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Appendixes

Appendix A: Discussion of Cooper (2000) on the Stage-Gate process

Cooper (2000) differentiates between the Stage-Gate process and conventional project management practices by stating: “Stage-Gate is a macro process – an overarching process. By contrast, project management is a micro process.” This is also debatable as concurrent engineering (Smith, 1997) can also be seen as a macro process, but is still a project management method. Cooper (2000) further states that project management remains applicable as part of more complex stages. The question then becomes what are the criteria that a process should satisfy to be considered project management? Various sources exist that provides information regarding the desired criteria of a project management approach. The following table evaluates the criteria of project management against the objectives of the Stage-Gate approach:

Table A.1: Project Mangement criteria vs. Stage-Gate objectives:

Project management criteria	Does the Stage-Gate process satisfy this?	Source of project management criteria
The application of knowledge, skills, tools, and techniques to project activities to meet the project requirements	Yes. The Stage-Gate is the application of knowledge proposed by Cooper (2000). It can be seen as a tool and/or technique to be used to achieve project requirements.	PMBOK (2004)
The planning, monitoring and control of all aspects of a project and the motivation of all those involved in it to achieve the project objectives on time and to specified cost, quality and performance	Yes. The cross-functional team approach of the Stage-Gate process aims to “control … all aspects of a project.” The Stage-Gate process furthermore addresses objectives of cost, quality and performance.	British Standards (BS6079, 2010)

The conclusion drawn from the comparison between what is considered to be criteria for project management and what the Stage-Gate process aims to achieve is that the Stage-Gate process aims to achieve project management. However, the project management characteristics of a stage/phase-gate process are not unique to the Stage-Gate process of Cooper (2000). Any of the stage/phase-gate approaches presented in Table 2.1 will satisfy the criteria for project management. The conclusion is then expanded to state that all stage/phase-gate processes can be viewed as project management models if they satisfy the criteria as stated in the above table of this Appendix. Furthermore, the uniqueness of the parallel development process of the Stage-Gate process is highly debatable as parallel development forms the basis of concurrent engineering (Lawson et al, 1994, Loch, et al 1998).

Table B.1: Summary of stages/phases and gates (Cooper, 2000), their purpose and activities to be completed during each

Component	Purpose	Activities
Discovery Stage	Towards a defined, proactive idea generation system.	• technical research; • search new technological possibilities; • uncover unarticulated needs; and • uncover market opportunities.
Gate 1: Idea Screen	First decision to commit resources to an idea.	• Decide on idea's strategic fit; • Evaluate market attractiveness; • Investigate technical feasibility; and • Investigate definite project stoppers.
Stage 1: Scoping	Determine project's technical and marketplace merits in short time with low cost.	• Do preliminary market assessment; • Do preliminary technical assessment; and • Deliver first pass business and financial analysis as input to Gate 2.
Gate 2: Second Screen	Re-apply the "must meet" and "should meet" criteria of Gate 1 more stringently considering the improved and additional information available. Additional criteria can be added.	• Similar as in Stage 1 with expansions.
Stage 2: Building the Business Case	Clearly define the product and verify market attractiveness.	• Define target market; • Delineation of product concept; • Specify product positioning and strategy; • Specify product benefits; and • Specify essential and desired product requirements.
Gate 3: Go to Development	To complete product definition and/or project definition.	• Review Stage 2 activities for completeness, quality of work and positive product outcome, and; Designate project team.
Stage 3: Development	To deliver a lab-tested product prototype.	• Do full scale technical design; • Advance the marketing of product; and • Resolve legal aspects of product.
Gate 4: Go to Testing	Check product development and continued product attractiveness.	• Review development work for completeness and quality; • Check consistency of Gate 3 product definition; and • Review product financials.
Stage 4: Testing and Validation	Test product viability. Negative results will send the product back to Stage 3.	• Do in-house product tests; • Execute user or field product trials; • Do pilot production; • (Pre)test market; and • Revise business and financial plan.
Gate 5: Go to Launch	A go-ahead will lead to full production and market launch.	• Determine quality of testing and validation; • Evaluate final financials; and • Evaluate start-up plans.
Stage 5: Launch	To implement marketing and production launch.	• Implement marketing and production launch.
Post-Launch review	Determine project's and product's strengths and weaknesses.	• Do post-project audit.

Appendix B: Financial considerations of illustrative case study

Table B.1: Summary of cost involved in implementing the existing predictive control system

Description	Cost	Symbol
Cost of existing control system	US$1,200,000	A1
Normal % defects	5%	B1
Accuracy of predictive control system available on the market	73%	C1
Expected annual reliability per sensor	99.7%	D1
Number of inputs required (one sensor per input)	20	E1
Plates with defects historically sent to clients	1.43%	F1
Total annual revenue	US$100,000,000	G1
Loss in revenue per year	US$1,433,609	H1
Allowable payback period (years)	3	I1
Cost associated with existing control system and loss of revenue for a 3 year period	US$5,500,826	J1

Calculating the number of plates with defects historically sent to clients (F1):

$$F1 = \frac{B1 \times (1 - C1)}{D1^{E1}} \tag{1}$$

Calculating the loss in revenue per year (H1):

$$H1 = F1 \times G1 \tag{2}$$

Calculating the cost associated with existing control system and loss of revenue for a 3 year period (J1):

$$J1 = A1 + H1 \times I1 \tag{3}$$

Table B.2: Summary of cost involved in implementing the existing predictive control system		
Description	**Cost**	**Symbol**
Cost of newly developed predictive control system	US$855,000	A2
Normal % defects	5%	B2
Accuracy of predictive control system developed	73%	C2
Expected annual reliability per sensor	99.7%	D2
Number of inputs required (one sensor per input)	1	E2
Plates with defects historically sent to clients	1.35%	F2
Total annual revenue	US$100,000,000	G2
Loss in revenue per year	US$1,354,062	H2
Allowable payback period (years)	3	I2
Cost associated with existing control system and loss of revenue for a 3 year period	US$4,917,187	J2

Calculating the number of plates with defects historically sent to clients (F2):

$$F2=\frac{B2\times(1-C2)}{D2^{E2}} \qquad (4)$$

Calculating the loss in revenue per year (H2):

$$H2=F2\times G2 \qquad (5)$$

Calculating the cost associated with existing control system and loss of revenue for a 3 year period (J2):

$$J2=A2+H2\times I2 \qquad (6)$$

Cost associated with developing and implementing a new predicative control system		
Description	**Cost**	**Symbol**
Stage 1	US$40,000	A3
Stage 2	US$85,000	B3
Stage 3	US$210,000	C3
Stage 4	US$80,000	D3
Stage 5	US$440,000	E3
Total development and implementation cost	US$855,000	F3

The total cost was determined by equation 7:

$$F3=A3+B3+C3+D3+E3 \qquad (7)$$

Appendix C: Details of the case study stage investigations

During Stage 1 a principle component analysis (PCA) was performed on a data set consisting of the twenty inputs that the control system available on the market required. PCA is a vector space transformation often used in exploratory data analysis to lower the multidimensional space of data. Encouraging results were obtained in that a lower dimensional space, i.e. using less than the twenty input parameters, was obtainable that retained most of the higher dimensional space's information.

The PCA result indicated that it was probable that a predictive control system could be developed that needed less than twenty input parameters. Using less than twenty input parameters were listed as a "must meet" criterion. Options that produce models that were difficult to interpret, like artificial neural networks (ANNs), were eliminated. Developing human interpretable models was a "should meet" criterion. The encouraging results of the first stage lead to the successful passing of the second gate.

Computer programming and data mining experts further investigated the potential benefits of a newly developed predictive control system. Various modelling options, like support vector machines (SVM) and genetic programming (GP), were investigated.

On laboratory scale, during Gate 4, it was found that only one specific input parameter of the twenty measured was required to deliver the same predictive performance of the control system available on the market. The human interpretability of a predictive model based on the value of a single input parameter is trivial.

The added advantage of the new model was that it resulted in an explicit model that could be analysed. It must be remember that the predictive control system available on the market was a 'black box' system which gave the user no insight into the logic used during predictions.

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Appendix D: 1st and 2nd Questionnaire

CDM questionnaire to the CDM Association (To be used to direct further research)

Chair of Life Cycle Engineering
Graduate School of Technology Management, University of Pretoria

Room 4-11, Engineering 2, Main campus, Pretoria, 0002

Tel: +27 12 420 3929
Fax: +27 12 362 5307
E-mail: alan.brent@up.ac.za
Web: http://www.up.ac.za/gstm

1. Approximately how many potential CDM projects are your company currently working on?

0	1 – 3	4 – 6	7 – 10	MORE

2. How many registered CDM projects do your company have? (Please do omit this question if you feel this compromises the anonymity of the questionnaire)

0	1 – 2	3 – 4

3. Where are the majority of the current projects situated? (Indicate percentage)

South Africa %	Africa %	Global %

4. Where is the priority of your future CDM focus? (Indicate percentage)

South Africa %	Africa %	Global %

5. What aspect of the CDM do you specialize in? (Indicate percentage)

Financial %	Technical	Regulatory %

6. Do you follow a formalised project management model or standard? (Such as PMBOK®, PRINCE2, etc.)

   YES NO

7. If yes, what specific project management model or standard is used?

……………………………………………………………………………………
……………………………………………………………………………………

8. Why is the specific project management model or standard used? **OR** Why is project management not formalised?

……………………………………………………………………………………
……………………………………………………………………………………

9. Do you see the need for a formalised project management structure?

   YES NO

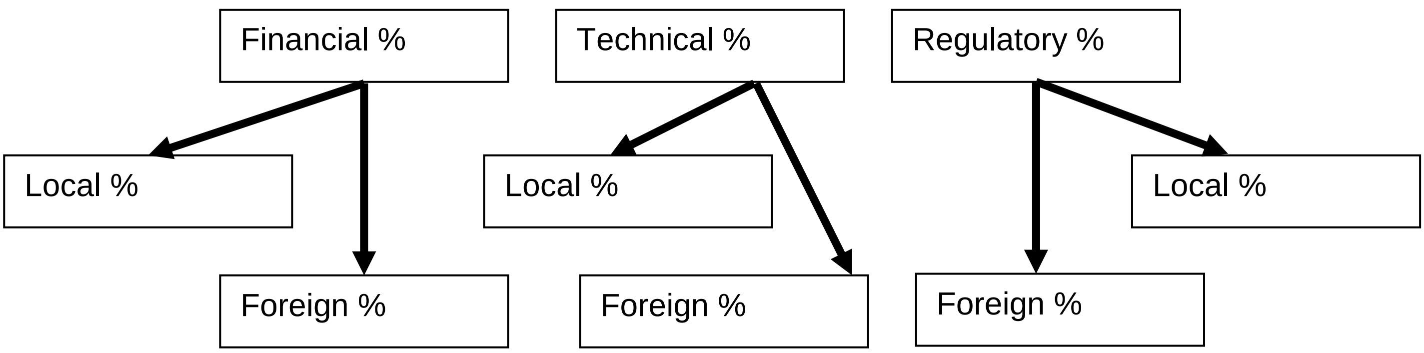
10. Do you have a person/group acting as dedicated project manager for CDM?

   YES NO

11. If applicable, does the project management manager/group succeed in facilitating the development of CDM projects?

   YES NO

12. Where do you experience bottlenecks in a CDM project?
   Are these bottlenecks caused by South African considerations/parties/influences or foreign?
   (Indicate percentage)



Questions focussed on the proposed CDM project management model:

13. Please complete the following table regarding the proposed model:
(Each aspect should be scored from 1 to 10. The same score may be used more than once. A higher score denotes a higher cost, effort level, importance, or the like.)

Aspect	Phase[30]											
	1	2	3	4	5	6	7	8	9	10	11	12
Effort level: Time												
Effort level: Money												
Effort level: Amount of work												
Score importance of each phase												

14. Please provide a narrative description of what is considered, in your opinion, to be the success and failure criteria for a CDM project

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15. Please provide comment on the proposed CDM model regarding applicability, completeness, practicality, areas that are unclear or any other comment.

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[30] These phases refer to the phases of Model β as presented to the 2nd questionnaire respondents.

Appendix E: Summary of the 1st Questionnaire

Summary of answers to questionnaire:				
No	Question	Average		Number of replies
1	Approximately how many potential CDM projects are your company currently working on?	4.3		8
2	How many registered CDM projects do your company have?	0.5		6
3	Where are the majority of the current projects situated?	South Africa:	91%	8
		Africa:	2%	
		Global:	7%	
4	Where is the priority of your future CDM focus?	South Africa:	79%	8
		Africa:	12%	
		Global:	9%	
5	What aspect of the CDM do you specialize in?	Financial:	44%	8
		Technical:	41%	
		Regulatory:	14%	
6	Do you follow a formalised project management model or standard?	38% (Yes)		8
7, 8	Commentary questions discussed later			
9	Do you see the need for a formalised project management structure?	88% (Yes)		8
10	Do you have a person/group acting as dedicated project manager for CDM?	63% (Yes)		8
11	If applicable, does the project management manager/group succeed in facilitating the development of CDM projects?	100% (Yes)		5
12	Where do you experience bottlenecks in a CDM project? Are these bottlenecks caused by South African considerations / parties / influences or foreign?	Financial – Local:	17%	7
		Financial – Foreign:	7%	
		Technical – Local:	6%	
		Technical – Foreign:	25%	
		Regulatory – Local:	28%	
		Regulatory – Foreign:	17%	

Appendix F: Complete representation of Model α

Table F.1: Phase 1				
Phase name	**1. Project identification and planning**			
Purpose of project phase	1	Identify potential emission reduction projects		
	2	Ascertain eligibility of projects regarding fundamental CDM criteria		
Gate 1 criteria	**No**	**Criteria**	**No**	**Yes**
Kill/Go criteria	1	Does this project conform to the fundamentals of the CDM?	Kill	Go
	2	Does the project fit the strategic business alignment of the project proponents?	Kill	Go
Comments	1	Fundamentals of CDM refers to concepts like measurable emission reductions, additionality, measurable sustainable development contribution, etc.		
	2	Strategic business alignment refers to project proponent's identified business visions and missions.		
Ranking criteria	**No**	**Criteria**		**Score**[31]
	1	What is the strategic importance of the proposed project?		
	2	Is this project reproducible?		
Comments	1	If the proposed projects have benefits, like opening up new markets, then give a higher ranking score.		
	2	Reproducible projects achieve higher scores since the role out of following projects are highly beneficial.		

[31] A value of 1 – 10 will be awarded per point in the ranking phase. It is important to note that a "higher is better" scoring system will be used. Relative ranking criteria weights were not added. This could be added in the project meetings during which gates are discussed.

Table F.2: Phase 2				
Phase name	**2. Feasibility assessment**			
Purpose of project phase	1	Clarify the need for the project. (revenue / corporate responsibility / etc)		
	2	Do an initial estimate of the emission reductions		
	3	Asses what is necessary in monitoring the inputs to calculate emission reductions		
	4	Do initial assessment of project risk (financial, technical and regulatory)		
	5	Obtain initial approval from local DNA		
Gate 2 criteria	**No**	**Criteria**	**No**	**Yes**
Kill/Go criteria	1	Is there a need for this project?	Kill	Go
	2	Does the initial emission reduction warrant a CDM project?	Kill	Go
	3	Is the project risk level acceptable?	Kill	Go
	4	Are all inputs required measurable / obtainable?	Kill	Go
Comments	1	Various strategic reasons can exist for proposed emission reduction projects. Clarifying the need of these projects will help in obtaining backing from management.		
	2	If the estimated emission reduction achievable is too small then no CDM project exists. The project proponents should decide what they consider to be the lower cut off value regarding emission reductions achieved.		
	3	Projects should be stopped as soon as project risk reaches unacceptable levels.		
	4	It is foreseeable that insufficient data are available to accurately establish emission reductions. If the emissions reductions are not measurable then the project should be stopped.		
Ranking criteria	**No**	**Criteria**		**Score**
	1	Are there any perceived or real objections from the local DNA?		
	2	How attractive is the amount of CERs earned?		
Comment	1	In the development of this model it is proposed to get initial host country approval for a project at the earliest possible stage. This will help in managing project risk from the start although host country approval is according to CDM guidelines not strictly necessary at such an early stage.		
	2	The amount of carbon credit revenue earned is a direct function of the amount of CERs obtainable. All else being equal projects producing more CERs should take preference.		

Table F.3: Phase 3				
Phase name	**3. Initial design**			
Purpose of project phase	1	Do initial design for early estimates of regulatory / financial / technical requirements and iterate to determine initial best fit		
	2	Build and evaluate initial financial model		
Gate 3 criteria	**No**	**Criteria**	**No**	**Yes**
Kill/Go criteria	1	Is the project technically viable?	Kill	Go
	2	Is the project regulatory viable?	Kill	Go
	3	Does the project make financial sense?	Kill	Go
Comments	1	CDM projects necessitate real and measurable emission reductions. This entails the use of sound technical equipment. No project exists without technical viability.		
	2	CDM projects should conform to all regional, provincial/state and national regulatory requirements. Above this the proposed CDM project should also conform to CDM EB regulatory requirements. The project should be stopped if it does not conform to all regulatory requirements.		
	3	A financial model must be developed. Only financially viable projects should be investigated further.		
Ranking criteria	**No**	**Criteria**		**Score**
	1	How easy are the technical aspects?		
	2	Is the regulatory environment in place?		
	3	Is the required capital relatively low?		
Comments	1	Technically difficult projects should receive a lower score.		
	2	Projects that have all regulatory requirements in place are more desirable and must receive a higher score.		
	3	Low capital projects should be pursued more vigorously and thus receives a higher score.		

Table F.4: Phase 4				
Phase name	**4. Detailed design**			
Purpose of project phase	1	Do a detailed design for the financial / technical and non-CDM specific regulatory requirements and iterate to determine optimal case		
	2	Identify/develop the required CDM methodology		
	3	Develop the PDD		
	4	Develop all documentation required by the DNA		
Gate 4 criteria	**No**	**Criteria**	**No**	**Yes**
Kill/Go criteria	1	Does the detailed optimal design prove a bankable project?	Kill	Go
	2	Does the appropriate CDM methodology exist or can it be developed?	Kill	Go
	3	Is the CDM PDD developed and completed?	Kill	Go
	4	Is all the documentation required by the DNA developed?	Kill	Go
Comment	1	The project should be stopped if the detailed design does not provide a bankable study. All potential risks and questions that investors / financial instructions could raise must be addressed in the detailed design.		
	2	Without a CDM methodology no CDM project will be registered. If no methodology exists that is applicable to the envisaged project then a new methodology has to be developed. If no current or developed methodology is approved then the project should be stopped.		
	3	A PDD must be developed to illustrate the application of the CDM methodology to the specific proposed project.		
	4	To achieve host country approval various submissions must be prepared and submitted to the DNA and possibly other governmental departments. This phase is not completed before the required documentation is completed.		
Ranking criteria	**No**	**Criteria**		**Score**
	1	How easy are the technical aspects?		
	2	Is the regulatory environment in place?		
	3	Is the required capital relatively low?		
	4	Is there an existing appropriate CDM methodology?		
	5	Can the PDD be completed with relative ease?		
Comments	1	The importance of ranking criteria 1 – 3 was answered in the comments of the discussion of phase 3 above.		
	2	Projects that have existing applicable CDM methodology should receive a higher score since CDM methodology development can be expensive and time consuming.		
	3	Completing the PDD can be problematic even with an existing CDM methodology. Projects for which PDD development is foreseen as problematic should have a lower score.		

Table F.5: Phase 5				
Phase names	**External phases: 5. Approval, 6.Validation, 7.Registration**			
Purpose of project phase	1	To achieve project approval		
	2	To achieve project validation		
	3	To achieve project registration		
Gate 5 criteria	**No**	**Criteria**	**No**	**Yes**
Kill/Go criteria	1	Are all the necessary written approvals in place from the host party? (From DNA and other parties.)	Kill	Go
	2	Was the project validated by the selected DOE?	Kill	Go
	3	Was the project registered by the CDM EB?	Kill	Go
Comment	1	Host country approval is obligatory to achieve project registration. Without host country approval the project can not progress.		
	2	The DOE validation is required before the project will be registered. Without DOE validation the project can not progress.		
	3	CDM EB registration has to be obtained to complete the CDM registration process.		
Ranking criteria	**No**	**Criteria**		**Score**
		NA		
Comment		No ranking criteria exist. All objectives of these phases are mandatory.		

Table F.6: Phase 8				
Phase name	**8. Build and Commissioning**			
Purpose of project phase	1	To build and commission all equipment associated with the project activity		
Gate 6 criteria	**No**	**Criteria**	**No**	**Yes**
Kill/Go criteria	1	Are equipment build, commissioned and operating properly?	Kill	Go
Comment	**1**	The project activity can only start if all equipment associated with the project is functioning properly. This phase can be subdivided into the classical project management phases of non-CDM type projects.		
Ranking criteria	**No**	**Criteria**		**Score**
	1	Can the building and commissioning phase be completed quicker with acceptable increases in cost?		
Comment	1	In many projects the duration of certain phases can be reduced by incurring extra costs. The time saving actions of this phase must be ranked taking cost into account. Where ever cost effective the time decreasing options must be implemented.		

Table F.7: Phase 9				
Phase name	**9. Monitoring**			
Purpose of project phase	1	To monitor all inputs required as prescribed in the registered PDD		
Gate 7 criteria	**No**	**Criteria**	**No**	**Yes**
Kill/Go criteria	1	Are all inputs measured in accordance to the PDD and all applicable tools?	**Kill**	**Go**
Comment	1	The accurate measurement of all inputs required for monitoring the achieved emission reductions are discussed in detail in the registered PDD. It is essential to conform to the PDD instructions on measuring to ensure the issuance of CERs.		
Ranking criteria	**No**	**Criteria**		**Score**
Comment	1	Identify and rank all steps that can be taken to increase the accuracy of the monitored data while still complying with the PDD.		

Table F.8: Phase 10 and 11				
Phase name	**External phases: 10. Verification and certification, 11. Issuance of CERs**			
Purpose of project phase	1	Obtaining verification and certification of CERs from DOE		
	2	Obtain issued CERs from UNFCCC EB		
Gate 8 criteria	**No**	**Criteria**	**No**	**Yes**
Kill/Go criteria	1	Did the DOE verify and certify the CERs?	Kill	Go
	2	Did the UNFCCC EB issue the CERs?	Kill	Go
Comment	1	It is a necessity to obtain DOE verification and certification before CERs can be issued.		
	2	The UNFCCC EB is the party that will issue the obtained CERs after completion of the previously described project phases.		
Ranking criteria	**No**	**Criteria**		**Score**
	NA	NA		
Comment	1	The above mentioned objectives of the phases are mandatory for successful project completion. No ranking is applicable.		

Table F.9: Phase 12				
Phase name	**12. Distribution of CERs**			
Purpose of project phase	1	To distribute the CERs to the relevant parties		
Gate 9 criteria	**No**	**Criteria**	**No**	**Yes**
Kill/Go criteria	1	Was the CERs distributed to the relevant parties as contractually agreed upon?	**Kill**	**Go**
Comment	1	Formalized contractual agreements will provide guidance regarding the distribution of the issued CERs. Legal intervention must be sourced if the parties involved in the project are not satisfied with the issuance of the CERs. Project termination should be the last option.		
Ranking criteria	**No**	**Criteria**		**Score**
	NA	NA		
Comment	1	No ranking criteria exist in this phase.		

Table F.10: Phase 13				
Phase name	**13. Annual post mortem**			
Purpose of project phase	1	To investigate and correct any shortcomings that exist in the project activity		
Gate 10 criteria	**No**	**Criteria**	**No**	**Yes**
Kill/Go criteria	1	Can all problems be overcome?	Kill	Go
Comment	1	CDM project termination will be investigated if problems of the post mortem keep the project from producing CERs annually.		
Ranking criteria	**No**	**Criteria**		**Score**
	1	Identify and rank changes that can be made to increase the amount of CERs issued in the following year		
Comment	1	It will be attempted to solve the post mortem identified problems. By doing so it is envisaged that the amount of CERs earned will be increased.		

Appendix G: Input received from Designated National Authority (DNA)

Input from DNA

Interview date: 24 January 2009

Interviewer: Marco Lotz

Interviewee 1: Ndiafhi Patrick Tuwani

Title: Deputy Director: Designated National Authority

Interviewee 2: Olga Lindiwi Chauke

Title: Deputy Director: Designated National Authority

Focus of discussion:

- Understanding the sustainable development (SD) criteria used in evaluating CDM projects;
- Discussion of SD criteria and application on the case studies, and;
- DNA’s issues and sideline notes

Understanding the sustainable development (SD) criteria used in evaluating CDM projects

The DNA indicated that the National Environmental Management Act (NEMA) is the over arching legislative framework that regulates all environmental affairs. This said the DNA is an autonomous unit embedded in the South African Department of Mineral and Energy. The sole purpose of the DNA is to facilitate the development of CDM projects in South Africa. The evaluation of the SA CDM SD criteria is a fundamental function that the DNA performs to ascertain whether the proposed project activity will obtain host country approval or not.

The three aspects of the SD criteria were discussed. These aspects are:

- Environmental;
- Economic, and;
- Social

It also quickly became apparent that these aspects cannot always be viewed in isolation. As an example the employment of a person as a result of a CDM project has positive economic and social implications.

The DNA relies on the input from project developers to evaluate the SD criteria of a project. This input is provided by the project developers in the Project Idea Note (PIN) and the PDD. The execution and monitoring of the actions of the project developers in implementing the stated SD improvements/advances are extremely difficult. The DNA does not have a mandate to ascertain or enforce the SD advances proposed by a project developer once the project has obtained host country approval.

On Project Management:

The DNA does not involve them with the management approach followed by project developers. For this reason no input was obtainable from the DNA regarding existing management approaches followed in industry or inputs on the proposed project management model. The DNA does however provide fundamental input for the understanding of the case studies of this research.

Side notes:

- The project developers/country needs assistance from government and other (UNFCCC) for developing new methodologies;
- UNFCCC CDM timeline too long. (This is Meth Panel, Secretariat, etc.);
- Lack of DOEs leads to:
    - Long waiting time for visits and work to be finished;

    - Very expensive to get overseas DOEs for developing countries to pay in US$ or Euro
- SA government should assist project developers financially and then government gets cut of credits to reinvest in new project development;
- This is what India do. They do not assess social component of proposed project, but rather take cut of CERs obtained for social upliftment;
- EIA takes long and recent changes in CDM process leads to confusion;
- DNA can advice on % financial contribution to a specific cause, but cannot enforce it. They can also not withhold host country approval on the basis of not following DNA's advise on % financial contribution;
- DNA will from 2009 have annual questionnaire to registered projects to determine whether the originally claimed SD benefits were achieved;

Appendix H: Summary of Case study 1 (Animal waste management)

According to the PDD (ref) Kanhym is the biggest pig farm in South Africa It houses approximately 45,000 pigs at any given time. The swine are confined to enclosed feeding lots. These feeding lots are equipped with a sewer system that drains into a large, three-staged anaerobic lagoon. The swine manure is collected from the enclosed feeding lots' concrete floors into the main sewer channel which terminates in an anaerobic lagoon. The unlined and uncovered lagoon produces a mixture of greenhouse gasses, which include CH_4, N_2O and CO_2. Currently these gasses are vented to atmosphere.

The project activity entails building a new lined lagoon with an expandable membrane roof. By doing this the greenhouse gases can be captured and controlled. The digester residue will be used as fertilizer.

The project will be executed in a phased approach as follows:

- Phase 1: Combustion of methane rich gas using a flare and/or using the generated heat in a boiler system. The boiler will produce steam which will be used to maintain the temperature in the new digester;
- Phase 2: Internal combustion engines will be installed to generate electricity from the biogas if the amount of gas produced warrants the capital investment. The project developer estimated that it could be feasible to install $1MW_e$ generating capacity in the future. The electricity produced will be used by the farm or the surrounding communities and the waste heat from the internal combustion engine will heat the digester

The project developer states the following sustainable development[32] benefits:

- Phase 1:
    - Temporary creation of employment during the construction phase;
    - Limited permanent employment for operation purposes;
    - Training for the employed people;
    - Purchasing of South African based technology suppliers will benefit the local economy;
    - The revenue received for the CERs generated is viewed by the project developer as foreign investment;
    - The project owner presented black economic empowerment (BEE) credentials. The aim of the BEE aspect is to historical inequalities;
    - The project owner will use some of the CDM revenue for training people from the surrounding communities in information technology related fields;
    - The project developer argues that the health situation at Kanhym farm will be improved by the project by replacing the present anaerobic lagoon with a covered anaerobic lagoon;
    - The smell of the rotting manure will be improved, and;
    - The possibility of groundwater pollution by the present waste stream will be greatly reduced;
    - Installing electricity generation capacity running on renewable energy sources will contribute to the national economic development, and;
    - Will leads to energy diversification

An interview with the DNA affirmed that the DNA agreed that the proposed project would better the living conditions of the local communities from a health perspective and in reducing the smell of the surroundings.

[32] A discussion of the South African DNA's view on the CDM SD will be included in the appendixes

The DNA commented on the fact that if possible the methane would not be only flared, but also used to generate electricity. This demonstrated that the project developer wanted to use the methane to the best possible application. Generating electricity from the renewable biogas manure source was seen as the best possible scenario. The DNA granted this project host country approval.

Appendix I: Summary of Case study 2 (Energy efficiency)

Transalloys is a division of Highveld Steel and Vanadium Corporation Ltd. Transalloys is a manganese alloy smelter in the Witbank area of South Africa. The aim of this project is to reduce the amount of electricity required in the production of silicomanganese (SiMn).

The planned energy efficiency project will decrease the amount of electricity by 10-20% per ton of alloy produced. This energy saving will translate in ±0.5MWh/ton alloy product.

The project developer states the following sustainable development benefits:

- Reduces demand side electricity requirements;
- Acts as a demonstration project for cleaner production;
- Reduces the particulate matter pollution in the local environment;
- Leads to increased job security for the workers of the plant;
- Help in mitigating currency risk associated with a commodity industry like manganese alloys

The DNA commented on the SD criteria by stating that this project will do more than generate foreign revenue from CDM. It will also generate electricity that:

- Decrease coal combustion which leads to less indirect pollution;
- Generate income over and above CDM revenue

The DNA granted the Transalloys project host country approval

Appendix J: Summary of Case study 3 (Mine methane capture)

According to the PDD (ref) the Star Diamond Mine is located in an area rich in underground methane. It is believed that the methane originates from coal deposits that occur in the mined area. Methane gas is known to be transported in a series of geological faults that cut through the mining areas. Methane is a colourless and odourless explosive gas which has caused fatalities in other mines in the region in the past. Underground are point sources where the methane is emitted into the mining working areas. In 2002 a methane explosion in the Star Diamonds mine resulted in the death of two miners.

The company tried to prevent future explosions by:

- Sealing off mining areas which had methane present. This was unsuccessful as the pressure behind the sealed off areas resulted in methane leakages into the mining areas;
- Piping the methane to surface. The methane was then simply vented to atmosphere.

It was proposed that the sole purpose of this project activity is to destroy mine methane that is currently venting to atmosphere. The project developer stated that the amount of mine methane captured and piped to atmosphere was not sufficient to warrant the capital of electricity generation equipment.

Embedded unit of analysis: Beatrix

The Beatrix project is analogous to the Star Diamonds project in that the project aims to reduce mine methane emissions. (Beatrix is a gold mine in the Free State province of South Africa.) Just like in the Star Diamonds project methane will be piped to surface. This project differs from the Star Diamond project in that the project developer argues that the captured methane can be used since sufficient mine methane can be captured and controlled. Currently all mine methane is released to atmosphere as ventilation air methane.

The captured mine methane will be used to:

- Generate steam in a boiler system;
- Generate electricity using internal combustion engines;
- Generate chilling in absorption chillers, and;
- Only excess mine methane will be flared

The project developer states the following sustainable development benefits:

- The project will donate R0.20 per ton of CO_2e and 0.5% of pretax profit to the Goldfields Foundation. (The Gold Fields Foundation is the vehicle by which social responsibility investment is done by Gold Fields.);
- On a global scale, like all CDM projects, green house gas emissions will be reduced;
- Local air quality will be improved as less SO_x containing coal has to be combusted for electricity generation and steam production;
- The revenue from CERs will help to alleviate the strong financial dependence of the mine on the gold price. This will aid in securing the jobs of the miners, and;
- The technology used in the project activity will lead to a transfer of skills to the local mine employees

Summary of the DNA's view on the SD evaluation:

The findings of the DNA interview regarding the Star Diamonds and Beatrix project is summarized in Table:

Table Appendix J.1: Summary of DNA's evaluation of the sustainable development criteria

Regarding the Star Diamonds project:	Regarding the Beatrix project:
The Star Diamonds project only involves the flaring of non-renewable mine methane.	The Beatrix project involves the combustion of mine methane and the application of the liberated energy. (Electricity and chilling will be produce)
The fact that such a project will generate foreign revenue does not qualify as a sufficient economical contribution to SD since all CDM project generate foreign revenue.	Not only is foreign income generated, but also electricity and chilling which have monetary value.
No additional permanent employment would be generated by the project. The temporary employment during the construction process was also considered negligible.	During construction temporary employment will be generated. In addition it is foreseen that some permanent operators will be employed for the electricity generation and chilling activities.
Very little or no skill transfer will be achieved by this project.	Specialized equipment will be installed which will lead to skill transfer.
All CDM projects achieve reduced greenhouse gas emission reduction.	Methane combustion will lower green house gas emissions, but the electricity generated will offset the combustion of coal in power stations.
Conclusion: The DNA did not grant host country approval	Conclusion: The DNA granted host country approval