr>
<td>2</td>
<td>Medium level positive impact (between minor and major)</td>
</tr>
<tr>
<td>3</td>
<td>Major positive impacts</td>
</tr>
</tbody>
</table>

Table B.3-8 SouthSouthNorth matrix tool (SouthSouthNorth (no date))

<table>
<thead>
<tr>
<th>Component</th>
<th>Indicator</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local, regional or global environment</strong></td>
<td>Water quantity (availability compared to baseline) and quality (measure of pollution and effluents)</td>
<td>From -3 to +3</td>
</tr>
<tr>
<td></td>
<td>Air quality (emissions other than GHGs)</td>
<td>From -3 to +3</td>
</tr>
<tr>
<td></td>
<td>Other pollutants (toxicity, radioactivity, POPs (persistent organic pollutants), stratospheric ozone layer depleting gases)</td>
<td>From -3 to +3</td>
</tr>
<tr>
<td></td>
<td>Soil condition (quality – pollutants and quantity – erosion)</td>
<td>From -3 to +3</td>
</tr>
<tr>
<td></td>
<td>Biodiversity (species and habitat conservation)</td>
<td>From -3 to +3</td>
</tr>
<tr>
<td><strong>Social sustainability and development</strong></td>
<td>Employment (including job quality – highly or poorly qualified and temporary or)</td>
<td>From -3 to +3</td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
<td>Impact</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Livelihood of the poor</td>
<td>(poverty alleviation, distributional equity, access to essential services, and access to clean energy services)</td>
<td>From -3 to +3</td>
</tr>
<tr>
<td>Human and institutional capacity</td>
<td>(empowerment, education, gender equality)</td>
<td>From -3 to +3</td>
</tr>
<tr>
<td>Economic and technological development</td>
<td>Employment (numbers of jobs directly generated)</td>
<td>From -3 to +3</td>
</tr>
<tr>
<td></td>
<td>Sustainability of balance of payments (savings of net foreign currency through reducing fossil fuel imports)</td>
<td>From -3 to +3</td>
</tr>
<tr>
<td></td>
<td>Technological self-reliance (project replicability, hard currency liability, skills development, institutional capacity, technology transfer)</td>
<td>From -3 to +3</td>
</tr>
</tbody>
</table>
### B.3.7 Huq (Prepared for the Prototype Carbon Fund)

Table B.3-9 Prototype Carbon Fund sustainable development categories (Huq 2002)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Global</th>
<th>National</th>
<th>Local/Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic</td>
<td>GDP</td>
<td>Trade</td>
<td>Employment</td>
</tr>
<tr>
<td></td>
<td>GDP per capita</td>
<td>Taxes</td>
<td></td>
</tr>
<tr>
<td>Environmental</td>
<td>GHG emissions</td>
<td>Biodiversity</td>
<td>Local air quality</td>
</tr>
<tr>
<td></td>
<td>Biodiversity</td>
<td>Air quality</td>
<td>Local water quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water quality</td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>HDI</td>
<td>Employment</td>
<td>Health</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poverty reduction</td>
<td>Community participation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Capacity building</td>
</tr>
</tbody>
</table>

### B.3.8 MATA-CDM

Table B.3-10 MATA-CDM criteria and methods of assessment (Sutter 2003)

<table>
<thead>
<tr>
<th>Sustainable Development Pillar</th>
<th>Criterion</th>
<th>Type of Assessment</th>
<th>Method of Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social criteria</td>
<td>Stakeholder participation</td>
<td>Qualitative</td>
<td>Qualitative description with results based on descriptive 5 step scale</td>
</tr>
<tr>
<td></td>
<td>Improved service ability</td>
<td>Semi-quantitative</td>
<td>Change in availability of services compared to baseline with quantitative results based on descriptive 5 step scale</td>
</tr>
<tr>
<td></td>
<td>Capacity development</td>
<td>Qualitative</td>
<td>Qualitative indicator with descriptive 5 step scale</td>
</tr>
<tr>
<td></td>
<td>Equal distribution</td>
<td>Quantitative</td>
<td>Share of turnover benefiting</td>
</tr>
<tr>
<td>Environmental criteria</td>
<td>Fossil energy resources</td>
<td>Quantitative</td>
<td>MWh coal saved/GHG reduction relative to baseline</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------</td>
<td>--------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Air quality</td>
<td>Semi-quantitative</td>
<td>Change relative to baseline based on judgments of odour and prevalence of respiratory diseases</td>
<td></td>
</tr>
<tr>
<td>Water quality</td>
<td>Semi-quantitative</td>
<td>Change relative to baseline based on judgments of quality of drinking water, acidification and eutrophication</td>
<td></td>
</tr>
<tr>
<td>Land resources</td>
<td>Semi-quantitative</td>
<td>Change relative to baseline based on judgments of soil erosion, pressure on land use, waste production, erosion, biodiversity and unsustainable use of biomass</td>
<td></td>
</tr>
<tr>
<td>Economic Criteria</td>
<td>Regional economy</td>
<td>Semi-quantitative</td>
<td>Economic performance of project location to determine economic disadvantage based on average income, unemployment rate and GDP per capita</td>
</tr>
<tr>
<td>Microeconomic efficiency</td>
<td>Quantitative</td>
<td>Internal rate of return</td>
<td></td>
</tr>
<tr>
<td>Employment generation</td>
<td>Quantitative</td>
<td>Additional person-month per GHG reduction compared to baseline</td>
<td></td>
</tr>
<tr>
<td>Technology transfer</td>
<td>Qualitative</td>
<td>Qualitative description with results based on descriptive 5 step scale</td>
<td></td>
</tr>
</tbody>
</table>
### B.3.9 CD4CDM Sustainable Development Guidelines

Table B.3-11 CD4CDM sustainable development criteria (Olhoff et al. 2004)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improve quality of life</td>
</tr>
<tr>
<td></td>
<td>Alleviate poverty</td>
</tr>
<tr>
<td><strong>Economic</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improve equity</td>
</tr>
<tr>
<td></td>
<td>Provide a financial return to local entities</td>
</tr>
<tr>
<td></td>
<td>Result in a positive impact on balance of payments</td>
</tr>
<tr>
<td></td>
<td>Transfer new technology</td>
</tr>
<tr>
<td><strong>Environmental</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduce GHG emissions and use of fossil fuels</td>
</tr>
<tr>
<td></td>
<td>Conserve local resources</td>
</tr>
<tr>
<td></td>
<td>Reduce pressure on local environments</td>
</tr>
<tr>
<td></td>
<td>Provide improved health and other environmental benefits</td>
</tr>
<tr>
<td></td>
<td>Meet local renewable energy portfolio standards and other environmental</td>
</tr>
<tr>
<td></td>
<td>policies</td>
</tr>
</tbody>
</table>
Table B.4-1 The Gold Standard matrix scoring guide (The Gold Standard 2008)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Preliminary Score either – 0 or +</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air quality</td>
<td>- to +</td>
</tr>
<tr>
<td>Water quality and quantity</td>
<td>- to +</td>
</tr>
<tr>
<td>Soil conditions</td>
<td>- to +</td>
</tr>
<tr>
<td>Other pollutants</td>
<td>- to +</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>- to +</td>
</tr>
<tr>
<td>Quality of employment</td>
<td>- to +</td>
</tr>
<tr>
<td>Livelihood of the poor</td>
<td>- to +</td>
</tr>
<tr>
<td>Access to affordable and clean energy services</td>
<td>- to +</td>
</tr>
<tr>
<td>Human and institutional capacity</td>
<td>- to +</td>
</tr>
<tr>
<td>Quantitative employment and income generation</td>
<td>- to +</td>
</tr>
<tr>
<td>Balance of payments and investment</td>
<td>- to +</td>
</tr>
<tr>
<td>Technology transfer and technological self-reliance</td>
<td>- to +</td>
</tr>
</tbody>
</table>
B.4.2 Social Carbon

Table B.4-2 Social Carbon methodology (Rezende & Merlin 2003)

<table>
<thead>
<tr>
<th>Type of Resource</th>
<th>Definition</th>
<th>Indicators</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>Networks, social duties, social relations, trust, affiliations and community associations</td>
<td>Negotiated</td>
<td>1 to 6</td>
</tr>
<tr>
<td>Financial</td>
<td>Cash, credit, debt and savings</td>
<td>Negotiated</td>
<td>1 to 6</td>
</tr>
<tr>
<td>Natural</td>
<td>Soil, water, air and environmental services such as the maintenance of the hydrological cycle</td>
<td>Negotiated</td>
<td>1 to 6</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Assessment of species and genes present, integrity of natural communities, human interaction with biodiversity, degrees of conservation, pressures and threats to biodiversity</td>
<td>Negotiated</td>
<td>1 to 6</td>
</tr>
<tr>
<td>Carbon</td>
<td>Sequestration (including reforestation, agroforestry); substitution (biodiesel, biomass use, agricultural residue use); and conservation (low impact forest management and protection from forest fires)</td>
<td>Negotiated</td>
<td>1 to 6</td>
</tr>
<tr>
<td>Human</td>
<td>Skills, knowledge, good health and work ability of host community</td>
<td>Negotiated</td>
<td>1 to 6</td>
</tr>
</tbody>
</table>
B.4.3 Climate, Community and Biodiversity Design Standards

Table B.4-3 CCB checklist requirements and description (Climate 2008)

<table>
<thead>
<tr>
<th>Section</th>
<th>Checklist Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td>Original condition in project area</td>
<td>Includes physical parameters such as soil, geology, climate, vegetation; community cultural diversity and socio-economic information; and biological diversity</td>
</tr>
<tr>
<td></td>
<td>Baseline projections</td>
<td>Most likely land use scenario in absence of project and estimated carbon stock changes as a result</td>
</tr>
<tr>
<td></td>
<td>Project design and goals</td>
<td>Summarises objectives, map, timeline, risks, measures to maintain conservation values, stakeholder participation</td>
</tr>
<tr>
<td></td>
<td>Management capacity and best practices</td>
<td>Identifies the roles of each project participant, documents technical skills needed, plan for building employee and community member skills and knowledge, equal opportunity plan, list of labour rights, worker risks and financial health of implementing organisation</td>
</tr>
<tr>
<td></td>
<td>Legal status and</td>
<td>Lists relevant national and local laws, approval documents from relevant authorities,</td>
</tr>
<tr>
<td><strong>Property Rights</strong></td>
<td>Consultations, and statement that project does not require involuntary relocation of people or activities important for livelihood or culture and if this is voluntarily undertaken, that adequate compensation is made. Title to carbon rights stated here also</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Climate</strong></td>
<td>Net positive climate impacts</td>
<td>Shows net change in carbon stocks, also of non CO₂ gases, other GHG emission resulting from activities and how double counting is avoided</td>
</tr>
<tr>
<td>Offsite climate impacts (leakage)</td>
<td>Determines types of leakage and mitigation plans</td>
<td></td>
</tr>
<tr>
<td>Climate impact monitoring</td>
<td>Selects carbon pools such as biomass, litter, wood products etc. and non CO₂ GHGs that are to be monitored and outlines the frequency of monitoring which is to take place within 6 months of project start date or within 12 months of validation</td>
<td></td>
</tr>
<tr>
<td><strong>Community</strong></td>
<td>Net positive community impacts</td>
<td>Use of appropriate methods to determine impact on local communities including socio-economic, cultural, well-being and compared to baseline</td>
</tr>
<tr>
<td>Offsite stakeholder impacts</td>
<td>Outline potential negative offsite stakeholder impacts and mitigation plan</td>
<td></td>
</tr>
<tr>
<td>Community impact monitoring</td>
<td>Plan and select variables for monitoring and the frequency of this for community development objectives and for anticipated impacts within 6 months of project start date or within 12 months of validation</td>
<td></td>
</tr>
<tr>
<td><strong>Biodiversity</strong></td>
<td>Net positive biodiversity impacts</td>
<td>Use appropriate methods to estimate and compare to baseline the biodiversity impacts and ensure no high conservation values will be negatively affected by the project</td>
</tr>
<tr>
<td>Offsite biodiversity impacts</td>
<td>Identify potential offsite biodiversity impacts and document mitigation plans</td>
<td></td>
</tr>
<tr>
<td><strong>Biodiversity impact monitoring</strong></td>
<td>Plan which biodiversity values will be monitored and with what frequency to measure effectiveness in maintaining or enhancing high conservation values</td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Optional</strong></td>
<td><strong>Bonus Gold Standard (require one of three)</strong></td>
<td></td>
</tr>
<tr>
<td>Climate change adaptation benefits</td>
<td>Projects which are designed to reduce the vulnerability or enhance the capacity of communities to adapt to forecasted climate changes</td>
<td></td>
</tr>
<tr>
<td>Exceptional community benefits</td>
<td>For example if the project is in an area of low human development such as where at least 50% of the population of that area is below the national poverty line or 50% of households are in the lowest category of well-being and state how the benefits of the project will flow to the poorer households</td>
<td></td>
</tr>
<tr>
<td>Exceptional biodiversity benefits</td>
<td>For example projects with exceptional biodiversity impacts such as in areas that are vulnerable or for species which are considered irreplaceable</td>
<td></td>
</tr>
</tbody>
</table>
B.5 Voluntary Carbon Standards

B.5.1 Verified Carbon Standard

Verified Carbon Standard (VCS), formerly Voluntary Carbon Standard when it was launched in 2005, provides a voluntary certification standard for energy, manufacturing, chemical, construction, transport, mineral and metal production, fugitive emissions, solvents use, waste handling and disposal, agriculture and forestry and livestock and manure management sectors (Verified Carbon Standard 2012). It can be used in conjunction with the CDM and a range of other carbon standards (Verified Carbon Standard 2012). The VCS requires an EIA only if required by the national legislation of the host country and asks for a list of ‘relevant’ stakeholder comments made in consultations and the methods for ongoing stakeholder communication (Verified Carbon Standard 2012). There are no requirements for specific stakeholder consultation nor social, economic or environmental impact assessments to be undertaken.

B.5.2 VER+

VER+ is a voluntary standard developed by TÜV SÜD in 2007. The VER+ Standard incorporates an assessment of project eligibility, additionality, permanence, exclusivity, avoidance of double-counting, a defined ex-post crediting period, a conservative methodological calculation approach and environmental and social criteria (TÜV SÜD 2008). Like the VCS standard, an EIA is only required if the host country requires one by law and the only requirement for environmental development is that negative environmental impacts must be mitigated. Severe social impacts are also not permitted under this Standard, although qualification of what this entails or how it is evaluated is not provided (TÜV SÜD 2008). For stakeholder engagement, consultation is only required if it is required by the laws of the host country, and if it is not, the project developer can decide whether to a) conduct stakeholder consultation voluntarily and include such information in the VER+ Project Design Document (PDD), or b) clarify in the PDD that the project does not affect the local population. VER+ will make documents publicly available, however there is no similar global stakeholder consultation to the CDM (TÜV SÜD 2008).

B.5.3 Plan Vivo

Plan Vivo is a standard started in 1994 that focuses on livelihoods, a bottom up development approach, continuous improvement, restoring and conserving native ecosystems and an equitable distribution of benefits (Plan Vivo 2011). The standard applies to changes in land-use systems including afforestation, agroforestry, forest conservation, restoration and avoided deforestation (Plan Vivo 2011). For projects to be approved and issued with emission reduction certificates, a Project Idea Note (PIN) must first be submitted, followed by a Project Design Document (PDD), and the project must then undergo validation and registration, annual
reporting and verification processes (Plan Vivo (no date)). Given the community driven planning required by this standard, there is no set sustainable development method of evaluation or monitoring of sustainable development contributions used.
## B.6 Comprehensive Checklist Assessment

### B.6.1 Indicators used in the Comprehensive Checklist Assessment

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicator</th>
<th>Other Frameworks using this Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic</strong></td>
<td>Regional integration</td>
<td>Brazilian DNA Annex III (Interministerial Commission on Global Climate Change 2003)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grupo de Pesquisa em MDL da UFBA (CDM Research Group of the University) Research Methods (Andrade unpublished; Guillen 2010)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Development Dividend (Cosbey et al. 2006)</td>
</tr>
<tr>
<td></td>
<td>Increase in taxes received by municipal/national government</td>
<td>Grupo de Pesquisa em MDL da UFBA (CDM Research Group of the University) Research Methods (Andrade unpublished; Guillen 2010)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UNFCCC Assessment Method (United Nations Framework Convention on Climate Change 2011)</td>
</tr>
<tr>
<td></td>
<td>Increased in employment</td>
<td>Brazilian DNA Annex III (Interministerial Commission on Global Climate Change 2003)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SouthSouthNorth Assessment (SouthSouthNorth (no date))</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gold Standard (Ecofys, TÜV-SÜD &amp; FIELD 2009)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MATA-CDM (Sutter 2003)</td>
</tr>
<tr>
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<td>Social Carbon (Social Carbon 2011)</td>
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<td>Training, worker education and capacity building</td>
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<td>Improve quality of life in rural areas</td>
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<td>Development Dividend (Cosbey et al. 2006)</td>
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<td>Brazilian development priorities as determined in Chapter Two of this thesis</td>
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<th>OH&amp;S and staff health</th>
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| Improved health of population due to project | Climate, Community and Biodiversity Project Design Standards (Climate 2008)  
Social Carbon (Social Carbon 2011)  
UNFCCC Assessment Method (United Nations Framework Convention on Climate Change 2011)  
Brazilian DNA Annex III (Interministerial Commission on Global Climate Change 2003)  
Development Dividend (Cosbey et al. 2006) |
| Improved environmental education of population | Brazilian DNA Annex III (Interministerial Commission on Global Climate Change 2003)  
Social Carbon (Social Carbon 2011)  
Climate, Community and Biodiversity Project Design Standards (Climate 2008)  
UNFCCC Assessment Method (United Nations Framework Convention on Climate Change 2011) |
| Improved service availability (other than electricity provision – already accounted for) | MATA-CDM (Sutter 2003) |
| Funding of charity or community project | Climate, Community and Biodiversity Project Design Standards (Climate 2008)  
Brazilian DNA Annex III (Interministerial Commission on Global Climate Change 2003)  
Grupo de Pesquisa em MDL da UFBA |
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(CDM Research Group of the University) Research Methods (Andrade unpublished) UNFCCC Assessment Method (United Nations Framework Convention on Climate Change 2011)
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<td>Initiative of the researcher</td>
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### B.6.2 Standardised Contribution of Project Sub-Types to Selected Benefit Indicators

Table B.6-2 Standardised contribution of project sub-types to selected benefit indicators (a)

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<th>Energy Efficiency</th>
<th>Fossil Fuel Switch</th>
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Table B.6-3 Standardised contribution of project sub-types to selected benefit indicators (b)

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<th>Landfill gas</th>
<th>Landfill composting</th>
<th>Landfill flaring</th>
<th>Landfill power generation</th>
<th>Methane Avoidance</th>
<th>N₂O Destruction</th>
<th>PFCs and SF₆</th>
<th>Reforestation</th>
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Where:

E = End of Pipe – where there is an introduction of new technology systems that capture pollutants to reduce negative environmental impacts (Guillen 2010);

C = Cleaner Technology – where technology does not seek to treat pollution after it has been produced and instead seeks to avoid such emissions in advance (Guillen 2010);

Ex = Exogenous technology source or first of its kind in Brazil according to the Grupo de Pesquisa em MDL da UFBA framework;
En = Endogenous technology source according to the Grupo de Pesquisa em MDL da UFBA framework;
Y = Yes;
YE = Yes due to an environmental legislation requirement;
N = No;
1 = According to data from the PDD and Annex III documents;
2 = Improvement in atmospheric composition through a decrease in GHG emissions from business-as-usual is accounted for in CER sales so therefore not included here to avoid double counting of benefits. Where there are improvements to odour, particulate matter, volatile organic compounds or other air quality health benefits, these are included here and in the quality of life or health of population indicators. Improvements to air quality and health of population for bagasse projects are not counted as they are efficiency increasing projects and the use of bagasse itself, rather than fossil fuels, is not additional; and
3 = reduction in use of fossil fuels is attributed to all projects that contribute towards improved energy efficiency, renewable energy production or are a fossil fuel switch. While Brazil sources 83% of its electricity needs from renewable energy (Instituto de Pesquisa Econômica Aplicada & Secretaria de Planejamento e Investimento Estratégicos 2010; U.S. Energy Information Administration 2013), and therefore any reduction in the use of this energy matrix contributes to the reduction of fossil fuels from the remaining 17%.