Reaching sustainability:
Combining sustainable development with emission reductions in the Clean Development Mechanism

A study of the sustainability contributions in the CDM projects with Norwegian investment

DEPARTMENT OF COMPARATIVE POLITICS

UNIVERSITY OF BERGEN

Marie Koksvik Thorsen

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Abstract

This thesis investigates how projects of The Clean Development Mechanism (CDM) contribute to sustainable development. These are projects with the dual objective of reducing greenhouse gas emissions and contribute to sustainable development. As these projects' contributions to sustainable development vary considerably, this thesis investigates combinations of factors in order to explain these variations. Which factors are decisive for obtaining substantial or unsubstantial contributions to sustainable development are assessed by using Qualitative Comparative Analysis (QCA) as a research method. QCA is a combinatorial method and was used in order to find combinations of factors that affected the projects contributions to sustainable development.

The 85 CDM projects with Norwegian investment were used as a sample, and five explanatory variables, the conditions, were used for investigating how the outcome for the projects contributions varied. Three of the conditions were related to the project design while two conditions were related to the project participants. It was a purpose of the thesis to compare the relevance of these two types of conditions for explaining the projects' outcomes. The project design variables were *Project Category*, *Project Scale* and the *Emission reductions* generated from a project while *the project participant* conditions were *Ownership type* and *Economic performance* of the host country of a project.

The *project design* conditions appeared to be less relevant for explaining the outcome than the conditions of *the project participants*. The *Project category* and the *Emission reductions* generated from a project both appeared relevant for explaining the outcome, while the *Project Scale* appeared to be irrelevant. The findings suggested that the *Ownership type* of the projects was the most decisive factor for explaining the project's contributions to sustainable development, although the *Economic performance* of the host country of a project seemed decisive for which ownership type the projects would have. However, also country specific contexts seem to explain some of the variations in the outcomes among the projects.

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Table of contents

List of tables:

Chapter 1: Introduction

1.1 The Clean Development Mechanism and its twofold objective

The Clean Development Mechanism (CDM) was created to be a part of the climate quota system under the Kyoto Protocol. Its objective is to reduce greenhouse gas emissions and at the same time contribute to sustainable development in the host country for a project. In order to fulfil this twofold objective of the mechanism, industrialized countries are committed to the Kyoto Protocol to invest in CDM projects in developing countries. For each CDM-project, there exist measures for reducing emissions, as well as criteria for achieving sustainable development in the host country. Transfers of resources and technology to the host countries take place in order to support the projects. Investments in these projects can therefore be seen as a form of aid, and not only a way to reduce emissions.

Industrialized countries committed to the Kyoto-protocol must reduce their greenhouse gas emissions to a certain level. The emission reductions generated from the CDM projects are represented by certified emission reduction credits (CER) that can be sold in the market for climate quotas. The industrialized countries can therefore buy CER credits in order to fulfil their own targets for emission reductions.

Sustainable development of a country means that it can meet today's generation's needs and at the same time preserve the needs for coming generations. The sustainability contributions from single projects often focus on measures to improve the quality of life in the local communities surrounding the project. Moreover, sustainable development can be reached in various ways, and for the CDM system one usually distinguishes between environmental, economic and social contributing factors (Olhoff, Markandya, Halsnaes and Taylor 2004: 17-18). Typically, contributions to sustainable development can for the environmental dimension be made by reducing pollution and preserving natural resources, while the social dimension can include improvement of health conditions and provision of education. Lastly, economic contributions are often made through job creation, improvements of infrastructure and by the use of new technology (United Nations Framework Convention on Climate Change (UNFCCC) 2012: 15).

The sustainability contributions vary with the unique projects. As of today, the total amount of CDM projects is approximately 8700, and the projects are located in many different countries (United Nations Environment Programme DTU Partnership (UNEP DTU

Partnership 2014a). There are also many types of projects in the CDM, and some of the most common are in the industries of hydro power, solar energy, landfill gas, energy efficiency, transport, wind power, agriculture, biomass energy, fossil fuel switch and gas gathering and utilization. As will be elaborated later, the types of sustainability contributions that the different projects provide, as well as the quality of them, are of great variety, and can also be affected by the preferences of the different host countries of the projects.

The CDM system was created for economic purposes as well as for political ones. Economically, the CDM-system was a mechanism for reducing greenhouse gas emissions where it was found most cost efficient. Reducing emissions in developing countries (non-Annex I Parties) of the Kyoto protocol through CDM projects can be a more cost efficient solution than to carry out all the emission reductions in the industrialized countries (Annex I Parties). If the costs of conducting emission reductions are lower in developing countries than in developed countries, the CDM-system would make it possible for developed countries to pay for fulfilling parts of their emissions reductions in developing countries rather than paying more for conducting all of their emissions reductions in their own country. Politically, the mechanism was a strategy for including developing countries in an international agreement for combatting climate change. Since the developing countries have contributed little to climate change compared to the most developed countries, it is seen as reasonable that they should not have to pay the cost for the damage that have been done. At the same time, they would want to reach higher living standards that would probably raise emissions and contribute to global warming. Therefore, the CDM has the objective of contributing to sustainable development while reducing emissions.

As described, the objective of the mechanism consists on the one side of establishing CDM-projects that generate climate quotas by reducing emissions. The other part of the objective claims that each project will contribute to a sustainable development for the host country of the project. The objective is therefore twofold, and each part of the objective is supposed to be of equal importance in the fulfilment of the mechanism. In practice, however, the claim for sustainability seems to come second.

Goal attainment and trade-offs

One problem related to the twofold objective is that the sustainable development claim often seems to be set aside, as there appears to exist a trade-off between reaching the development claim and the emission claim (Alexeew, Bergset, Meyer, Petersen, Schneider and Unger 2010, Sutter and Parreño 2007). Reaching the sustainability claim is shown to be the largest challenge for the CDM, as many projects seem to fall short of the sustainability criteria. The host countries for the projects are basically left to themselves in defining the criteria the sustainable development claim must meet. In order to meet both objectives in the least costly manner, and thereby make a project more profitable to investors, the demands for sustainable development generally seems to be set to a low level. Furthermore, different traits of the projects seem to contribute to considerable differences in meeting both the development claim and the emission claim (Sutter and Parreño 2007).

1.2 Research question

After the realization of the CDM, several studies have been carried out in order determine the sustainability contributions from CDM projects (Alexeew et al. 2010, Boyd, Hultman, Roberts, Corbera, Cole, Bozmoski, Ebling, Tippman, Mann, Brown and Liverman 2009, Disch 2010, Lee and Lazarus 2011, Nishiki 2007, Nussbaumer 2009, Olsen and Fenhann 2008, Sutter and Parreño 2007, Watson and Fankhauser 2009). Overall, research findings suggest that the spread in sustainability contributions is large among the projects, and they point to different factors that are of significance for the achievement of sustainability. Although the existent research findings are somewhat disparate in assessing the significance of different factors, there is a general consensus claiming that, overall, the CDM does not bring sufficient sustainability benefits.

The purpose of this thesis is to find out under which circumstances the CDM projects can contribute sufficiently to sustainable development or not by examining combinations of factors. Contributions to earlier research will be made by investigating combinations of factors systematically, and not only investigate the effect of each factor separately. Therefore, this thesis might more accurately explain the observed variations in sustainability. The existing projects with Norwegian funding will be used as a sample for investigating the factors. The research question will therefore be stated as '*What explains the variation in the level of sustainability contributions for the CDM-projects with Norwegian funding?*'

The data used for the analysis are derived from *The CDM Registry* of *The United Nations Framework Convention on Climate Change (UNFCCC)*. In this registry, *The Project Design Documents (PDDs)* contains detailed information about each existent CDM project, including a description of how the projects shall contribute to sustainable development.

As a method, Multi Valued Qualitative Comparative Analysis (mvQCA) will be used for handling the research question. It is a method suitable for finding patterns and combinations of variables that affect the outcome of interest. For the CDM projects, a better insight into how combinations of project traits matter for their contributions to sustainability is valuable, since most of the existent knowledge deals with how single characteristics contributes to sustainable development. This thesis will focus on how combinations of project characteristics relate to the achievement of the sustainability objective.

1.3 Case selection

The role of Norway in the CDM

Norway has invested in 85 CDM projects (Finansdepartementet 2013a), where a considerable variety of projects is represented. This reflects the fact that the Norwegian government has stated that it is its rationale to invest in a project portfolio that can be representative for the global composition of projects. These projects are therefore to a considerable degree representative for the global distribution of projects regarding the project traits that form the variables of interest for this analysis. In the sample, the main different project categories are represented, and the variation in the other explanatory variables relating to the project design and the project participants is suitable for conducting an analysis aimed at explaining the variation in their contributions to sustainability. The population of projects with Norwegian investment is therefore considered to be appropriate for bringing complexity into the analysis on the variables of interest.

Furthermore, in addition to the rationale of investing in a diversity of projects that corresponds to the global distribution of projects, it is a rationale for the Norwegian Government to invest in projects that sufficiently satisfy the goals for sustainable development, even though the emission quotas from some of these projects may come at a higher price (Finansdepartementet 2013b). Norway was the country that first proposed the option of including global emission trading into an international treaty for mitigating climate change. It was this initial proposal that later led to the establishment of the three flexibility mechanisms of the Kyoto protocol, that included the CDM as one of the forms of emission trading (Sutter 2003: 49). The government of Norway has been one of the leading actors in establishing the current system of global emission trading, and has also stated that it's a rationale for the Norwegian CDM investment that considerable emphasis shall be given to the promotion of sustainable development (Finansdepartementet 2013b). As such, it could be expected that the sample of CDM projects with Norwegian investment would, in total, be good sustainability providers. As it is claimed that the CDM projects overall do not contribute adequately to sustainability, it is of interest to investigate if the findings for the Norwegian CDM project portfolio would support this claim or not. As Norway regards itself as an ambitious actor in climate change mitigation and in the CDM, a potential low fulfilment among this country's portfolio of projects could support the claim of a general low fulfilment of the sustainability objective. In this manner, the sample of projects having Norway as an Annex I partner can be viewed as a critical case for evaluating the claim of an existing underperformance of sustainability contributions in the CDM. Using the Annex I country as a constant for the sample of projects might then disqualify the Annex I country as an intervening variable in this analysis.

1.4 The variables

The outcome variable: contributions to sustainable development

As stated in the research question, the contributions to sustainable development from CDM projects will in this thesis represent the outcome variable. This variable will be constructed as a dichotomous measure, in creating a threshold between the projects that give substantial and unsubstantial contributions to sustainable development. To be counted as giving substantial contributions, the project must possess indicators on all the three dimensions of sustainable development, where at least one concrete measure for sustainability must be defined for at least one dimension.

Conditions

Five conditions, or variables, are employed to analyse the sustainability contributions for the CDM projects. These conditions can be placed into two groups, where the first group relates to characteristics of *the project design*: the *project category*, *the scale* of the project and the amount of *emission reductions* generated from a project. The second group considers characteristics of *the project participants*: *the ownership type* for the project and *economic performance* of the host country of a project. These variables are identified as being of significance for the fulfilment of the sustainability objective in the research literature, but they will be named conditions, and not independent variables, as conditions is the proper term in the QCA method, where independence between variables are not assumed (Berg-Schlosser, De Meur, Rihoux and Ragin 2009: 9). Furthermore, these two types of conditions each serve its own purpose for the analysis of this thesis. More theory exists about the relevance of the three conditions of project design than for the two conditions of project participants. The *project design* conditions can therefore serve the purpose of theory testing, while the *project participants* conditions will serve an exploratory purpose of theory generation. It will also be a purpose for the analysis to compare the relevance of the two types of conditions in explaining the outcomes.

1.5 Choice of method: Multi Valued Qualitative Comparative Analysis

The method chosen for handling the research question is Multi Valued Qualitative Comparative Analysis (mvQCA), a method made for combining qualitative and quantitative attributes in a research method. With this method, larger numbers of cases than in ordinary qualitative research is easily possible. The number of cases used in research conducted with this method varies a great deal, from small N-analysis with only a handful of cases, to large studies with over a thousand cases (Rihoux 2006: 968). The main qualitative attribute of the method lies in its need for actual insight into each case in order to perform a reasonable coding of them, before conducting the analysis (Ragin 1987). With mvQCA, the conditions can have more than only two values, which is the case for the original version of the method, Crisp Set QCA. Dichotomous variables can be useful for many research studies using QCA if it is possible to make meaningful thresholds when dichotomizing the phenomenon constituting the variable. However, classifying cases into one of two categories might make the phenomenon of interest indistinct, so that it becomes problematic to conduct a fruitful analysis (Cronqvist and Berg-Sclosser: 70-72). mvQCA can be suitable for data sets with variables on the nominal, ordinal and interval scales, and where one also see it more suitable for the analysis to make more than two thresholds for distinguishing between the cases on some of the variables (Vink and Van Vliet 2009). For this thesis analysis, most of the five conditions are non-metrical, and for some of them there are also more than two values of interest. In this case, making dichotomous variables would have proven difficult and probably would have led to losing valuable information about the distribution of the cases and thereby weakened the analysis. Among the traits of QCA are also its ability for seeking combinations and patterns. QCA is a method made especially for finding different paths that leads to the same outcome, as well as for finding necessary and sufficient conditions for the outcome of interest to occur (Ragin 1987). How different combinations of the variables can lead to the same outcome is one of the main questions of interest in this method, which is important for explaining under which contexts the outcome of interest can occur or not. In this thesis, QCA can accordingly be a suitable tool for investigating under which conditions the CDM projects contribute substantially to sustainable development and under which conditions they do not.

1.6 Main findings

The results of the analysis suggested that the project participants were more decisive for explaining the outcomes than the conditions relating to the project design. The type of project ownership seemed to represent the most important condition, although the economic performance of the host country seemed to be decisive for which type of ownership the CDM host countries could attain. In addition, the findings of the analysis pointed to country specific contexts being of relevance for explaining the outcome.

1.7 Structure of thesis

In chapter 2, the background chapter, the Clean Development Mechanism will be contextualized as part of a development strategy and as a market-based mechanism in the Kyoto protocol. Second, the meaning and the implications of the concept sustainable development in the CDM will be elaborated. Lastly, the CDM system will be described with a focus on key aspects on its workings.

Chapter 3 is a theory chapter, and will present the theories and hypothesis for the conditions. In addition, this chapter will describe how contributions to sustainable development is defined and assessed in the research literature.

Chapter 4 first presents the scope of this study, regarding the research approach, case selection and use of data and measurements. Second, it presents the basic features of QCA as a method and as a research approach. Lastly, the operationalizations of the outcome variable and the conditions will be described in detail.

Chapter 5 presents the analysis and the discussion of the findings. QCA will be used to assess the relevance of the conditions on the outcome by constructing two models. Lastly, two illustrative contexts of the CDM are described on the basis of the findings in order to demonstrate how the CDM projects fulfil the sustainability objective under different settings.

The final conclusions for the analysis are made in chapter 6. The main findings from the analysis will presented and discussed, and suggestions for further research will be made.

Chapter 2: Background

2.1 The international governance of climate change and sustainable development

The challenges of mitigating climate change and promoting sustainable development can be regarded as global collective action problem, and the Clean Development Mechanism has been one of the largest measures taken to integrate different partners for overcoming the barriers to collective action. Nevertheless, the success of this international mechanism for sustainable development rests upon national interpretations of sustainability. These interpretations could be negatively influenced by the need to make economic profit, as sound criteria for sustainability are not rewarded economically.

The CDM as an international partnership initiative

The CDM can be seen as an international initiative for combatting climate change that seeks to include all countries to a mitigation plan that is effective and fair (Streck 2004). Effectiveness is addressed in creating a market mechanism designed to ensure that the most cost efficient solutions take place. Fairness is achieved by making the largest emitting countries responsible for paying the price of reducing emissions, while the least emitting countries are receiving financial aid and technology transfers in order to reduce emissions, develop and adapt for a low-emitting future. According to Streck (2004: 301), during the negotiation process towards the CDM, the mechanism was welcomed as a mitigation strategy from all parts, because no one could loose from it, and because it opened up for mutual gains. Developing countries were given new possibilities for funding and investment, and the developed countries would be able to reduce the costs of emissions reductions compared to other proposed solutions. Furthermore, the CDM was an agreement that succeeded in making developing countries commit to a plan for climate change mitigation. Moreover, Streck (2004) describes the CDM as an example of new models of governance that has arisen in the international arena for finding responses to complex global problems. The distinctiveness of these new models of governance is that not only states, but also non-governmental organizations (NGOs) and lager international institutions such as the United Nations and the World Bank participate together. Streck (2004) describes these new governance forms as 'collaborative networks' that represents new forms of partnerships in global politics and that combines public and private actors.

2.1.1 From economic development towards sustainable development

As strategies for development have been among the dominating themes on the international agenda in the post-war period, the need for development to become sustainable has emerged as an increasingly important issue (Hicks, Parks, Roberts and Tierney 2008: 190-198). Development has mainly been understood as generating wealth through modernization. Helping poorer countries to develop has been promoted through implementation of measures directed to modernize through industrialization and advancement of technology. The means, as well as the goals for development has been mainly economic, as development is considered to be reached in adapting to a capitalist economy. As much attention has been concentrated upon economic development, it has at the same time become clear that increasing the world's wealth in the current manner leads to over-exploitation of natural resources, excessive environmental damage and climate change. During the period of the 1980s and onwards, where the development regime of the so-called Washington Consensus with its market oriented strategies for development dominated the global agenda, environmental concerns were integrated in the policy goals (Matz 2005: 273-278, Wayenberge: 26-27). The capitalist growth economy evidently had environmental costs, and the need to integrate the environmental costs when initiating development became clear. Sustainable development was consequently launched as a concept, and with it, new strategies and goals for development were made (Matz 2005: 273-275).

2.1.2 The concept of sustainable development

Sustainable development was firstly defined in *Our Common Future*, a report from *the United Nations' World Commission on Environment and Development* published in 1987. In the report, sustainable development was defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs.' (United Nations 1987). Moreover, as the report states, this definition includes the two different concepts which form the basis of sustainable development: the concept of needs and the concept of limitation. Sustainable development can therefore be seen as combining the task of meeting the needs of the world's population at present and in the future, and simultaneously imposing limits to the extraction of the world's resources to prohibit over utilization. Furthermore, in the concept of sustainable development one usually operates with three dimensions with different criteria that all must be satisfied in order to achieve sustainability. Criteria on the environmental, the social and the economic dimensions are interrelated, and must all be taken to account when initiating sustainable development

(Langhelle and Ruud 2012: 184). Still, the definition of sustainability is wide, and the results from action taken to achieve sustainability will depend on the interpretations of the concept. So far, different suggestions have been proposed for conceptualizations and measurements, but no broad consensus has been reached (Langhelle and Ruud 2012: 173). Furthermore, in order to achieve actual benefits for sustainable development, there is an emphasis on the need to carry out concrete measures to improve people's living conditions (Olhoff et al. 2004: 18).

Sustainable development in the CDM

In the CDM, sustainability contributions from projects are to be found within all the three dimensions of the concept. The individual projects will make different contributions to sustainable development, and some projects can make several different types of contributions, while others will only claim to make one sort of contribution. However, many aspects of the sustainability dimensions can be achieved in the CDM projects by a limited amount of criteria (Olhoff et al. 2004: 17-19). One has to make indicators for the different dimensions in order to operationalize the achievement of them. In addition, the national goals for development among the host countries can have an influence on the interpretation of sustainable development and thereby the priority of the different dimensions (Olhoff et al. 2004: 17). Even so, a convergence in the sustainability criteria seem to have appeared, as selected criteria in different host countries often focus upon 'local environmental benefits, employment generation, and poverty and equity concerns' (Olhoff et al. 2004: 18). However, there seems to be a special emphasis on the economic dimension, as the national interpretations of sustainability in the CDM projects have focused most heavily on the need for economic growth.

As a single CDM project can only make small contributions to sustainable development, the benefits it brings for the local communities surrounding the project will be of outmost importance. Many such local benefits focusing upon improvements for the people in local communities will then sum up to make improvements for the sustainability of the national development (Olhoff et al. 2004: 19-20).

2.1.3 Market-oriented development strategies

The Washington Consensus' regime of market-oriented arrangements has been dominant in the strategies for development in since the 1980s. Extensive measures have been promoted by the industrialized countries in order to help poorer countries develop, and these measures have relied heavily on economic theory and centered upon growth initiated by international trade (Fine 2006). The economic development theory has emphasized the need to become self-reliant, and lessened the extent of official aid. Simultaneously, aid has become more incentive driven and selective (Waeyenberge 2006: 35-37).

Under the regime of the Washington Consensus and the Post-Washington Consensus, marketization and conditional aid has increasingly been applied to promote development. Notions of 'new growth theory', 'new trade theory' and 'new partnerships' between the recipient governments and NGOs, became important in promoting development (Waeyenberge 2006: 29-34). Particularly, the World Bank has had the leading role in implementing the new market-oriented strategies for development that often have imposed restriction upon the government's scope of action in developing countries (Fine 2006, Morrissey 1993, Waeyenberge 2006).

Criticism of development strategies' influence on state autonomy

Much of the criticism of development strategies and aid relates to the question of the roles the richer and poorer countries should play, and in what manner and how actively the developed countries should help the poorer countries develop. The Washington Consensus development strategies and the increase in conditional aid have been criticized for imposing too many limits on the autonomy of governments in developing countries and of utilizing poor countries in making favorable trade agreements for the benefits of the donor countries more than the recipient countries (Hicks et al 2008: 93-97, Morrissey 1993).

In front of the negotiation process towards the CDM, there was considerable skepticism among the developing countries towards suggestions for climate change mitigation plans that would impose too many restrictions on the developing countries' state autonomy. However, the CDM was accepted as a fair mitigation plan among developing countries (Streck 2004: 301). Accordingly, the reason why an international standard for assessing contributions to sustainability was not passed when the mechanism was established was that the developing countries considered it to represent an imposition on their state autonomy. With the current national sustainability standards, the host countries can decide which criteria they conceive of as most important for sustainable development in their own country, and prioritize these criteria when making claims to sustainability (Olsen and Fenhann 2008: 2819).

2.2 The role of the Clean Development Mechanism in the Kyoto Protocol

The Kyoto Protocol and its flexibility mechanisms

The United Nations Framework Convention on Climate Change (UNFCCC) became the first international treaty for climate change mitigation in 1992, followed up by the Kyoto Protocol in 1997. These two treaties represent the most consequential international actions towards climate change, and they have been ratified by 192 and 120 countries respectively (UNFCCC 2014a, Yamin and Depledge 2004: 2). The Kyoto Protocol was negotiated in order to specify concrete and binding targets for reducing greenhouse gas emissions, building upon the agreements made by the Conference of the Parties (COP) in the United Nations framework convention of 1992. Binding targets for the reduction of greenhouse gas emissions has been set for each of the parties of the protocol. In order to reach the targets, the Annex I Parties can take advantage of new technical solutions and market-oriented strategies in achieving the goals for emission reductions (Yamin and Depledge 2004: 2). The Annex I Parties to the protocol are the industrialized countries which have committed themselves to reducing their greenhouse gas emissions according to their individual 1990-levels of emissions. The major goal of the Kyoto Protocol was to reduce the overall level of greenhouse gas emissions in the atmosphere to a level that is compatible with sustained growth and sustainable development. In operation, this resulted in a commitment to reduce the overall level of emission reductions to at least five per cent below the 1990-level in the period 2008 to 2012 among the Annex-I Parties of the protocol. Successively, from 2013 to 2020, commitments to the protocol were renewed (Freestone and Streck 2005: 9-11).

The parties of the protocol will enjoy the advantage of its three flexibility mechanisms to attain cost efficient solutions for reducing emissions at the global level, making efficiency gains that would not be possible to achieve at the national or regional levels. The efficiency gains are drawn from the flexibility to execute the emission reductions in the places where the costs are the lowest. The Clean Development Mechanism represents one of the three flexibility mechanisms of the Kyoto Protocol, and is the only flexibility mechanism that included the developing countries without binding commitments into an international agreement for mitigating climate change. The other flexibility mechanism, 'The International Emission Trading' and 'The Joint Implementation', include the Annex I Parties only. In the Clean Development Mechanism, the Annex-I parties invest in emission reducing projects in the parties without commitments, the non-Annex I parties (UNFCCC 2014c, Yamin and Depledge 2004: 136-140).

Partnership structures and ownership types

The CDM system opens up for many types of actors in forming different constellations of partnerships. Even though the Kyoto Protocol was the result of a development of the UN Framework convention of 1992, the Kyoto Protocol lacks operational details specifying the roles of the actors, which have led to a large variety of actors forming partnerships. The Kyoto Protocol still appears more as a framework for how the parties can act rather than a treaty (Streck 2004: 299, Yamin and Depledge2004: 160). Nevertheless, three main types of ownership models reflecting partnership structures have evolved within the CDM framework (Yamin and Depledge 2004:160-161):

Unilateral ownership

In a unilateral project, the non-Annex I partner, a developing country, undertakes the investment of the CDM project alone, without forming any partnership with an Annex I Party. The unilateral investor can then profit from selling the CER-quotas generated from the project, or the quotas can be banked for later purposes.

Bilateral ownership

The bilateral ownership reflects a traditional model for investment. In this type of ownership, the Annex I Party invests in a CDM project in partnership with the host country of the project. The industrialized Annex I country then receives CERs from a direct investment in the CDM project.

Multilateral ownership

In a multilateral ownership design, the industrialized countries rather place the investment in a centralized fund which invests in a portfolio of projects, rather than taking a decision of doing a direct investment in a particular project. The Annex I partner then receives CERs from the fund in proportion to the size of its investment. The multilateral approach can therefore be perceived as the ‘portfolio approach’. It is commonly an international financial institution which crates the portfolio and invests in it on behalf of other actors. The World Bank in particular has been in charge for establishing multilateral trust funds for investing in CDM projects. Several trust funds by the World Bank have been created for promoting certain sectors, areas or goals of the CDM (Freestone and Streck 2005: 22-24).

The working of the mechanism

The additionality principle

The emission reductions generated in a CDM project must be reckoned as additional to what would have happened in the absence of the CDM project. Consequently, these reductions can be counted as a reduction in greenhouse gases emitted elsewhere. In the project proposal, additionality has to be demonstrated by presenting a baseline scenario. This baseline scenario describes how the project will operate in order to achieve additional emission reductions – reductions that would not have occurred in the absence of the project. A counterfactual scenario must also be presented in order to describe the consequences of not implementing the CDM project in question (Streck 2004: 304). In general terms, this often implies that the project would have to be unprofitable without the additional financial support it receives from taking part of in the CDM. In contrast to comparable enterprises operating in a competitive market, the CDM projects will have the additional income from selling the CERs it produces. A project then has to demonstrate that it is dependent upon the sales of CERs to be profitable in order to be validated as a CDM project. Since the project and its project activity would not have taken place without taking part of the CDM and producing CERs, the project activity can be reckoned as additional measures for reducing emissions. However, the additionality of a project does not have to endure a financial test. The additionality testing is a highly technical issue which is conducted by using specially developed methodologies for the specific project types (Yamin and Depledge 2004:176-178).

Either directly or indirectly, the project activity shall take measures to reduce emissions. As an example, the renewable power from a CDM hydro project added to the electricity grid of the host country would reduce the use of greenhouse gas emitting fossil fuels in that country. The respective hydro project would receive an amount of CERs according to the level of renewable electricity produced, and the Annex I Party would be able to subtract emissions according to the number of CERs from its permitted level of emissions. As such, by increasing the amount of renewable electricity on a country's electricity grid, the CDM project indirectly lowers the amount of greenhouse gas emissions in the atmosphere (UNFCCC 2007: 7, UNFCC 2012: 15). In other cases, like in an energy efficiency project in households, the energy saved from using new and more energy efficient equipment like cooking stoves will lower the overall energy use, and thereby contribute indirectly to reducing emissions from electricity generation (Olhoff et al. 2004: 42). Direct measures taken in CDM projects to reduce emissions can be made in projects that have installed a technology to reduce greenhouse gases directly from its source. Factories that emit the strong greenhouse gas HFC for example, can install gas cleansing technology that destroys the gas components so that the gas greenhouse effect is lessened (Haya 2009: 21). Cleansing technology of gases can also be applied to reduce the emissions from the flaring of oil on oil platforms, and as such reduce the amount of greenhouse gases directly (UNFCCC 2008).

Project methodologies: large scale and small scale methodologies

For a project to be validated, it has to conform to an approved methodology for achieving additional emission reductions than what would have occurred in a baseline scenario. The methodology must also include a method for monitoring the emission reductions that are being generated. The project can use an already established methodology applied to its project type and project scale, or the project sponsors can propose a new methodology to be approved by the CDM Executive Board (Streck 2004: 304).

There are two main types of methodologies, namely small scale- and large scale methodologies. This division was made for promoting the participation of more small scale projects. Most projects are of large scale, and their project cycle from the preliminary phase to implementation is more complex than for the small scale projects. In comparison, the small scale methodologies provide more standardized and simplified methods for a project to complete the project cycle (Yamin and Depledge 2004: 179). Small scale projects are supposed to hold other qualities than the large scale ones in that they might better respond to the needs of local communities and as such improve the sustainability aspect of the project activity. Additionally, more small scale projects might also improve the geographical distribution of projects within a host country (Michaelowa 2007: 24).

The CDM Project cycle – the implementation process

A CDM project will be approved if it has completed the specific CDM project cycle and fulfilled all the criteria for each of the steps in the cycle (Yamin and Depeldge 2004: 161-164). The process of developing a CDM project and going through the project cycle can take several years until it is ready to start up with the project activity, and a successful implementation is relying upon actors which can provide suitable knowledge and skills as well as sufficient financial capital. It is the first step of the project design which involves the most actors. In this phase, a variety of different actors meet to elaborate the project design. The main actors are the governments of the countries involved, project developers, Non-governmental organizations (NGOs), international institutions like development banks and other types of investors. In the following phases, it is the specialized institutional actors of the CDM that carry through the distinct responsibilities for the remaining stages in the project cycle (Streck 2004: 303).

The first step is the development of the project design. A standardized *Project Design Document (PDD)* containing all relevant information regarding the project activity is submitted for validation. The project has to make use of one of the approved methodologies for how a CDM project can be implemented in order to be able to reduce emission reductions in accordance with a baseline scenario. In this first phase of the project cycle the means to which a project shall contribute to sustainable development is also described in the PDD. The measures to which a project is described to contribute to sustainability have to comply with the nationally sustainability criteria of the host country. After the PDD has been submitted, it is a *Designated Operational Entity (DOE)* which undertakes the assessment of the PDD in order to validate the project according to the CDM modalities. This is a legal entity which acts as a third individual party securing an impartial assessment of the PDD for validation (Streck 2004: 303-304). Following validation, the project operators are responsible for monitoring the CDM project activity during a verification period, where the level of emission reduced resulting from the project activity is monitored. Monitoring implies ensuring transparency of the project activity in that the emission reductions giving basis for the issuance of CERs are actually taking place. The last steps concern certification and the issuance of emission quotas of the CDM project. After the verification period, *Certified Emission Reductions (CERs)* will be issued to the project. These are emission permits or quotas for emissions which can be sold to the Annex I entities. On the command of the Executive Board, the CDM Registry Administrator will issue a specific number of CERs based on their calculations of emission reductions resulting from the project activity (Yamin and Depledge 2004:163).

The nature of sustainability benefits in the CDM project activity

Contributions to sustainable development can be made from engagements taken on different levels of locality. In the CDM project activities, the sustainability contributions are taken mainly at the micro level, as there is put a large emphasis on the needs of small communities in developing countries. Additionally, the projects can make either direct or indirect sustainability benefits (Boyd et al. 2009: 823, Freestone and Streck 2005: 216-217, Olhoff et al. 2004: 37-45).

Varieties of project activities will provide different types of benefits for its local community as well as for the host country. Some project activities are directly related to the well-being of the local population in that the project activity brings about direct benefits to them, while other projects has activities that to a low degree involves or affect the surrounding community. Projects that by the project activity itself produce direct benefits to the local population will easier provide a greater amount of sustainability benefits. For example, in an oil flaring project where the main activity is reducing greenhouse gases from oil flaring might at the same time reduce pollutants (UNFCCC 2008: 54). The air quality for the local population is therefore also increased, and the gas cleansing will as such provide an environmental sustainability benefit as a result of its main activity. An energy efficiency project providing new electricity based on cooking stoves for a community might improve the indoor quality and thereby the health conditions for the households. The indoor quality is improved by eliminating the smoke from cooking stoves based on firewood. As such, the project introduces an energy efficient measure for households which also improves the health conditions for these households (Freestone and Streck 2005: 240-241, Olhoff et al. 2004: 42). Numerous sustainability benefits can be detracted from the CDM projects, and one of the most common benefits are the provision of job opportunities to the local population, as many projects are depended upon work capacity (UNFCCC 2012: 16). In addition to the sustainability benefits that a project provides by the nature of its activity, the project developers can plan for supplementary or indirect measures to contribute to sustainability, and many CDM projects will have a mixture of benefits deriving automatically from the project activity and additionally made benefits. Supplementary benefits are often established as side-activities for the local population, as providing social welfare goods, sometimes through a fund for development activities. This could be a community development program that in cooperation with the CDM project satisfied the needs of the local population and promotes sustainable development (Olhoff et al. 2004: 43, Olsen and Fenhann 2008: 2823).

Negative environmental impacts of the project activity

Another aspect of the project activity is its possible negative environmental impacts. As any other business activity, also the activity in the CDM might cause some negative effects on its surroundings (Freestone and Streck: 245, Olhoff et al. 2004: 43-44). In a hydro project for example, both the construction phase and the project activity in itself will affect the habitat of the species surrounding the dam used in the electricity generation. The project might then to some degree cause harmful effects on the local environment (UNFCCC 2006: 36-37). However, the severity of the negative environmental impacts is elucidated in the planning phase of the project and is reported in a project's PDD. Mitigation measures for possible negative consequences are also elaborated in the PDD, so these are minimized. In addition, possible negative environmental consequences can be compensated for with the creation of positive environmental benefits elsewhere (Olhoff et al. 2004: 43). However, as it is the project developers who prepare the PDDs in order to have a CDM project validated, there is a concern about environmental negative impact being partly concealed as a consequence of project developers not wanting to expose the negative consequences of the project when applying for validation (Olsen and Fenhann 2008: 2822).

Project categories and subtypes

There are 25 project types eligible for participating in the CDM, which can be viewed in the table below. In addition, most of the 25 CDM project types cover several sub-types (Fenhann and Hinostroza 2011: 119-124). Although there are many project types, several of the project types are represented by similar sectors. One sector concerns energy efficiency measures, as in households, industries or services. Other types represent renewable industries, like hydro, wind, tidal, solar and geothermal projects. A third group of projects concentrate on reducing greenhouse gases directly, such as the gases HFC, methane, CO_2, PFCs, SF_6, NO_2 and landfill gas. Lastly, projects types are found in distinct sectors such as agriculture, transport and forestry.

Table 2.1: CDM project types

1. Agriculture	14. Fugitive
2. Biomass energy	15. Geothermal
3. Cement	16. HFCs
4. CO_2 usage	17. Hydro
5. Coal Mine/bed CH_4	18. Landfill gas
6. Energy distribution	19. Methane avoidance
7. Energy efficiency households	20. N_2O
8. Energy efficiency industry	21. PFCs + SF_6
9. Energy efficiency own generation	22. Solar
10. Energy efficiency service	23. Tidal
11. Energy efficiency supply side	24. Transport
12. Forests	25. Wind
13. Fossil fuel switch	

Source: Fenhann and Hinostroza (2011: 119-124)

Chapter 3: Theory

This chapter focus on the research done on the sustainability objective in the CDM. Firstly, I describe how the problems for fulfilling the sustainability objective in the CDM are related to the lack of solid criteria for sustainable development, and how the concept of sustainable development in the CDM is defined through national interpretations.

Secondly, the existing theory on each of the conditions of the analysis is presented. These represent the factors found to be most relevant for the achievement of sustainability in the CDM projects. Hypotheses for each of the conditions will be formulated for presenting the theoretical assumptions of how the presence of the condition will relate to the outcome for sustainable development.

Third, how contributions to sustainable development in the CDM are assessed in the research literature is elaborated. Much attention is given to the approaches and measurement techniques in the research on sustainability in the CDM. It is therefore necessary to describe how contributions to sustainability are assessed. In chapter four, I elaborate how the assessment of sustainability contributions in this thesis relates to these approaches and measurement techniques.

3.1 The sustainability objective of the CDM

Much of the research on the CDM has focused on the mechanism's' ability to meet the sustainability objective, and in the research literature there emerged a consensus claiming that a relatively large part of the projects do not contribute sufficiently to sustainable development in the host country for the project, even though sustainability criteria are set for the project that have been validated (Olsen 2007). Since the CDM is a market mechanism made for reducing emissions effectively, a project's contribution to sustainability for the host country does not matter for generating revenue as long as a project is validated. Sustainability is widely defined, and the criteria for sustainability that a project must meet are defined by the host country for a project. As the criteria for sustainable development can make a project more expensive to run, these criteria seem to be set at a low level so the project becomes more profitable and more attractive to investors (Sutter and Parreño 2007). In this way, some say that the CDM as a market mechanism has partly failed, as it does not make sufficiently contributions to the sustainability objective. However, Pearson (2007) points out that the

CDM as a market mechanism works perfectly well, as the logic behind the mechanism is to reduce greenhouse gas emissions in the most cost efficient manner by producing climate quotas for the lowest cost possible. In a market mechanism like the CDM, no country is served by making stronger sustainability claims than necessary, as that will make the production of climate quotas more costly. When the definition of sustainability is wide, and solid criteria for meeting the claim do not exist, a market mechanism will not reward projects with high benefits for sustainability.

National sustainability criteria

The national sustainability criteria for the CDM host countries may vary among the countries, as the host countries may prioritize these criteria differently and create their own country specific criteria as well (Olsen and Fenhann 2008: 2820-2821). One of the main problems related to the assessment of the sustainability benefits and in validating projects, is that several of the different national criteria are not measurable. Benefits for the economic, social and environmental dimension are varied in nature, and therefore difficult to assess. To find the level of sustainability contributions generated from a project, one solution can be to weigh the different criteria according to how valuable they are considered to be for sustainability. However, this would be an assessment relying upon normative preferences. In addition, the extension of a single criterion can be larger than another in a particular project and for a particular area. As such, a project with fewer sustainability criteria than another would not need to provide less sustainability benefits overall (Olsen and Fenhann 2008: 2825).

3.2 Conditions and hypotheses for the fulfilment of the sustainability objective

In this part of the chapter, the theory relevant for each of the conditions is presented. In addition, for each condition a hypothesis is formulated on the basis of the theoretical expectations that can be inferred from the existing theory. The hypotheses are formulated according to the expectations on how the conditions are related to the outcome variable. The outcome variable is defined as the contributions to sustainable development provided in the CDM projects. The outcome of providing substantial contributions will be referred to as the positive outcome while the outcome of providing unsubstantial contributions will be referred to as the negative outcome. Regarding the conditions, the first types of conditions relates to *the project design*. The hypotheses for these variables can be used for theory testing, as more theory exists about their effect on the outcome. For the other two variables relating to *the* *project participants*, their hypothesis can be used for a theory-generating purpose, as less theoretical basis exist about their relevance for the outcome.

The hypotheses for the conditions of this analysis describes how it assumed that each value on the conditions are related to the outcome, and can therefore not be tested directly in order to provide unambiguous results. The hypotheses are rather formulated in order to guide the analysis when investigating the relevance of each condition. However, in a QCA-analysis, where both the conditions' individual and combinatorial effects on the outcome are investigated, it can be useful to express hypotheses about the combinatorial effects of conditions (Rihoux, Ragin, Yamasaki and Bol 2009: 175). Such hypotheses are applicable for verifying or falsifying theoretical assumptions (Berg-Schlosser et al. 2009: 16). In this thesis, one such combinatorial hypothesis was formulated in order to test a theoretical assumption.

3.2.1 Project categories

The CDM have different project types that can be placed in different categories of sectors. In addition, the project subtypes represent the varieties of the project types. Which project type the projects belong to appears to influence both its contributions to sustainable development and its level of emission reductions (Sutter and Parreño 2007, Alexeew et al. 2010). Some project types appear better adapted for obtaining sustainable development, while others are reducing emissions more effectively. The project type also seems to be decisive both for the projects' level of sustainability contributions and for the kind of sustainability benefits it provides.

The relevance of the project type for explaining the fulfilment of the sustainability claim in CDM projects is elaborated in several studies (Alexeew et al. 2010, Boyd et al. 2009, Disch 2010, Lee and Lazarus 2011, Olsen and Fenhann 2008, Sutter and Parreño 2007, Watson and Fankhauser 2009), whereof the studies of Alexeew et al. (2010) and Olsen and Fenhann (2008) both suggest that the project type is the most important factor for determining the sustainability benefits. However, Boyd et al. (2009) did not find a direct connection between the type of project and how it contributes to sustainable development. Rather, these authors emphasize the relevance of local participants in the provision of sustainability benefits.

Alexeew et al. (2010) and Sutter and Parreño (2007) both make an assessment of the overall level of sustainability contributions among their projects, and their findings are to a large degree in accord. In both studies the overall sustainability contributions are found to be relatively low. However, the variety in the sustainability scores between the project types was considerably high. The projects types of biomass, hydro and wind were among the project types that reached the highest sustainability scores in both studies. The renewable projects of hydro and wind were also found to provide the highest number of sustainability benefits in Olsen and Fenhann (2008), and they provided mostly social and economic benefits. Nevertheless, the biomass projects were among the types that provided the lowest amount of benefits, but also these projects provided benefits mainly of a social or economic character. Inconsistency in the findings for the same projects types might be the result of variation between the subtypes. The incoherence in the findings of the biomass projects may also be explained by a generally large difference found between the subtypes of the bioenergy projects discovered by Lee and Lazarus (2011). In their study, the sustainability benefits of 77 biomass projects of different subtypes were investigated. Both the lowest and the highest sustainability achievements where assessed among the subtypes of biomass projects. In total, the distribution had an average score on sustainability when compared to other project types assessed in the study of Disch (2010), which used the same measurement technique.

For the project types with the lowest sustainability contributions, there seems to be a general agreement on gas reduction projects of strong greenhouse gases such as the HFC and N_2O, being the weakest sustainability achievers. These are usually also large scale projects. Because they reduce the strongest greenhouse gases, these projects also generate the highest amounts of emission reductions (Alexeew et al. 2010, Disch 2010, Olsen and Fenhann 2008, Sutter and Parreño 2007, Watson and Fankhauser 2009). Some of the energy efficiency projects, like industrial energy efficiency projects and energy distribution projects, are also found to be among the project types with the smallest sustainability contributions (Alexeew et al 2010, Olsen and Fenhann 2008). For the HFC projects and industrial energy efficiency projects, they were in some cases found to have negative effects on the environment (Alexeew et al. 2010: 241).

As the fulfilment of the sustainability objective have been found to vary considerably among the project types, most of the studies assessing the sustainability claim has been quantitatively oriented, and has not investigated the direct causes explaining the variety in sustainability contributions provided by different types of projects. Boyd et al. (2009) conducted a closer review of ten CDM projects where the main purpose for their analysis was to gain more insight into the function of the project developer's contribution to develop sustainability benefits in the PDDs. They did not find a direct relationship between the project type and the project's sustainability benefits. Rather, they found that the local project participants can be important for realizing a project's potential. Overall, the projects sustainability contributions to local communities were considered to be small, as the direct benefits were low. However, employment creation as a direct sustainability benefit seemed to be the strongest determinant condition for achieving sustainability in the project sample. Furthermore, some projects can also have direct negative impacts for the local communities where the project is situated, due to conflicting interest of various groups that takes part in the project, as NGOs, the government and private actors (Boyd et al. 2009: 823-826).

Basis for the hypotheses:

For the purpose of this thesis, the project types have been classified into three project categories which jointly form a condition for the analysis. These categories are gas reduction projects, renewable energy projects and energy efficiency projects. As the condition *Project Category* is a categorical variable, a hypothesis will be formulated for each of the three project categories, reflecting the theoretical expectations for the outcome for each project category. In addition, a hypothesis about the combinatorial effect of three conditions will be formulated in order to test a theoretical assumption.

The project types of the renewable category generally seem to be reckoned as the projects with the highest contributions to sustainability, where hydro and wind projects constitute the largest share of the projects in this category (Alexeew et al. 2010, Olsen and Fenhann 2008, Sutter and Parreño 2007, Watson and Fankhauser 2009). For both the categories of energy efficiency and gas reduction, the contributions to sustainability seem to vary more. Several of the gas reduction types are found to provide relatively high or average amounts of sustainability benefits compared to other project types (Olsen and Fenhann 2008, Watson and Fankhouser 2009), while the large scale gas reduction projects of the strongest greenhouse gases seem to provide the fewest benefits (Alexeew et al. 2010, Olsen and Fenhann 2008, Sutter and Parreño 2007, Watson and Fankhouser 2009). Overall, energy efficiency projects seem to provide the smallest amount of benefits (Alexeew et al. 2010, Olsen and Fenhann 2008). These findings for the project categories form the basis for the following hypotheses:

> ***Hypothesis 1a:*** Renewable energy projects constitute the project category the most often associated with the positive outcome.

Hypothesis 1b: Gas reduction projects constitute the project category the second most associated with the positive outcome.

Hypothesis 1c: Energy efficiency projects constitute the project category the least associated with the positive outcome.

Hypothesis 1d: The presence of a large scale gas reduction project with high emission reductions is sufficient to produce the negative outcome.

3.2.2 Project scale

In the CDM, small scale projects are generally seen as better providers of sustainability benefits than the large scale projects (Michaelowa 2007: 24). Small scale projects are in several ways simpler and less costly both in establishment and in operation, which makes it easier to focus on providing sustainability benefits and in engaging the local population (Cosbey, Parry, Browne, Babu, Bhandari, Drexhage and Murphy 2005: 16). Sutter and Parreño (2007) found that the small scale projects provided higher sustainability contributions than the large scale projects. Employment generation is an important sustainability benefit in the CDM, and Sutter and Parreño (2007: 81) found that the small scale projects had a higher employment generation than the large scale projects. Therefore, the small scale projects can be better in achieving sustainability in that they are better job creators. They also found that large scale projects provide fewer sustainability benefits than the small scale projects, while simultaneously reducing emissions more efficiently. However, the findings of Olsen and Fenhann (2008) and Watson and Fankhauser (2009) suggest that the scale of the project is of minimal significance for sustainability. Olsen and Fenhann (2008: 2829) contradict the claim of project size of being of importance for providing sustainability contributions. Regarding the contributions from small scale projects, their findings suggest that they do not contribute much more to sustainability than large scale projects. In their study, the project scale only has a small effect on the achievement of sustainability benefits. Their findings suggest that the project scale explains sustainability benefits only to a small degree, as small scale projects on average give a few more sustainability benefits than the large ones. Rather, the differences in outcome that the project size gives are found in the type of sustainability benefits that they generate. In general, the large scale projects obtained more of certain environmental benefits and health benefits, while small scale projects obtained more social and economic benefits. Also the findings of Watson and Fankhauser (2009: 13) suggest that small scale projects do not make larger sustainability contributions than those of large scale. However, also they find that the type and distribution of sustainability benefits that the small scale projects provide diverge from the large scale project only to a minimal degree.

Basis for hypothesis:

The scale of a project seems to matter for the achievement of sustainability contributions, although two studies contradict this claim. Small scale projects can be better at providing jobs and integrating the local population in the project activity then those of large scale, which might have a lower employment generation. Accordingly, the following hypothesis can be stated about the influence of the project scale on the outcome for sustainability contributions:

> ***Hypothesis 2*****:** Projects of small scale increase the probability for the positive outcome to occur, while projects of large scale increase the probability for the negative outcome to occur.

3.2.3 Emission reductions

Trade-offs between emission reductions and sustainability contributions

Sutter and Parreño's (2007) analysis points to a trade-off between the level of emission reductions and the sustainability claim, while the study of Alexeew et al. (2010) supports this finding, in that it finds a trade-off between additionality and sustainability among its projects. Additionality is measure of real emission reductions, and their study as such suggest that the projects that have most benefits for sustainability also represents the project the least likely for producing real emission reductions. Sutter and Parreño (2007) investigate both the level of sustainability contribution and the level of emission reductions in a CDM project. Their findings suggest that there exists a trade-off between emission reductions and sustainability contribution in a project. Moreover, their findings suggest that there are great differences in the amounts of emission reductions that the individual projects generate. Overall, their findings suggested that a fourth of the projects fell short of both objectives of the mechanism, since they did not have measurable effects on neither sustainability nor emission reductions. Furthermore, no project had a high level of fulfilment on both objectives simultaneously.

However, in the time trend analysis of Watson and Fankhauser (2009), there is no sign of declining sustainability contributions since the realization of the CDM, suggesting that the magnitude of the trade-off is overstated. In the time trend analysis they investigate differences in the distribution for the three types of sustainability benefits and the amount of claimed benefits that are found in the PDDs. They find no major trends for the types of benefits that are claimed in the PDDs, and they also find that the amount of benefits claimed in the PDDs have been quite steady, which they take as a suggestion that a decrease in sustainability contributions have not occurred (Watson and Fankhauser 2009: 14) This implies that they did not find signs of a decline in the claimed sustainability contributions, due to the costs that the sustainability benefits can represent.

Basis for hypothesis:

As the CDM is a mechanism for generating emission reductions in a cost efficient manner, benefits for sustainability may come at the expense of emission reductions. The amount of emission reductions produced in a project generates the CER-credits to be sold in the market for climate quotas. To the contrary, contributions to sustainable development do not generate revenue, but can represent higher costs. Therefore, the project developers with an objective of maximizing profit may concentrate on generating high emission reductions while they put less attention to create sustainability benefits. Accordingly, projects with higher emission reductions may have small benefits for sustainability and vice versa, as is stated in the following hypothesis:

> ***Hypothesis 3:*** Lower emission reductions generated from a project increase the probability for the positive outcome to occur, while higher emission reductions increase the probability for the negative outcome to occur.

3.2.4 Economic performance of the host country

The CDM projects are unevenly distributed among countries and regions, and conditions relating to the host country of the project may have effects on the probability for success of a project. Risk taking investors minimizes risk by investing in countries where the conditions for investment are optimal. How the government contributes to make the market conditions good for investors and make a stable environment is therefore important. It is particularly the new largest industrializing countries with a substantial growth during the latest decade that seems to be the countries that investors most heavily rely on (Ellis, Winkler, Corfee-Morlot and Gagnon-Lebrun 2007). China represents the region with the highest numbers of projects (UNEP DTU Partnership 2014a), and is considered to have a particularly attractive investment climate. It seems that the investment climate in China is especially favourable with its growing markets and a government actively contributing to favourable investment climate (World Bank Institute 2011). Less developed countries seems to be less desirable for hosting projects, as many of the least developed countries do not host any CDM projects (Norad 2009: 2). In Africa especially, investing in CDM projects seems less attractive (Ellis et al. 2007). The least developed countries usually perform poorly in providing 'the basic governance conditions' that is necessary for providing a favourable investment climate (Ellis et al. 2007: 17). However, although the continent of Africa hosts relatively few projects, Sub-Saharan African countries are very diverse when it comes to economic growth, and more foreign investment has taken place in Africa in the recent years. The continent has been considered to have a risky investment climate but with chances of high return if the investment is successful (Whitfield 2009: 363).

Lack of skill and knowledge among the least developed countries

Several of the least developed countries that do not host any, or only a very few CDM projects, do have excellent foundations for some project types due to their natural resources. Even so, they do not start developing projects, because the needed expertise is not to be found (Norad 2009). The host country's capabilities for making a project work from the beginning of the planning process, and later in running the project, demands a considerable amount of expertise that is rare or non-existent in the least developed countries (Michaelowa 2007: 25-28) . As a skilled labour force with the appropriate knowledge has to be found and committed to the project for a longer time period, these types of skills are not often to be found in the host country. The validation process is also uncertain, in the sense that there exists a certain risk that the project does not succeed in being validated at the end of a time consuming process. As the validation process is long and involves risk, it is also costly. In these regions, the investment climate is typically unfavorable due to other factors as well, such as weak government structure and low achievement of the rule of law (Ellis et al. 2007, Norad 2009).

Investment climate and host country attractiveness in the CDM

As the CDM was constructed as a market mechanism, it has evolved to be a new investment market. Furthermore, as Ellis et al. (2007) demonstrate, the CDM investment in developing countries generally follows the same patterns as other foreign investment flows to the developing countries. Because developing countries lack what they call 'the strong enabling conditions' or 'the basic governance conditions', foreign investment will be relatively low in such countries. Ellis et al. (2007: 17) define 'strong enabling conditions' as 'stable political regimes, strong legal environments for contracts and proven enforcement capabilities'.

Consequently, traditional foreign aid continues to be of higher importance for development in the poorest countries, and the CDM is of higher importance for development in states that are more developed and already have larger shares of foreign investment.

However, Jung (2006) contradicts those claiming that the CDM investment flows follow the same patterns as foreign direct investment. According to Jung (2006), the explanations of the patterns of the CDM investment flows are too simplistic. Rather, the host country's attractiveness for CDM investment is assumed to depend upon three main factors, where the general investment climate counts as one of the important factors. The two other decisive factors for investment in the CDM were presented as the possibility for producing cheap emission reductions in the host country and the institutional capacity of the host country to process agreements for the CDM (Jung 2006: 2174). As such, countries that are adaptable to fit the CDM system might be favorable investment countries although the general investment climate is less favorable. Furthermore, Jung (2006) uses cluster analysis to explore how these variables are distributed among the CDM countries. The analysis points to four different levels of attractiveness for a host country, based on combinations of the three factors. Clusters of countries are found, where a few countries dominate as especially investment attractive. However, most of the countries were considered as very unattractive for CDM investment (Jung 2006: 2182-2183).

Basis for the hypothesis

How attributes of the CDM host countries might be relevant for the achievement of the sustainability objective in the CDM seems not to have been investigated closely. However, national specific sustainability criteria as well as national policies and capabilities for hosting CDM projects could possibly influence the sustainability contributions made in the projects. For this analysis, attributes relating to the economic performance of the host countries will be applied as a condition for the projects contribution to sustainable development. When formulating the hypothesis for this condition, it is assumed that countries with low economic performance may have less capabilities and opportunities for developing CDM projects with high sustainable development benefits than the host countries with high economic performance. However, as little theoretical foundations exist to supports this claim; this hypothesis is made mainly for an exploratory purpose. The hypothesis for the condition of economic performance in the host country will therefore be stated as follows:

***Hypothesis 4**:* The presence of high economic performance in a host country increases the chance for the positive outcome to occur, while the presence of low economic performance increases the chance of the negative outcome to occur.

3.2.5 Ownership type

Many constellations of partnerships are possible in the CDM ownership types, and which partners are involved might be decisive for how a project is developed in order to contribute to sustainability (Nishiki 2007). This section elaborates on how the ownership structure of a project can influence its measures taken for providing sustainability contributions. The actors involved in a project may represent different sectors between the public and the private sphere in addition to different levels of locality. The three levels of locality constitute of the local, national and international levels. The actors' roles in the development of a project might therefore vary according to the sector and level of locality they represent (Nishiki 2007). As elaborated in the background chapter, the three ownership types in the CDM represent different partnership structures. In unilateral projects, the host country for the project is the only investor, and no partnership is formed with foreign partners. The project owner can then make a profit by selling CERs to the Annex I Parties. In the bilateral projects, a partnership is formed between the host country and one foreign partner, who invests directly in the project. In the multilateral projects, a multilateral trust fund is in charge of the investments in a portfolio of projects. The Annex I Parties invest in a portfolio of projects by placing their investments in the fund and receive CERs in proportion to their size of investment.

Actors and ownership structures

The ownership structure of a CDM project is used to assess how CDM projects contribute to sustainable development in the two research studies of Nishiki (2007) and Sutter and Parreño (2007). Nishiki (2007) conducts a qualitative study of 24 projects, investigating how different partnership structures influence the sustainability benefits provided in the CDM projects, while Sutter and Parreño (2007) use the ownership type as one of their indicators to assess the overall sustainability contributions in a CDM project. As such, the analysis of Nishiki concentrate directly upon the actors' roles in a partnership structure, while Sutter and Parreño (2007) use the ownership structure as one of their indicators to calculate an overall sustainability score of the projects in their sample.

The findings of Nishiki (2007) suggest that the type of actor can be decisive for reaching the sustainability objective, and less the level of locality of the project. The most important difference was found to be the division between the private actors and the other types of actors. The internationally owned projects often succeeded in being good sustainability providers due to the sectors of actors they involved, especially regarding their involvement of Non-governmental organizations (NGOs). The ten highest rated projects all had somewhat different constellations of actors involved, regarding both their 'objectives, levels and sectors of actors' (Nishiki 2007: 15), but only one of them was implemented by business actors exclusively. By contrast, the projects with the lowest rankings most often had only business actors involved (Nishiki 2007: 15). In sum, the constellation of actors involved appeared to be more important than the level of locality they represented, particularly as the private actors contributed the least to sustainability on all levels of locality. However, Sutter and Parreño (2007) rate the projects with international ownership with the lowest utility rating for sustainability, while the local and the national projects are given higher utility ratings, regardless of which sector the owners belong to. Because it is assumed that larger parts of revenues generated from locally and nationally owned projects go to the inhabitants of the host country than in transnationally owned projects, these projects receive higher sustainability ratings than the transnational ones. The locally owned projects receive the highest rating because it is anticipated that more of their revenue is going to the poorest part of the population than in the case with the other ownership types (Sutter and Parreño's 2007: 83-84). As such, the utility ratings based on the ownership structure used in the methodology of Sutter and Parreño (2007) rely on the owner's level of locality rather than their sectors of actors.

Furthermore, in the study of Nishiki (2007), the interaction between the project actors was found to be decisive for how the projects contributed to the local sustainable development benefits. Nishiki (2007: 15-16) found that international organizations and NGOs often act as key actors in the development of projects with good benefits for the local population because they cooperate to gather useful knowledge for the development of the project. The international and national NGOs often outsource tasks of information gathering to the local NGOs. This tends to be a procedure for successful interaction with the local communities, which better secures that their needs are secured in the development of a project. However, for the involvement of a local NGO to be effective, the involvement should be long term with a certain level of intensiveness (Nishiki 2007: 16). Nishiki (2007: 12) also emphasize that the actor's objective for participating in a project can be significant for how sustainability benefits might be prioritized. The relatively low sustainability contributions among the private actors might as such illustrate that they represents the business sector, where the actors are normally involved in order to make a profit.

Benefits of the unilateral projects contra bilateral projects

One of the main advantages of accepting the unilateral ownership type in the CDM is argued to allow the CDM host countries to utilize their capabilities for investment where the foreign countries are reluctant, as foreign investors normally have a higher risk assessment than the local investors. Local investors can be more accurate in their risk assessment than the foreign ones, due to a better knowledge of the conditions affecting the national investment climate, such as the political and the economic situation (Michaelowa 2007: 22). It is also argued that unilateral projects would be better adapted to developing small scale projects, which are supposed to be better suited to promote sustainability benefits than the large scale projects (Michaelowa 2007: 23-24). However, regarding the critics of the unilateral design, this ownership type does undermine sustainability contributions through capacity building and technology transfer from the industrialized countries to the developing countries. In a unilateral project a technology transfer will not take place between the project participants. The unilateral projects might also be more prone to financial constraints than projects with foreign investment. The investors of unilateral projects are more vulnerable to the financial risk of fluctuations in the prices of CERs, as well as the risk of delay of revenues after the registration and development of a project before it can start to offer CERs to the market. The local investor of a unilateral project bears these risks alone, and is in need of robust financial backing in order to accomplish the development of a project and succeed in selling enough CERs to make a profit (Michaelowa 2007: 24-25).

The main assumptions regarding the strengths and weaknesses of unilateral CDM projects were investigated empirically in the Chinese CDM market by Maraseni and Xinquand (2011), who undertook a questionnaire survey and interviews with key CDM stakeholders in China. They summarized the main perceived strengths and weaknesses of the unilateral ownership type. First among the strengths is the possibility of actors in the host country to undertake the local risk assessment, which may lead to a lower perceived investment risk. Secondly, unilateral projects may imply lower transaction costs which promote the investment of small scale projects. Thirdly, unilateral projects increase the possibility for larger shares of the CERs to be banked in the host country for fulfilling commitments to emission reduction at a later stage. The main weaknesses of the unilateral CDM are identified as the lack of technology transfer between the industrialized and the developing countries, and lastly the risk of experiencing a delay in financial flows to the unilateral projects (Maraseni and Xinquand 2011: 340). The surveys and interviews among the Chinese CDM stakeholders supported all the pre-stated assumptions about the unilateral ownership type.

However, even given the ability for local investors to perceive a lower risk and attain lower transaction costs for developing CDM projects, the unilateral CDM projects are generally centred in a few countries, which are among the highest developed host countries of the CDM. These are also the most popular countries for bilateral CDM investment. The possibility to choose a unilateral ownership then seems not to have aided the countries with an unsatisfactory investment climate for bilateral investment to develop more CDM projects. Rather, the host countries most adapted for bilateral investment also represent the ones most suitable for unilateral investment (Maraseni and Xinquand 2011: 341).

In order to assess the potential for unilateral investment for some of the dominating CDM countries, Michaelowa (2007) developed a methodology with ten indicators related to both a host country's economic and educational capabilities for unilateral investment. Among the economic capabilities, the most decisive for carrying out CDM projects are that the domestic capital market is capable of providing the private sector with sufficient amounts of finance for developing projects. The educational capabilities of a country are also consequential in order to acquire a sufficient amount of skilled labour for developing the project and maintain the project activity (Michaelowa 2007: 26-27). The level of economic and educational capabilities sufficient for developing CDM projects unilaterally were found mainly in the most developed CDM host countries.

Michaelowa (2007: 27-30) assesses Brazil together with other Latin American countries to be more risky to foreign investment than several of the East-Asian countries such as China. The Latin American countries with high capabilities could therefore gain more from developing unilateral CDM projects compared to the most investment attractive Asian countries.

Multilateral ownership and initiative programmes

When regarding the multilateral ownership, this type of ownership is often represented by trust funds governed by the World Bank or other international actors, such as international NGOs. Several trust funds are established as initiative programmes for supporting particular aspects of the CDM, such as a particular sector or geographical area. They often set their own standards for the sustainability contributions provided of the projects, and some initiative programmes are particularly developed in order to make high contributions to sustainable development (Freestone and Streck 2005: 17-23).

The study of Nussbaumer (2009) supports the claims of the multilateral initiative programmes in providing more sustainability benefits in their projects. Nussbaumer (2009) compared the outcomes for sustainability between so-called 'labelled' CDM projects with other CDM projects. Labelled projects are projects supported by initiative programmes or specialized funds. The labelled projects were found to give higher sustainability contributions than non-labelled ones. However, this difference was found to be small, and the largest difference between the labelled and non-labelled projects was found in the types of sustainability contributions they made. While the non-labelled projects were found to give most economic contributions in providing jobs, the labelled projects made more contributions towards social sustainability.

Basis for the hypotheses

The three different ownership types in the CDM capture the central partnership structures. These are the unilateral, bilateral and multilateral ownership types, and constitute a condition for this analysis. Few empirical findings exist that are relevant for explaining how the ownership type of a project affects its fulfilment of the sustainability objective. Therefore, this hypothesis of how the ownership type relates to the outcome for sustainability contributions is made mainly for an exploratory purpose. First, the expectations for the unilateral ownership type are more ambiguous than for the two other types. This ownership type has been promoted as providing the host countries with possibilities to more easily fulfill the sustainability objective, although some inopportuneness related to this ownership type might contribute negatively to providing sustainability benefits. Second, the bilateral ownership type is expected to be the least favorable for the projects contributions to sustainability, because they involve foreign business actors that may concentrate more on profit maximizing which can be less compatible with providing sustainability benefits. Third, the multilateral ownership is expected to provide most sustainability benefits. This is because the international actors that govern these funds often set specific criteria for sustainability that the project must satisfy, and because this ownership type may involve a larger variety of actors which can provide more knowledge into the process of developing a CDM project and support the needs of the local population. The hypothesis for the condition *Ownership type* is threefold because this condition is a categorical variable consisting of three categories. A hypothesis is formulized for how each ownership type is expected to relate to the outcome for sustainable development:

> ***Hypothesis 5a:*** The unilateral ownership is the ownership type the second most associated with the positive outcome among the ownership types.
> ***Hypothesis 5b:*** The bilateral ownership is the ownership type the least associated with the positive outcome among the ownership types.
> ***Hypothesis 5c:*** The multilateral ownership is the ownership type the most associated with the positive outcome among the ownership types.

3.3 Assessing sustainable development

There are different approaches for and methods of measurement of sustainability used in the research on the CDM. In general, the three dimensions of sustainable development are included in the concept, but the actual definition and measurement of the concept varies in the different studies. In each of the tree dimension of sustainability, different contributing factors to sustainability can be found, and these can be registered as specific criteria contributing to sustainable development. Consequently, these criteria are often more concrete and easier to measure than a dimension in itself.

The Project Design Documents as an Assessment Tool for Sustainability

In the different research studies assessing the sustainability benefits for the CDM, *The Project Design Documents (PDDs)* are used as the only or the main investigation tool for most of them. They are suitable because they consist of detailed information about the project, and used for the validation of a project. They are also easily accessible for the public. The documents contain information about the sustainability benefits that are planned to be made by realizing the project (Boyd, Hultman, Roberts, Corbera, Cole, Bozmoski, Ebeling, Tippman, Mann, Brown, Liverman 2009). When investigating a PDD for assessing the sustainability benefits in a CDM project, one does in reality only assess the sustainability claims, or potential of a project, not its actual contributions. This is especially problematic when considering the fact that project developers are not obligated to realize the sustainability claims. It is only before constructing a project, under the validation process, that the potential sustainability benefits are estimated. Neither at the national nor the international level, is it required that the sustainability benefits for a project are monitored or evaluated after a project has been realised. After the realization of a project, the project developers are not obliged to commit to the planned sustainability benefits (Olsen and Fenhann 2008: 2821). Another problem in the assessment of sustainability is that potentially negative sustainability contributions are hard to discover, as the project developers would not like to emphasize negative impacts when promoting a project for validation in the PDD (Olsen and Fenhann 2008: 2822).

Indicator sets of sustainability criteria

There are numerous and almost unlimited different benefits for sustainability that it is possible for a CDM project to claim. Nevertheless, there are some types of criteria that are more common than others, and most of them can be placed in one of the dimensions of sustainability. As no international standard for the sustainability criteria exist, and the host countries are allowed to make their own priorities for sustainable development, it is difficult to weigh the sustainability criteria without being normative. In the research literature, there is no standard indicator set for assessing the sustainable development claims of CDM projects, although most studies use indicator sets that have similarities and are comparable to a large degree. The usage of indicators that resembles the ones in other studies also enhances the degree of comparability of their results (Lee and Lazarus 2011: 7, UNFCCC 2012: 14). By contrast, one could count the sustainability claims in the PDDs without a predefined set of indicators. However, this could lead to inconsistency in assessing the sustainability contributions, making the results of the analysis less valid (Sutter 2003: 31).

Assessment approaches: descriptive assessment and overall assessment of sustainability

Two types of approaches exist in measuring the sustainability contributions in the research literature on the CDM (UNFCCC 2012:13). The studies applying the first approach will here be referred to as *'descriptive sustainability assessments'*. These are investigating how projects contribute to sustainable development by identifying which and how many specific sustainability contributions are provided by a project. As such, it is the number and the nature of the sustainability benefits that are compared among the projects. Most studies assessing the sustainability contributions in CDM projects apply this focus on sustainability (see Cosbey et al. 2006, Disch 2010, Nussbaumer 2009, Olsen and Fenhann 2008). The studies that apply the second approach will here be referred to as *'overall sustainability assessments'* which measure how much the projects contribute to sustainable development. The strength or value of each sustainability contribution provided by a project is evaluated and aggregated into an overall score of sustainability contributions for the respective projects. In applying this approach, the quantity of sustainability contributions can be compared among individual projects. This type of sustainability assessment is conducted in the two studies of Alexeew et al. (2010) and Sutter and Parreño (2007).

Measurement techniques

In addition to the assessment approaches of sustainability, there are also different measurement techniques. Olsen and Fenhann (2008) and Lee and Lazarus (2011) have investigated the different techniques used for measuring sustainability, and they both classify the measurement techniques into two main types. These techniques are distinguished by which type of indicator sets of sustainability criteria are applied for assessing the sustainability contributions. Here, they will be referred to as '*check-list methods* and *'multi-criteria methods*.

By using the check-list method, the sustainability claims for a single project is compared to a predefined set of sustainability indicators. This is a qualitative technique where the PDDs are the only data material used for determining which sustainability criteria are related to the project activity. The sustainability criteria found to be described in these documents are compared to the set of sustainability indicators, and registered as an existing criterion if it matches an indicator. As such, the amount of benefits that are associated with a project can function as an approximate assessment of the overall sustainability contribution from the project (Olsen and Fenhann 2008: 2820).

The multi-criteria method applies both qualitative and quantitative data to compose an indicator set that can be weighted. The individual projects can then be given scores on the basis of the weights in the indicators set. In this method the indicators and weights are chosen on the basis of survey analysis of the project stakeholders in different regions or company survey data, in addition to the project design documents and scientific literature (Olsen and Fenhann 2008: 2822). As such, the multi-criteria method relies on more data sources than the check-list approach, which only relies on the PDDs. The multi-criteria method is the least used of the two methods, probably because of the need for applying survey data (Lee and Lazarus 2011: 8).

Both types of measurement techniques have been applied in each of the sustainability assessment approaches. Each of the assessment approaches requires a predefined list of indicators which can be used for identifying the sustainability benefits that are present in a project. The descriptive assessment approach needs only a list of predefined indicators in order to assess which sustainability criteria are present in the PDD, while the overall assessment approach in addition needs a measure for scoring the sustainability criteria into an overall score (UNFCCC 2012: 13).

Chapter 4: Method and data

This chapter is divided into three parts. In the first part, the scope of study is elaborated. I first describe how the approach and measurement technique of this study relates to other research studies of sustainability. Thereafter, the principles used for case selection and the potential for generalizability of the findings will be presented. Second, multi value QCA is chosen as the research method for this thesis, and therefore the basic features of QCA as a method and as research approach will be described. This method has its own principles for the construction of variables. How these principles are used to construct the variables of this study will be elaborated. Lastly, the operationalizations for the outcome variable and the conditions will be presented.

4. 1 Scope of study

The main purpose of this study is to investigate the conditions for providing contributions to sustainable development in the CDM. As the contributions to sustainable development vary considerably between the projects, combinations of factors are investigated in order to evaluate how different factors in combination can affect the outcome. By investigating the factors in conjunctions, one can assess which factors might be relevant for explaining the outcome under different contexts, and how different factors might interact.

4.1.1 Research approach

Among the analyses that have investigated the sustainability claim of the CDM, there exist two main types of approaches for assessing the sustainability contributions from the projects. Most of the studies assess the different types of sustainability contributions or benefits that a project provides. These studies were referred to as *descriptive assessment approaches.* With this approach one identifies the different indicators or criteria for sustainability that are to be found in the unique projects, but not the level of sustainability contributions compared to other projects. Which sustainability criteria that are present or not are investigated, and sustainability profiles for different kinds of projects are found. The other approach has focused upon the overall level of sustainability contributions generated from the projects, by making a score for assessing the overall level of sustainability contributions. This approach was referred to as *the overall assessment approach*. With this approach, comparisons of the sustainability contributions between projects are feasible. This has been done only in two studies (see Sutter and Parreño 2007, Alexeew et al. 2010). Both these studies apply criteria from the three dimensions of sustainable development in order to construct a sustainability score for projects. As such, the level of sustainability is compared among the different projects. This thesis' analysis also seeks to differentiate between the projects on the basis of their overall sustainability, and will not compare the projects on the specific types of sustainability contributions. However, a dichotomous measure consisting of a threshold between projects that generate substantial or unsubstantial contributions to sustainable development will be used to differentiate the projects. This study relates to the overall assessment approach, although a fine-grained scoring of the projects' contributions will not be done. Rather, this study will apply a set of necessary and sufficiency criteria to set a threshold in order to categorize the project into one of two values.

Since a minimum standard for contributions to sustainable development from a CDM project does not exist, and since almost all projects do claim to give some contributions, it will be suitable to create a measure that seeks to differentiate between the projects that generates substantial and unsubstantial contributions, based on the notion of the concept of sustainable development, as well as measurable criteria for sustainability. Accordingly, in this analysis, projects that claim contributions to all three dimensions of the concept of sustainable development will be reckoned as substantial contributors to sustainability, if at least one of the claims is a concrete one. Those projects that do not meet these claims will be counted as giving unsubstantial contributions to sustainable development, although they may provide some sustainability contributions.

Since there are only two studies that have attempted to assess the overall fulfilment of the sustainability claim (see Alexeew et al. 2010, Sutter and Parreño 2007), additional research using this approach is valuable. The findings in both these studies suggested that the level of sustainability contributions from the projects in general were low, although there was considerable variation in the sustainability scores among the projects. However, no research study has clarified what is to be perceived as high or low contributions to sustainability in CDM projects. Rather, the relative amount of contributions is compared among the projects in their samples. As this thesis' analysis will operate with a dichotomous measure for sustainability contributions that concentrates on the fulfilment of the basic elements of the sustainability concept; it attempts to clearly differentiate between the projects with lower or higher achievement of sustainability contributions. Accordingly, it can be valuable to perceive the number of projects that fulfil these criteria set to be classified as projects with substantial sustainability contribution or not.

Concerning the sample size, the relatively large sample of 85 projects could also increase the comparability and the reliability of its findings. As this thesis aims at clarifying the determinants for providing sustainability contributions in the CDM, a medium to large sample size is advantageous in order to compare the projects on the set of conditions that is modelled to determine the outcome.

4.1.2 Data and measurement

The 'Project Design Documents' (PDDs) will be used as the data material in order to assess the projects' sustainability contributions. The claims for sustainability found in these documents will be compared to the indicator set of UNFCCC from 2012 in order to identify the contributions made on the different dimensions, and to secure consistency in the assessment of the sample. As such, this analysis *applies a check-list method* to assess the sustainability contributions. Check-list methods use the PDDs as the only data source when identifying sustainability contributions in projects in contrast to multi-criteria methods which use both qualitative and quantitative data in their assessments. In consequence, due to the extensiveness of the data gathering, the multi-criteria method is considerably more time consuming for investigating projects than the check-list method. As such, only a very limited number of projects could have been included in the sample of this thesis if a multi-criteria method had been used. A considerably smaller sample would not be desirable for this analysis, as the sample easily could have proven too small for making a comprehensive comparison of the projects on all the conditions included in this analysis. As the contributions to sustainable development stated in the PDDs only reflects the projects' potential contributions, the use of these documents as the only data source for assessing sustainability contributions can pose problems related to the reliability of the results. The claims stated in the PDDs cannot be verified as being realised without using additional data. Accordingly, the multi-criteria method can bring a higher degree of reliability of the results. However, a check list method can increase the reliability of its findings by using a predefined set of criteria that concentrate upon claims that are described in a concrete manner and therefore will be more likely to represent realised sustainability claims. Using a check-list method which concentrates on the robustness of the sustainability claims that are being identified can thereby enhance the validity of the study. As this study does not attempt to create an overall score of sustainability contributions, but rather to set a minimum threshold for separating the cases, the use of a multi criteria method might be less relevant for this study. A rough measure focusing on the basic attributes of sustainability has been applied to this study, and therefore the check-list method can represent a suitable tool for assessing the presence of the each of the three sustainability dimensions that constitute the basic elements of sustainable development.

4.1.3 Case selection

As stated in the introduction, there are two rationales for choosing the population of the 85 CDM projects with Norwegian investment as the cases for this analysis. Firstly, Norway as an Annex I Party can be viewed as a most likely case of investing in projects with high contributions to sustainability, so that the positive outcome, as well as the negative, would be likely to appear among the cases in this analysis. Secondly, the population of Norwegian projects displays great variation on the explanatory variables which is needed to perform a fruitful analysis of explaining the outcomes of interest.

As a research approach, QCA can be regarded as being more of a qualitative method than a quantitative one, as the method relies on a great emphasis on case knowledge (Ragin 1987). In QCA, a maximum variety on the explanatory variables is assumed in order to find the different causal combinations that can produce the outcome of interest (Rihoux and Lobe 2009: 228). Additionally, to be able to explain the variation in the outcome of interest, the cases chosen for the analysis should also vary on the outcome variable (Rihoux and Lobe 2009: 230-231). Rihoux and Lobe (2009: 231) stress that the definition of the outcome in QCA should be guided both by the empirical characteristics of the cases as well as theory. In this thesis' analysis, the distribution on the outcome among the cases cannot be known before the analysis is conducted, as it relies on the operationalization of the outcome variable. Therefore, the cases for investigation are chosen strategically, in order to achieve variation on the outcome variable.

The case selection in QCA should be chosen with regard to enclosing the factors of interest for the analysis while contextual factors are minimized. There should therefore be a considerable degree of variation among the cases on the chosen variables for the analysis, while their contextual factors should be as similar as possible, so that other factors than the variables of interest cannot be expected to interfere with the results. The case selection in QCA therefore demands some degree of case knowledge in the initial phases of the analysis, in order to bring fruitful results (Rihoux and Lobe 2009: 230-231). In this thesis, the total of 85 projects which have Norway as an Annex I Party is chosen as a sample. As stated, the population of projects with Norwegian involvement was suitable for bringing in variation on the explanatory variables of interest, namely the conditions. The contextual factors related to the Annex I Party of the projects are sought to be controlled for by choosing one single country as the Annex I Party of the projects. In this analysis, two of the conditions relate to the characteristics of the project participants. The condition *Economic performance* relates to attributes of the host country, while the condition *Ownership type* relates to the attributes of the partnership of the actors involved. Accordingly, it can be suitable to exclude a possible interference from the characteristics of the Annex I Parties particularly for the conditions relating to project participants.

In a qualitative research design, one should try to avoid a selection bias when choosing ones cases. Choosing cases on the dependent variable has been shown to often produce selection bias because the cases sharing the positive outcome tend to be overrepresented (Goertz 2006: 178). 'The Possibility Principle' can be used in order to avoid such a sample bias, in that it presents a technique for choosing negative cases. According to Goretz (2006: 186), one should choose cases where the occurrence of the negative outcome is possible, on the basis of the values on the explanatory variables. If the values on some of the explanatory variables are expected to be associated with the negative outcome, the occurrence of the negative outcome should be regarded as possible.

For the CDM projects in general, the negative outcome for sustainable development could be expected to be the most present, because of the general agreement claiming that CDM projects tend to underperform in providing sustainability benefits. However, the projects with Norwegian investment could be expected to produce a relatively high amount of projects with a positive outcome, due to the policies of the Norwegian government which has a rationale for putting additional emphasis on the sustainability objective in its selection of projects (Finansdepartementet 2013b). Nevertheless, the negative outcome could also be expected to be present among these cases, due to the great diversity in the projects' traits representing the explanatory variables. Within this sample, project traits associated with both high and low achievements of sustainability contributions are present, as stated in this thesis hypotheses.

Accordingly, Norway as an Annex I Party can be seen a most-likely case for investing in projects with a positive outcome, although it is possible that the country has also invested in projects with a negative outcome. For this reason, when following the logic of the Possibility Principle in selecting cases, the population of projects with Norwegian investment was seen as suitable cases for the analysis. A most likely-case is a case with a high probability of producing the outcome in question. However, if the expected outcome does not occur for the most-likely case, the theoretical claim might be disconfirmed (Gerring 2007: 115). As such, if the projects with Norwegian investment do not tend to produce the positive outcome, this might weaken the claim of Norwegian projects being good sustainability providers and strengthen the claim of underperformance of the sustainability objective in the CDM.

4.1.4 Generalizability of the findings

As the purpose of this thesis is to explain the variations in sustainability contributions among the CDM projects, this thesis aims at finding factors that can be decisive for the sustainability contributions made in projects also outside of this thesis' sample. However, also factors specific to this sample could have an impact on the results. This is emphasized by the fact that QCA aims at 'modest empirical generalization', as stressed by Ragin (1987: 31). Especially since all the projects of this study have Norway as their Annex I Party, the outcomes for other projects might be affected by the presence of other Annex I Parties. The findings of this thesis could therefore be generalizable to some extent, although one must be aware of that specific features of this sample might produce findings that are less generalizable to other CDM projects.

4.2 QCA as a method and as a research approach

Qualitative Comparative Analysis (QCA) is a method developed mainly for integrating qualitative and quantitative techniques in a research method. In contrast to quantitative statistical method, QCA demands greater knowledge about each case of investigation, and thereby seeks to compare the cases qualitatively. In addition, it attempts to make the results of the comparative analysis more generalizable, by comparing a larger number of cases in a systematic manner, like in a quantitative method (Ragin 1987). Moreover, QCA is reckoned not only as a research method, but also as a distinctive research approach. As an approach it relies upon its own fundamental assumptions about how to draw inferences about causality. QCA is defined as an empirical comparative approach by Schneider and Wagemann (2012:

10). This implies that assumptions about casual relationships are drawn upon the theoretical and empirical case specific knowledge of the researcher. This holds for both the preliminary stages of the analysis, as well as for interpretation of the causal combinations of cases in the last stage (Schneider and Wagemann 2012: 11-12). Furthermore, a phenomenon is understood in terms of set-relations, as it is the distinctive set or composition of conditions that is defined as the determinant of an outcome to occur (Schneider and Wagemann 2012: 12). As QCA is a more case-oriented than a variable-oriented method which draws most upon the case knowledge of the researcher and which does not rely upon measures of uncertainty, QCA can be regarded as a more qualitative oriented method than a quantitative method (Ragin 1987: 82-84, 122-123).

The QCA method is normally applied to samples of intermediate size, where one wishes to carry out a systematic comparative analysis, where the within-variation of the cases is taken into account (Rihoux and Ragin 2009: xviii) An intermediate sample size is not a definite number, and it usually refers to sample sizes between 10-15 cases and 50-100 cases (Berg-Schlosser et al. 2009: 4). In order to execute a systematic analysis of several cases that also incorporates within-case variation, QCA relies upon a set theoretic-approach of configurations, or combinations of conditions that are determinate for the outcome. This reflects that QCA is a combinatorial method, which relies upon sets of configurations that determine the outcome. By investigating the different combinations of conditions that are present when the outcome of interest occurs or not, it becomes possible to identify conditions that are necessary and sufficient for the outcome to occur. A necessary condition is a condition that is always present when the outcome occurs, while a sufficient condition is a condition sufficient for the outcome to occur by itself alone. Several necessary conditions may in combination be sufficient for an outcome to occur, or a condition may be both necessary and sufficient. The set theoretic approach of QCA uncovers which conditions are necessary and sufficient to produce the outcome of interest by comparing the combination of conditions that are present for the different cases. While conducting the analysis of comparing the combinations, one can make equations of the values of the different conditions that lead to an outcome. Thereby one can find patterns of combinations that can be converted into simplifying expressions for the outcome to occur if the analysis uncovers conditions that are necessary and sufficient (Berg Schlosser et al. 2009: 8-11). In the original version of QCA, called crisp set QCA (csQCA), the variables can only have one threshold for distinguishing between the values on dichotomous variables. Multi Value QCA (mvQCA) was together with fuzzy set QCA (fsQCA) developed for overcoming the shortcomings of using only dichotomous variables. The multi value variant follows the same logic as the crisp set, but can apply several values for categorical variables on the nominal and ordinal scale. The outcome variable must however be dichotomous, like in csQCA. Fuzzy sets are applicable mainly for variables on the interval scale where numeric thresholds are constructed for the variables (Schneider and Wagemann 2012: 13-16).

4.2.1: The conditions and the construction of their thresholds values in mvQCA

The main strength of mvQCA is that one can operate with nominal variables with more than two values of interest that reflects so-called multinominal phenomena. That a phenomenon is multiple in its nature reflects that the phenomenon is categorical and is difficult to divide by one single threshold that is meaningful. (Cronqvist and Berg-Schlosser 2009: 70-72). In mvQCA, one can create the number of values that is desired for a variable, except for the outcome variable that must be dichotomous. Nevertheless, there is a need for keeping the number of values of the conditions down, because larger number of threshold values will make it more difficult to find parsimonious paths to the outcome of interest. Preferably, one should not create conditions with much more than five thresholds, but the number of thresholds one should allow also depends on the size of the sample and the distribution of units. For the number of conditions, one should normally not operate with more than six to seven conditions (Cronqvist and Berg-Schlosser 2009: 76-84).

The distribution of units is another element that has to be taken into consideration when setting the threshold of a condition. In QCA, the intervals between the thresholds do not need to be of the same size. Instead, one wishes to create thresholds that are meaningful and appropriate for the analysis. The thresholds can be set on the basis of which group that the cases meaningfully could be placed into, based on the theoretical and empirical knowledge about the phenomenon or the distribution of units. It is important to try to avoid artificial or unnatural thresholds that separate units with quite similar values into different groups, while they just as well could have been placed in the same group if the threshold were set marginally different. As the threshold setting is done in a subjective manner, the thresholds that are chosen can influence the results of the analysis. This is considered as a strength of QCA, because one can expect to receive meaningful results if the threshold setting is done in an informed and applicable manner, based on knowledge about each case. One should also take into account the sizes of the different groups of cases resulting from the setting of thresholds. Preferably, the number of units that are to be placed within a value should not be very unequal. It is important not to set thresholds such as they place very few cases into one group, as this decreases the chances for producing generalizable findings. In the case where a meaningful threshold is difficult to find, one should on the basis of the distribution of cases try to set a threshold that does not artificially separate between cases, and create groups of cases that are not too unequal in size. Nevertheless, the preferable setting of thresholds will be subjected to the researcher (Cronqvist and Berg Schlosser 2009: 76-78).

4.2.2 Choice of method

In this thesis' analysis, QCA have been chosen as a research method primarily because of its ability to discover combinatorial casual relationships that affect the outcome of interest in an intermediate sample size. Regarding the research studies conducted on the sustainability aspect of the CDM, it appears plausible that distinct combinations of factors are affecting the outcome for contributions to sustainability in the projects. As the interaction between important variables regarding the sustainability aspect of the CDM has not been investigated systematically, QCA can be a suitable tool for examining the interaction of the variables found to be important for the outcome of sustainability contributions. Furthermore, as this study focus on explaining why the contribution to sustainability is different among the CDM projects, it can be particularly useful to use QCA to find the different combinations of variables that is associated with positive and negative outcomes for the sustainability objective. Additionally, the multi-value variant of QCA, mvQCA, was chosen in order to operate with several thresholds on the variables where this was found necessary or desirable.
Regarding the sample size, QCA is suitable for handling the relatively large sample size of 85 projects, which is normally too large for a qualitative-oriented study. A relatively large sample is also better adapted to bring more complexity into the analysis; in including more conditions with several thresholds. In addition, the sample size can bring a higher level of validity to the findings.

4.3 Operationalization of variables

In this section, how the outcome variable and the conditions have been operationalized will be described. In QCA, the cases must be 'calibrated' into a set membership when setting thresholds for the conditions (Schneider and Wagemann 2012: 32). This implies that empirical information about the cases must be used in order to create thresholds that separate the cases in manner that is fruitful for the analysis. Information about the distribution of cases should therefore be used in order to guide the construction of conditions.

4.3.1 Outcome variable: Contributions to sustainable development in CDM projects

The outcome variable for this analysis is the projects contributions to sustainable development. It will be constructed as a dichotomous variable, where its threshold separates between projects that generate substantial and unsubstantial contributions to sustainable development. The variable is constructed with necessary and sufficiency criteria in order to create a threshold that can consistently separate the cases into one of the outcome values. Using a necessary and sufficient concept structure can be particularly suitable for forming dichotomous concepts, where a clear separation between cases that comply to the concept or not can be made (Goertz 2006: 29). Although what can be regarded as substantial or unsubstantial contributions in the CDM is debatable, it has for this analysis been attempted to construct a solid and applicable threshold for distinguishing between projects. The purpose is to be able to compare the contributions of the projects in a rough but expedient manner, where a suitable distinction between projects with substantial or unsubstantial contributions to sustainable development is made.

Table 4.1: Operationalization of the outcome variable

Outcome variable: Contribution to sustainable development	
Variable notation: Sustainable development {0,1}	
Outcomes:	
{0} Unsubstantial contribution to sustainable development	{1} Substantial contribution to sustainable development

Calibration

Necessary and sufficient conditions

In order for a CDM project to provide sufficient sustainability contributions to be reckoned as a substantial project, it must claim to generate at least one contribution to sustainability in each of the three dimensions of the concept; namely the environmental, the economic and the social dimension. In consequence, the presence of contributions made on each of the three dimensions of sustainability will jointly be sufficient in order for a project to be classified as providing substantial sustainability contributions, which will be referred to as the positive outcome. Conversely, unsubstantial contributions will be referred to as the negative outcome.

In this manner it is attempted to assure that a project contributes to sustainable development in a broader sense; in claiming contributions to the main aspects of the sustainability objective in the CDM. It assures that a project that is counted to give substantial contributions to sustainable development has not narrowed its contributions to count for criteria on one or two of the dimensions only. Since contributions to sustainable development in the CDM focus on specific measures taken at the local level to increase the quality of life, it is also attempted to assess the concrete contributions from the projects, and give less attention to the indiscrete claims found in the PDDs. Lastly, the sustainability claims found in the unique PDDs must be of a kind that makes it possible to categorize them in one of the ten indicators of sustainable development in the CDM from UNFCCC (2012), listed in table 4.2 below.

In the research literature of the CDM, an emphasis is normally put on assessing the benefits to sustainability that are representing actual contributions. Therefore, some research studies only rely on measureable sustainability claims in the PDDs. If it is described how the sustainability claim will be produced, it is perceived as a measurable claim (see Disch 2010, Lee and Lazarus 2011, Olsen and Fenhann 2008). In this manner, this analysis also attempts to increase the probability of assessing actual sustainable development benefits by concentrating on the sustainability claims that are made explicit in the PDDs. Therefore, a necessary criterion for being counted to give substantial contributions to sustainable development is that the PDD for a project must describe at least one concrete and measurable contribution to sustainable development, regardless of the other sustainability claims that are stated in the document. Many of the claims to sustainability made in the PDDs are of a more general character that to a low degree provides information about how the project is supposed to achieve the sustainability contributions claimed. Some projects do claim indistinct or potential sustainability contributions only, and these will not be counted as giving substantial contributions to sustainable development, regardless of the overall amount of sustainability claims made. This necessary criterion attempts to assure that the projects with the positive outcome provide actual sustainability contributions, although this can never be certain by referring to claims in the PDDs only. For this criterion, it has been regarded as sufficient that only one concrete claim has to be present in a projects' PDD, as it could be inconvenient to evaluate the concreteness of each claim to be found in the PDDs.

The last necessary criterion claims that a project must not represent a considerable risk for damaging the local environment. All project developers are obliged to describe potential negative impacts of the CDM project for the local environment in the project's PDD. If this risk is described as significant, a project will not be reckoned to provide the positive outcome, regardless of its overall claims.

In sum, a project which holds claims on each of the three sustainability dimensions, of which at least one of them is a concrete one, will be assessed as a project that contributes substantially to sustainable development if it neither represents a considerable potential threat to the local environment.

Choice of indicators

The ten indicators of UNFCCC (2012) are to be found within the three dimensions of sustainable development. They are relatively broad indicators, referring to several forms of contributions that can be captured within each indicator. Furthermore, this list of indicators has been developed on the basis of the indicators of an earlier analysis of the UNFCCC (2011) with fifteen indicators. The UNFCCC analysis of 2012 narrowed down the sustainability indicators into ten, because some indicators were found apt to capture several aspects of sustainability. Often several claims in the PDDs can be counted as one single contribution or indicator, because they are effects of the same action (UNFCCC 2012: 14, 16). As an example, employment generation for the poorest part of the population and poverty alleviation should according to this indicator set be counted as one contribution, not two. By holding the indicator set to a limited number that can include most sustainability claims, while at the same time assure that these claims are not overvalued or double counted, this indicator set is found to be especially appropriate for this analysis.

Table 4.2: Sustainable development dimensions and indicators for CDM projects

Dimension	**Indicator**	**Description**
Economic	Stimulation of the local economy including job creation and poverty alleviation	Economic improvements for the population through: direct or indirect job creation or retention of jobs, during the operation and construction phases; domestic or community cost savings; poverty reduction; financial benefits of the project for the national economy of the host country; enhancement of local investment and tourism; improvement of trade balance for the country; reinvestment of clean development mechanism proceeds into the community; creation of tax revenue for the community
	Development and diffusion of technology	Development, use, improvement and/or diffusion of a new local or international technology, international technology transfer or development of an in-house innovative technology

	Improvement to infrastructure	Creation of infrastructure (e.g. roads and bridges) and improved service availability (e.g. health centres and water availability)
Environment	Reduction of pollution	Reducing gaseous emissions other than greenhouse gases, effluents, and odour and environmental and noise pollution; and enhancing indoor air quality
	Promotion of reliable and renewable energy	Supplying more or making less use of energy; stabilizing energy for the promotion of local enterprises; diversifying the sources of electricity generation
		Converting or adding to the country's energy capacity that is generated from renewable sources; reducing dependence on fossil fuels; helping to stimulate the growth of the renewable power industries
	Preservation of natural resources	Promoting comprehensive utilization of the local natural resources (i.e. utilizing discarded biomass for energy rather than leaving it to decay, utilizing water and solar resources); promoting efficiency (e.g. compact fluorescent lamps rather than incandescent lamps); recycling; creating positive by-products; improvement and/or protection of natural resources, including the security of non-renewable resources such as fossil fuels, or of renewable resources such as: soil and soil fertility; biodiversity (e.g. genetic diversity, species, alteration or preservation of habitats existing within the project's impact boundaries and depletion level of renewable stocks like water, forests and fisheries); water, availability of water and water quality
Social	Improvement of health and safety	Improvements to health, safety and welfare of local people through a reduction in exposure to factors impacting health and safety, and/or changes that improve their lifestyles, especially for the poorest and most vulnerable members of society; improved human rights
	Engagement of local population	Community or local/regional involvement in decision-making; respect and consideration of the 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
	Promotion of education	Improved accessibility of educational resources (reducing time and energy spent by children in collecting firewood for cooking, having access to electricity to study at night, and supplementing other educational opportunities); donating resources for local education
	Empowerment of women, care of children and the frail	Provision of and improvements in access to education and training for young people and women; enhancement of the position of women and children in society

Source: UNFCCC (2012: 15)

4.3.2 Conditions

Five conditions are included in this analysis: *Project Category*, *Project Scale*, *Emission reductions*, *Economic performance* and *Ownership type*. In this section, the operationalization of each condition will be presented.

For conducting a fruitful QCA-analysis, a sufficient amount of complexity is needed in order to make meaningful distinctions between the cases. However, as stated, too much complexity can individualize the explanations of the cases, so that generalizability becomes difficult. When adding conditions to the analysis, one need to limit both the number of conditions and the number of thresholds on the conditions to a level where enough variation becomes apparent (Cronqvist and Berg Schlosser 2009: 76-78). In this analysis, both for the nominal variables *Project category* and *Ownership type* there was a particular need for multiple values in order to perform a comprehensive analysis. Also the condition *Emission reductions* has three values, because it was found desirable to separate between more than to values for examining the effect of the great span in the amount of emission reductions generated in the projects. The two remaining conditions of the analysis are dichotomous variables with one threshold. *Project scale* is naturally a dichotomous variable, while *Economic performance* could have had more than one threshold. However, for this variable, one threshold was found to bring sufficient variation in the distribution of cases.

Condition 1: Project category

For this analysis, three categories for the project types have been constructed. These are broad categories, including several project types each. Together they include most of the project types that are eligible for the CDM (see Fenhann and Hinostroza 2011: 119-124). The first category is a category of project types that deals with reduction of greenhouse gases directly. The second category concerns the project types of renewable energy which are to be found among the projects in the sample. They include almost exclusively wind power projects and hydro power projects, which also represent the most common types of renewable energy in the CDM (UNEP DTU Partnership 2014b). The last and smallest category consists of project types that concern energy efficiency, as the projects deals with measures for using energy more efficiently, often due to better conservation of energy sources.

The different project types in the sample have been divided into broad categories that nevertheless have been judged reasonable to compare on the basis of the nature of their activities. The number of logically possible configurations increases with the number of values on the conditions. Keeping the number of values on the conditions down therefore also increases the chances for conducting a fruitful analysis that generates parsimonious minimization formulas. Although mvQCA makes it possible to include as many values as is wished, it is advised that they are limited to a number that separates the units of analysis into groups that are appropriate to compare but at the same time includes as many units as possible. Simultaneously, it is not recommended to set thresholds values which create groups of units that are very different in number, as this will make it less likely for the analysis to lead to results that can be generalized across the units of the analysis (Cronqvist and Berg-Schlosser 2009: 76-77). The categorization of project types into three categories attempts to follow the principles of threshold setting in mvQCA. However, a broad categorization of the project types will not be able to assess the variation in sustainability contributions that might be found within the groups of project types that are included in a category. At the same time, it can also be useful to investigate the sustainability contributions for project categories within the same broad field, as well as for the narrowly defined project types.

Table 4.3: Operationalization of condition 1

Condition 1: Project category		
Number of values: 3		
Variable notation: Project category {0,1,2}		
Threshold values:		
{0} Gas reduction projects Number of units: 23 **Subtypes:** a) Biogas: 5 units b) Methane capture or avoidance: 4 units c) Gas recovery and utilization : 4 units d) Landfill gas: 3 units e) HFC-23: 2 units f) Coal mine and generation: 1 unit g) Animal manure: 1 unit h) Solid waste composting: 1 unit i) Alternative fuels: 1 unit j) Blended sement: 1 unit	**{1} Renewable energy** Number of units: 46 **Subtypes:** a) Wind power: 27 units b) Hydro power: 17 units c) Solar power: 1 unit d) Geothermal energy: 1 unit	**{2} Energy efficiency** Number of units: 14 **Subtypes:** a) Biomass: 5 units b) Brick industry: 3 units c) Waste heat recovery: 2 units d) Electrogaz lamp distribution: 1 unit e) Bagasse: 1 unit f) Energy conservation: 1 unit g) Soil conservation (increasing land productivity): 1 unit

Condition 2: Project scale

The CDM projects use either a large scale methodology or a small scale methodology in its project activity. Therefore, the projects using a small scale methodology will be categorized as a small scale project and vice versa.

Table 4.4: Operationalization of condition 2

Condition 2: Project Scale	
Number of values: 2	
Variable notation: Project scale {0,1}	
Threshold values:	
{0} Small scale projects Number of units: 29 Definition: Projects applying small scale methodologies	**{1} Large scale projects** Number of units: 54 Definition: Projects applying large scale methodologies

Condition 3: Emission reductions

The condition *Emission reductions* have been divided into three categories. Because there are relatively large differences in emission reductions generated from the projects, it has been found useful to use more than one threshold for separating between the cases. The calibration of the cases has been done by using the distribution of units to find suitable thresholds.

Tab1e 4.5: Operationalization of condition 3

Condition 3: Emission reductions		
Definition: Estimated emission reductions in metric tonnes of CO2 equivalent per annum		
Number of values: 3		
Variable notation: Emission reductions {0,1,2}		
Threshold values:		
{0} Low emission reductions Number of units: 32 Operationalization: Project reducing emissions in the range of 0-50.000 metric tonnes CO_2 equivalent per annum. Range of units: 4609 – 46990 metric tonnes CO_2 equivalent per annum	**{1} Medium emission reductions** Number of units: 38 Operationalization: Projects reducing emissions in the range of 50 001 – 200 000 metric tonnes CO_2 equivalent per annum. Range of units: 50293 – 179242 metric tonnes CO_2 equivalent per annum	**{2} High emission reductions** Number of units: 13 Operationalization: Projects reducing emissions in the range of > 200 001 metric tonnes CO_2 equivalent per annum. Range of units : 220 439 – 10 437 249 metric tonnes CO_2 equivalent per annum

Condition 4: Economic performance

The fourth condition is the *Economic performance* of the host country of a CDM project, which relates both to the investment attractiveness for foreign investors as well as the country's own capabilities to develop a CDM project and maintain its activity. As elaborated in the theory chapter, the advancement and capabilities of a country's economy relates to many influencing factors which together would be decisive for the investment climate. Therefore, different indicators decisive for the economic capabilities of a country should be included in a variable representing a country's overall economic performance. For operationalizing the condition *Economic performance* in this study, the index called 'Economic Transformation' or 'market economy status' of 'The Bertelsmann Stiftung's Transformantion Index' (BTI) is applied as a measure. It consist of fourteen indicators which together form the following seven criteria: '*level of socioeconomic development, organization of the market and competition, currency and price stability, private property, welfare regime, economic performance*[1] *and sustainability'* (Transformation Index BTI 2014: 124-126).

Table 4.6: Operationalization of condition 4

Condition 4: Economic performance	
Number of values: 2	
Variable notation: {0,1}	
Indicator: Bertelsmann Stiftung's Transformantion Index (BTI)	
Threshold values:	
{0} Low economic performance Number of units: 25 Operationalization: score from 0.0 to 6.0. Range of units: score 4.1-6.0	**{1} High economic performance** Number of units: 58 Operationalization: score from 6.1 to 10.0. Range of units: score 6.2-8.6

Calibration

One threshold was set for the condition *Economic performance*. The market economy status index ranges from 0 to 10 where 10 is the highest possible score a country can get. The CDM projects in the sample were registered in the period 2005-2012. Therefore, as the market economy status can change for each year, the average score for the market economy status in this period is used as a basis for calibration. Scores for each second year between 2006 and

[1] The criterion economic performance in the BTI-index refers to quantitative indicators of economic performance (Transformation Index BTI 2014: 126), and does not refer to the same as the condition *Economic performance* in this thesis.

2012 was available, and therefore the average score for each of the countries in the sample was calculated. After all the host countries for the CDM projects were assigned its raw value, a threshold was set for dividing the countries of the CDM projects into either low or high economic performance[2]. The countries raw values ranged from 4.1 to 8.6. The threshold value was set at 6.1 because this appeared to be suitable cut off point in the distribution where the two groups of countries also would constitute sufficiently equal share of cases.

Condition 5: Ownership type

The condition *Ownership type* reflects the main ownership types in the CDM, which are the unilateral, bilateral and the multilateral ownership types. This condition is therefore a categorical variable, including each of the three ownership types.

Table 4.7: Operationalization of condition 5

<table>
<tr><td colspan="3">Condition 5: Ownership type</td></tr>
<tr><td colspan="3">Number of values: 3
Variable notation: Ownership type {0,1,2}</td></tr>
<tr><td colspan="3">Threshold values:</td></tr>
<tr><td>{0} Unilateral ownership
Number of units: 17

Definition:
Project ownership by the host country of the project.</td><td>{1} Bilateral ownership
Number of units: 28

Definition:
Shared project ownership between the host country and one foreign actor.</td><td>{2} Multilateral ownership
Number of units: 38

Definition:
Project ownership by a multilateral fund with several foreign investors.</td></tr>
</table>

[2] Other operationalizations with more than two thresholds for this condition were also assessed. However, a single threshold value was found to be most appropriate for receiving sufficient variation of cases in the truth table for conducting this analysis.

Chapter 5: Analysis and discussion

An analysis of which patterns are associated for the CDM projects to produce substantial or unsubstantial contributions for sustainable development and which factors are decisive for explaining the positive and the negative outcome for sustainability are the purposes of this chapter. Throughout this chapter, the positive outcome will refer to the outcome of substantial contribution to sustainability, while the negative outcome refers to the opposite outcome of unsubstantial contributions. For carrying out the QCA-analysis, a data matrix showing the path of each unique case towards its outcome will be restructured and minimized into configurations in a truth table showing the number of existing configurations for the outcomes. These configurations will then be further minimized into prime implicants, which correspond to the different conjunction of conditions that are found to be sufficient for the outcomes to occur. Hence, these are the reduced expressions for explaining the occurrence of the outcomes, and one prime implicant includes all the configurations in the truth table which could be reduced into the same expression by using Boolean algebra.

Nevertheless, it is often the case that many of the prime implicants resulting after the first minimization procedure are still quite complex (Rihoux and Gisèle de Meur 2009: 59). This was also the case for *the first solution* in this thesis's analysis. Therefore, another model was constructed in order to bring more parsimonious results than *the first solution* of minimized expressions, which will be referred to as *Model I: the complete model*. After having analyzed *the first solution*, one condition was anticipated to be irrelevant for explaining the outcome. Therefore, *the reduced model* with one less condition, *Model II*, was constructed, leading to a more parsimonious solution than in the first one. Furthermore, the prime implicants constituting *the second solution* were interpreted in order to simplify the results and attain additional insight about the relevance of the conditions.

Together these two solution sets will be compared and used to assess the plausibility of the different solution terms and the influence of the different conditions on the outcome. Although the Boolean minimization procedure which results in the solutions sets of the prime implicants can seem mechanical and straightforward, the interpretation of them will be guided by theoretical and empirical knowledge. This reflects that QCA as an approach is foremost qualitative oriented. The plausibility and the implications of the solution terms will be assessed and interpreted by the researcher, which will be a vital part of the analysis. The minimization process will be a tool for assisting the researcher in systematizing and interpreting the results of the analysis, and it is not a means toward a conclusion of its own. Lastly, part 5.3 will illustrate the contexts for projects in two CDM sectors. The illustrative contexts presented are chosen on the basis of the findings in this analysis. They are chosen in order to exemplify how CDM projects achieve the sustainability claim under different settings.

5.1. The mvQCA-analysis

5.1.1 The QCA-minimization procedure: Constructing a truth table and reaching a parsimonious solution

It is on the basis of the raw data matrix that the distinct QCA-procedure of restructuring and minimization of the data takes place. In the data matrix, each case is represented in one row, where it's respective values one the conditions and the outcome are displayed. In sum, 83 cases are included in the data matrix[3]. As has been elaborated in the method chapter, the variables have been operationalized by the researcher, as well as the coding of the units in order to present them in the data matrix. Before commencing the QCA procedure it can also be useful to study the frequency distribution in the raw data matrix. The raw data matrix is presented in table 5.1, and the frequency distribution of the cases is summarised in table 5.2, which will be discussed before interpreting the results from the QCA-analysis.

[3] Two cases are withdrawn from the sample. First, project number 38, 'Bagasse cogeneration-1458' was withdrawn because it lacked data on condition 4: *Economic performance*. The BTI-index used for categorizing the cases on this condition lacks data for the host country of this project, which is Guyana. Second, project number 49, 'Gas company fuel switch-3048' was withdrawn from the sample because it has been rejected from participation in the CDM.

Table 5.1: Raw data matrix

Outcome 1: Substantial contributions to sustainable development						
Units	Conditions					Outcome
	Type I variables			Type II variables		
	1	2	3	4	5	
Project name	Project category	Project scale	Emission reductions	Economic performance	Ownership type	Sustainable development
1) Hydroelectric-0009	1	0	0	0	1	1
2) Hydropower-0088	1	0	0	1	2	1
3) Biogas support program-0136	0	0	0	0	2	1
4) Biogas support program-0139	0	0	0	0	2	1
5) Landfill gas recorvery-0140	0	1	0	1	2	1
6) Biomass heating-0160	2	0	0	0	2	1
7) Biomass heating-0159	2	0	0	0	2	1
8) Energy c/GHG red-0173	2	0	0	0	2	1
9) Bagasse cogeneration-0181	2	1	0	1	2	1
10) Hydropower-0251	1	0	0	1	2	1
11) Hydroelectric-0248	1	1	2	1	0	1
12) Windpower-0194	1	1	0	1	2	1
19) Wind-0453	1	1	1	0	2	1
20) Alternative fuels-0493	0	1	1	0	2	1
21) Blended sement-0526	0	1	2	0	2	1
22) Hydroelectric-0606	1	1	1	0	2	1
25) Bricks -blocks-0707	2	0	0	1	2	1
28) Hydropower-0904	1	1	1	1	2	1
33) Hydroelectric power-1052	1	1	1	1	2	1
34) Hydroelectric power-0809	1	1	1	1	0	1
35) Mitigation of Methane-1051	0	1	0	1	2	1
36) Methane avoidance/waste manag.-1547	0	0	0	0	2	1
40) Soil conservation-1948	2	1	1	0	2	1
42) Eco-farming biogas-2221	0	0	1	1	2	1
43) Landfill gas capture-2338	0	0	0	1	2	1
47) Renewable energy/minihydro-1713	1	0	1	0	2	1
50) Electrogaz lamp dstribution-3404	2	0	0	0	2	1
62) Geothermal Expansion-3773	1	1	1	0	2	1
63) Wind farm project-3252	1	1	1	1	0	1
65) Solid waste composting-3841	0	1	2	0	2	1
71) Reduction of GHGs/hydro-4229	1	1	2	1	0	1
75) Hydro electrical power plant-4546	1	1	0	0	0	1
76) Hydro electrical power plant-4547	1	1	1	0	0	1
79) Brick & block project-4585	2	0	0	1	2	1
80) Kiln efficiency/brick industry-5125	2	0	1	0	2	1
83) Biogas support program-5416	0	0	0	0	2	1
84) Biogas support program-5415	0	0	0	0	2	1
Contradictory cases						
18) Hydropower-0378	1	1	2	1	2	1
45) Animal manure-1891	0	1	1	1	2	1
23) Landfill gas to electricity-0545	0	1	1	1	2	0
81) Wind farm-5029	1	1	2	1	2	0

Oucome 0: Unsubstantial contributions to sustainable development						
Units	Conditions					Outcome
	Type I variables			Type II variables		
	1	2	3	4	5	
Project name	Project category	Project scale	Emission reductions	Economic performance	Ownership type	Sustainable development
13) Methane avoidance-0268	0	0	2	1	0	0
14) Mini hydel/hydro-0312	1	1	0	1	0	0
15) HFC-23-0011	0	1	2	1	2	0
16) Waste heat recovery-0433	2	1	0	1	0	0
17) HFC-23-0306	0	1	2	1	2	0
24) Hydro/electrification-0775	1	0	0	0	2	0
26) Biomass-renewable-0697	2	0	0	1	0	0
27) Waste heat recovery-0855	2	1	1	1	0	0
29) Wind farm-0992	1	0	0	1	0	0
30) Renewable energy/hydro-0943	1	0	0	1	0	0
31) Methane capture-0945	0	0	0	1	0	0
32) Bundled wind power-1021	1	0	0	1	0	0
37) Biomass residue-1568	2	0	1	1	0	0
39) Biomass renewable-2115	2	0	0	1	0	0
41) Gas utilization/fugitive-2029	0	1	2	0	1	0
44) Coal mine generation-1896	0	1	2	1	2	0
46) Grid-connected SHP/hydro-2729	1	0	0	1	1	0
48) Gas gathering & utilization-2422	0	1	2	0	1	0
51) Gas recovery & utilization-3208	0	1	1	1	1	0
52) Wind farm phase IV-3287	1	1	1	1	1	0
53) Wind farm phase III-3264	1	1	1	1	1	0
54) Wind power phase II-3167	1	1	1	1	1	0
55) Wind power-3679	1	1	1	1	1	0
56) Wind power phase II-3253	1	1	1	1	1	0
57) Recovery and marketing of gas-3740	0	1	2	0	1	0
58) Windfarm stage I-3371	1	1	1	1	1	0
59) Wind power project-3792	1	1	0	1	1	0
60) Wind power project-3134	1	1	1	1	1	0
61) Wind power project-3282	1	1	1	1	1	0
64) Wind power project-3800	1	1	1	1	1	0
66) Wind power-4001	1	1	1	1	1	0
67) Wind park-3919	1	0	1	1	1	0
68) Wind power-4038	1	1	1	1	1	0
69) Wind power-4035	1	1	1	1	1	0
70) Wind power-4369	1	1	1	1	1	0
72) Wind power-4381	1	1	1	1	1	0
73) Windfarm project-4405	1	1	1	1	1	0
74) Wind power-4124	1	1	1	1	1	0
77) Wind farm Phase II-4222	1	1	1	1	1	0
78) Wind power phase V-4689	1	1	1	1	1	0
82) Solar power-5379	1	1	0	1	1	0
85) Wind farm phase III-7515	1	1	1	1	1	0

Table 5.2: Frequency distribution

Variable	Distribution		Total
Outcome: Sustainable development	**{1} Substantial**	**{0} Unsubstantial**	
Total number of cases:	**39 (47%)**	**44 (53%)**	**83 (100%)**
Type I variables:			
1) Project category			
{0} Gas reduction	13 (57 %)	10 (43%)	23 (100%)
{1} Renewable energy	17 (37 %)	29 (63%)	46 (100%)
{2} Energy efficiency	9 (64%)	5 (36%)	14 (100%)
Total	39	44	83
2) Project scale			
{0} Small scale	18 (62%)	11 (38%)	29 (100%)
{1} Large scale	21 (39%)	33(61%)	54 (100%)
Total	39	44	83
3) Emission reductions			
{0} Low	20 (62, 5%)	12 (37, 5%)	32 (100%)
{1} Medium	14 (37%)	24 (63%)	38 (100%)
{2} High	5 (38%)	8 (62%)	13 (100%)
Total	39	44	83
Type II variables:			
4) Economic performance			
{0} Low	21 (84%)	4 (16%)	25 (100%)
{1} High	18 (31%)	40 (69%)	58 (100%)
Total	39	44	83
5) Ownership type			
{0} Unilateral	6 (35%)	11 (65%)	17 (100%)
{1} Bilateral	1 (4%)	27 (96%)	28 (100%)
{2} Multilateral	32 (84%)	6 (16%)	38 (100%)
Total	39	44	83

5.1.2 Preliminary results from the frequency distribution

The raw data matrix gives valuable information about the distribution of cases on the different conditions and the outcomes before taking further steps in the analysis. It is therefore worth studying the preliminary results from the raw data matrix before they are restructured and minimized into a truth table. The distribution of cases on each of the conditions values is summarized in table 5.2, where also the percentage of each of the values share on the outcome is presented. Firstly, when looking at the distribution of the outcome variable, there is a small overweight of projects which shares the negative outcome. 39 cases are associated with the positive outcome, and 44 cases to the negative outcome. This finding is consistent with the claim that the contributions to sustainable development in the CDM are relatively poor compared to the initial intensions for the mechanism. Secondly, the distribution for the type II variables, *the project participants*, are clearly more divided between the outcomes than the distribution for the type I variables, related to *the project design*. For *Ownership type*, both unilateral and bilateral projects most frequently have the negative outcome. Consequently, most of the multilateral projects have the positive outcome. Only 1 of the 28 bilateral projects has the positive outcome. The relationship is weaker among the unilateral projects, where 6 of the 17 cases are associated with the positive outcome. Multilateral projects represent the most frequent ownership type, and 32 of the 38 multilateral projects have the positive outcome. For *Economic performance*, there is a clear tendency for the cases in host countries with low economic performance to belong to the positive outcome, as 21 of the 25 cases belonging to this category are positive. Cases belonging to the category of host countries with high economic performance most often share the negative outcome, although with a lower frequency than in the other category. In sum, from displaying the distribution for *the project participants*, only the distribution for the bilateral ownership type is clearly consistent with the theoretical expectations.

For *the project design*, the tendencies are weaker than for *the project participants*, and the distributions of cases are consistent with the theoretical expectations for the conditions *Project Scale* and *Emission reductions*. However, for *Project category*, the frequency distribution is not corresponding to the theoretical expectations. The projects belonging to the categories for gas reduction and energy efficiency are more often associated to the positive outcome, while the renewable energy projects are most associated with the negative outcome. Energy efficiency projects constitute the group with the highest rate of positive outcomes, as 64% of the projects are related to the positive outcome. However, this is also the smallest project category, with a total of 14 projects of which 9 projects are positive and 5 are negative. The energy efficiency projects constituted the category expected to be the least associated to the positive outcome among the project categories. Renewable energy projects form the largest group of 46 projects where 17 of them are positive and 29 are negative. As such, 64% of the renewable projects are negative, which is the largest share of negative projects among the project categories. This finding contradicts the theoretical expectation of this category being the most associated to the positive outcome among the project categories. For *Project scale*, the distribution of projects supports the theoretical claim that small scale projects tend to promote the positive outcome more often than large scale projects. There are more large scale projects than those of small scale, and just above 60% of the small scale project share the positive outcome, while just above 60% of the large scale projects share the negative outcome. The distribution for *Emission reductions* follows the one for *Project scale* to a large degree. Just above 60% of the projects belonging to the category of low emission reductions shares the positive outcome, while the opposite is true for the projects in the categories for medium and high emission reductions, where just above 60% of the projects in both these categories are belonging to the negative outcome. This shows that the frequencies for the outcome are the same for the categories of medium and high emission reductions. However, the category for high emission reductions consists of fewer projects than the one for medium emission reductions, as there are 13 projects with high emission reductions and 38 projects with medium emission reductions. As the number of projects is relatively low in the category for high emission reductions, the comparability of the distribution of these categories is dubious. Nevertheless, the distribution for emission reductions is consistent with the theoretical expectations.

In sum, by studying the frequencies of projects on the different conditions, some of the theoretical expectations stated in the hypothesis seem supported, while others are not. In addition, the strongest relationships between the conditions and the outcome were found for *the project participants*. The frequency distribution does however not disclose how combinations of conditions relate to the outcome. In the next section the conditions will be seen as parts of conjunctions representing potential combinatorial effects on the outcomes.

5.1.3 Presentation of results: Transforming the data matrix into a truth table

The truth table is constructed by gathering the units sharing the same configuration in the same row. A configuration is a distinct combination of conditions, where the units belonging to the same configuration share the same values on all the conditions. The truth table displays all the configurations found to produce the outcome for the units of analysis. This also implies that each configuration can be regarded as a sufficiency row, as it represents a configuration that is sufficient for the outcome to occur. Conditions combined by the logical AND (*) are said to be in a conjunction. As such, combinations of conditions constituting parts of an expression are in a conjunction (Schneider and Wagemann 2012: 104-105). In the next step of the minimization procedure, the conditions found to be redundant for the outcome to occur when comparing configurations are factored out. In mvQCA, if a series of configurations sharing the same outcome differ in only one condition, then this condition can be withdrawn. Additionally, in order to withdraw the condition, all the values of the condition must be present in the series of configurations compared. Finally, all configurations in the truth table are compared, and the process results in the prime implicants (Cronquist and Berg-Sclosser 2009: 74-75). The prime implicants therefore represent the reduced expressions of sufficiency for an outcome to occur. They represent the units belonging to the configurations that could be successfully minimized into the same prime implicant (Schneider and Wagemann 2012: 107).

The minimization of configurations into prime implicants must be conducted separately for the negative and the positive outcome[4], as the two outcomes must be regarded as separate phenomena that have distinct configurations of sufficiency for the outcome. A distinct feature of the Boolean minimization process is that the prime implicants can represent concurrent explanations towards the outcome for some of the cases. Since the prime implicants are reduced expressions for the outcome to occur, some configurations may be covered by several prime implicants, where distinct prime implicants can cover different parts of the configurations. Hence, the units which can be explained by several prime implicants have so-called concurrent explanations. Although the concurrent explanations could bring more complexity into the analysis instead of more parsimony, they can also give additional information about the causal mechanisms bringing about the outcome. The concurrent explanations can therefore provide an opportunity to evaluate the relevance of different casual paths toward the outcome (Rihoux and De Meur 2009: 56-58).

[4] The technical process of constructing the truth table and reduce the configurations into prime implicants is for the respective study conducted in the computer software Tosmana version 1.2, developed by Lasse Cronquist. This is a QCA-software with operations for conducting the mvQCA-analysis.

In the following section, the findings from *Model I* and *Model II* will be presented and discussed successively. The first and the second solutions represent the truth table and the prime implicants for both the positive and the negative outcome[5]. In the tables for the prime implicants, each prime implicant shows which projects it corresponds to. Moreover, the projects corresponding to the same configuration are presented in succession, followed by the sign '+' to separate the different configurations which are included in the same prime implicant.

5.2 Interpretation of the results: assessing the relevance of the conditions

5.2.1 Model I: The complete model

Overall, when studying the configurations in the truth table and the resulting prime implicants, the overall image from the frequency distribution is upheld, although it is difficult to observe a distinct pattern for some of the conditions. The three type I variables are the three first conditions relating to the characteristics of the project design, while the type II variables relates to the characteristics of the project participants. A pattern is observable for *the project participants*, while the appearance for the conditions of *project design* seems to be of a more complex nature. In the following section, the resulting pattern for *the project participants* and its possible implications will be elaborated first, as the relationship between these variables appear to be interrelated and at the same time being most relevant for bringing about both the positive and the negative outcome. When interpreting the minimized expressions from the prime implicants it is important to be aware of the fact that one cannot assess the power of influence on the outcome of a condition in QCA. With QCA, the researcher is provided with a method for interpreting whether the presence or the absence of a condition is relevant for the outcome to occur or not, as well as which combinations of conditions are relevant for the outcome. (Schneider and Wagemann 2012: 8, 53). Causal inferences and their plausibility

[5] The first minimization procedure from the truth table can be complemented by using additional techniques for simplification. So-called simplifying assumptions about non-observed cases could be used in the minimization procedure in order to create more parsimonious solutions terms. However, as a more parsimonious solution would rely upon assumptions about cases not observed, the risk of making untenable conclusions from the resulting solution term also increases (Schneider and Wagemann 2012: 160-168). The use of simplifying assumptions is a choice of the researcher. In this analysis, only the prime implicants will be used in order to interpret the results. The use of logical remainders based on simplifying assumptions was considered to be used, but were found to be inadequate for producing more parsimonious results. Additional simplification by the use of simplifying assumptions was in this case regarded as leading to less reliable results. Instead, a simplification of Model I based on the findings from the model was considered to be more appropriate on order to produce reliable results.

cannot be assessed in a technical manner but must be interpreted by the researcher (Rihoux and De Meur 2009: 65).

Table 5.3: Truth table for Model I

a) Outcome 1: Substantial contribution to sustainable development						
Conditions					Units	Unit number
Type I			Type II			
1	2	3	4	5		
Project category	Project scale	Emission reductions	Economic performance	Ownership type	Project name	
1	0	0	1	2	Hydropower-0088 Hydropower-0251	2 10
0	1	0	1	2	Landfill gas recorvery-0140 Mitigation of Methane-1051	5 35
2	1	0	1	2	Bagasse cogeneration-0181	9
1	1	0	1	2	Windpower-0194	12
2	0	0	1	2	Bricks and blocs-0707 Brick & block project-4585	25 79
0	0	0	1	2	Landfill gas capture-2338	43
0	0	0	0	2	Biogas support program-0136 Biogas support program-0139 Methane avoidance and and waste management-1547 Biogas support program-5416	3 4 36 84
2	0	0	0	2	Biomass heating-0160 Biomass heating-0159 Energy c/GHG red-0173 Electrogaz lamp distribution-3404	6 7 8 50
1	1	1	0	2	Wind-0453 Hydroelectric-0606 Geothermal Expansion-3773	19 22 62
0	1	1	0	2	Alternative fuels-0493	20
2	1	1	0	2	Soil conservation-1948	40
1	0	1	0	2	Renewable energy/minihydro-1713	47
1	1	1	1	2	Hydropower-0904 Hydroelectric power-1052	28 33
1	1	1	1	0	Hydroelectric power-0809 Wind farm project-3252	34 63
1	1	1	0	0	Hydro electrical power plant-4547	76
2	0	1	0	2	Kiln efficiency/brick industry-5125	80
1	0	0	0	1	Hydroelectric-0009	1
1	1	2	1	0	Hydroelectric-0248 Reduction of GHGs/hydro-4229	11 71
0	1	2	0	2	Blended sement-0526 Solid waste composting-3841	21 65
0	0	1	1	2	Eco-farming biogas-2221	42
1	1	0	0	0	Hydro electrical power plant-4546	75

Contradictory configurations						
Project category	**Project scale**	**Emission reductions**	**Economic performance**	**Ownership type**	**Project name**	**Unit number**
1	1	2	1	2	Hydropower-0378	18
					Wind farm-5029	81
0	1	1	1	2	Landfill gas to electricity-0545	23
					Animal manure-1891	45
b) Outcome 0: Unsubstantial contribution to sustainable development						
Project category	**Project scale**	**Emission reductions**	**Economic performance**	**Ownership type**	**Project name**	**Unit number**
1	1	0	1	0	Mini hydel/hydro-0312	14
1	0	0	1	0	Wind farm-0992	29
					Renewable energy/hydro-0943	30
					Bundled wind power-1021	32
2	1	0	1	0	Waste heat recovery-0433	16
2	0	0	1	0	Biomass-renewable-0697	26
					Biomass renewable-2115	39
0	0	0	1	0	Methane capture-0945	31
2	1	1	1	0	Waste heat recovery-0855	27
2	0	1	1	0	Biomass residue-1568	37
1	0	0	1	1	Grid-connected SHP/hydro-2729	46
1	1	0	1	1	Wind power project-3792	59
					Solar power-5379	82
1	1	1	1	1	Wind farm phase IV-3287	52
					Wind farm phase III-3264	53
					Wind power phase II-3167	54
					Wind power-3679	55
					Wind power phase II-3253	56
					Windfarm stage I-3371	58
					Wind power project-3134	60
					Wind power project-3282	61
					Wind power project-3800	64
					Wind power-4001	66
					Wind power-4038	68
					Wind power-4035	69
					Wind power-4369	70
					Wind power-4381	72
					Windfarm project-4405	73
					Wind power-4124	74
					Wind farm Phase II-4222	77
					Wind power phase V-4689	78
					Wind farm phase III-7515	85
1	0	1	1	1	Wind park-3919	67
0	0	2	1	0	Methane avoidance-0268	13
0	1	2	1	2	HFC-23-0011	15
					HFC-23-0306	17
					Coal mine generation-1896	44
1	0	0	0	2	Hydro/electrification-0775	24
0	1	2	0	1	Gas utilization/fugitive-2029	41
					Gas gathering & utilization-2422	48
					Recovery and marketing of gas-3740	57
0	1	1	1	1	Gas recovery & utilization-3208	51

Minimization of the 1-outcome: 13 configurations

Table 5.4a: Prime implicants for the 1-outcome

Prime implicant 1a: corresponds to 9 cases
Emission reductions{0} * Ownership type{2} * Economic performance{1}
2) Hydropower-0088, 10) Hydropower-0251+ 5) Landfill gas recorvery-0140, 35) Mitigation of Methane-1051 + 9) Bagasse cogeneration-0181 + 12) Windpower-0194 + 25) Bricks and blocs-0707, 79) Brick & block project-4585 + 43) Landfill gas capture-2338
Prime implicant 2a: corresponds to 6 cases
Project category {0} * Project scale{0} * Emission reductions{0} * Ownership type{2}
3) Biogas support program-0136, 4) Biogas support program-0139, 36) Methane avoidance and waste management-1547, 83) Biogas support program-5416, 84) Biogas support program-5415 + 43) Landfill gas capture: 2338
Prime implicant 3a: corresponds to 6 cases
Project category{2} * Project scale{0} * Emission reductions{0} * Ownership type{2}
6) Biomass heating-0160, 7) Biomass heating-0159, 8) Energy c/GHG red-0173, 50) Electrogaz lamp distribution-3404 + 25) Bricks and blocks-0707, 79) Brick and block project-4585
Prime implicant 4a: correspond to 5 cases
Project scale{1} * Emission reductions{1} * Ownership type{2} * Economic performance{0}
19) Wind-0453, 22) Hydroelectric-0606, 62) Geothermal Expansion-3773 + 20) Alternative fuels-0493 + 40) Soil conservation-1948
Prime implicant 5a: corresponds to 4 cases
Project category{1} * Emission reductions{1} * Ownership type{2} * Economic performance{0}
19) Wind-0453, 22) Hydroelectric-0606, 62) Geothermal Expansion-3773 + 47) Renewable energy/minihydro-1713
Prime implicant 6a: corresponds to 5 cases
Project category{1} * Project scale{1} * Emission reductions{1} * Ownership type{2}
19) Wind-0453, 22) Hydroelectric-0606, 62) Geothermal Expansion-3773 + 28) Hydropower-0904, 33) Hydroelectric power-1052
Prime implicant 7a: corresponds to 3 cases
Project category{1} * Project scale{1} * Emission reductions{1} * Ownership type{0}
34) Hydroelectric power-0809, 63) Wind farm project-3252 + 76) Hydro electrical power plant-4547
Prime implicant 8a: corresponds to 2 cases
Project category{2} * Emission reductions{1} * Ownership type{2} * Economic performance{0}
40) Soil conservation-1948 + 80) Kiln efficiency/brick industry-5125
Prime implicant 9a: corresponds to 1 case
Project category{1} * Project scale{0} * Emission reductions{0} * Ownership type{1} * Economic per.{0}
1) Hydroelectric-0009
Prime implicant 10a: corresponds to 2 cases
Project category{1} * Project scale{1} * Emission reductions{2} * Ownership type{0} * Economic per.{1}

11) Hydroelectric-0248, 71) Reduction of GHGs/hydro-4229
Prime implicant 11a: corresponds to 2 cases
Project category{0} * Project scale{1} * Emission reductions{2} * Ownership type{2} * Economic per.{0}
21) Blended sement-0526, 65) Solid waste composting-3841
Prime implicant 12a: corresponds to 1 case
Project category{0} * Project scale{0} * Emission reductions{1} * Ownership type{2} * Economic per.{1}
42) Eco-farming biogas-2221
Prime implicant 13a: corresponds to 1 case
Project category{1} * Project scale{1} * Emission reductions{0} * Ownership type{0} * Economic per.{0}
75) Hydro electrical power plant-4546

Minimization of the 0-outcome: 11 configurations

Table 5.4b: Prime implicants for the 0-outcome

Prime implicant 1b: corresponds to 4 cases
Project category{1} * Emission reductions{0} * Ownership type{0} * Economic performance{1}
14) Mini hydel/hydro-0312 + 29) Wind farm-0992, 30) Renewable energy/hydro-0943, 32) Bundled wind power-1021
Prime implicant 2b: corresponds to 3 cases
Project category{2} * Emission reductions{0} * Ownership type{0} * Economic performance{1}
16) Waste heat recovery-0433 + 26) Biomass-renewable-0697, 39) Biomass renewable-2115
Prime implicant 3b: corresponds to 6 cases
Project scale{0} * Emission reductions{0} * Ownership type{0} * Economic performance{1}
26) Biomass-renewable-0697, 39) Biomass renewable-2115 + 29) Wind farm-0992, 30) Renewable energy/hydro-0943, 32) Bundled wind power-1021 + 31) Methane capture-0945
Prime implicant 4b: corresponds to 2 cases
Project category{2} * Emission reductions{1} * Ownership type{0} * Economic performance{1}
27) Waste heat recovery-0855 + 37) Biomass residue-1568
Prime implicant 5b: corresponds to 3 cases
Project category{1} * Emission reductions{0} * Ownership type{1} * Economic performance{1}
46) Grid-connected SHP/hydro-2729 + 59) Wind power project-3792, 82) Solar power-5379
Prime implicant 6b: corresponds to 20 cases
Project category{1} * Emission reductions{1} * Ownership type{1} * Economic performance{1}
52) Wind farm phase IV-3287, 53) Wind farm phase III-3264, 54) Wind power phase II-3167, 55) Wind power-3679, 56) Wind power phase II-3253, 58) Windfarm stage I-3371, 60) Wind power project-3134, 61) Wind power project-3282, 64) Wind power project-3800, 66) Wind power-4001, 68) Wind power-4038, 69) Wind power-4035, 70) Wind power-4369, 72) Wind power-4381, 73) Windfarm project-4405, 74) Wind power-4124, 77) Wind farm Phase II-4222, 78) Wind power phase V-4689, 85) Wind farm phase III-7515 + 67) Wind park-3919
Prime implicant 7b: corresponds to 1 case
Project category{0} * Project scale{0} * Emission reductions{2} * Ownership type{0} * Economic per.{1}

13) Methane avoidance-0268
Prime implicant 8b: corresponds to 3 cases
Project category{0} * Project scale{1} * Emission reductions{2} * Ownership type{2} * Economic per.{1}
15) HFC-23-0011, 17) HFC-23-0306, 44) Coal mine generation-1896
Prime implicant 9b: corresponds to 1 case
Project category{1} * Project scale{0} * Emission reductions{0} * Ownership type{2} * Economic per.{0}
24) Hydro/electrification-0775
Prime implicant 10b: corresponds to 3 cases
Project category {0} * Project scale {1} * Emission reductions {2} * Ownership type{1} * Economic per.{0}
41) Gas utilization/fugitive-2029, 48) Gas gathering & utilization-2422, 57) Recovery and marketing of gas-3740
Prime implicant 11b: corresponds to 1 case
Project category{0} * Emission reductions{1} * Ownership type{1} * Economic per.{1}
51) Gas recovery & utilization-3208

Type II variables: Characteristics of the project participants

4) Ownership type and 5) Economic performance

Overall, when investigating the resulting formulas from the minimization procedure, *the project participants* seem to be more relevant for explaining both outcomes than *the project design*. For the positive outcome of substantial contribution to sustainable development, low economic performance (*Economic performance{0}*) is found in six of the thirteen prime implicants, while high economic performance (*Economic performance{1}*) is present in three of them. In contrast, *Economic performance{1}* is found in nine of the eleven prime implicants for the negative outcome. However, in two of the prime implicants containing *Economic performance{1}* leading to a positive outcome, namely *1a* and *12a*, *Economic performance{1}* is combined with a multilateral ownership (*Ownership type{2}*). One prime implicant exist which has the value *Economic performance{1}* without being combined with *Ownership type{2}*, namely number *10a*, which has a unilateral ownership (*Ownership type{0}*).

For the negative outcome, one prime implicant corresponding to one project has the combination of *Ownership type{2}* and Economic performance{0}, namely number *9b*. Nevertheless, this prime implicant is found to be the only exception from the conjunction *Ownership type{2}*Economic performance{0}* being sufficient for producing the positive outcome. The project represented by this prime implicant is a renewable project (*Project *category{1})*, which is expected to be the project category most associated with the positive outcome, but from the frequency distribution were found to be the project category most frequently associated with the negative outcome. Moreover, the three prime implicants *8b-10b* are the only prime implicants for the negative outcome which contain the values *Ownership type{2}* or *Economic performance{0},* which are values otherwise found in the prime implicants for the positive outcome. Both prime implicants *8b* and *10b* represent large scale gas reduction projects with high emission reductions, signified by the conjunction *Project category{0}*Project scale{1}*Emission reductions{2}*. Together they might strengthen *hypothesis 1d*, which claims that this particular conjunction tends to produce the negative outcome. The two prime implicants mentioned differ in both *Ownership type* and *Economic performance*. Prime implicant *8b* has the conjunction *Ownership type{2}*Economic performance{1}* which is a combination of the ownership type most associated with the positive outcome and the economic performance most associated with the negative outcome. The opposite is the case for prime implicant *10b*, with the conjunction *Ownership type{1}*Economic performance{0}*. Here, the bilateral ownership type is the one the most associated with the negative outcome while the low economic performance is most associated to the positive outcome. The differences in the conjunctions of *Ownership type* and *Economic performance* for these prime implicants may reflect that the characteristics of *the project participants* matter less for large scale gas reduction projects with high emission reductions than for other projects. These particular projects have been claimed to provide the fewest sustainability benefits in the research literature (see Alexeew et al. 2010, Olsen and Fenhann 2008, Sutter and Parreño 2007). However, neither of these prime implicants had the conjunction of *project participants* most related to the positive outcome, namely *Ownership type{2}*Economic performance{0}*, which corresponds to a multilateral project in a country with low economic performance. In the sample, most of the large scale gas reduction projects with high emission reductions are projects where the main purpose is often the direct reduction of greenhouse gases, due to a specific technology. These projects represent large plants that do not provide many jobs for the local population and neither much involvement or benefits for the local population otherwise. For the positive outcome, project number 21 and 65 are also large scale gas reduction projects. In contrast, they have the conjunction *Ownership type{2}*Economic performance{0}*. Their project activities are however of a different kind than for the other projects with the same conjunction of *project design* conditions, as they did not depend upon reducing gas directly.

For the negative outcome, bilateral projects (*Ownership type{1}*) are the ones the most associated to projects with unsubstantial contributions to sustainable development. Unilateral projects (*Ownership type{0})* also appear more often in the prime implicants for the negative outcome than the positive outcome. In addition, the conditions *Ownership type* and *Economic performance* are always present in the prime implicants for the negative outcome, as well as *Emission reductions*. Although not much reduction has been achieved in the minimization procedure, it is observable that the values for the two remaining conditions change more among the prime implicants. *Project scale* is the condition that is the least present in the prime implicants, followed by *Project category*.

In sum, for *the project participants*, it is conceivable that it is the condition *Ownership type* which is the most decisive for bringing about the outcomes, and less the economic performance in the host country. It is also noticeable that *Ownership type* is present in all the prime implicants for both outcomes. Being a multilateral project appears to be more decisive for bringing about the positive outcome than the situation of low economic performance of the host country. *Economic performance{0}* without being combined with *Ownership type{2}* does not seem to matter much for bringing about the positive outcome. Initially, countries with a low economic performance could be expected to have a higher probability for obtaining a negative outcome, due to the lack of specialized institutions, lack of expertise and less means for developing CDM-projects. As elaborated in the theory chapter, the presence of these characteristics would make it harder for a host country to attract investment for CDM projects. However, in this sample, the projects in these countries seem to obtain more aid in the form of multilateral funds for developing CDM-projects. These funds often pay special attention to the objective of sustainable development, and may set specific criteria for sustainable development that the respective projects must fulfil. Some of these funds are especially target for providing financing for the least developed countries and secure their participation in the CDM (Freestone and Streck 2005: 17-23). Remarkably, in this sample, these funds more often set criteria for the social dimension of sustainable development, which many of the unsubstantial projects are lacking. This is in accordance with the findings of Nussbaumer (2009), who found that the projects supported by multilateral initiative programmes provided slightly more sustainability benefits than other projects, usually by providing more social benefits. Furthermore, in this sample, the social criteria are often met by providing community development programmes initiated by the multilateral fund, which are meant to secure the involvement of the local communities and provide additional social benefits related to the project. Countries with higher economic performance may have the means to develop unilateral projects of their own or attract investors to become project participants in bilateral projects (see Michelowa 2007). The project developers representing these ownership types might have been more focused on creating a profitable business when developing a project, and therefore paid less attention in creating good sustainability benefits. Private owners are more often represented in the unilateral and bilateral ownership than in the multilateral. As was found by Nishiki (2007), projects with private partnerships tended to provide fewer sustainability benefits than other projects, probably due to the objective for profit by the private actors. Within the sample of this analysis, the multilateral ownership also seems to increase the chance for countries with higher economic performance to obtain projects with substantial sustainability benefits, which strengthens the claim that it is the ownership type of the project which is most decisive for the contributions to sustainability. However, it is not clear why the outcome for the unilateral projects vary more than for the other ownership types. It might be that the intensions for making sustainability benefits vary more among the project developers of these projects. While most of the bilateral projects in the sample are Chinese, the nationalities of the unilateral projects are more diverse. National goals for sustainability might have grounds to be better incorporated in the unilateral projects than in bilateral projects with foreign investment.

Type I-variables: project characteristics

1) Project category

The project type has been considered to be the most decisive variable for determining the extent of sustainability contributions in a CDM project in two studies (Alexeew et al. 2012 and Olsen and Fenhann 2008). In this study, the project types have been divided into three broad categories representing several subtypes. As for the other *project design* conditions, the resulting prime implicants for *Project category* do not reveal a clear pattern for project categories in determining the outcomes. All three values of *Project category* appear frequently in the prime implicants for both outcomes. Nevertheless, as displayed in the frequency distribution, the renewable projects *(Project category{1})* are most often classified as negative cases. This is exemplified in prime implicant *6b*, which corresponds to the largest group of cases which is covered by one prime implicant. This is a group of 20 bilateral renewable projects. Moreover, these are all wind power projects, and it is observable that wind power projects in general are more associated to the negative outcome than the hydro projects, which is the second largest subtype of *Project category{1}*. Most of the hydropower projects are represented in the prime implicants for the positive outcome, while most of the wind projects are covered by the prime implicants for the negative outcome. When observing the prime implicants for the positive outcome, *Project category{1}* is found in conjunction with all values of *Ownership type*. However, only one prime implicant corresponding to one project contains *Ownership type{1}* in its conjunction. This is a hydropower project covered by prime implicant *9a*, which also holds the conjunction *Project scale {0}*Emission reductions{0}*. This conjunction would be expected to produce the positive outcome, as both condition's values are expected to be associated to this outcome. Additionally, the prime implicant for this project also contains the condition *Economic performance{0},* which has shown to be most associated to the positive outcome in the sample for this analysis. As the case represented in *9a* is the only bilateral project with a positive outcome, it has the conjunction of the conditions *Project scale {0}*Emission reductions{0}*Economic performance{0}* which could be expected to be associated to the positive outcome. It is also interesting that *9a* corresponds to a hydro power project and not a wind power project, as more hydro power projects are associated to the positive outcome than the wind power projects. Among the projects with a negative outcome, prime implicant *5b* is identical with *9a* except for *Economic performance*. This prime implicant corresponds to three different subtypes of *Project category{1},* namely wind-, hydro-, and solar power projects.

With regard to the two other project categories, namely gas reduction (*Project category{0}*), and energy efficiency (*Project category{2}*), they both have a larger share of the projects belonging to positive outcome when displaying the frequency distribution, although this difference is minimal. Both categories appear frequently for both outcomes, and it seems as if it is *Ownership type* that is decisive for whether the project can be associated with the positive or the negative outcome. Most of the large gas reduction projects with large emission reductions have a negative outcome. As stated earlier, these projects are found in configuration *8b* and *10b* and do not possess sustainability benefits that can benefit the local population directly. They are projects mostly focused upon cleansing greenhouse gases directly, and have a large effect as greenhouse gas reducers. For the projects in these two configurations, it was stated that *Ownership type* and *Economic performance* appeared not to be decisive for the outcome. There were also two other such gas projects belonging to the positive outcome, but these were of another character, as they consist of a blended cement project and a solid waste composting project, belonging to configuration *11a*. These projects with the positive outcome therefore represent other subtypes of gas reduction projects than the negative ones. Although they are large scale gas reduction projects with large emission reductions, they are not projects that are made for reducing gas directly such as the HFC-23 projects and gas utilization projects associated with the negative outcome.

In sum, after having investigated the relevance of the condition *Project category*, *the project participants* still seem to be more decisive for the outcome than *the project design*. For the negative outcome, the prime implicants containing *Project category{1}* in its expressions often include the conjunction *Ownership type{1}*Economic performance{1}* as a part of the expression. For the positive outcome, *Project category{1}* is more often in conjunction with *Ownership type{2}* and *Economic performance{0},* although the picture seems complex. The distinction between the renewable subtypes hydro power and wind power may be expected to have an influence on the outcome, although this is not reflected in the values of the variable *Project category*, where they have been placed in the same category. However, the largest group of hydro power projects consists of multilateral projects, while the second largest group consists of unilateral projects. The wind power projects are almost exclusively bilateral Chinese projects, and most of them are negative cases. Interestingly, the two wind projects which are multilateral are positive cases. These are projects number 12 and 19, and are situated in Colombia and Chile. Project number 71 is the third and last wind power project which is a positive case, and it is a unilateral Chilean project. Interestingly, the only bilateral project with a positive outcome is a hydro project. When it comes to the hydro power projects, they are situated in more countries than the wind projects, and many of the hydro projects are in Latin American countries. However, a Chinese hydro power project with multilateral ownership is also found to give substantial sustainability contributions. This is project number 18, which constitutes a contradictory configuration with number 81, a Chinese multilateral wind project which is found to be a negative case. This might again mean that there is a difference between hydro- and wind power projects which makes it more likely for the hydro power projects to give substantial contributions to sustainability than the wind power projects.

Overall, although most of the renewable projects belong to the group of the negative outcome, it does seem that *Ownership type* and possibly also the *Economic performance* of the host country are the most decisive conditions for determining the outcome. All but one bilateral project is classified as having the negative outcome. As such, the condition of being a bilateral project seems to come close to being a sufficient condition for determining the negative outcome for this sample. Unilateral projects are also most often related to the negative outcome. The fact that most of the hydropower projects are multilateral, while most wind power projects are bilateral strengthens the claim for ownership type being most important for determining the outcome, although there may be other factors which could be decisive for the outcome. The subtypes of renewable projects may possibly have an impact on the outcome as well as the policy for the different host countries and investment countries in the CDM.

2) Project scale

For both outcomes, the values of *Project scale* vary considerably within the prime implicants, and a pattern for the appearance of this condition is not detectable. In addition, *Project scale* appears to be redundant for bringing about the outcomes for several groups of cases when compared with *Emission reductions*.

When observing the concurrent explanations for the positive outcome, *Project scale* appears to be less relevant for the outcome compared to *Emission reductions*. For the positive outcome, the prime implicants *2a* and *3a* both include the condition *Project scale {0}*Emission reductions{0}* in their configurations. Simultaneously, prime implicant *1a* corresponds to 9 projects, and is a concurrent explanation for project 43 in *2a* and project 25 and project 79 in *3a*. Prime implicant *1a* also represents the most parsimonious expression of the prime implicants in including three conditions in a conjunction. It is also the prime implicant which holds an explanation for the largest group of projects with the positive outcome, as it represents an explanation for nine cases. The condition *Project scale* has been factored out in *1a* while *Emission reductions{0}* is present. This could imply that *Project scale* is not a necessary part of the explanation for the three projects number 25, 79 and 43, which holds concurrent explanations in the three first prime implicants. In addition, the other concurrent explanations found for both the positive and the negative outcome show that the projects with concurrent explanations can be explained without *Project scale*. For the positive outcome, three concurrent explanations in the prime implicants *4a*-*6a* are found for the projects number 19, 22 and 62. These cases can also be explained without *Project scale* in *5a*. Two concurrent explanations exist for project 40 in *4a* and *8a*. The project can be explained without *Project scale* in *8a*. For the negative outcome, concurrent explanations are present for two groups of cases. In *1b* and *3b*, concurrent explanations exist for the projects number 29, 30 and 32 which are explained with *Project scale* in *3b* and without it in *1b*. The last concurrent explanations are found in *2b* and *3b* for the projects number 26 and 39. Again, an explanation with *Project scale* appears in *3b*, while this condition is absent in *2b*. In sum, all the concurrent explanations for both outcomes show that the projects covered by these explanations can be explained without *Project scale*, which weakens the impact of this condition. Additionally, in the concurrent explanations where *Project scale* was not present *Emission reductions* was always present. This finding is in accordance with other research findings elaborated in the theory chapter (Olsen and Fenhann 2008, Watson and Fankhauser 2009) who found that the scale of the CDM projects was of little importance for the sustainability benefits provided by the projects. Moreover, when displaying the conjunctions of *Project Scale* and *Emission reductions* found for both outcomes, the values of the conditions most often go in the same direction, implying that *Project scale{0}* most often appear in the conjunction with *Emission reductions{0}*, while *Project scale{1}* most often appear in conjunction with *Emission reductions{1}* or *Emission reductions{2}*. This exemplifies the fact that large scale projects tend to have higher emission reductions and vice versa. Only the prime implicants *12a*, *13a* and *7b* have conjunctions where the values of these conditions go in the opposite direction.

In sum, when investigating the prime implicants and the concurrent explanations, the values of *Project scale* and *Emission reductions* seem to be interrelated, and *Emission reductions* seem to represent a stronger determinant for the outcome than *Project scale*.

3) Emission reductions

Noticeably, the condition *Emission reductions* is present in all the prime implicants for both outcomes. This might also strengthen the claim for this condition being of more relevance for the outcome than *Project scale*. As elaborated, in the prime implicants where *Project scale* and *Emission reductions* are both present, they most often go in the same direction. However, the values for *Emission reductions* vary considerably among the prime implicants for both outcomes, making it difficult to bring clarity in the relationship between this condition and the outcome. As described for *Project scale*, the condition *Emission reductions* is a part of several prime implicants representing concurrent explanations. For the positive outcome, the prime implicants *1a*-*3a* represent two concurrent explanations for two groups of cases, and the condition *Emission reductions{0}* is present in all three of them. As described, prime implicant *1a* corresponds to both groups of cases with concurrent explanations in its expression, and does not include *Project scale{0}*, which was present in both the other concurrent paths. For the negative outcome, *Emission reductions* was also a part of all concurrent explanations, while *Project scale* could be altered. This might again suggest that

Emission reductions represents a more important variable than *Project scale* for explaining the outcome.

The project scale and the amount of emission reductions often go in the same direction due to the definition of project scale. The scale of a project is decided either by the methodologies used in a project for reducing emissions, or the amount of emission reduction generated from the project (Yamin and Depledge 2004: 179-180). In the sample, most projects are of large scale while the projects with the smallest amounts of emission reductions are small scale projects. For these reasons, it might be difficult to separate the effect of scale and emission reductions on the outcome. Nevertheless, as can be seen from the raw data matrix and the truth table, there is a considerable variation among the conditions *Project Scale* and *Emission reductions*, except for the projects in the category of high emission reductions, *Emission reductions{2}*, which corresponds to the smallest group of projects for this condition. There is only one prime implicant (*7b*) which corresponds to one project (number 13) which is both a small scale project and has high emission reductions (*Project Scale{0}*Emission reductions{2}*). This case has the negative outcome, which is most associated to high emission reductions.

A QCA-analysis can be a suitable tool for exposing how the interaction of these two conditions affects the outcome. As stated, independence between the variables is not an assumption in QCA. On the contrary, interaction effects are attempted to be found in a QCA-analysis, and therefore constitute a reason for using QCA.

Contradictory configurations

Two contradictory configurations corresponding to four projects in total occurred in Model I. These configurations have been withdrawn from the analysis, as they cannot be included without first being solved (Rihoux and De Meur 2009: 48). The projects constituting the contradictory configurations shall rather be given case specific explanations. These explanations may point to factors affecting the outcomes that have not been included in the model (Rihoux and De Meur 2009: 48-50). Firstly, all the four projects in both the contradictory configurations share the conjunction *Ownership type{2}*Economic performance{1}*. Interestingly, this conjunction consists of the ownership type most associated with the positive outcome and the level of economic performance which is most associated with the negative outcome. Moreover, the first contradictory configuration have *Project category{1}* in its conjunction, and corresponds to one hydro power project and one wind power project, namely number 18 and 81. In addition, they share the conjunction *Project scale{1}*Emission reductions{2}* which is associated with the negative outcome. It is the renewable projects which are expected to yield the highest benefits for sustainable development, while at the same time there is a difference between the hydro power projects and the wind power projects, where the hydro power projects have been found to bring most sustainability benefits among the two subtypes. Within this contradictory configuration, it is the hydropower project which is the positive case, and the wind power project which is the negative case. As these cases are described by a configuration where some of the conditions usually belong to the positive outcome, while others to the negative, the outcome for these projects might be less predictable. Again, this contradictory configuration might show that there could be a difference between the subtypes hydro and wind of the renewable types in *Project category{1}*. These two projects are also situated in China. As earlier described, all wind power projects situated in China belong to the negative outcome. This might reflect that the characteristics of the particular host county could also be decisive for the outcome.

The second contradictory configuration corresponds to project number 45 and 23 which are both gas reduction projects. These are both large scale projects with medium emission reductions. However, their project activities are of a different nature, and can therefore also be counted as different subtypes of gas reduction projects. Project number 45 is a gas reduction project related to the farming industry, as it is utilizing a technology for transforming biogas from chicken farms into electricity. This project provides direct benefits to the local community, and especially to the people attached to the farming industry. Among other benefits, the project brings health benefits for the local population by increasing the air and water quality for the area by utilizing an animal manure management system for a better treatment of these wastes where contamination is largely reduced. As the project provides new technology to the farming industry it can also help farmers increase their incomes and provide jobs for skilled workers who can handle the system and equipment of the technology (UNFCCC 2010: 2-3). Project number 23, which produces the negative outcome, actually provides several of the same contributions to sustainability as the positive case, like increased air and water quality and a few job opportunities for skilled workers. However, it does not describe direct or concrete social benefits for the local population such as the other 'positive' project in the farm industry (UNFCCC 2014b: 2).

Summary of findings for Model I

In the analysis for *Model I*, thirteen prime implicants was derived for the positive outcome, and 11 for the negative outcome. *The project design* conditions were found to be of less relevance for the outcome than *the project participants*. The relevance of *Project category* seemed unclear, although some support for theoretical expectations were found. Also subtypes of the *Project Category* might be relevant for explaining the outcome. *Project Scale* appeared to be irrelevant for explaining the outcome, but also appeared to be interrelated with *Emission reductions*. In turn, *Emission reductions* seemed relevant for explaining the outcome to some extent. *The project participants* appeared to be of highest relevance for the outcome. *Ownership type* seems to be the most decisive condition for determining the outcomes. At the same time, the two conditions of *the project participants* seem to be interrelated in that *Economic performance* might influence which type of ownership a project can attain. Also country specific contexts might be decisive for explaining the outcomes. Lastly, two contradictory configurations occurred. These were withdrawn from the minimization procedure and given case specific explanations.

5.2.2 Model II: The reduced model

The main purpose of *Model II* was to create a simpler model which could provide more clarity to the results and to provide a more parsimonious solution. After having assessed the relevance of the five conditions in the first model, one condition appeared to be irrelevant for explaining the outcomes. In order to achieve a more parsimonious solution than in *the first solution*, this condition was omitted in the second model. *The second solution* from *Model II* will be compared to *the first solution* in order to evaluate the strengths of the two solutions and to gain additional insight.

Table 5.5: Truth table for Model II

a) Outcome 1: Substantial contribution to sustainable development					
Conditions				Projects	Unit number
Type I		Type II			
1	3	4	5		
Project category	Emission reductions	Economic performance	Ownership type		
0	0	1	2	Landfill gas capture-2338	43
2	0	1	2	Bagasse cogeneration-0181 Bricks and blocs-0707 Brick & block project-4585	9 25 79
0	0	0	2	Biogas support program-0136 Biogas support program-0139 Methane avoidance and and waste management-1547 Biogas support program-5416 Biogas support program-5415	3 4 36 83 84
0	1	0	2	Alternative fuels-0493	20
0	2	0	2	Blended sement-0526 Solid waste composting-3841	21 65
2	0	0	2	Biomass heating-0160 Biomass heating-0159 Energy c/GHG red-0173 Electrogaz lamp distribution-3404	6 7 8 50
1	1	0	2	Wind-0453 Hydroelectric-0606 Renewable energy/minihydro-1713 Geothermal Expansion-3773	19 22 47 62
2	1	0	2	Soil conservation-1948 Kiln efficiency/brick industry-5125	40 80
1	1	1	2	Hydropower-0904 Hydroelectric power-1052	28 33
1	1	1	0	Hydroelectric power-0809 Wind farm project-3252	34 63
1	1	0	0	Hydro electrical power plant-4547	76
1	0	0	1	Hydroelectric-0009	1
1	2	1	0	Hydroelectric-0248 Reduction of GHGs/hydro-4229	11 71
1	0	0	0	Hydro electrical power plant-4546	75

Contradictory configurations					
Project category	**Emission reductions**	**Economic performance**	**Ownership type**	**Projects**	**Unit number**
1	2	1	2	Hydropower-0378 Wind farm-5029	18 81
0	1	1	2	Landfill gas to electricity-0545 Eco-farming biogas-2221 Animal manure-1891	23 42 45
b) Outcome 0: Unsubstantial contribution to sustainable development					
Project category	**Emission reductions**	**Economic performance**	**Ownership type**	**Projects**	**Unit number**
1	0	1	0	Mini hydel/hydro-0312 Wind farm-0992 Renewable energy/hydro-0943 Bundled wind power-1021	14 29 30 32
2	0	1	0	Waste heat recovery-0433 Biomass-renewable-0697 Biomass renewable-2115	16 26 39
0	0	1	0	Methane capture-0945	31
0	2	1	0	Methane avoidance-0268	13
0	2	1	2	HFC-23-0011 HFC-23-0306 Coal mine generation-1896	15 17 44
1	0	0	2	Hydro/electrification-0775	24
2	1	1	0	Waste heat recovery-0855 Biomass residue-1568	27 37
0	2	0	1	Gas utilization/fugitive-2029 Gas gathering & utilization-2422 Recovery and marketing of gas-3740	41 48 57
1	0	1	1	Grid-connected SHP/hydro-2729 Wind power project-3792 Solar power-5379	46 59 82
0	1	1	1	Gas recovery & utilization-3208	51

				Wind farm phase IV-3287	52
				Wind farm phase III-3264	53
				Wind power phase II-3167	54
				Wind power-3679	55
				Wind power phase II-3253	56
				Windfarm stage I-3371	58
				Wind power project-3134	60
				Wind power project-3282	61
				Wind power project-3800	64
1	1	1	1	Wind power-4001	66
				Wind park-3919	67
				Wind power-4038	68
				Wind power-4035	69
				Wind power-4369	70
				Wind power-4381	72
				Windfarm project-4405	73
				Wind power-4124	74
				Wind farm Phase II-4222	77
				Wind power phase V-4689	78
				Wind farm phase III-7515	85

Minimization of the 1-outcome: 9 configurations

Table 5.6a: Prime implicants for the 1-outcome

Prime implicant 1a: corresponds to 9 cases
Emission reductions{0} * Ownership type{2} * Economic performance{1}
2) Hydropower-0088, 10) Hydropower-0251, 12) Windpower-0194 + 5) Landfill gas recorvery-0140, 35) Mitigation of Methane-1051, 43) Landfill gas capture-2338 + 9) Bagasse cogeneration-0181, 25) Bricks and blocs-0707, 79) Brick & block project-4585
Prime implicant 2a: corresponds to 8 cases
Project category{0} * Ownership type{2} * Economic performance{0}
3) Biogas support program-0136, 4) Biogas support program-0139, 36) Methane avoidance and waste management-1547, 83) Biogas support program-5416, 84) Biogas support program-5415 + 20) Alternative fuels-0493 + 21) Blended sement-0526, 65) Solid waste composting-3841
Prime implicant 3a: corresponds to 7 cases
Project category{2} * Emission reductions{0} * Ownership type{2}
6) Biomass heating-0160, 7) Biomass heating-0159, 8) Energy c/GHG red-0173, 50) Electrogaz lamp distribution-3404 + 9) Bagasse cogeneration-0181, 25) Bricks and blocks-0707, 79) Brick and block project-4585
Prime implicant 4a: correspond to 7 cases
Emission reductions{1} * Ownership type{2} * Economic performance{0}
19) Wind-0453, 22) Hydroelectric-0606, 47) Renewable energy/minihydro-1713, 62) Geothermal Expansion-3773 + 20) Alternative fuels-0493 + 40) Soil conservation-1948, 80) Kiln efficiency/brick industry-5125
Prime implicant 5a: corresponds to 6 cases

Project category{1} * Emission reductions{1} * Ownership type{2}
19) Wind-0453, 22) Hydroelectric-0606, 47) Renewable energy/minihydro-1713, 62) Geothermal Expansion-3773 + 28) Hydropower-0904, 33) Hydroelectric power-1052
Prime implicant 6a: corresponds to 3 cases
Project category{1} * Emission reductions{1} * Ownership type{0}
34) Hydroelectric power-0809, 63) Wind farm project-3252 + 76) Hydro electrical power plant-4547
Prime implicant 7a: corresponds to 1 case
Project category{1} * Emission reductions{0} * Ownership type{1} * Economic performance{0}
1) Hydroelectric-0009
Prime implicant 8a: corresponds to 2 cases
Project category{1} * Emission reductions{2} * Ownership type{0} * Economic performance{1}
11) Hydroelectric-0248, 71) Reduction of GHGs/hydro-4229
Prime implicant 9a: corresponds to 1 case
Project category{1} * Emission reductions{0} * Ownership type{0} * Economic per.{0}
75) Hydro electrical power plant-4546

Minimization of the 0-outcome: 9 configurations

Table 5.6b: Prime implicants for the 0-outcome

Prime implicant 1b: corresponds to 8 cases
Emission reductions{0} * Ownership type{0} * Economic performance{1}
14) Mini hydel/hydro-0312, 29) Wind farm-0992, 30) Renewable energy/hydro-0943, 32) Bundled wind power-1021 + 16) Waste heat recovery-0433, 26) Biomass-renewable-0697, 39) Biomass renewable-2115 + 31) Methane capture-0945
Prime implicant 2b: corresponds to 1 case
Project category{0} * Emission reductions{2} * Ownership type{0} * Economic performance{1}
13) Methane avoidance-0268
Prime implicant 3b: corresponds to 3 cases
Project category{0} * Emission reductions{2} * Ownership type{2} * Economic performance{1}
15) HFC-23-0011, 17) HFC-23-0306, 44) Coal mine generation-1896
Prime implicant 4b: corresponds to 1 cases
Project category{1} * Emission reductions{0} * Ownership type{2} * Economic performance{0}
24) Hydro/electrification-0775
Prime implicant 5b: corresponds to 2 cases
Project category{2} * Emission reductions{1} * Ownership type{0} * Economic performance{1}
27) Waste heat recovery-0855, 37) Biomass residue-1568
Prime implicant 6b: corresponds to 3 cases
Project category{0} * Emission reductions{2} * Ownership type{1} * Economic performance{0}
41) Gas utilization/fugitive-2029, 48) Gas gathering & utilization-2422, 57) Recovery and marketing of gas-3740
Prime implicant 7b: corresponds to 3 cases
Project category{1} * Emission reductions{0} * Ownership type{1} * Economic performance{1}
46) Grid-connected SHP/hydro-2729, 59) Wind power project-3792, 82) Solar power-5379
Prime implicant 8b: corresponds to 1 case
Project category{0} * Emission reductions{1} * Ownership type{1} * Economic performance{1}
51) Gas recovery & utilization-3208
Prime implicant 9b: corresponds to 20 cases
Project category{1} * Emission reductions{1} * Ownership type{1} * Economic performance{1}

52) Wind farm phase IV-3287, 53) Wind farm phase III-3264, 54) Wind power phase II-3167,
55) Wind power-3679, 56) Wind power phase II-3253, 58) Windfarm stage I-3371,
60) Wind power project-3134, 61) Wind power project-3282, 64) Wind power project-3800,
66) Wind power-4001, 67) Wind park-3919, 68) Wind power-4038, 69) Wind power-4035,
70) Wind power-4369, 72) Wind power-4381, 73) Windfarm project-4405, 74) Wind power-4124,
77) Wind farm Phase II-4222, 78) Wind power phase V-4689, 85) Wind farm phase III-7515

Model II, where the condition *Project scale* has been omitted, presents a more parsimonious solution than the first model. As it has four conditions instead of five, fewer configurations in the truth table corresponding to more cases resulted in fewer and more reduced prime implicants. The model also consists of less individualized explanations where one prime implicant explains only one project. This implies that a larger number of projects can be explained by the same prime implicant of factored terms. In addition, there are fewer factored terms in the prime implicants of the second model, with three or four terms in each prime implicant. Both outcomes are explained by nine prime implicants each, and for the negative outcome there are no concurrent explanations for any of the cases, while there were two in the first model. For the positive outcome, there are still several concurrent explanations, but fewer than in the first model. As in *Model I*, more reduction of the factored terms has been achieved in the prime implicants for the positive outcome than for the negative outcome. Most of the prime implicants for the positive outcome could be reduced into a conjunction of three factored terms, while for the negative outcome only one prime implicant could be reduced to a conjunction of three factored terms. In the rest of the prime implicants for the negative outcome, no reduction of conditions could be achieved, but more cases could be explained by the same prime implicants as a result of excluding *Project scale* as a condition.

A risk relating to reducing the complexity of the model by omitting one of the conditions is the occurrence of more contradictory configurations (Schneider and Wagemann 2012: 120-121). In this case, no other contradictory configuration has emerged as a result of dropping one of the explanatory conditions. One case was added to the second contradictory configuration, namely case number 42, which is a small scale gas reduction project, and which otherwise has the same conjunction of conditions as the other two projects (number 23 and number 45) in this configuration. The absence of more contradictory configurations may again suggest that *Project Scale* is a variable irrelevant for explaining the outcome. If a relevant variable were omitted from the model, it would be likely that more contradictory configurations would appear. This could be the result of more cases lacking a relevant condition which could differentiate their causal combinations in the configurations. In sum, when comparing the solutions of the two models, the same overall picture emerges, although a clearer pattern for *Emission reductions* appears which may strengthen the suggested relationship between this condition and the outcomes. At the same time, *the second solution* points to some additional insights in the causal relationship between the conditions.

When studying the concurrent explanations represented in the prime implicants for the positive outcome, they strengthen the relationship between *Ownership type* and *Economic performance* found in *Model I*. Three concurrent explanations are found in *Model II*, and they are found in prime implicants *1a*-*5a* for the positive outcome. In two of the concurrent explanations, the projects can be explained without *Economic performance* while *Ownership type* is a part of both explanations. The projects number 9, 25 and 79 are present in prime implicant *1a* and *3a*. They are explained with the inclusion of *Economic performance{1}* in *1a*, while *Ownership type{2}* is present in both prime implicants. The same goes for the concurrent explanations in *4a* and *5a*, where the projects number 19, 22, 47 and 62 have *Ownership type{2}* as a part of both explanations, but *Economic performance{0}* only in *4a*. For project number 20, however, the conjunction *Ownership type{2}*Economic performance{0}* is present in both its explanations in *2a* and *4a*. It is also noticeable that *Ownership type* is present in all the prime implicants for both outcomes, like it was in *Model I*, while *Economic performance* is absent in *3a*, *5a* and *6a*. This could again strengthen the claim for *Ownership type* constituting the condition most relevant for explaining the outcomes, while at the same time being interrelated with *Economic performance*.

Another insight from the concurrent explanations is that *Project category* is a condition which is absent in one of each concurrent explanations for each group of cases. For the cases number 9, 25 and 79, *Project category{2}* is present in *3a* but absent in *1a*. For project number 20, *Project category{0}* is present in *2a* but absent in *4a*. For the third concurrent explanation, *Project category{1}* is present 5a and absent in 4a for explaining the projects number 19, 22, 47 and 62. As such, by studying the concurrent explanations it is observable that *Project category* is a condition which is not a necessary part in each of the explanations for the projects with concurrent explanations. In addition, each of the three concurrent explanations contains a different value of *Project category,* implying that each of the three different project categories could be factored out in a set of concurrent explanations.

Lastly, *Emission reductions* is absent in one prime implicant in the second model, namely *2a*, which also represents a concurrent explanation for project number 20. In *4a* which also represents this project, *Emission reductions{1}* is present. Otherwise, *Emission reductions* is always present in the prime implicants in the model. When considering the distribution for *Emission reductions* for both outcomes, a clearer pattern than was observed in the first model emerges, as the values for *Emission reductions* are more divided between the two outcomes in the second model. *Emission reductions{0}* is present in four of the nine prime implicants for the positive outcome and in three for the negative outcome. *Emission reductions{1}* appears three times for both outcomes, and *Emission reductions{2}* appears in three prime implicants for the negative outcome compared to one for the positive outcome. As such, *hypothesis 3* seems strengthened, claiming that when emission reductions generated from a project increases, the probability for producing the negative outcome increases, and vice versa.

In addition, the three prime implicants *2b*, *3b* and *6b* for the negative outcome containing *Emission reductions{2}* are all representing gas reduction projects. These prime implicants therefore contain the conjunction *Project category{0}*Emission reductions{2}* as a part of their expressions. For the positive outcome, the prime implicant *8a* represent renewable projects with high emission reductions, represented by the conjunction *Project category{1}*Emission reductions{2}*. This finding is in accordance with the initial assumptions about the relation between the project types and the outcomes stated in *hypothesis 1a, 1b* and the combinatorial *hypothesis 1d,* with some modification. *Hypothesis 1d* stated that the presence of large scale gas reduction projects with high emission reductions is sufficient to produce the negative outcome. Prime implicant *2b* is corresponding to one small scale project, while *3b* and *6b* are corresponding to large scale projects. As such, *Project scale* does not appear relevant for the outcome to occur for these configurations, although most gas reduction projects with high emission reductions are large scale projects. The conjunction *Project category{0}*Emission reductions{2}* therefore represents a sufficient condition for the negative outcome to occur in this analysis. *Hypothesis 1a* also states that *Project category{1}* is the project category most associated to the positive outcome. It is therefore interesting that in the only prime implicant for the positive outcome containing *Emission reductions{2}* it is in conjunction with *Project category {1},* signified by *Project category{1}*Emission reductions{2}*. This is prime implicant *8a* which correspond to two hydro power projects. As stated, this subtype of *Project category{1}* seems to be more often associated to the positive outcome than the other subtype wind power.

Moreover, all the four prime implicants including *Emission reductions{2}* are combined with all three categories of *Ownership type*. The three prime implicants *2b*, *3b* and *6b* for the negative outcome containing *Emission reductions{2}* are found in conjunction with one of each of the values for *Ownership type*. Also both values of *Economic performance* are present among these three prime implicants. In *8a* for the positive outcome, the conjunction *Ownership type{0}*Economic performance{1}* is present for the conditions of *the project participants*. As this particular conjunction is otherwise related to the negative outcome in *1b*, *2b* and *5b*, it seems less probable that it is the combination of *the project participants* that has been decisive for the outcome to occur for the cases in prime implicant *8a*. Overall, these findings may suggest that the ownership type matters less for the projects with the highest emission reductions.

When considering the relevance of *Project category* in *Model II*, the distribution of the values on this condition has changed, giving a slightly different picture from that in *Model I*. Although most of the renewable projects belonging to *Project category{1}* are negative cases, most prime implicants including this condition belong to the positive outcome. Five of nine prime implicants for the positive outcome include *Project category{1}* and three of nine for the negative outcome. This finding might therefore strengthen *hypothesis 1a*, claiming the renewable projects are the ones the most associated to the positive outcome. This relationship was present but weaker in *Model I*. In addition, three of the five prime implicants for the positive outcome include *Ownership type{0}*, which are *6a*, *8a* and *9a.* For the negative outcome, two of the three prime implicants including Project *category{1}* also includes *Ownership type{1}*, which again strengthens the claim for *Ownership type* representing the most decisive condition for the outcome. The outcome for energy efficiency projects in *Project category{2}* are divided equally, as one prime implicant for each of the outcomes includes this value of the condition, namely *3a* and *5b*. As such, *hypothesis 1c*, which claims the energy efficiency projects are the least associated to the positive outcome, can neither become strengthened nor weakened. *Project category{0}* is represented in one of the prime implicants for the positive outcome, namely *2a*. In this prime implicant *Emission reductions* is not a part of the explanation. For the negative outcome, three of the prime implicants containing *Project category{0}* are combined with *Emission reductions{2},* as mentioned, and the fourth, *8b*, is combined with *Emission reductions{1}. Hypothesis 1b* therefore seems strengthened, as it claimed that gas reduction projects are the second most associated to the positive outcome, unless they are large scale gas reduction projects with high emission reductions, as stated in the combinatorial *hypothesis 1d*.

As for *Model I*, the results for *Ownership type{0}* was more varied than for the other values of *Ownership type*. In *Model II*, *Ownership type{0}* is appearing in three prime implicants for both outcomes, namely, *6a*, *8a*, *9a* and *1b*, *2b* and *5b*. Unilateral ownership therefore seems to be associated to the positive outcome more often than in the first model, and the findings support *hypothesis 5a*, claiming that unilateral projects are the second most associated to the positive outcome.

Summary of findings for Model II

Model II, the reduced model, had four conditions. Nine prime implicants were derived for each of the outcomes. In total, this model provided a more parsimonious solution than *Model I*, the complete model, as the relevance of the two remaining *project design* conditions appeared to be stronger and more in accordance with the theoretical expectations. The patterns found for the three categories of *Project category* were clearer than for the complete model, although this condition was redundant in several concurrent explanations. *Emission reductions* also seemed to be relevant for the outcome, especially when the emission reductions were high. The relevance of *the project participants* still appeared to be the strongest among the conditions, and the relationship between *Ownership type* and *Economic performance* seemed strengthened. *Ownership type* still appears to be most decisive for the outcome, although the presence of a unilateral ownership produces more varied results than the other types of ownership. Lastly, no additional contradictory configurations emerged. Only one project was added to one of the existing contradictory configurations. That no other contradictory configurations emerged supports the finding of *Project scale* being irrelevant for explaining the outcome.

5.3. Illustrative contexts for two CDM sectors

After having completed the interpretation of the QCA models, it can be valuable to return to the cases in order to demonstrate how the existing theory applies to them. This sort of investigation can also be used to formulate new theoretical assumptions for further research (Rihoux and Lobe 2009: 225). In this section, the contexts of two CDM sectors will be described in order to illustrate and clarify how the outcome varies under these settings.

Specific cases from the analysis will be investigated closely in order to explain their outcomes. Lastly, this section will be used to highlight findings of the analysis that are explained by factors outside the QCA models. The analysis pointed to the specific host countries as being of relevance for the outcome, but this variation between the countries could not be explained by the QCA model. These country specific findings will be discussed, and used to point out possible implications for further research.

5.3.1 Large scale gas reduction projects: the most efficient emission reducers

Elimination of gas flaring in Nigeria and Iran

Projects number 41, 48 and 57 represent two Nigerian and one Iranian project. The elimination of gas flaring from oil wells is the project activity of these projects. Furthermore, these projects are characterized by being large scale gas reduction projects with high emission reductions. In addition, these projects represent three of the four CDM projects in the sample situated in host countries with low economic performance but which have a bilateral ownership type. The Norwegian private company Carbon Limits AS is the only foreign actor involved in the three projects (UNFCCC 2008: 3) These three projects which all have high emission reductions from the reduction of gases, might represent projects which due to high profitability are able to attract a foreign project partner in a risky investment climate. If the mitigation potential of greenhouse gases is large, the amount of CER-credits to be sold increases, which again increases the expected profitability of the project. Both Nigeria and Iran were classified as very unattractive countries for CDM investment by Jung (2006: 2183) However, Jung (2006: 2174) included the emission reduction potential in a host country as one of the main indicators for determining the investment attractiveness of a CDM host country. Although these countries might not have the potential for attracting many CDM investors overall, these particular projects evidently have a large emission reductions potential which may render the expected profitability of the projects as high. For instance, in project number 41, the process of developing this project took more time than expected, because terrorist activities hindered the transportation of the oil from the oil field to the market. This situation led to a closing of the oil field for two years, a situation which caused great financial difficulty for the project (UNFCCC 2008: 2) This incidence might reflect potential risks of making investments in the Nigerian petroleum industry. The potential for high emission reductions might, however, have been decisive for making the decision of investing in this project. Due to a specific technology, the emission reductions from the flaring of gas were reduced effectively. These projects had little potential for contributing to sustainable development, as the projects did not bring many benefits to the local population.

The HFC-projects

The HFC- gas is a strong greenhouse gas, and therefore, the reduction of the gas has been one of the most effective methods of reducing emissions among the CDM projects. This project type has been found to be the most efficient emission reducer and the weakest sustainability achiever in the CDM (Alexeew et al. 2010, Olsen and Fenhann 2008, Sutter and Parreño 2007). Because The HFC-gas could be reduced so effectively, the reduction of the gas became more profitable than the production of the gas itself. The reduction of the gas generated so high amounts of CER-credits that it created incentives for producing larger amounts of the gas. This led to a scenario where more gas was produced in order to make reductions of it later. After this relationship was discovered, measures were taken in order to regulate this industry (Haya 2009: 23). In the sample of this analysis, there are two HFC-projects (number 15 and 17). These projects have the highest emission reductions among the projects in the sample and they both have the negative outcome. These projects are also both multilateral projects situated in China. As elaborated in the first section of this chapter, they represent two of the three projects in the sample which have a multilateral ownership but also a negative outcome.

5.3.2 The CDM renewable sector in country specific contexts

As observed in the frequency distribution from the first part of the chapter, the majority of the renewable projects in the sample has been classified with the negative outcome. Most of the renewable projects are wind power and hydro power projects, which are the project types found to generally bring the highest sustainability benefits in the research literature (see Alexeew et al. 2010, Olsen and Fenhann 2008, Sutter and Parreño 2007, Watson and Fankhauser 2009). In the sample of this analysis however, most of the renewable projects were found to have the negative outcome, and were also found to most often have a bilateral or unilateral ownership type in host countries with high economic performance. Additionally, these projects were most often situated in China and in India. One of the main problems related to the CDM as a mechanism for reducing emissions globally, is the difficulty of assessing additionality, which implies that the emission reductions from the project can be counted as real reductions. In short, a project is considered to be additional if the project activity could not be implemented without being a part of the CDM. Basically, if a project is not dependent upon CDM investment or the sales of CER–quotas, the project activity must be considered as a business-as-usual project, and not an additional project (Haya 2009: 4-5). The principle of additionality must be achieved in order to be eligible for selling quotas which can compensate for emissions taking place in other countries. A project included in the CDM should therefore not be a profitable business on its own. However, many CDM projects have been estimated to be non-additional by Haya (2009), who investigated the additionality of 70 large scale projects in India which were of the types hydro, wind and biomass. In addition, 20 Chinese hydro projects were investigated. The majority of the projects were found not to be additional. India and China are fast growing economies where the need for new energy sources is pressing. This situation in turn reduces the likelihood for these projects to be additional. When the demand for energy is increasing, the costs of investing in new energy industries usually decrease. Haya (2009) claims that many project developers see the funding availabilities of the CDM as a source for increasing the profitability instead of a way to make an energy enterprise profitable. This seems to be emphasized by the fact that many project developers do not apply for validation in the CDM until after the construction of the project has started (Haya 2009: 17-20). The timing of the request for validation does therefore not support the claim of the project developers to need additional funding. China and India are the host countries receiving the most investments in CDM, and the renewable energy sectors in both countries are expanding. In India, renewable energy is especially promoted by the government, in order to strengthen the energy security (Haya 2009: 13, 20). In this analysis, both China and India belong to the group of countries with high economic performance, and together they host most of the unilateral and bilateral projects of the sample of this analysis.

The low achievement for sustainability contributions in the renewable projects in China and India might mean that more of these projects are oriented towards a business as usual activity, and therefore have lower probability of being additional. Alexeew et al. (2010) investigated the relationship between additionality and sustainability in forty Indian projects, and found that the projects with the highest sustainability benefits were the least likely to be additional. As the hydro and wind projects were found to have the highest sustainability benefits among the projects in their sample, they were also the projects the least likely to be additional. The fact that these projects were of lower probability of being additional is in accordance with the findings of Haya (2009), who found that the majority Indian renewable projects were non-additional. In the sample for this analysis, most of the Indian renewable projects have the negative outcome. In contrast, many of the renewable projects with a positive outcome in this sample are found in Latin America.

The renewable projects in Latin America are more often associated to the positive outcome, although the other project characteristics often resemble the characteristics of many of the renewable projects with the negative outcome in China and India. As an example, project number 43, which is a Brazilian hydro power project, has medium emission reductions and a unilateral ownership. Brazil is also a country of high economic performance, and also one of the host countries receiving most CDM investment. However, it is common for projects in Brazil to operate Corporate Social Responsibility (CSR) programmes (Olsen and Fenhann 2008: 2829). This specific Brazilian project could be said to incorporate a CSR strategy, as it was especially concerned with providing social benefits for the local population. Facilities for providing social services such as health assistance were provided to workers and sometimes to the entire community. Educational programs focusing upon environmental concerns were also provided for by the project activity (UNFCCC 2007: 35-36). In addition, there are three other unilateral renewable projects situated Latin America in the sample (number 11, 63 and 74) which are all Chilean. As the Brazilian example, these projects also had the positive outcome. They did not have CSR-activities like the Brazilian example, but nevertheless they were contributing substantially to sustainability, unlike the Indian unilateral projects. All the unilateral Indian projects gave unsubstantial contributions to sustainability, whichever the project category. Hence, the unilateral projects in Latin-American countries seem to better enhance the claim for sustainability than the Indian unilateral projects.

This finding therefore illustrates that national priorities for the CDM may constitute an important factor for the sustainability objective and that the national priorities might have good opportunities to be incorporated in the unilateral ownership model.

Chapter 6: Conclusion

The main rationale for this thesis was to be able to explain the variations of sustainability contributions in CDM projects. As earlier research conducted on the sustainability objective of the CDM has shown, the contributions to sustainability in the unique projects vary considerably, and in total, the CDM provides fewer contributions to sustainable development than it was initially supposed to. The findings of this thesis support the claim that the CDM sustainability objective is given less priority than the other objective of reducing greenhouse gas emissions effectively. Less than half of the 83 projects in the sample were classified as substantial contributors to sustainable development. Optimally, each single project should fulfil the sustainability objective, and therefore this sample's share of substantially contributing projects could be considered to be a low share of projects satisfying the objective of sustainability. In this thesis, characteristics relating to the participants of the CDM projects were found to be most decisive for sustainable development contributions.

For explaining variation, QCA has shown to be a suitable research tool. The variables are seen in combinations, and patterns can be found for the interactions of variables which may have an effect on the outcome. In the research of assessing the sustainability benefits in the CDM, possible interaction effects had not been investigated systematically, and it was therefore useful to explore the interactions of variables that could be of relevance for the outcome.

QCA is also a method apt for both theory testing as well as for exploratory purposes. Another rationale of the analysis was to compare the relevance of the conditions of *the project design* and of *the project participants*. The five conditions was divided into type I and type II variables, where the type I variables represented the characteristics of *the projects design* and the type II variables represented characteristics of *the project participants*. As more research is conducted on the specific effects of *the project design* on the contributions to sustainable development, these variables are included more for the purpose of theory testing than the two *project participants* conditions. The specific influence of the project participants on the sustainability contributions that their projects provide have been under less scrutiny in the research of the CDM. *The project participants* were therefore included in the analysis of a more exploratory purpose. Hypotheses for all the five conditions were formulated, as well as one hypothesis about the combinatorial effect of a particular conjunction of conditions. The combinatorial hypothesis was suitable for direct hypothesis testing, because it stated the expected outcome of a particular combination of variables. The other hypotheses described assumptions about how the presence of conditions were expected to relate to the outcome, and could therefore not be tested directly in order to give a transparent answer. They were, however, formulated in order to guide the analysis of the prime implicants, in seeking patterns of relevance for the outcomes based on theoretical assumptions.

QCA as a research method cannot unravel the causal mechanisms which produce an outcome, and it can neither determine the explanatory power of the conditions on the outcome. The method is mainly a tool for investigating under which conditions the outcome of interest can occur. Further implications of the results can be assumed by the researcher (De Meur, Rihoux and Yamasaki 2009: 159-160). Consequently, the use of theoretical and empirical knowledge is decisive for interpreting the results and making inferences about causality.

The analysis was conducted in two parts, and the results from the analysis of the first *complete model* were used to specify a new *reduced model*. The solutions from the complete and the reduced models could then be compared in order to bring more clarity to the results. The overall results of the two models were in accordance, and the reduced model succeeded in bringing more parsimony and clarity to the results. *The project participants* were found to be more relevant for explaining the outcomes than *the project design*.

The three *project design* conditions consisted of the *Project category*, *Project Scale* and *Emission reductions*. One of these conditions, namely *Project scale*, was found to be redundant for explaining the outcomes. The project scale and the amount of emission reductions that a project generates seems to be interrelated to some degree, as small scale projects tend to have low emission reductions while large scale projects tend to have higher emission reductions. In the analysis, it appeared that the amount of emission reductions was relevant for explaining the outcome, but that the project scale was not. Why the amount of emission reductions is a more plausible explanatory factor for sustainability contributions than the scale of project can possibly relate to the fact that the scope for cheap emission reductions is a decisive factor for investment in the CDM (see Jung 2006). The ability to reduce large quantities of emission effectively with low costs increases the profitability and therefore makes a project more attractive to investors. As such, it might be that such projects attract investors who are more concerned about profitability than sustainability. In addition, the characteristics of the project activity and the technology used in these projects seem not to provide many contributions to sustainability on its own.

Another element relevant for the characteristic of the project design was discovered when considering the implication of the subtypes of project categories. The operationalization of this condition referred to broad categories which represented several subtypes of projects. The broad categories probably did not capture all the relevant differences between the subtypes, which was noticeably when observing the patterns found between the hydro- and wind projects, which constituted two subtypes of renewable projects. In sum, this study supports the claim that there are substantial differences between the project types which affect the contributions to sustainability that the project provides. The different natures of the project types seem to incorporate different potentials for providing sustainability benefits.

A rationale for the analysis was to compare the relevance of the conditions of *project design* and *the project participants*. Interestingly, the two conditions of the project participants, *Ownership type* and *Economic performance*, seem to constitute stronger determinants for the outcome than *the project design*. In addition, the relationship between the two conditions *Ownership type* and *Economic performance* appears to be interrelated. It is plausible that the economic performance of the host country affects the kind of ownership type project in the host country can attain. Moreover, the ownership type of the CDM project seems to be the most decisive for determining the sustainability contributions that a project generates. A good overall economic performance seems to increase the probability for a project to attain foreign bilateral investment. It also increases the chance of the country to attain unilateral investment, as a country seem to need a higher level of economic performance in order to attract national investors which are capable of developing a project by providing the financial means, but also the needed expertise (see Michealowa 2007). Developing a CDM project is a business related to considerable financial risk as the process of developing and verifying the project is time consuming and could lead to rejection at the end of the verification process. The projects situated in countries with higher economic performance less often had multilateral ownership, although these projects should be attractive also for this type of ownership. However, the projects with multilateral ownership were most often found in the countries with low economic performance. As elaborated, several multilateral funds have been established in order to provide developing countries otherwise not able to attract CDM investment with funding. These countries are often the least developed countries, and the multilateral funds are established with a special attention to the development aspects of the CDM with benefits for sustainability (Freestone and Streck 2005: 22-23). Among the multilateral projects in the sample, some funds set specific criteria for sustainability, and especially for the social dimension. This was found to be in accordance with the findings of Nussbaumer (2009), who found that the projects of multilateral initiative programs contributed more to the social dimension of sustainability than other projects. In this study, contributions for the social dimension was most often found to be absent among the projects with unsubstantial contribution to sustainable development, and this might reflect that it demands more planning and action from the project developers in order to comply with the criteria on this dimension. The environmental and the economic dimensions seem easier to fulfill because the nature of the project activity in itself more often complies with these dimensions. For instance, many projects could provide job opportunities and improve the utilization of natural rescores for their surrounding area, which would contribute to the economic and the environmental dimension of sustainable development. The multilateral ownership seem more often to pay special attention to development goals, while the bilateral and the unilateral projects may more often have a business as usual profile. As the financing of a project is associated with considerable risk, special attention to sustainability benefits could raise the cost of the project activity. Interestingly, projects with multilateral ownership also more often produced the positive outcome for projects in countries with high economic performance. As such, the multilateral funds involved in these countries also seem to have more focus on the projects' contributions to sustainability.

However, although the type II variables relate to characteristics about the project participants, they do not incorporate country specific effects. The specific CDM host countries are entitled to make their own claims and prioritizations for sustainable development in the CDM. As elaborated in the analysis, country specific contexts might also count for central aspects in explaining the outcome. This became apparent especially when looking at the outcomes for the unilateral ownership type. With this ownership type, only actors from the host country participate in the project. Unilateral projects might therefore to a larger extent incorporate the national policies for sustainable development than the other ownership types where foreign actors are represented. This was exemplified by that the unilateral projects in the Latin American countries Brazil and Chile tended to make substantial contributions to sustainable development while the Chinese and the Indian unilateral projects tended to make unsubstantial contributions. However, how national policies are incorporated in the CDM projects should be investigated in future research, as well as how other country specific contexts affect the measures taken towards sustainability. As country specific contexts for the CDM host countries appear to affect the contributions to sustainable development, more research on the national aspects, such as national policies for sustainable development may matter for achieving the desired outcome.

Nevertheless, the ownership type of a project is found to constitute the most relevant condition for deciding the outcome for contributions to sustainability overall. However, this seems to be because it is the characteristics of the host country which is decisive for which ownership type the country can attain. Countries with higher economic performance usually attain other ownership types than the countries with low economic performance. Lastly, that it is the ownership type which is found to be the most decisive condition for reaching sustainability contributions may seem plausible, as it is the owners of the projects who develop a project and make the decisions about how to comply with the contributions to sustainability. If the profitability of the project is the main concern, additional actions for making contributions to sustainability might be given less priority. In such a situation, only the easiest measures towards sustainability which might suffice for being approved would be made. This finding might also emphasize the need for specific standards for fulfilling the objective for sustainable development in the CDM.

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Appendix

The data source for each unit of analysis is available from the United Nations Framework Convention on Climate Change (UNFCCC) *Project Search*: https://cdm.unfccc.int/Projects/projsearch.html. The reference number of each unit gives direct access to the 'Project Design Document' (PDD) of each CDM project used as a unit of analysis.

Table A-1: List of units of analysis with reference numbers

Unit number	Project name	Reference number
1	Hydroelectric	0099
2	Hydropower	0088
3	Biogas support program	0136
4	Biogas support program	0139
5	Landfill gas recorvery	0140
6	Biomass heating	0160
7	Biomass heating	0159
8	Energy c/GHG red	0173
9	Bagasse cogeneration	0181
10	Hydropower	0251
11	Hydroelectric	0248
12	Windpower	0194
13	Methane avoidance	0268
14	Mini hydel/hydro	0312
15	HFC-23	0011
16	Waste heat recovery	0433
17	HFC-23	0306
18	Hydropower	0378
19	Wind	0453
20	Alternative fuels	0493
21	21) Blended sement-0526	0526
22	Hydroelectric	0606
23	Landfill gas to electricity	0545
24	Hydro/electrification	0755
25	Bricks -blocks	0707
26	Biomass-renewable	0697
27	Waste heat recovery	0855
28	Hydropower	0904
29	Wind farm	0992
30	Renewable energy/hydro	0943
31	Methane capture	0945
32	Bundled wind power	1021
33	Hydroelectric power	1052

(The table is to be continued on the next page)

Unit number	Project name	Reference number
34	Hydroelectric power	0809
35	Mitigation of Methane	1051
36	Methane avoidance/waste manag.	1547
37	Biomass residue	1568
38	Bagasse cogeneration	1458
39	Biomass renewable	2115
40	Soil conservation	1948
41	Gas utilization/fugitive	2029
42	Eco-farming biogas	2221
43	Landfill gas capture	2338
44	Coal mine generation	1896
45	Animal manure	1891
46	Grid-connected SHP/hydro	2729
47	Renewable energy/minihydro	1713
48	Gas gathering & utilization	2422
49	Gas company fuel switch	3048
50	Electrogaz lamp dstribution	3404
51	Gas recovery & utilization	3208
51	Wind farm phase IV	3287
53	Wind farm phase III	3262
54	Wind power phase II	3167
55	Wind power	3679
56	Wind power phase II	3253
57	Recovery and marketing of gas	3740
58	Windfarm stage I	3371
59	Wind power project	3792
60	Wind power project	3134
61	Wind power project	3282
62	Geothermal Expansion	3773
63	Wind farm project	3253
64	Wind power project	3800
65	Solid waste composting	3841
66	Wind power	4001
67	Wind park	3919
68	Wind power	4038
69	Wind power	4035
70	Wind power	4369
71	Reduction of GHGs/hydro	4229
72	Wind power	4381
73	Windfarm project	4405
74	Wind power	4124
75	Hydro electrical power plant	4546

(The table is to be continued on the next page)

Unit number	Project name	Reference number
76	Hydro electrical power plant	4547
77	Wind farm Phase II	4222
78	Wind power phase V	4689
79	79) Brick & block project-4585	4585
80	Kiln efficiency/brick industry	5125
81	Wind farm	5029
82	Solar power	5379
83	Biogas support program	5416
84	84) Biogas support program-5415	5415
85	Wind farm phase III	7515