Company's Competitiveness Enhancement for Thai Agribusiness through the Clean Development Mechanism (CDM) under the Kyoto Protocol

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Abstract

Ratification of the Kyoto Protocol allows Thailand to voluntarily participate in the Clean Development Mechanism (CDM). CDM not only promotes environmental integrity but also offers business sustainability, which will then be able to enhance a company's competiveness. Following enthusiastic reception, the number of CDM registered projects in Thailand has increased from 5 to 40 projects between 2005 and 2010. Several business sectors in Thailand have been moving their positions toward CDM including the agribusiness sectors of sugar, tapioca, rice, agrofuel, livestock and forestry. This study carries out an in-depth analysis on the correlations between CDM and agribusinesses in Thailand through a competitiveness indicator with a view to affirm that the level of competitiveness in Thailand agribusinesses can be enhanced through the CDM scheme. Productivity improvements in terms of technological and financial factors before and after the CDM application serve as competiveness indicators. The study concludes that CDM guidelines offer opportunities for companies to move toward better technology with better operational performance and greenhouse gas reduction. The improvement of productivity level is found through an anticipated revenue stream from carbon credits which resulted in a project rate of return well above a company's hurdle rate of approximately 10-16% for 4 types of agribusinesses, i.e. palm oil, rice mill, ethanol and tapioca. Despite the abovementioned benefits, CDM still faces a lot of challenges including a requirement for a substantial amount of investment required for starting the CDM process, risk of local and international approvals, deliverable risk, and uncertainty on CDM processing time and the future of CDM after the first commitment period, 2012. These challenges, however, can be overcome by well-disciplined preparation and better understanding of CDM processes and requirements.

Keywords: Thailand, Agribusiness, CDM, Competitiveness

1. Introduction

As a result of the dynamic economic changes around the world which have led to a sustained period of growth in Thailand's economy, a robust, strategically working plan emphasising enhanced levels of competition to tackle these changes is required. One of Thailand competitiveness agenda needs proposed by Michael E. Porter is the necessity for transformation of a company's strategies, particularly on its strategy to increase productivity, which can affect the real wealth of the company (Porter, 2003). When such a recommendation is combined with the changing world environment, opportunities and challenges for productivity enhancement have gradually emerged from global responses to the global climate change issues. This is because there has been a continuous and urgent call for a global treaty to address the challenge since the IPCC's first scientific report came out in 1990, stating the serious threats that climate change represents (IPCC, 1990). Reports such as the IPCC Fourth Assessment Report clearly illustrated scientific evidences of the global climate change in addition to several scenarios on future climate. All scenarios led to the same conclusion: that the global mean temperature is likely to increase in the range of 1.1-6.4 degrees Celsius, depending on assumptions of economic growth and technological development (IPCC, 2007). Hence, global communities increasingly call for more ambitious mitigation targets. A deeper cut of the world carbon dioxide concentration to 440-495 ppm in the atmosphere has been accepted by both developed and developing countries in the Kyoto Protocol to keep the average global temperature under the two degree threshold by 2020 (EU, 2009; UNFCCC, 2009). Moreover, countries of the Alliance of Small Island States (AOSIS) are campaigning for a far more ambitious target of 1.5 º C (AOSIS, 2008).

Ratification of the Kyoto Protocol in 2002 allows Thailand to voluntarily participate in the Clean Development Mechanism (CDM) as identified in Article 12. Such participation assists parties not included in Annex I, like Thailand, in achieving sustainable development and in contributing to the ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC), to prevent ultimate devastation from climate change; and assists parties included in Annex I, developed countries mostly, in achieving compliance with their quantified emission limitation and reduction commitments under Article 3 (UNFCCC, 1998). Global awareness has financially converted carbon from a valueless hazard to a remaining hazardous, but valuable, economic commodity. A concerted effort to reduce greenhouse gas emissions has also led to the development of a carbon trading scheme which lies at the centre of global climate policy. This carbon trading scheme is projected to become one of the world's largest commodities markets. The value of the primary Certified Emission Reductions (CERs) market in 2009 was 2,678 million US dollars, representing approximately 80% of project-based transaction (Kossoy and Ambrosi, 2010).

Green industrial agricultural practices which have been playing an important role in both mitigation (that is, measures to deal with the causes of climate change) and adaptation contexts (that is, measures to tackle its effects) are being strongly promoted. This attribution paves the way for agribusinesses to enter the playing field of CDM which provides considerable opportunities for Annex I countries to buy CERs to meet their emission caps. In return, the revenue stream from CERs is reverted back to the project developer in the host country (Non-Annex 1) which could enhance the level of company competitiveness. Thailand is well endowed with favorable conditions which allow agricultural activities to flourish. Agriculture, together with the food and tobacco industries, contribute approximately 14.1% of the total country GDP (NESDB, 2010). With a significant share of Thai GDP, it can be assumed that the level of GHG emission being released from these industries is relatively high compared to other industiral sectors. Supplementing the nature of Thailand's agricultural business and its operational approach with the expected high levels of GHG being released, it can be presumed that the contribution of Thailand's agricultural businesses in CDM opportunities is likely to be considerable. In reality, it is found that the majority of the proposed CDM projects in Thailand are related to agribusinesses such as sugar mills, rice mills, tapioca factories, palm oil refineries, agrofuels and livestock which is alined with the presumptions above. This study therefore aims to domonstrate evidence that a company's competitiveness is enhanced as a result of CDM implementation under the Kyoto Protocol, emphasising projects related to the agricultural industries in Thailand.

2. Methodological Approaches

The study employs the 'Systematic Reviews and Meta-analysis' techniques outlined in the Cochrane Handbook for Systematic Review of Interventions (Cochrane Collaboration, 2004) as a core methodology. These methodologies have often been selected as a core methodology in qualitatively analysing economic or policy questions. This method aims to minimise bias in the review which will then provide more accurate results compared with other approaches. The overall methodological framework is shown in figure 1.

Developing a systematic review for an assessment of a company's competitiveness enhancement for Thai agribusinesses requires a number of discrete steps as follows:

2.1 Defining an appropriate question

This study emphasises a contribution of a CDM scheme in the Thai agricultural industries to enhance their levels of competitiveness. An appropriate question, therefore, needs to be related to a CDM scheme and the level of competitiveness. The CDM process is a time-consuming and detailed process involving several parties to be interactive. The CDM project cycle is figuratively presented in figure 2. CDM requires that emission reductions be ‘additional’ in the sense that they would not have occurred if the CDM project had not existed. This requirement for reduced emissions is critical to the environmental integrity of the CDM. Company competitiveness is determined by the ‘productivity’ with which a company uses its human, capital and natural resources (Porter, 1988). The Porter’s study stated clearly that productivity of local industries is of fundamental importance to competitiveness. The key ingredients of productivity improvement are technology and innovation, in addition to macro economic infrastructure created by the government. Economically, there are two main criterion to gauge the level of competiveness, including a) the final production cost per unit and b) the internal rate of return (IRR) (FAOb, 2010). The proposed CDM activity usually is a part of existing company business or green field activities. The impact of carbon credit revenues on the total cost of production is not required. Consequently, there is no information relating to the former criteria in the PDDs or the production cost per unit. On the contrary, the latter criteria, IRR, or NPV can be found in the investment analysis which is normally stated in Section A-General description of project activity of the Project Design Document (PDD) – a core document for a CDM project. Consequently, to assess the level of competitiveness of agriculture businesses, IRR which takes the revenue stream from the CDM scheme into an account is selected. An appropiate question for this study, therefore, is “*Does the CDM scheme improve the IRR of the agriculture businesses in Thailand?*”.

2.2 Searching the literature

With the abovementioned question, the main information required for this methodological framework is the information on CDM projects in Thailand and their financial information, IRR in particular. The CDM projects information, regularly mentioned in PDD, in relation to agribusinesses in Thailand can be commonly found on the official UNFCCC’s CDM websites—both those already registered at the Executive Board and those in the pipeline (UNFCCC, 2010).

2.3 Selecting the studies for inclusion in the review

The 32 CDM projects related to Thai agribusinesses are selected in the review because they have been registered, and CDM projects which are in the pipeline or have yet to be registered have been excluded. This is because registered CDM projects have better and more proven information after being intensively reviewed by the UNFCCC executive board and its members.

2.4 Assessing and reporting the quality of included studies

Similar to above, the quality of data and information shown in the registered Project Design Documents (PDDs) is recognised as the best available because they were validated by authorised designated operation entities (DOEs) and reviewed by the CDM Executive Board (CDM EB) prior to approval of their registration.

2.5 Combing the results

Findings on financial analysis from individual PDDs are then aggregated to produce a summary and analysis in the context of company competiveness enhancement triggered by the CDM.

Meta-analysis is a statistical technique to combine the results of several studies that address a set of related research hypotheses. Meta-analysis extends beyond standard literature reviews by analysing and synthesising the results of multiple studies in a statistical manner (Nelson and Kennedy, 2008; Stanley, 2001). A meta-analysis for this study is a two-step process. The first stage is the data extraction from each PDD, with an emphasis on financial aspects of projects in the cases with and without a stream of revenue from estimated emission reductions. The second stage involves analysis of financial benefits and the CDM process in general.

3. Results

3.1 CDM Status in Thailand

In Thailand, as of November 2010, there were 123 projects, with emission reduction of approximately 7.95 million tons of carbon dioxide equivalent per year, which received a Letter of Approval (LOA) from the Thailand Greenhouse Gas Management Organisation (TGO). Further analysis reveals that 67.5% of the total projects with LoA were related to agricultural industries including tapioca, sugar, palm oil, rice and agrofuel, representing 4,701,193 credits (Figure 3).

The number of CDM registered projects in Thailand have increased dramatically from 5 to 40 projects between 2005 and 2010 (TGO, 2010). These 40 CDM projects are equivalent to 2,295,445 tons of carbon dioxide equivalent (Figure 4). Of these, 32 projects are related to agricultural businesses, including tapioca, swine farms, sugar refinery, palm oil, rice mills and ethanol and a total of 1,734,073 CERs, representing 75.5% of the total CERs from the total of registered projects. Over a hundred projects have been started but held up somewhere in the middle of the CDM process, i.e. PDD development, validation and registration.

3.2 Roles of Carbon Credit in Competitive Enhancement for Thai Agribusinesses

It is found that CDM assists firms to overcome usual technology barriers and to move toward better or the best available practices in terms of operational excellence and GHG mitigation technologies. Data extraction from the 32 Thai registered CDM projects show baselines of current practices, new technology employed under the CDM schemes and analysis on contributions of new technology to productivity improvement (Table 1). It is found that CDM policies help industries to move up the technological ladder to turn waste into new types of resources, generate new kinds of outputs and improve efficiency of the existing system.

All projects using an investment analysis are found to deliver IRR well above a company's hurdle rate, in the range of 10-16% (Table 2). Even with a lack of a completed set of financial figures on IRR for the CDM case, it can be assumed that financial returns must be over the company's benchmark or pass the technology barriers; otherwise, the additionality of the project cannot be justified. There was one tapioca project which employed a NPV technique instead of IRR. The results of the analysis led to similar conclusions as the project income before the CDM project resulted in a negative NPV of 674,288 Bath compared to the positive figure of 1,201,790 Baht after having the CDM project. The distance of the IRR figure beyond the company benchmark in the case of with-CDM-project depends upon the hypothetical assumptions on what would have happened, particularly and on perceived price of emission reduction at the time of PDD development. Assumptions on CERs price found in the PDDs were in a wide range of spectrum, 5-23 Euros per ton of carbon dioxide equivalent.

3.3 Challenges of CDM

Embedding with the revenue stream from a CDM scheme, the total cost of CDM developing process including PDD development, a request for LoA and validation is estimated to be approximately around 4-6 million Thai Baht (€100,000 – 150,000), excluding registration and LoA application fees which both depend upon the numbers of CERs. These costs could be offset by the returns from sale of carbon credits as shown in the financial analysis above. However, there is another key factor hampering the development of a CDM project—validation and registration time. Authors' analysis of time consumed from the first date of comment posted until registration date posted reveals that it was in a range of 171-1,230 days for Thai CDM agribusiness projects (Figure 5). Note that, analysis excluded PDD development and LoA application time, which normally takes approximately 6 months at the minimum.

The Author's experiences found that most CDM projects started operation prior to the completion of the registration process at the CDM EB. Hence, benefits forgone from the early years of the project implementation can be anticipated. Average CERs of 40 Thai registered agricultural industry projects was 56,902 tons carbon dioxide equivalent per year (TGO, 2010) and the 2009 Prices averaged € 9.1per ton (Kossoy and Ambrosi, 2010),opportunity cost of the delay is estimated to be €517,808 /year/project or 20.7 million baht/year/project at 40 Baht exchange rate (Bank of Thailand, 2010). However, opportunity costs could be partially compensated by participating in the voluntary scheme.

In addition to the challenges of time and costs of CDM project development, there are several risks involved, including pre-registration and post-registration risk. The former risks cover the host country's approval, CDM registration and validation risks. The latter mainly includes deliverable risks, covering challenges on project implementation, monitoring, reporting and verification.

Pre-registration risks mostly involve the third parties for approvals. Host country approval is designed to ensure that the proposed CDM projects is in compliance with sustainable development criteria of the host country which covers the aspects of environment, social, economic and technological transfer. According to a discussion with TGO, as of December 2010, 6 projects were rejected due to incomplete data and disagreement with the criteria. 5 projects resubmitted and 2 received approval. During the validation and registration process, as of July 2010, the author's ana1ysis using UNFCCC data found that 1,030 or 16.2% proposed CDM projects failed due to rejection by the CDM EB (2.4%), negative report issuance from the DOE, (2.5%) validation termination (10.6%) and project withdrawal (0.8%). More than half of the rejections by the CDM EB was from additionality issues, followed by baseline and monitoring methodology and other reasons (Resanond, 2010) (Figure 6). Post-registration activities play a crucial role. Project emission reductions must be monitored, reported and verified in agreement with the CDM rules prior to delivery to buyer(s). Non conformity will result in losing carbon credits and, hence, money. Due to all challenges mentioned above, only 2 projects from Thailand have received carbon credit certificates (TGO, 2010).

Lastly, the first commitment period of the Kyoto Protocol, 2008-2012, is approaching to the end. Increasingly, questions are raised about the future of the CDM or any other post-2012 flexible mechanism if designed as off-setting mechanisms for Annex-1 emissions. At the COP16 held in Cancun, Mexico in late 2010, a key issue still left unresolved is the future of the Kyoto Protocol post-2012, although there is clear indication that the Clean Development Mechanism (CDM), as reformed, will continue (UNFCCC, 2010).

These challenges, however, can be overcome by well-disciplined preparation and a better understanding on the CDM process and its requirements. This includes well-written documents in compliance with PDD development, a good operational practices, and monitoring, reporting and verifying (MRV) approaches employed within the proposed CDM projects.

4. Conclusion and Discussion

The rules of the Kyoto Protocol stipulate CDM activities related to agricultural businesses in Thailand, including sugar, tapioca, swine, rice, agrifuels and palm oil. CDM not only promotes environmental integrity but also offers business sustainability and enhance competiveness through productivity and financial improvement. The study concludes that CDM can enhance the level of competitiveness in agriculture businesses in Thailand. Anticipated revenue stream from carbon credits has improved financial status of the project by delivering a project's rate of return well above a company's hurdle rate of approximately 10-16% for 4 types of agribusinesses i.e. palm oil, rice mill, ethanol and tapioca. In addition, CDM offers opportunities for companies to move toward better technology with a better operational performance and greenhouse gas reduction combined. However, CDM faces a lot of challenges including transaction costs for joining the whole process, risk of local and international approvals, deliverable risks, uncertainty on CDM processing time and the decision on post-2012.

For a broader view, Thailand is setting the target towards a 'low carbon society' with a sustainable prosperity. CDM is one mechanism of alternatives for Thailand to implement, with a view to achieve its goal. Since it is found that 'additionality' is the most critical assumption for Thai agricultural industries to pass and then be able to gain the benefits from CDM scheme, the Government should not make the proposed project activity the only alternative amongst the ones considered by the project participants which are in compliance with mandatory regulations with which there is general compliance, then the proposed CDM project activity is not additional. To encourage other Thailand agricultural businesses that have yet to implement CDM projects to apply one, the government must play a critical role to adapt to, and mitigate against, climate change. Hence, adequate financial resources must be made available to facilitate the transfer of technologies for mitigation and adaptation to developing countries. Funding seems to be available for Thailand to tap in as observed from the outcome of the work of the Ad Hoc Working Group on long-term Cooperative Action under the Convention as stated in the Draft decision of the COP16. It states that there will be a commitment by developed countries is to provide "new and additional resources for mitigation, technology development and transfer, capacity building and through international institutions, approaching US $30 billion for the period 2010 – 2012", "a goal of mobilizing jointly US $100 billion dollars a year by 2020", "funding will come from a wide variety of sources, public and private, bilateral and multilateral, including alternative sources of finance" (UNFCCC, 2011).

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Table 1. Productivity enhancement through CDM

Agribusiness Type	Baseline Technology	Technology under CDM Project	Analysis of Productivity Improvement
Palm Oil	Wastewater: Baseline technology was open lagoons to treat palm oil mill effluent (POME) with uncontrolled release of methane and odour to the atmosphere. Treated wastewater is discharged to water ways. No biogas captured for further use. Power: Empty fruit bunches (EFB) was left out as waste product of palm oil milling process. Baseline was electricity from grid	Wastewater: A closed tank digester system with biogas capture and utilization using a completely stirred tank reactor (CSTR) was introduced. Treated POME was sent to the existing lagoon series Power: biomass power plant using EFB as the primary fuel for power generation was implemented.	Project has improved the wastewater treatment performance by reducing the COD load of effluent entering the open lagoons and also provided additional outputs— electricity and heat for on-site consumption and/or sell to the grid under the very small power producer (VSPP) programme. . Productivity increases through innovation on waste utilisation to create additional output—electricity to the grid under the VSPP programme.
Sugar	Power: Baseline technology was a mature cogeneration technology introduced for commercial use about 100 years ago which consists of direct combustion of biomass residues in a low-pressure boilers to generate steam that expands through a single casing turbine.	Power: State-of-the-art technology for electricity generation in the sugar industry, employing high-pressure boilers and double casing turbine was introduced. Cane leaves in the sugar cane plantations and other biomass can be used as supplementary fuels to compensate for any shortfalls in sugar cane throughput.	Promotion of a leap-frog technology and new "best practices" in sustainable sugar cane plantation management and operation is established. This technology will allow electricity to be generated all year round, irrespective of sugar mill's operation and also reduce dependence on import of chemical fertilizer as bottom ashes from the boilers will be distributed to local farmers for improving soil quality.
Tapioca	Wastewater: Baseline technology was open lagoons to treat wastewater from tapioca processing plant. No biogas captured for further use.	Wastewater: Anaerobic wastewater treatment technologies such as Upflow Anaerobic Sludge Blanket (UASB) technology and Covered In-Ground Anaerobic Reactor -CIGAR were introduced. Biogas captured was used to generate heat and electricity.	Productivity improvement is through substitution of relatively less expensive fuel, biogas, for heavy oil in the starch drying process. Additional output is generated—electricity for internal use and as another source of revenue generation through the VSPP. Treated wastewater is used in more efficient manner either by recycle or provide to nearby farmers to use as fertilizer in the fields.
Rice	Power: Rice husk was left out as waste from rice mill.	Power: Renewable energy using rice husk was introduced. The project employed 3 main pieces of equipment: 1) a combustion system to generate thermal energy from the rice husk; 2) a boiler to generate steam from the thermal energy released in the combustion system; and 3) a steam turbine generator to generate electricity by extracting energy from the steam produced in the boiler.	Productivity is increased through technology innovation which makes use of waste from rice mill to generate electricity, creating additional revenue. CDM project employed high efficiency equipment, low maintenance and capable of long operating hours through technology transfer from suppliers in Annex I countries such as Germany and Japan.
Swine	Wastewater: Open lagoons system was developed for treatment of flushing effluent from swine farms. When the wastewater quality has met regulatory standards, it was then reused for flushing the barns. No biogas captured for further use	Wastewater: The application of prevailing technology on high rate continuous flow anaerobic wastewater reactors to treat 100% of the barn flushing wastewaters was introduced.	Productivity is increased through an introduction of the new technology which has higher efficiency in wastewater treatment than open lagoons and provides additional benefits such as electricity generation.
Ethanol	Wastewater: Wastewater from the ethanol factory was treated in a series of open lagoons. No biogas captured for further use.	Wastewater: Wastewater was treated in an anaerobic processing system (Digester).	New technology provides opportunity to utilise captured biogas, renewable energy, to be combusted in a gas engine to produce electricity for on-site consumption and/or sell to the grid under the VSPP programme.

Source: UNFCCC (2010). Retrieved on 25 November 2010. Author's analysis

Table 2. Financial returns of Thai agribusiness registered CDM projects

#	Agri-business type	CDM Project Name	CERs	IRR(%) W/O CERs	IRR(%) With CERs	Benchmark (%)	Estimated CER Price (Euro)
1	Palm Oil	Chumporn applied biogas technology for advanced waste water management	23,448	6.1	17	14.95	5.00
2	Palm Oil	TBEC Tha Chang Biogas Project	54,497	4.44	20.6	15.82	11.55
3	Palm Oil	Green Glory Wastewater Treatment and Electricity Generation in Suratthani, Thailand	16,916	-1.83	19.41	8.52	8.50
4	Palm Oil	Southern Palm Wastewater Treatment and Electricity Generation in Suratthani, Thailand	18,622	-1.07	19.81	8.52	8.50
5	Palm Oil	Srijaroen Palm Oil Wastewater Treatment Project in Krabi Province, Thailand	20,429	6.3		15.00	
6	Palm Oil	Green to Energy Wastewater Treatment Project in Thailand	29,876	17.48		24.10	
7	Palm Oil	Thachana Palm Oil Company Wastewater Treatment Project in Thailand	23,844	10		23.00	
8	Rice Mill	Power Prospect 9.9 MW Rice Husk Power Plant	33,367	12.83	15.35	15.00	11.55
9	Sugar	Dan Chang Bio Energy Cogeneration Project (DCBC)	93,129	7.93		9.69	6.39
10	Sugar	Phu Khieo Bio-Energy Cogeneration Project (PKBC)	102,493	7.66		9.69	6.39
11	Sugar	Khon Kaen Sugar Power Plant	61,449	10.3		11.70	
12	Ethanol	Biogas from Ethanol Wastewater for Electricity Generation	18,804	1	12.4	8.12	23.09
13	Tapioca	Eiamburapa Company Ltd. Tapioca starch wastewater biogas extraction and utilization project, Sakaeo Province, Kingdom of Thailand	56,004	6		8.68	
14	Tapioca	Siam Quality Starch Wastewater Treatment and Energy Generation Project in Chaiyaphum, Thailand	98,372	8.68		15.00	
15	Tapioca	Bangna Starch Wastewater Treatment and Biogas Utilization Project	18,804	5.24	17.37	6.56	

Source: UNFCCC (2010). Retrieved on 3 November 2010, Compiled by the author.

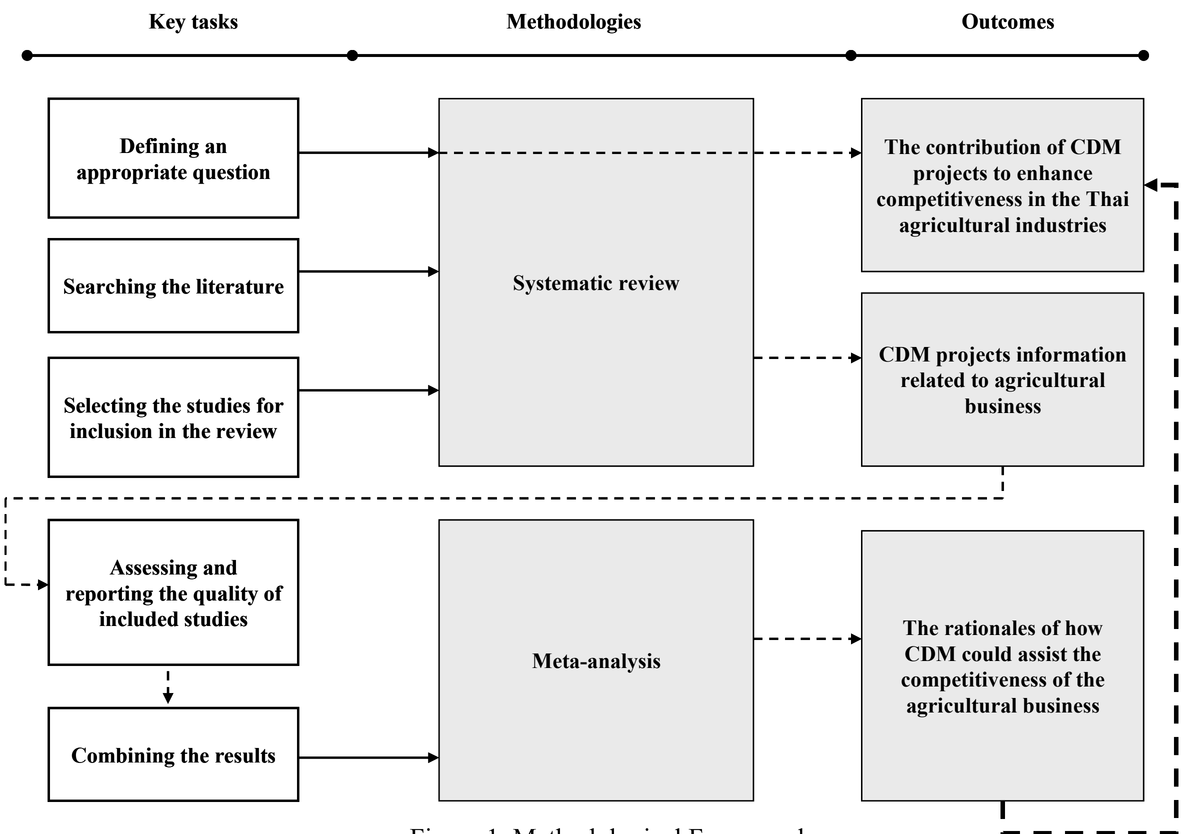
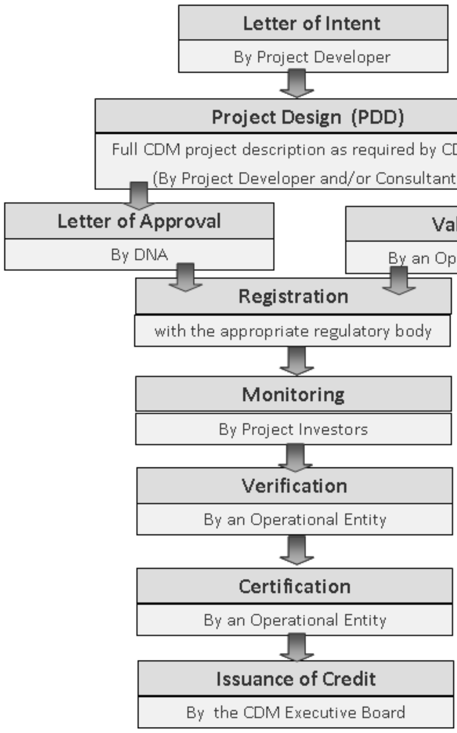
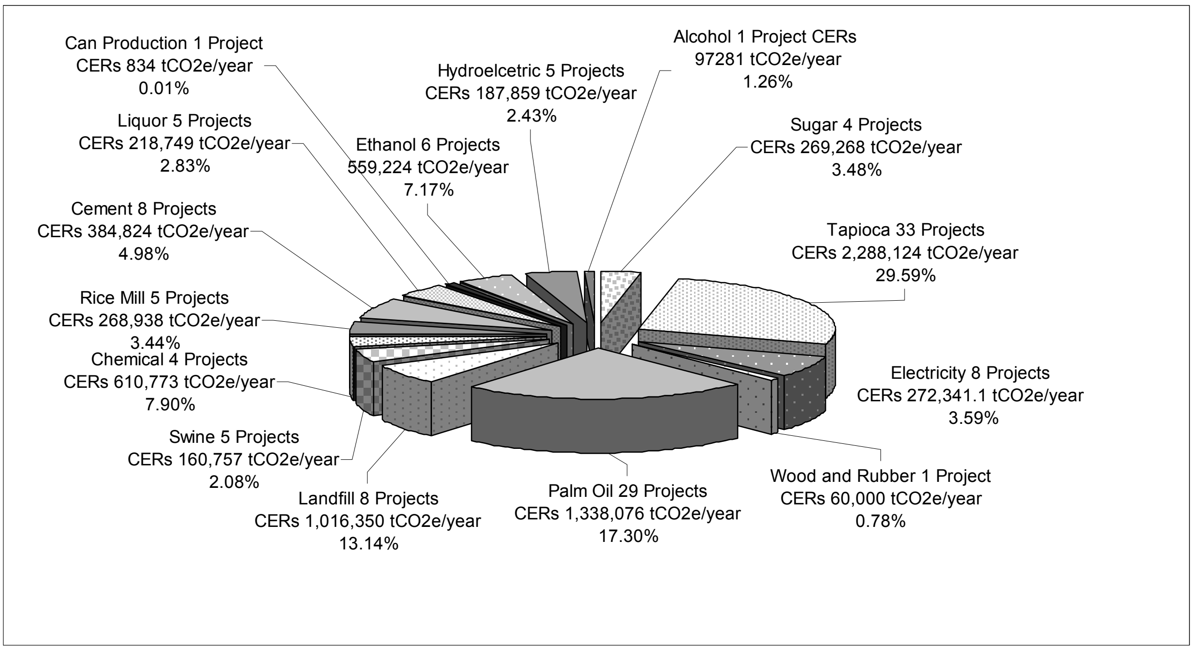


Figure 1. Methodological Framework



Source: TGO (2010). Modified by the author

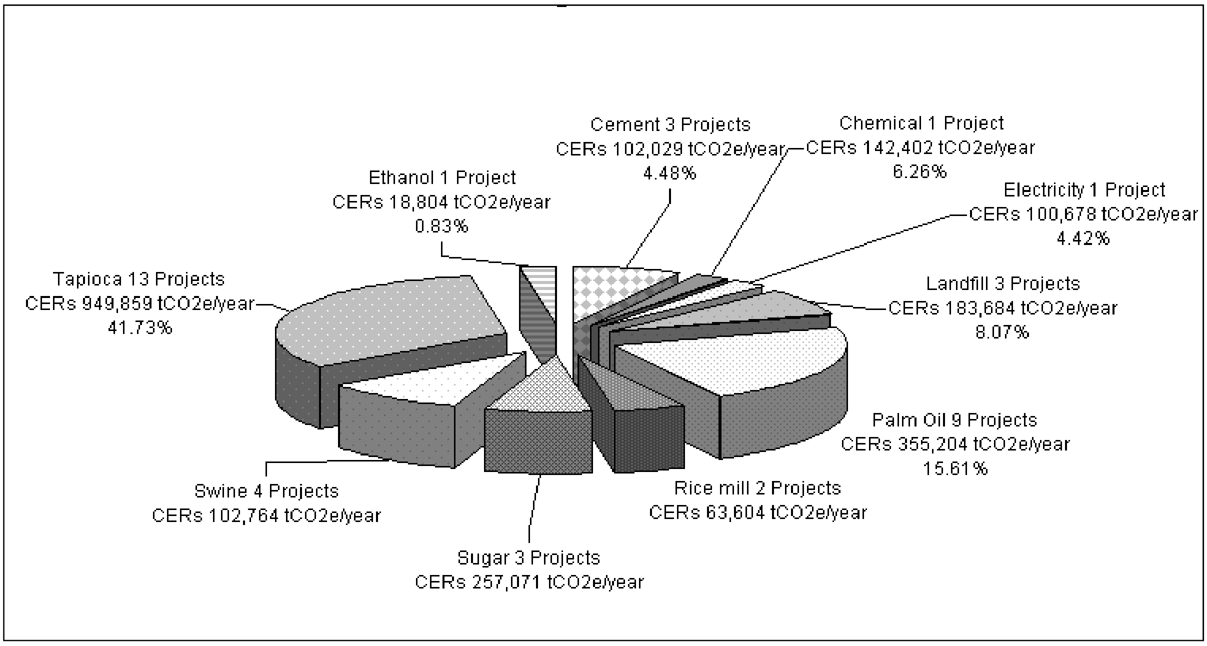
Figure 2. CDM Project Cycle



Source: TGO (2010). Retrieved on 3 November 2010. Author's analysis

Note: Data as of November 2010

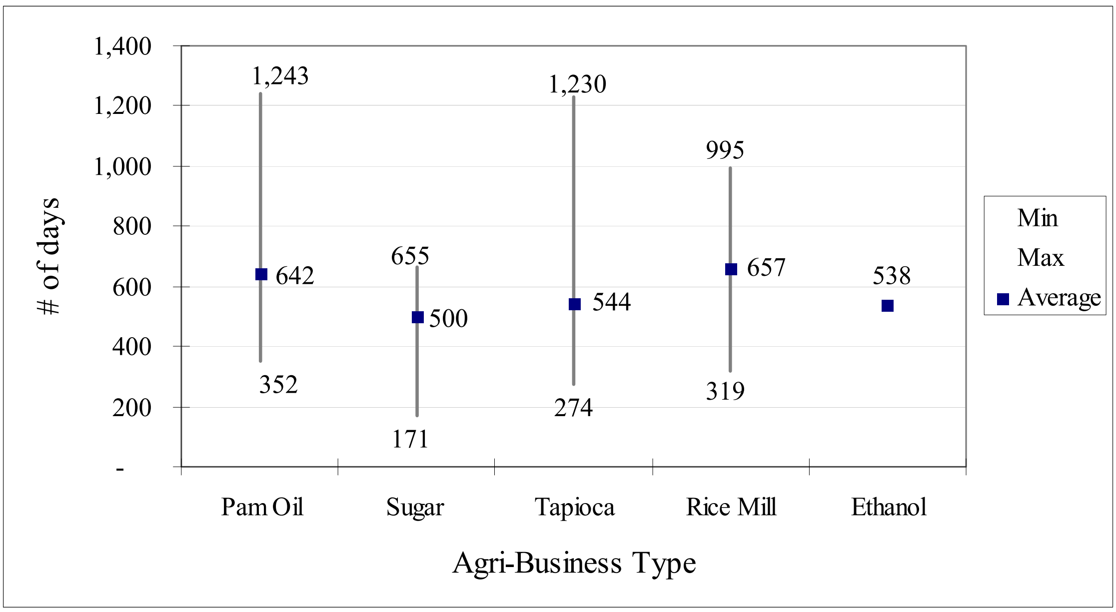
Figure 3. CDM Projects with the Letters of Approval from the Thai DNA (TGO)



Source: TGO(2010). Retrieved on 3 November 2010. Authors' analysis

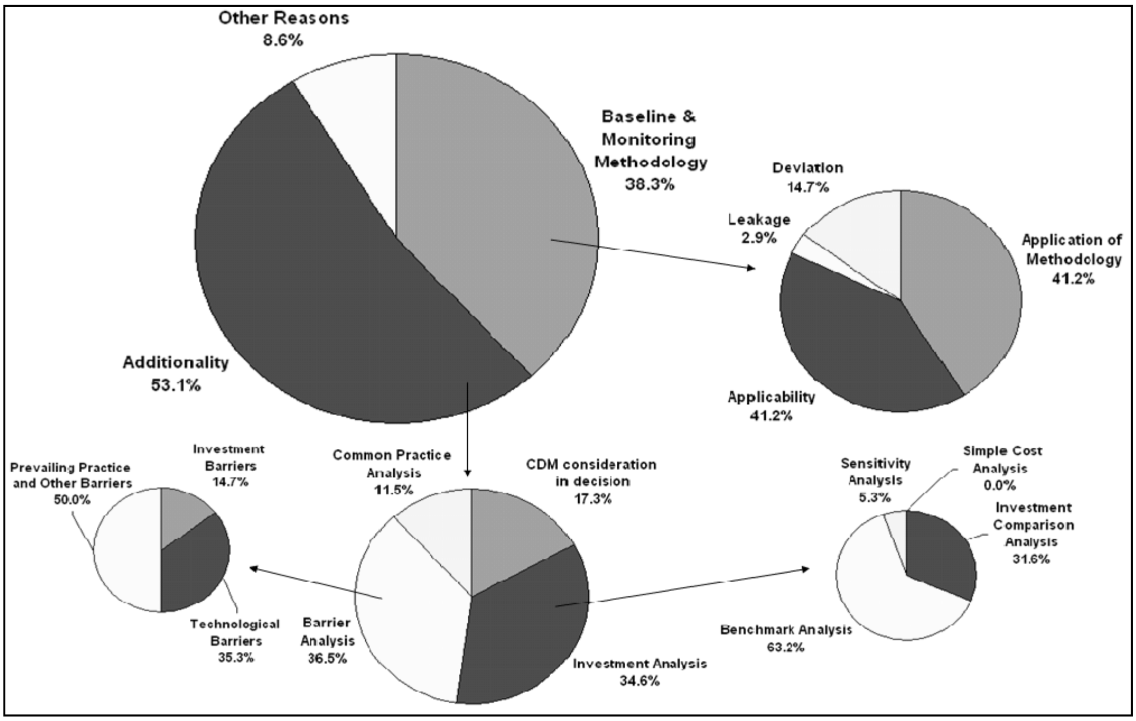
Note: Data as of November 2010

Figure 4. Thai CDM Projects Registered at the CDM EB



Source: UNFCCC (2010). Authors' analysis

Figure 5. Registration Time for Thai Agribusiness CDM Projects



Source: Resanond (2010)

Note: Data as of October 2008

Figure 6. CDM Projects Rejection Analysis