

# Evaluating CDM projects in South Africa:



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## Establishing and applying weighting values for sustainable development criteria



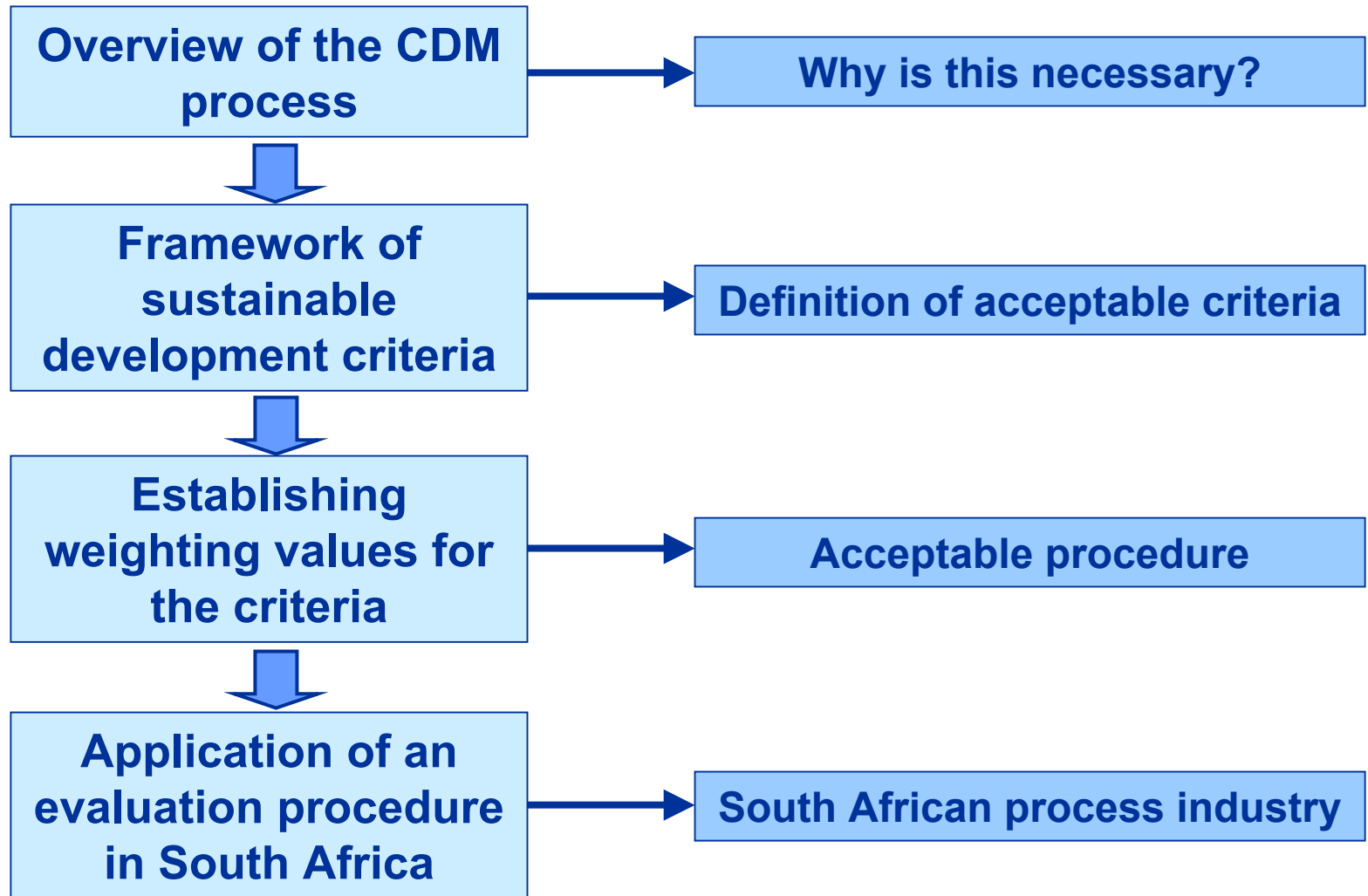
### Alan Brent

- Chair: Life Cycle Engineering
- Department of Engineering and Technology Management
- University of Pretoria
- Tel: +27 12 420 3929
- Fax: +27 12 362 5307
- E-mail: [abrent@eng.up.ac.za](mailto:abrent@eng.up.ac.za)

# Structure of the presentation



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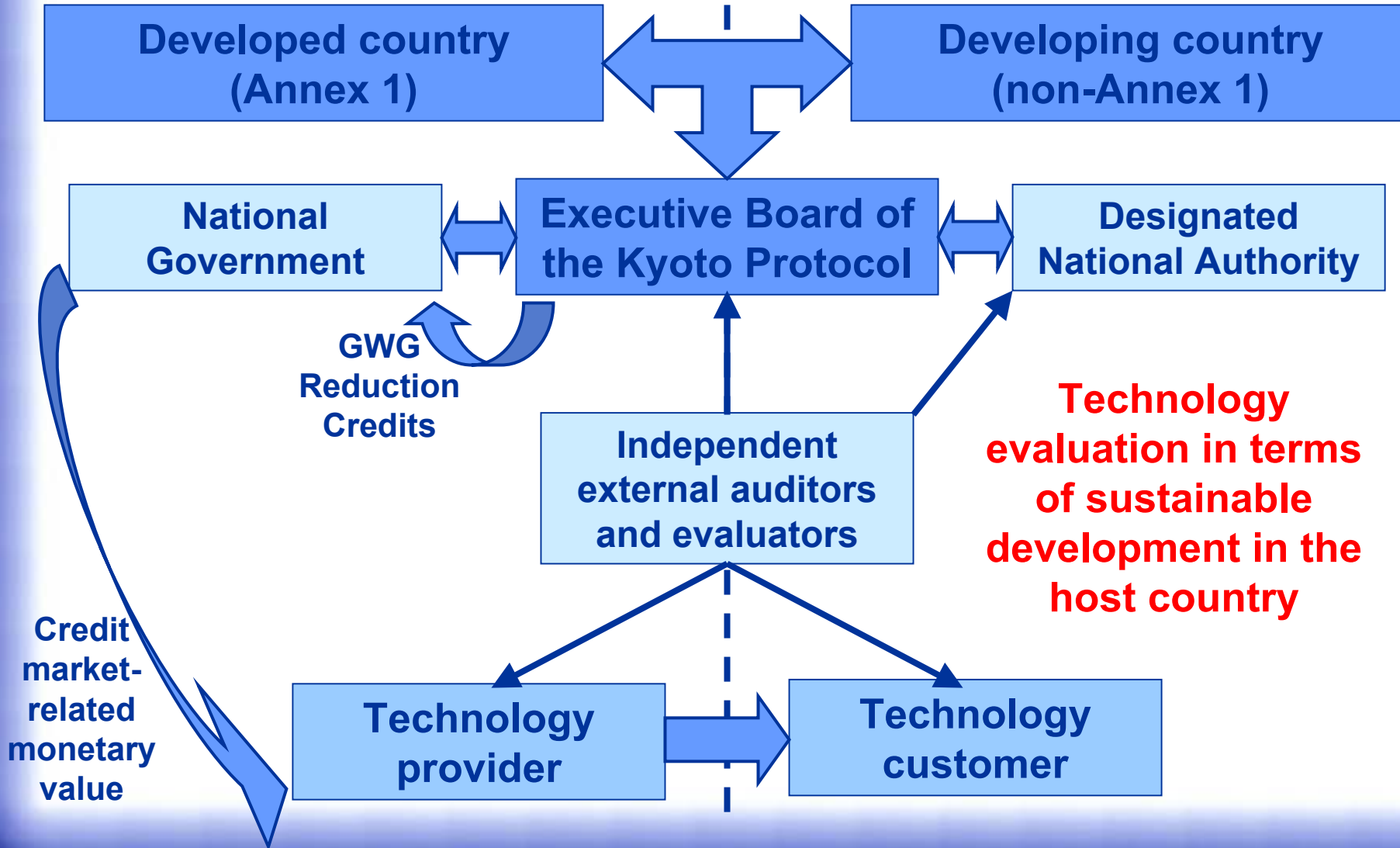
# The Clean Development Mechanism (CDM) of the Kyoto Protocol



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- **Aims to lower the overall cost of reducing greenhouse gas (GHG) emissions released to the atmosphere in developing countries, by forming a means for international trading of GHG emissions**
- **Annex 1 countries can thereby purchase reduced GHG emissions in non-Annex 1 countries and the funds are allocated to reduce the implementation cost of the CDM eligible project in the host country**
- **CDM credits are assigned to reduced GHG emissions**
  - **Emission Reduction Unit (ERU)**
  - **Certified Emission Reduction (CER)**
  - **Assigned Amount Unit (AAU)**
  - **Removal Unit (RMU)**
    - 1 metric tonne of CO<sub>2</sub> equivalent emissions
- **Subsidising of technology transfer**
  - **From developed country to developing country**

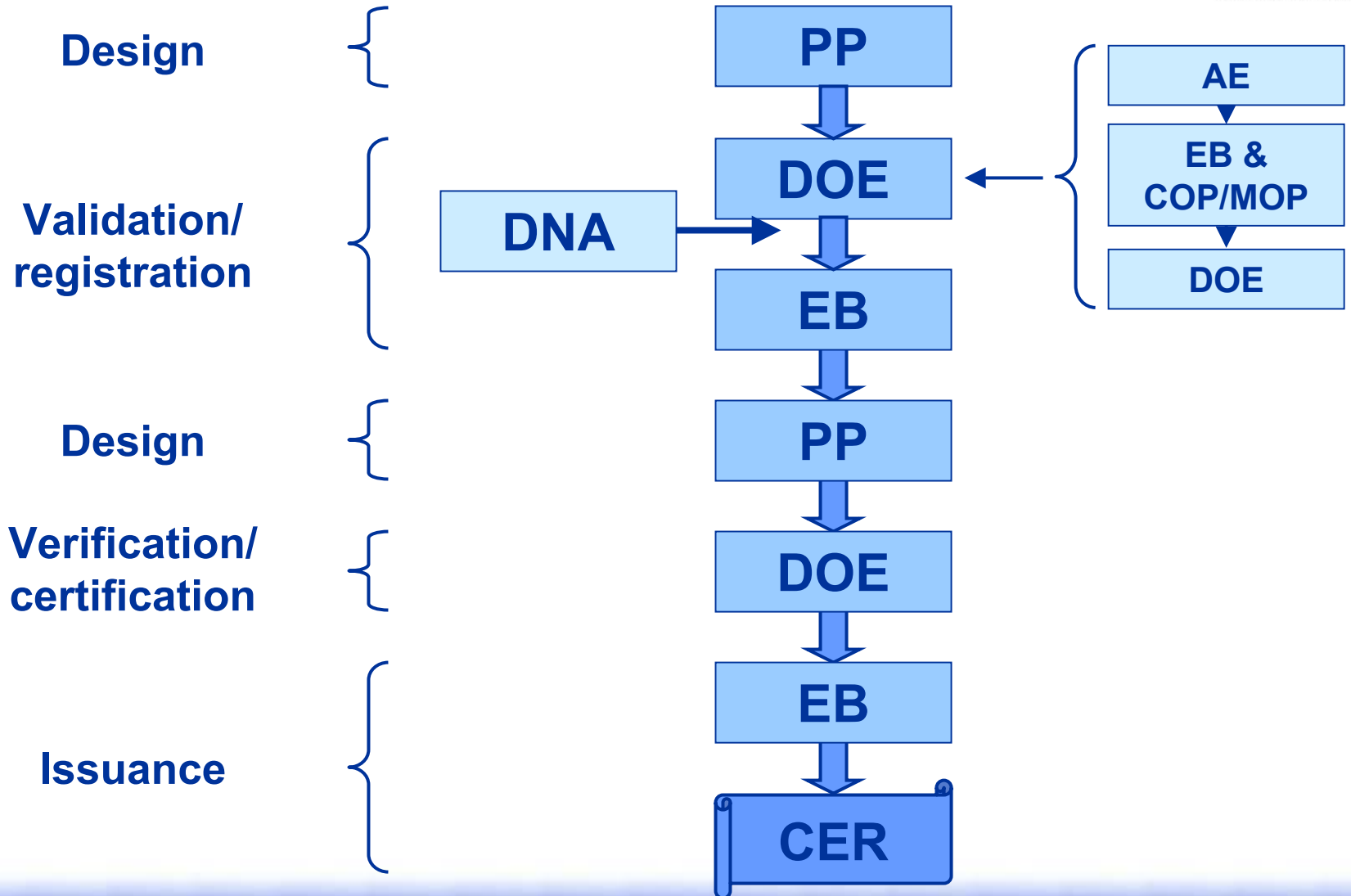
# The Clean Development Mechanism (CDM) of the Kyoto Protocol



# The CDM project activity cycle



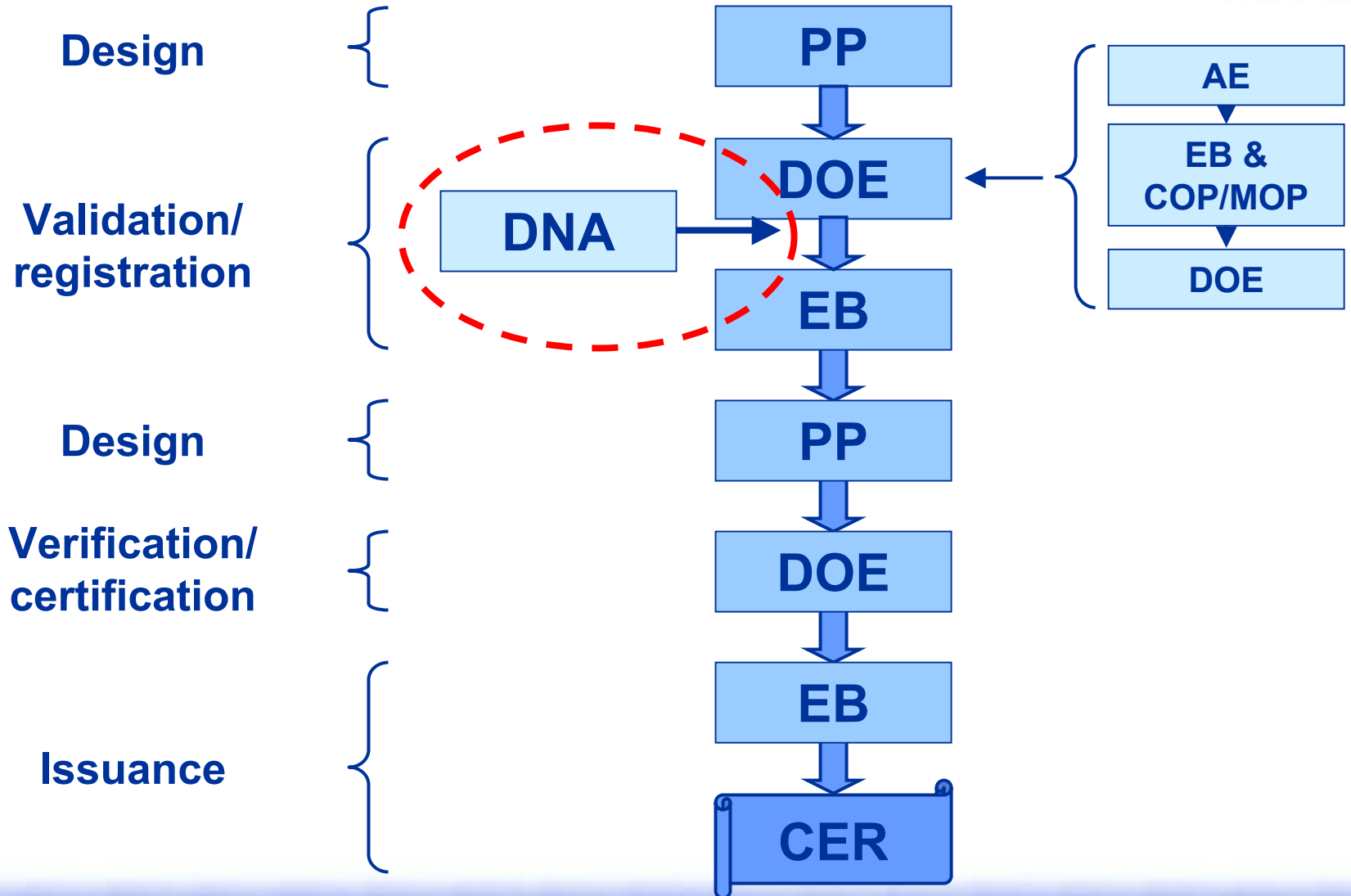
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# The CDM project activity cycle



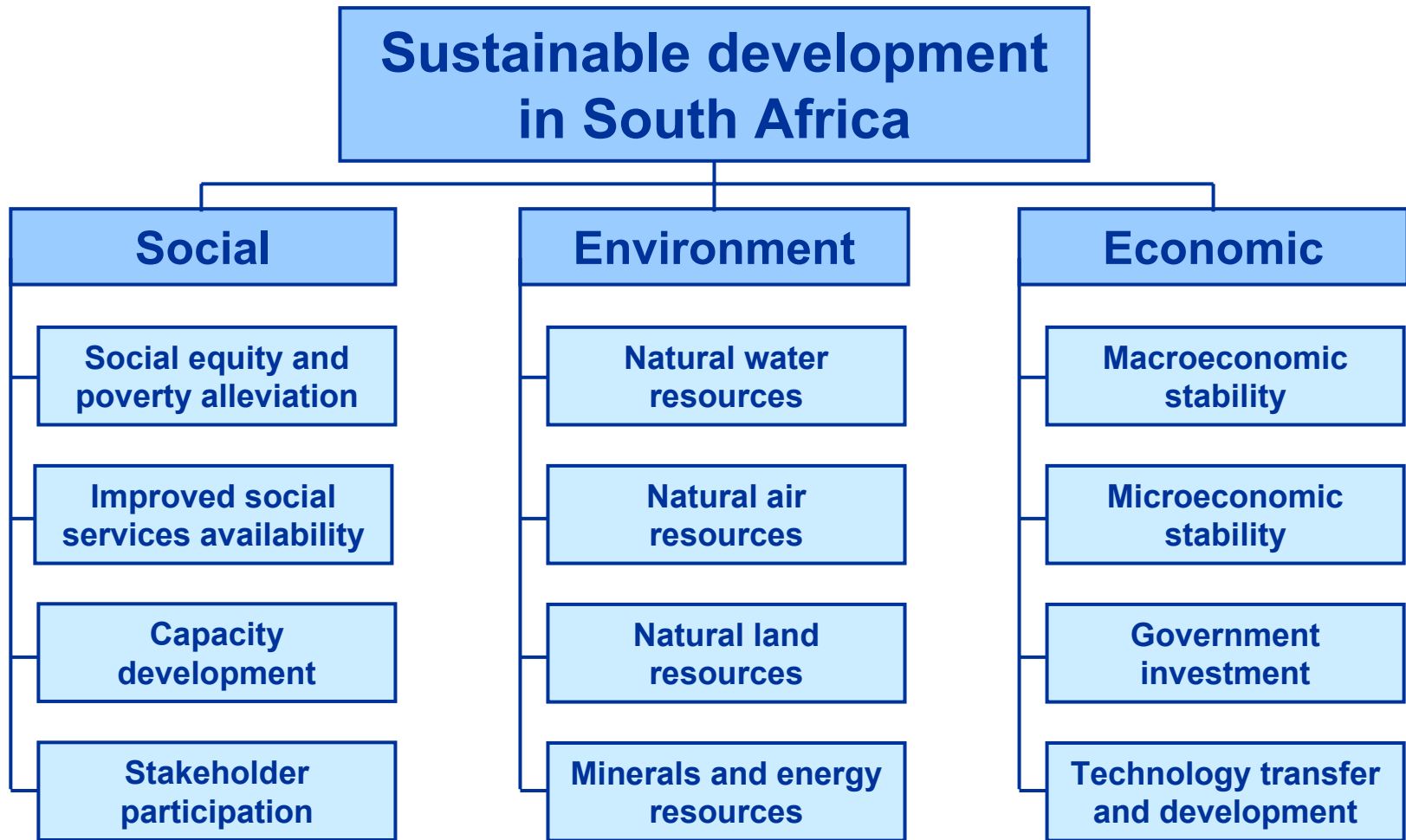
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- **Sustainable development criteria are typically focused on the society priorities of the specific country where a development takes place**
- **Generic approaches have been proposed**
  - **Global Reporting Initiative (GRI)**
    - **Company focus**
  - **United Nation's Commission on Sustainable Development's Framework**
    - **Country focus**
  - **Wuppertal Sustainability Indicators**
    - **Macro and micro level**
- **CDM-connect discussion**
  - **15 July to 2 August 2002**

# Suggested framework of sustainable development criteria for CDM evaluations in South Africa





# Social criteria of the framework



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## Social equity and poverty alleviation

- Number of employment opportunities created/destroyed
- Distribution of employment
- Types of employment
- Categories of people to be employed in terms of gender and racial equity

## Improved social services availability

- Assessment against available policies and plans of national, provincial and local development priorities, e.g. access to sanitation, energy and water supply

## Capacity development

- Training and skills development of project participants and beneficiaries

## Stakeholder participation

- Project developed by and benefiting local communities with meaningful participation
- Participation of neighbouring or other African countries

# Environmental criteria of the framework



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## Natural water resources

- Water availability and use
- Human health impacts, e.g. toxic metals and organics, smell, etc.
- Ecosystem toxicity, i.e. lethal to aquatic plants and animals
- Acidification, e.g. acid rain and acid drainage
- Eutrophication, e.g. nitrates and phosphates
- Loss of aquatic biodiversity

## Natural air resources

- Human health impacts, e.g. toxicity, respiratory (asthma), smell, noise, etc.
- Ecosystem toxicity, i.e. lethal to aquatic and terrestrial plants and animals
- Global warming potential, e.g. CO<sub>2</sub>, CH<sub>4</sub>, etc.
- Stratospheric ozone depletion potential, e.g. CFC-11

## Natural land resources

- Transformation of land or land use
- Loss of topsoil, e.g. erosion
- Loss of terrestrial biodiversity
- Human health impacts, e.g. toxic metals and organics on soil, etc.
- Ecosystem toxicity, i.e. lethal to terrestrial plants and animals
- Acidification, e.g. acid rain and acid drainage

## Minerals and energy resources

- Mineral use
- Non-renewable fossil fuel use

# Economic criteria of the framework



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## Macroeconomic stability

- Project contributes to foreign currency savings, i.e. decrease in forex requirements
- Project increases the value generated in a region, and especially export potential
- Project decreases poverty in a region, i.e. employment creation

## Microeconomic stability

- Project increases the return on investment for investors

## Government investment

- Reduction in public sector (local, provincial and national) investment due for a project

## Technology transfer and development

- New technologies to be used in the project
- Technological skills to be transferred and future self reliance
- Previous successful application of the technology
- Appropriateness of the technology for South Africa
- Project provides demonstration and replication potential

# Methodologies to establish weighting values for the sub-criteria



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- **Group decision-making techniques**
  - **Nominal group technique**
    - Workshop-type application
  - **Delphi technique**
    - Workshop-type and interactive survey-type application
- **Multi Criteria Decision Analysis (MCDA) methodologies**
  - **Direct weighting procedure**
  - **SWING procedure**
  - **TRADEOFF procedure**
  - **Analytical Hierarchy Process (AHP)**
    - **Pair wise comparisons of sub-criteria**
      - Participants have less difficulty to comprehend the required pair wise judgements
      - Can be easily compiled into a survey format
    - **Mathematical (matrix) calculation of relative weighting values**
    - **Inconsistencies of individual judgements can be checked**

# Analytical Hierarchy Procedure (AHP) to determine weighting factors



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Extremely more important

Strongly more important

Equally important

Strongly more important

Extremely more important



**Criterion 1**

← Importance

Importance →

**Criterion 2**

Air

Water

Air

Land

Air

Abiotic

Water

Land

Water

Abiotic

Land

Abiotic

# Application of the AHP to establish weights in the South African manufacturing industry



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- **Directed towards decision-makers in the manufacturing industry**
  - **Managing Directors of South African companies in the automotive supply chain, representing first, second and third tier suppliers**
    - **NAACAM**
    - **43 companies participated in the survey**
      - representing approximately one-quarter of the listed automotive supply industry
  - **Financial Directors of organisation or companies, primarily in the process-related manufacturing industry sector of South Africa, which are listed in the company database of PricewaterhouseCoopers SA**
    - **13 companies participated in the survey**
- **Survey did not include relative weighting values of the three main criteria, i.e. social, environmental and economic**
  - **Only sub-criteria**
  - **As a first approximate, it was assumed that the three main criteria are of equal importance**
    - **An evaluated technology should contribute positively to all three criteria**

# Obtaining overall weighting values from the individual judgements in the survey



- **Direct interactions with participants were not possible**
    - **Workshop**
    - **Interactive surveys**
- } Group decision-making techniques were not possible
- **Two techniques to aggregate the individual judgements**
    - **Aggregation of individual judgements (AIJ), whereby the judgements (pair wise comparisons) are combined before translation to relative weights**
      - Individual levels of inconsistencies are lost with AIJ
    - **Aggregation of individual priorities (AIP), whereby all individual judgments are first translated to relative weights and then combined**

The groups are not homogenous  
as it consists of individuals with  
respective values

  
**AIP**

# Further evaluation of the environmental sub-criteria (for comparative purposes)



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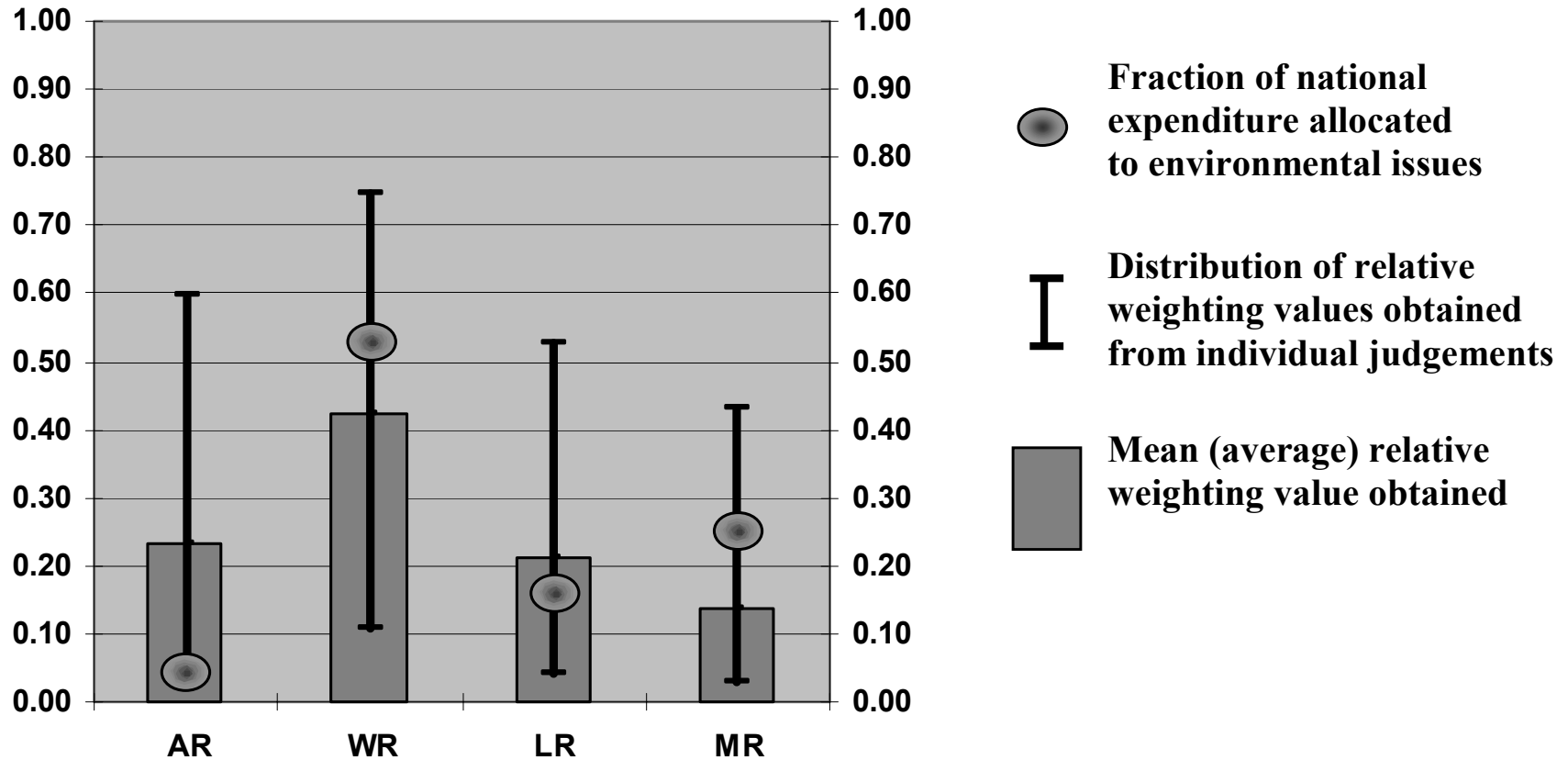
- **Expenditure trends of the national government on environmental issues**
  - **2002/2003 budget from the National Treasury**
    - 2% to environmental issues
  - **Budget for different directorates, departments and programmes**
- **Combined for the four different environmental aspects**
  - **Air resources** - R 252 million (4%)
  - **Water resources** - R 3 512 million (53%)
  - **Land resources** - R 1 118 million (17%)
  - **Mineral and Energy resources** - R 1 743 million (26%)



# AHP survey and national expenditure results for the environmental sub-criteria



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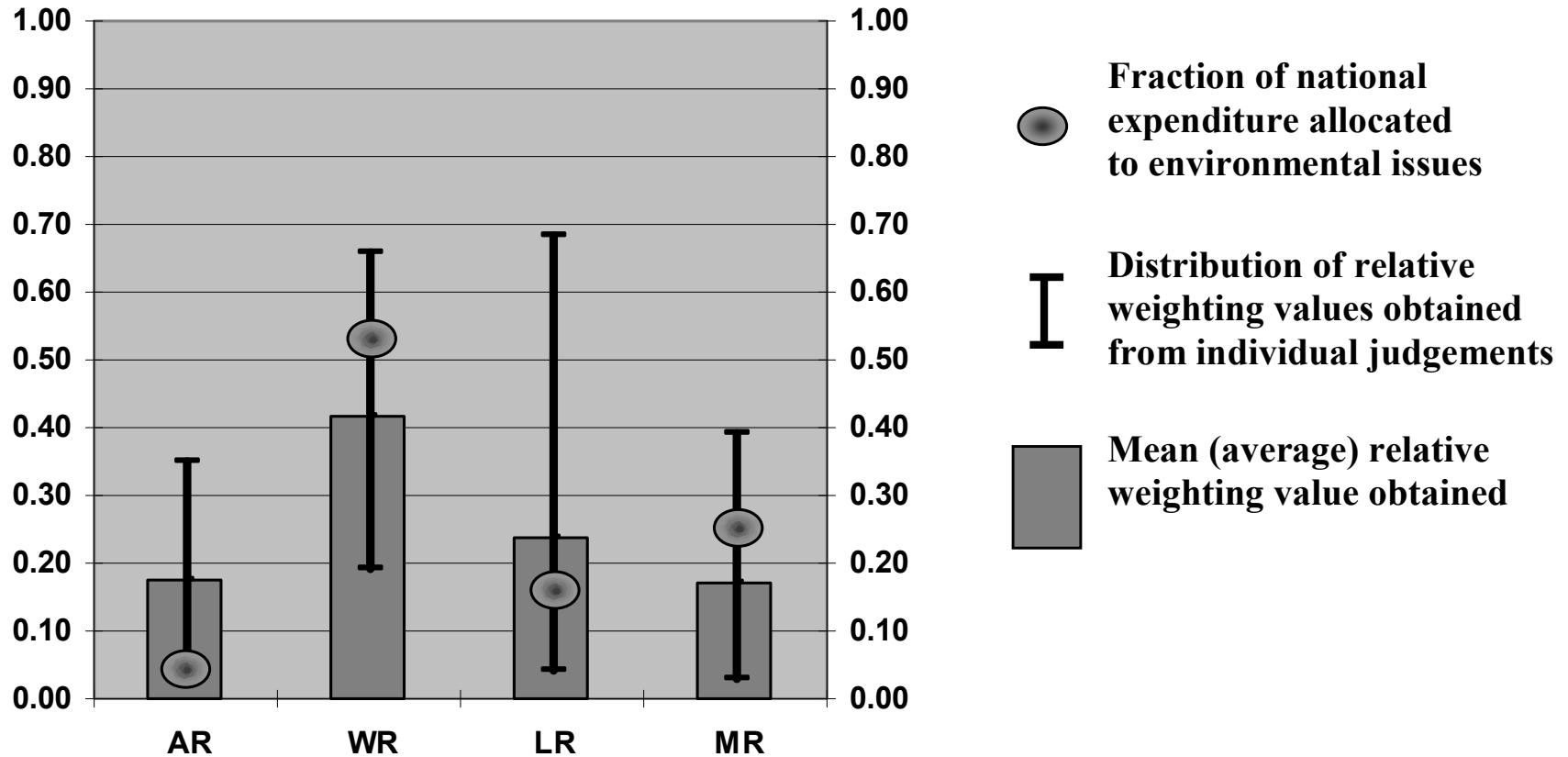


Managing Directors in the automotive supply chain

# AHP survey and national expenditure results for the environmental sub-criteria



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Financial Directors in the process industry

# Mean values of the AIP combination methods of the relative weighting values obtained



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Sustainable development sub-criteria	Mean weighting value	95% confidence interval level
Social equity and poverty alleviation (SE)	0.227	0.168 to 0.286
Improved social services availability (SS)	0.194	0.151 to 0.237
Capacity development (CD)	0.387	0.323 to 0.451
Stakeholder participation (SP)	0.187	0.147 to 0.228
Air resources (AR)	0.202	0.165 to 0.239
Water resources (WR)	0.420	0.371 to 0.468
Land resources (LR)	0.224	0.189 to 0.259
Mineral and energy resources (MR)	0.154	0.119 to 0.189
Macroeconomic stability (ME)	0.336	0.287 to 0.385
Microeconomic stability ( $\mu$ E)	0.235	0.190 to 0.280
Government Investment (GI)	0.140	0.109 to 0.171
Technology transfer/development (TT)	0.289	0.234 to 0.344

# Application of the criteria and weighting values to evaluate and compare ferrochrome technologies



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- **Conventional ferrochrome manufacturing technologies**
  - Pelletising-sintering treatment of the chrome ore before smelting
  - 240 GWh electricity (from coal) for 100 000 tpa plant
- **Newly developed ferrochrome manufacturing technology**
  - Saves in the order of 30% of the process energy (coal)
  - Reduction in GHG = 138 000 tpa > minimum of 100 000 tpa for CDM
- **The compared technologies/plants are similar in many respects:**
  - Economic scales
  - Required resources
  - Located region
- **But:**
  - Mineral resource is used more efficiently
    - High economic return and less emissions
  - Incorporate high level of technology
    - Training/capacity development but less involvement of stakeholders

# Evaluation procedure to compare the two technologies



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- **A scaling score is introduced**
  - Significant improvement in sustainable development through the new technology compared to the baseline
    - (1)
  - No significant difference for the technologies for the specific criterion
    - (0)
  - Significant reduced performance of the new technology compared to the baseline for the specific criterion
    - (- 1)
- **Requires a team of experts**
  - Subjective evaluation
- **Uses a mixture of data or indicators**
  - Qualitative
  - Semi-quantitative
  - Quantitative

# Comparing a new ferrochrome production process with conventional technologies



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Sustainable development sub-criteria (comparative)	Scaling score (comparative)	Main criteria performance
<b>SE</b> - job creation and income benefit to the poor <b>SS</b> - improved availability of essential services <b>CD</b> - generated capacity development opportunities <b>SP</b> - stakeholder participation in project development	0.25 0 0.5 - 0.5	<b>0.157</b>
<b>AR</b> - decreasing pressure on regional air quality <b>WR</b> - decreasing pressure on regional water resources <b>LR</b> - decreasing pressure on regional land resources <b>MR</b> - decreasing pressure on non-renewable resources	0.25 0 0 1	<b>0.205</b>
<b>ME</b> - value generation in a disadvantaged region $\mu$ <b>E</b> - increasing internal rate of return of the project <b>GI</b> - decreasing reliance on government support <b>TT</b> - innovative, local manageable technology	0 1 0 1	<b>0.524</b>

- **The implementation of the new ferrochrome production technology is evaluated to be overall positive for sustainable development in South Africa**
  - **It positively contributes to each of the three main sustainable development criteria**
    - **the largest contribution is made with respect to the internal financial health of the project and the introduction of the new technology in the local manufacturing industry**
    - **Beneficiations to the social and regional environmental aspects of sustainable development are of minor importance, although still positive**
- **Based on these criteria and established weights, it would therefore be proposed to support the newly introduced technology**



- **It is required to obtain the perceptions of the other parts of the South African society**
  - **Government departments, non-government organisations, academia and businesses not included in the manufacturing sectors**
- **For such a comprehensive analysis a workshop is proposed with representatives of the different parts of society, which are nominated by the Designated National Authority (DNA) as stipulated by the Kyoto Protocol**
  - **During the workshop group decision-making techniques together with the AHP approach can be used to obtain weighting values that are representative for South Africa**
  - **It can also be established if certain sustainable development criteria should be considered as thresholds from the perspectives of South African society**
    - **The potentially eligible CDM project must show a positive contribution to certain criteria, before it is further considered**



## Closure and questions

