CLEAN DEVELOPMENT MECHANISM

CDM-EB92-AA-A07

Concept note

Exploration of methodological options for developing ‘agriculture CDM’ (jointly by the MP, SSC WG, and secretariat)

Version 01.0

United Nations
Framework Convention on
Climate Change

TABLE OF CONTENTS **Page**

1. Procedural background

1. At its eighty-ninth meeting (EB89), the Executive Board of the clean development mechanism (CDM) (hereinafter referred to as the Board) considered the concept note on the "Exploration of methodological options for developing 'agriculture CDM'" and requested the secretariat, jointly with the Methodologies Panel (MP) and the Small-Scale Working Group (SSC WG), to prepare a detailed concept note prioritizing areas for new methodological developments, taking into account the criteria provided by the Board, including a timeline for development, resource implications, potential demand, possible issues related to additionality, feasibility of the proposed measures under the CDM and collaboration opportunities, inter alia with the Food and Agriculture Organization of the United Nations (FAO), for methodological work, and present it for the consideration of the Board at a future meeting.

2. This work relates to the activity “Development of new methodologies to broaden the applicability of the CDM” under objective 1(c): “Develop simplified and user-friendly standards and procedures that increase efficiency and ensure environmental integrity”, with a resource allocation as referred to in table 4 on page 15 of the CDM two-year business plan 2016–2017 and management plan 2016 (EB87, annex 1).

3. The call for inputs from stakeholders was open from 17 December 2015 to 27 January 2016, and in total nine public inputs was received. The summary of the comments are contained in Appendix 1.

4. The draft concept note was considered by MP71 (4-7 October 2016) and SSC WG52 (4-6 October 2016) and this version has been prepared jointly by the secretariat, MP and the SSC WG.

2. Purpose

5. The purpose of this concept note is to propose areas for development of new methodologies for the agriculture sector, based on potential demand, feasibility of proposed mitigation measures under the CDM and collaboration opportunities, taking into account issues related to additionality.

3. Key issues and proposed solutions

3.1. Contents and method of analysis

6. Four criteria were applied under this analysis to shortlist the areas for methodological work:

    a) Potential demand for methodological work;

    b) Viability of CDM project (e.g. possible issues related to additionality and feasibility/viability of the proposed measures under the CDM);

    c) Collaboration opportunities, inter alia with FAO, for methodological work;

    d) A reasonable timeline for development and resource implications.

7. This concept note first analyses each of the criteria listed above to provide the basis for assigning priority to different potential top-down methodological work areas. Second, it considers each of the proposals for methodological work suggested in the previous concept notes (CDM-EB87-AA-A10 and CDM-EB89-AA-A09) in the light of the four criteria. Finally, it proposes a list of specific top-down methodological work tasks to be undertaken.

3.2. Criteria for prioritization

3.3. Criteria I: Potential demand for methodology work

8. Existing and proposed projects in the agriculture sector which will reduce emissions and receive climate finance or have already received such financing were reviewed. Projects from the following sources were considered:

   (a) CDM methodologies, standardized baselines, and CDM projects in the CDM pipeline;

   (b) Projects in the nationally appropriate mitigation actions (NAMA) Registry;

   (c) Standards of other greenhouse gas (GHG) programmes;

   (d) Mitigation measures proposed in the submitted Intended Nationally Determined Contributions (INDCs).

3.3.1. Technologies/measures covered by CDM methodologies and standardized baselines

9. There are several CDM methodologies in the agriculture sector, but most methodologies have limited scope (e.g. applicable to specific mitigation activities with narrow scope). Most of the CDM methodologies relevant to agriculture are small-scale due to the small emission levels of project activities (farms are small production units compared to industrial plants). The relevant CDM methodologies are listed in table 1 below. Recently, one standardized baseline in the agriculture sector was also developed.

Table 1. Key CDM methodologies and standardized baselines for projects in the agriculture sector

Large-scale methodologies		**Number of projects**	**Number of Programme of Activities (PoAs)**
Manure management	ACM0010 (AM0006 and AM0016): GHG emission reductions from manure management systems	59	0
	AM0073: GHG emission reductions through multi-site manure collection and treatment in a central plant	2	0
Alternative waste treatment	ACM0022 (AM0025 and AM0039): Alternative waste treatment processes	11	0

Small-scale methodologies			
Manure management	AMS-III.D: Methane recovery in animal manure management systems	181	15
	AMS-III.R: Methane recovery in agricultural activities at household/small-farm level	34	8
	AMS-III.Y: Methane avoidance through separation of solids from wastewater or manure treatment systems	3	0
	AMS-III.AO: Methane recovery through controlled anaerobic digestion	6	1
Alternative waste treatment	AMS-III.E: Avoidance of methane production from biomass decay through controlled combustion	41	0
	AMS-III.F: Avoidance of methane production from biomass decay through composting	56	10
	AMS-III.BE: Avoidance of methane and nitrous oxide emissions from sugarcane pre-harvest open burning through mulching	0	0
Rice cultivation	AMS-III.AU: Methane emission reduction by adjusted water management practice in rice cultivation	0	0
Enteric fermentation	AMS-III.BK: Strategic supplementation of smallholder dairy sector to increase productivity	0	0
Fertilizer	AMS-III.BF: Reduction of N_2O emissions from use of Nitrogen Use Efficient (NUE) seeds that require less fertilizer application	0	0
	AMS-III.A: Urea offset by inoculant application in soybean-corn rotations on acidic soils on existing cropland	0	0
Energy efficiency	AMS-II.P: Energy-efficient pump-set for agriculture use	0	0
	AMS-II.F: Energy efficiency and fuel-switching measures for agricultural facilities and activities	1	1
Approved standardized baselines (ASB)			
ASB	ASB0008: Methane Emissions from Rice Cultivation in the Philippines	0	0

Source: UNFCCC

10. Because there is limited experience in the CDM at present, except manure management and alternative waste treatment, the NAMA Registry was also considered since these are other platforms for emission reduction projects seeking climate finance.

3.3.2. Technologies/measures proposed in nationally appropriate mitigation actions

11. An assessment of technologies/measures applied in the NAMAs was also carried out. The objective was to check whether there were technologies/measures that are of interest to host countries but not currently covered in the CDM.

12. There are 11 NAMAs relevant to the agriculture sector that have been submitted to the NAMA Registry and are publically available. The NAMAs are listed in table 2 below.

Table 2. List of NAMAs in the agriculture sector

ID	Party	Title	Mitigation technologies/measures
NS-147	Pakistan	Bio-energy generation and greenhouse gas mitigation though organic-waste utilization	• Production of biogas from livestock wastes of dairy farms so as to capture and utilize the CH_4 gas as a source of bioenergy; • Management and utilization of bio-digesters' slurry as source of bio-fertilizer to substitute the chemical fertilizer.
NS-149	Dominican Republic	Reducing Greenhouse Gases (GHG) Emissions in Pig Farms in the Dominican Republic	• Anaerobic digestion in the pig farms.
NS-152	Uganda	Promoting cultivation of high-yielding upland rice in Uganda	• Addressing methane emissions from rice cultivation.
NS-154	Uganda	Developing appropriate strategies and techniques to reduce methane emissions from livestock production in Uganda	• Appropriate feeding strategies that increase productivity while reducing methane emissions from enteric fermentations (e.g. feeding livestock on improve forages; feed supplements); • Various feed additives, including plant extracts and rumen modifiers (yeast, bacterial direct-fed microbials, and enzymes); • Improving feed efficiency through breeding and diet manipulation; • Manure and pasture management on both small and larger farms.
NS-156	Uganda	Integrated Wastewater Treatment for Agro-process Water in Uganda	• Increasing efficiency and value-addition prospects for wastewater treatment of agro-processing firms.
NS-72	Costa Rica	NAMA – Low-Carbon Coffee - Costa Rica	• Mitigation in the coffee sector: the farm (NO_2 mitigation and CO_2 fixation) and the mills (CH_4 and CO_2 mitigation). ✓ Adoption of efficient practices of fertilizer application. ✓ Improved water management in anaerobic treatment systems and introducing technologies for wastewater treatment. ✓ Aerobic treatment and energetic use of pulp. ✓ Energy savings by improving the coffee-drying process. ✓ Increased fixation of carbon by the spread of coffee agroforestry systems (intensified shading).

ID	Party	Title	Mitigation technologies/measures
NS-71	Costa Rica	Costa Rica Livestock NAMA	• Changes not only in the primary production of meat and milk, but also in the form of processing the product within the country's agricultural chain. ✓ Hedges-pasture sections ✓ Rational grazing ✓ Pasture improvement-feeding ✓ Improved fertilization plans ✓ Measures in the processing industry ✓ Genetic improvement of the herd and excreta management.
NS-206	Rwanda	Sustainable Fertilizers Production and Use	• The key mitigation actions include: ✓ Collection and production of livestock manure for organic fertilizer ✓ Improved efficiency in lime production and application ✓ Elimination and reduction of vertical lime burning ✓ Improved agronomic management of soils, fertilizers, and crop yields.
NS-210	Rwanda	Energy Efficiency Improvement in the Tea and Coffee Sector in Rwanda	• The promotion of energy efficiency will focus on energy-intensive activities in the tea and coffee industry pertaining to thermal energy and electrical energy requirements, namely roasting, drying, processing and packaging.
NS-200	Uruguay	Sustainable production with low-emission technologies in agriculture and agroindustry production chains	• Transformation of the different kinds of waste generated in the agriculture and agroindustry production chains in various types of energy or by-products, aimed at developing a low-carbon sustainable production model. ✓ Strengthening the policy framework to promote sustainable production schemes and implement low-emission technologies in target sectors; ✓ Energy production and other forms of waste valorization in target sectors; ✓ Laboratory research for target sectors for technology development, adaptation, assessment and transfer; ✓ Demonstration of the feasibility of production of energy by-waste.
NS-217	Mongolia	Multi-purpose utilization of biochar in Mongolia	• Within a biochar project, emissions reductions could come from changing fresh organic matter to a much more stable form of carbon through the production of biochar, from increasing soil carbon stocks upon biochar application, possible reductions in soil emissions of GHGs, enhanced carbon storage in growing crops, and decreases in fertilizer and other energy-intensive agricultural inputs.

Source: <http://www4.unfccc.int/sites/nama/SitePages/Home.aspx>

13. Some of the technologies/measures proposed in the above NAMAs are not adequately covered in the existing CDM methodologies (see (a) and (b) below), while many others may not be eligible under the CDM as per the current modalities and procedures:

    (a) Grazing land and livestock management (e.g. improved breeds with higher productivity);

    (b) Crop nutrition management (e.g. improved fertilizers).

3.3.3. Technologies/measures covered by other GHG programmes

14. The standards of the following GHG programmes were investigated to assess methodologies that have already been developed or are currently under development:

    (a) The American Carbon Registry (ACR);

    (b) The Climate Action Reserve (CAR);

    (c) Verified Carbon Standard (VCS);

    (d) The Gold Standard (GS);

    (e) Australia's Emissions Reduction Fund (ERF);

    (f) The Joint Crediting Mechanism (JCM).

15. Table 3 below provides information on the methodologies of the above GHG programmes in the agriculture sector as per the mitigation options listed in the Fifth Assessment Report (AR5) of Intergovernmental Panel on Climate Change (IPCC).

16. It can be seen that other GHG programmes have developed various methodologies that include soil carbon sequestration, which is not eligible under the CDM.

Table 3. Methodologies developed by other GHG programmes

Land-based agriculture		Covered by CDM
Croplands — plant management	• *VCS: VM0017 Adoption of Sustainable Agricultural Land Management* • *VCS: VM0021 Soil Carbon Quantification Methodology*	
Croplands — nutrient management	• ACR: Changes in Fertilizer Management • ACR: Reduced Use of Nitrogen Fertilizer on Agricultural Crops • CAR: Nitrogen Management • *VCS: VM0017 Adoption of Sustainable Agricultural Land Management* • *VCS: VM0021 Soil Carbon Quantification Methodology* • VCS: VM0022 Quantifying N2O Emissions Reductions in Agricultural Crops through Nitrogen Fertilizer Rate Reduction • ERF: Reducing greenhouse gas emissions from fertiliser in irrigated cotton	• AMS-III.BF • AMS-III.A

Land-based agriculture		Covered by CDM
	• *ERF: Estimating sequestration of carbon in soil using default values (model-based soil carbon)* • JCM: Methodology for N2O reduction by using coated fertilizers (draft methodology is developed but not approved yet)[1]	
Croplands — tillage/residues management	• *GS: Increasing Soil Carbon Through Improved Tillage Practices*	-
Croplands — water management	-	-
Croplands — rice management	• ACR: Rice Management Systems • CAR: Rice Cultivation	• AMS-III.AU
Rewet peatlands drained for agriculture	• *ACR: Restoration of Degraded Wetlands of the Mississippi Delta* • *ACR: Restoration of California Deltaic and Coastal Wetlands (currently under development)* • *VCS: VM0024 Methodology for Coastal Wetland Creation* • *VCS: VM0027 Methodology for Rewetting Drained Tropical Peatlands*	-
Croplands — set-aside and land-use change	-	-
Biochar application	-	-
Grazing lands — plant management	• ACR: Grazing Land and Livestock Management • *ACR: Compost Additions to Grazed Grasslands* • *VCS: VM0017 Adoption of Sustainable Agricultural Land Management* • *VCS: VM0021 Soil Carbon Quantification Methodology* • *VCS: VM0026 Methodology for Sustainable Grassland Management (SGM)* • *VCS: VM0032 Methodology for the Adoption of Sustainable Grasslands through Adjustment of Fire and Grazing* • *ERF: Sequestering carbon in soil in grazing systems* • *ERF: Estimating sequestration of carbon in soil using default values (model-based soil carbon)*	-
Grazing lands — animal management	• *VCS: VM0026 Methodology for Sustainable Grassland Management (SGM)* • *VCS: VM0032 Methodology for the Adoption of Sustainable Grasslands through Adjustment of Fire and Grazing*	-
Grazing land — fire management	• *VCS: VM0032 Methodology for the Adoption of Sustainable Grasslands through Adjustment of*	-

[1] As compared with AMS-III.BF and VCS: VM0022 "Quantifying N2O Emissions Reductions in Agricultural Crops through Nitrogen Fertilizer Rate Reduction", the draft JCM methodology claims that it offers wider application and reduced monitoring burden, while being sufficiently robust.

Land-based agriculture		Covered by CDM
	Fire and Grazing • ERF: Emissions abatement through savanna fire management[2]	
Revegetation	-	-
Organic soils — restoration	• *ACR: Avoided Conversion of Grasslands and Shrublands to Crop Production* • *CAR: Grassland* • *VCS: VM0017 Adoption of Sustainable Agricultural Land Management* • *VCS: VM0021 Soil Carbon Quantification Methodology*	-
Degraded soils — restoration	-	-
Biosolid applications	-	-
Livestock		
Livestock — feeding	• ACR: Grazing Land and Livestock Management • ACR: Reduced Carbon Intensity of Fed Cattle (currently under scientific peer review) • ERF: Reducing greenhouse gas emissions by feeding nitrates to beef cattle • ERF: Reducing greenhouse gas emissions by feeding dietary additives to milking cows • GS: Dairy Efficiency Accounting – Increase input efficiency while reducing emissions per kilogram of milk (currently under development)	• AMS-III.BK
Livestock — breeding and other long-term management	• ERF: Beef cattle herd management	-
Manure management	• ACR: Grazing Land and Livestock Management • CAR: Mexico Livestock • CAR: U.S. Livestock • CAR: Organic Waste Composting • CAR: Organic Waste Digestion • VCS: VMR0003 Revisions to AMS-III.Y to Include Use of Organic Bedding Material • GS: Revised Consolidated Baseline Methodology for GHG Emission Reductions from Manure Management Systems and Municipal Solid Waste • ERF: Destruction of methane generated from manure in piggeries • ERF: Destruction of methane from piggeries using engineered biodigesters • ERF: Destruction of methane generated from dairy manure in covered anaerobic ponds	• ACM0010 • AM0073 • ACM0022 (AM0025 and AM0039) • AMS-III.D • AMS-III.R • AMS-III.Y • AMS-III.AO • AMS-III.E • AMS-III.F • AMS-III.BE
Integrated systems		

[2] This methodology aims to abate GHG emissions from fire largely by using fire during the early dry season, with the intent to reduce the proportion of the total area burned by all fires that occur in the late dry season.

Land-based agriculture		Covered by CDM
Agroforestry (including agropastoral and agrosilvopastoral systems)	-	-
Other mixed biomass production systems	-	-
Integration of biomass production with subsequent processing in food and bioenergy sectors	-	-
Agroforestry (including agropastoral and agrosilvopastoral systems)	-	-
Bioenergy		
Bioenergy	-	• Type I small-scale methodology
Demand-side options		
Reduced losses in the food supply chain	-	-
Changes in human diets towards less emission-intensive products	-	-
Demand-side options related to wood and forestry	-	-
Energy		
Renewable energy or energy efficiency in food production, processing and/or food storage	• GS: Suppressed Demand Small-scale Methodology for Energy Use for the Processing of Agricultural Products • GS: Suppressed Demand Small-scale Methodology for Low GHG Food Preservation • GS: Cool Farm Tool – to reduce emissions for agricultural commodities along the production and supply chain (currently under development) • JCM: Installation of Energy-efficient Refrigerators Using Natural Refrigerant at Food Industry Cold Storage and Frozen Food Processing Plant	• AMS-II.P • AMS-II.F

Source:

- The American Carbon Registry (ACR): <http://americancarbonregistry.org/carbon-accounting/standards-methodologies>.
- The Climate Action Reserve (CAR): <http://www.climateactionreserve.org/how/protocols/>
- The Verified Carbon Standard (VCS): <http://www.v-c-s.org/methodologies/what-methodology>.
- The Gold Standard (GS): <http://www.goldstandard.org/>.
- The Australia's Emissions Reduction Fund (ERF): <http://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type/Opportunities-for-the-land-sector>.
- Joint Crediting Mechanism (JCM): <http://www.mmechanisms.org/e/initiatives/methodology.html>

3.3.4. Mitigation measures proposed in the submitted INDCs

17. According to FAO's working paper (2016), from the 161 INDCs (188 countries) submitted by 31 March 2016, agriculture is among the most referenced sectors in countries' mitigation contributions (targets and/or actions). Agriculture is included in 73 per cent of the countries' mitigation contributions.

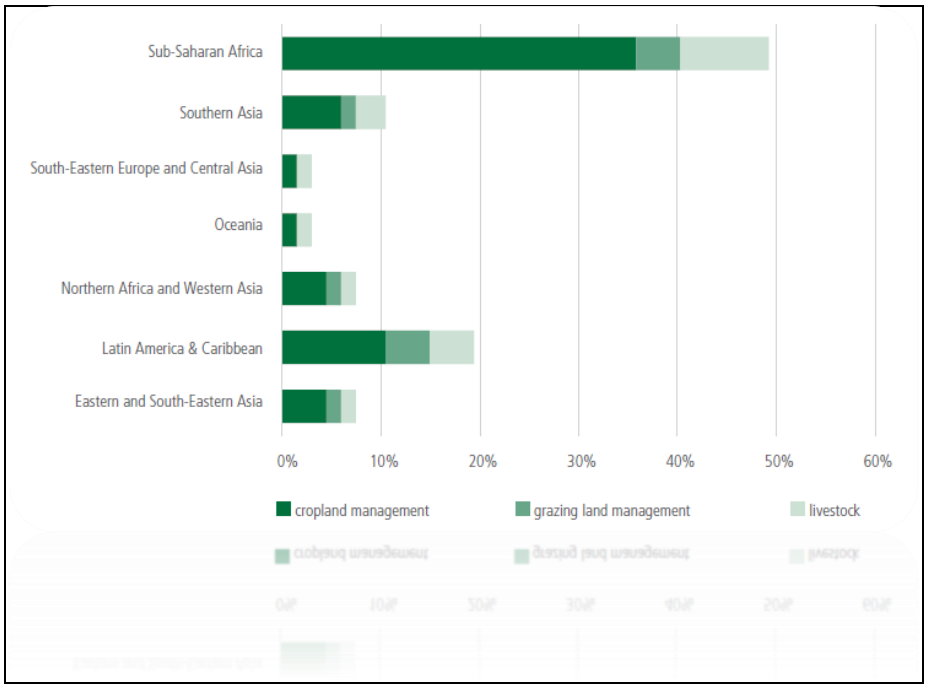
18. More than one third of the countries that include agriculture in their mitigation efforts do not provide further information regarding subsectors or activities. Seventy-seven countries propose mitigation measures in agriculture – either under a target, or as stand-alone action-based contributions – while 57 countries explicitly mention livestock. The level of detail varies, ranging from countries that only note the sector or respective inventory subcategories (e.g. managed soil, enteric fermentation) to comprehensive descriptions of intended policies and programmes/projects in this sector (e.g. Bangladesh, Burkina Faso, Malawi).

19. Among the mitigation actions highlighted by developing countries (including least developed countries) and economies in transition, cropland management features prominently (40 countries). In particular, countries mentioned: "nutrient management" (18); "plant management" (8); and "tillage/residue management" (5). Other related activities include rice management (12) and water management (8). Concerning livestock, some countries explicitly specified: grazing land management (9); feed management (10); breeding management (5); and manure management (9). Other frequently addressed strategies include integrated systems such as agroforestry (21) and climate-smart agriculture (16).

20. Also, the agriculture sectors are most often referred to in the INDCs as providing adaptation-mitigation synergies, as well as socio-economic and environmental co-benefits.

21. Figure 1 below illustrates a regional breakdown of mitigation measures included in INDCs.

Figure 1. Mitigation measures in agriculture, by type of activities and region



Source: FAO (2016): The Agriculture Sectors in the Intended Nationally Determined Contributions: Analysis

3.4. Criteria II: Viability of CDM project (e.g. possible issues related to additionality and feasibility of the proposed measures under the CDM)

22. The CDM must ensure that emission reductions are real, measurable and verifiable, and accurately reflect what has occurred within the project boundary. CDM modalities and procedures have operationalised those requirements. Thus, any project type that does not or may not comply with the requirements of CDM modalities and procedures is excluded, as the MP and the SSC WG considered that there is no explicit mandate from the Board to work in these areas at this point in time. For example measure for soil carbon management have not been considered.

3.5. Criteria III: Opportunities for collaboration

23. The work under this mandate would benefit from outside expertise and experience garnered from other efforts to quantify emission reductions in the agriculture sector. There are several organizations working on quantifying emission reductions from agriculture projects. Some examples are the Global Alliance for Climate-Smart Agriculture (GACSA),[3] FAO,[4] and the Consultative Group on International Agricultural Research (CGIAR)'s Program on Climate Change, Agriculture and Food Security. The

[3] GACSA was launched on 23 September 2014 at the United Nations Climate Summit in New York. GACSA is a voluntary alliance of partners dedicated to addressing the challenges facing food security and agriculture under a changing climate. In particular the alliance has the objective of scaling up the Climate-Smart Agriculture approach, a concept which was originally developed by FAO.

[4] FAO is developing a "Compendium on GHG Baselines and Monitoring" for the agriculture sector.

secretariat has made initial contacts and there is interest on the part of FAO to collaborate on the thematic area of "Reducing Enteric Methane for improving food security and livelihoods". FAO studies indicate that the livestock sector is expected to grow in most developing countries and there is scope for developing methodologies, including region-specific emission-intensity metrics.

24. Substantial work has also been conducted by FAO and the Global Initiative on Food Loss and Waste Reduction in the area of foot-printing food loss and wastage. There may be potential to collaborate. This will need to be further explored.

3.6. Criteria IV: Timeline for development and resource implications

25. Each new methodology is likely to incur three to five person months of efforts for development, and if the Board were to approve development, the new methodologies are likely to be finalized in Q4 of 2017 and Q1 of 2018.

3.7. Review of the proposals and proposed areas of top-down methodological work for the agriculture sector

26. From this review, the SSC WG, MP and the secretariat concluded that four areas (see table 4 below) would be suitable for further analysis.

Table 4. Potential areas for further methodological work in the agriculture sector

No.	Case
1	New methodology for grazing land and livestock management
2	New methodology for crop nutrition management
3	New methodology for reducing food loss and waste through efficient processing and/or storage
4	New methodology for application of renewable energy and energy efficiency for agriculture (e.g. solar powered water pumps, crop and grain drying, and greenhouse heating)

27. Appendix 2 provides details on the proposal for each specific top-down methodological work. Below is a summary:

(a) **New methodology for grazing land and livestock management:** There is substantial scope for reduced emission intensity (GHG emissions per unit of output) through increased productivity. For example, various technical mitigation options have been recommended by FAO, which include options related to feed additives and feeding practices, options related to manure management, and options related to animal and reproductive management practices and technologies. One consolidated methodology could be developed for a number of different technologies/measures, or individual methodologies for each technology/measure.

(b) **New methodology for crop nutrition management:** There is substantial scope for further emission reductions in this area. It is proposed that a new methodology be developed (based on AMS-III.BF "Reduction of N2O emissions from use of Nitrogen Use Efficient (NUE) seeds that require less fertilizer application") to cover various measures:

(i) Controlled release (coated) fertilizers, which improve efficiency of nitrogen use and reduce GHG emissions per unit of output;

(ii) Precision agriculture techniques to increase efficiency of production and reduce fertilizer-related emissions per unit of output;

(iii) Nitrification inhibitors to reduce N2O emissions.

(c) **New methodology for reducing food loss and waste through efficient processing and/or storage:** This is a new project area with large emission reduction potential and will contribute to food security. Project activities may reduce food waste at processing and storage facilities. The objective will be to reduce the volume of agricultural input supplied to the facility for a given food output from the facility. An example is a reduction in post-harvest losses of rice with a focus on storage (e.g. use of a special bag for rice storage, which protects rice from moisture, pest infestation and fungal growth) and milling (drying, threshing improvements or specific technologies) at a rice mill. One simple approach could be to start with simple methodologies applicable to specific crops and their processing chain. Rice could be the first candidate.

(d) **New methodology for application of renewable energy and energy efficiency for agriculture:** There is a lot of interest in this area (e.g. as expressed in INDCs) and the proposed work builds on existing methodologies. The specific cases identified are: solar-powered water pumps; crop and grain drying; and greenhouse heating.

28. The above areas are summarized in the table 5 below:

Table 5. Summary of proposals against four criteria

	Criteria I: Potential demand	**Criteria II:** Viability of CDM project	**Criteria III:** Collaboration opportunities	**Criteria IV:** Timeline and resource implications
New methodology for grazing land and livestock management	**High** Indicated in many INDCs	**Yes**	**Yes**	**Low** Collaboration with expert organizations such as FAO would ease the development.
New methodology for crop nutrition management	**High** Indicated in many INDCs	**Yes**	**Not known as of now**	**High**

	Criteria I: Potential demand	**Criteria II:** Viability of CDM project	**Criteria III:** Collaboration opportunities	**Criteria IV:** Timeline and resource implications
New methodology for reducing food loss and waste through efficient processing and/or storage	**High**	**Yes**	**Not known as of now**	**Medium** Collaboration with expert organizations would ease the development.
New methodology for application of renewable energy and energy efficiency for agriculture	**Medium** Categorized under Energy Sector	**Yes**	**Not known as of now**	**Low** New methodologies could be developed building on existing CDM methodologies.

29. Based on the discussion above, it is proposed that the work of development of new methodologies be undertaken for "**Grazing land and livestock management**" and **"Reducing food loss and waste through efficient processing and/or storage"**.

4. Impacts

30. The work proposed above would expand the types of agriculture projects that can be developed under the CDM with high mitigation potential. Development of new methodologies that are broadly applicable but include simplified approaches (e.g. emission intensity default factors) in agriculture sector through collaborations will facilitate implementation of CDM projects and programmes in the agriculture sector.

5. Subsequent work and timelines

31. Subject to approval by the Board, the above work would be undertaken jointly by the MP, the SSC WG and the secretariat as part of the 2017 CDM Management Plan. The SSC WG will take the lead in finalizing the recommendations, and the MP will provide inputs to the SSC WG.

6. Recommendations to the Board

32. The secretariat, MP and SSC WG recommend that the Board consider the analysis and approve the proposals for further methodological work (i.e. new methodology for "**Grazing land and livestock management**" and for **"Reducing food loss and waste through efficient processing and/or storage"**). The Board may also wish to provide further guidance as necessary.

Appendix 1. Summary of public inputs

1. Stakeholders were invited to provide their input including but not limited to issues and initial proposals indicated in the concept note. The call for inputs from stakeholders was open from 17 December 2015 to 27 January 2016, 24:00 GMT.

2. In total nine public submissions[1] were received from stakeholders and their inputs are summarized in the table below.

Table 1. Summary of public inputs

Organisation	Relevant comments
Research Institute of Organic Agriculture FiBL	• Include organic fertilisers for soil carbon sequestration
Coalition of Agricultural Greenhouse Gases	• Review ACR Grazing Land and Livestock Management methodology • Review Climate Action Reserve Nitrogen Management Project Protocol Version 1.1
ActionAid International	• Against inclusion of soil carbon
Agroscope (Institute for Sustainability Sciences)	• Mention of additional initiatives • Demand side measures. Reduced consumption of animal products
Environmental Defense Fund	• Consider in context of Paris Agreement • Look at aggregation and landscape approaches • Look at ACR, CAR and CARB work on agricultural emissions • Include Nitrous oxide and methane reduction potential in CSA • Consider organic fertilisers inputs • Look at USDA *COMET-Farm* Voluntary Carbon Reporting Tool
Carbon Market Watch	• Do not include avoided deforestation and soil carbon
Farmers Edge Inc	• Consider Alberta carbon offset system protocols
IRTA	• General inputs relating to Mediterranean conditions
Humane Society International	• Include reference to sustainable development, inter alia health and animal welfare impacts. • Demand side measures. Dietary choices.

[1] https://cdm.unfccc.int/public_inputs/2015/mp69_01/index.html

Appendix 2. Details of proposals

1. New methodologies for grazing land and livestock management

Case:
New methodologies for grazing land and livestock management

- Various measures can be taken to increase productivity and reduce GHG emissions per unit of output. For example, various technical mitigation options have been recommended by FAO, which include options related to feed additives and feeding practices; options related to manure management (dietary management); and options related to animal and reproductive management practices and technologies. One consolidated methodology for a number of different technologies could be developed or individual methodologies for each technology.

Included in other programs:
Alberta Offset Credit System Protocols

- Reduced Age at Harvest of Beef Cattle
- Reducing Days on Feed of Beef Cattle
- Selection for Low Residual Feed Intake Markers in Beef Cattle

Australia Emission Reduction Fund (ERF)

- Beef cattle herd management
- Reducing greenhouse gas emissions in milking cows through feeding dietary additives

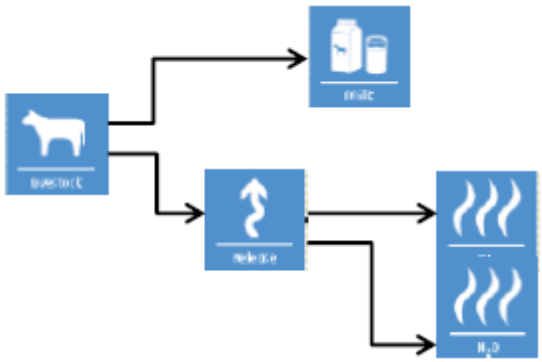
American Carbon Registry

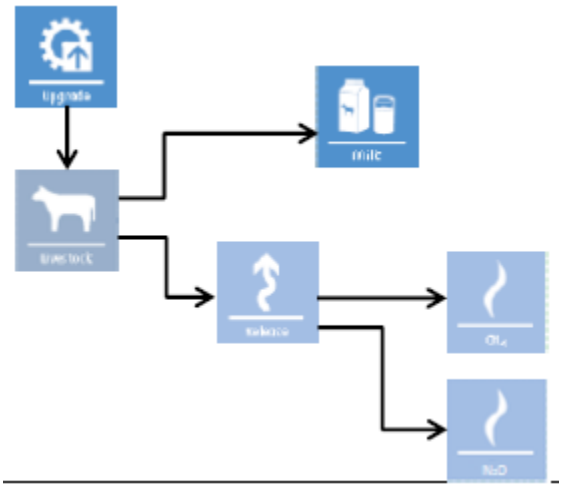
- Grazing Land and Livestock Management

Basic details of the methodological approach proposed: baseline, project and leakage emissions

- Baseline scenario would be historic emissions per unit of production – kgCO2e/head/year normalized for carcass weight or kgCO2/unit of milk normalized for fat content.
- CH4 emissions can be derived from default values based on feed intake multiplied by number of animals.
- N2O emissions from dung and urine can be based on the protein concentration of feed intake and the estimated net nitrogen excretion.
- Project and leakage – any increase in above and below ground or soil carbon stocks change. Soil carbon stocks accounted for as per the methodological tool: Project and leakage emissions from biomass.

Baseline Scenario



Project Scenario	
List of key parameters to be monitored • N2O and CH4 emissions per live weight gain/milk produced. Feed intake. Output.	
Bibliography • Tackling climate change through livestock. FAO, 2013 http://www.fao.org/3/i3437e.pdf • Mitigation of greenhouse gas emissions in livestock production. A review of technical options for non-CO2 emissions. FAO, 2013. http://www.fao.org/3/a-i3288e.pdf • Livestock – Climate Change's Forgotten Sector, Chatham House • Beef cattle herd management: overview of calculations - ERF	
Estimation of potential for emission reduction (if available in the literature) • Greenhouse gas emissions from the livestock sector are estimated to account for 14.5 per cent of the global total. Greenhouse gas emissions by the livestock sector could be cut by as much as 30 percent through the wider use of existing best practices and technologies, according to the FAO.	
Consideration of negative environmental impact • Impacts of further intensification of output on water and air quality should be considered.	
Other issues • Animal welfare concerns should be considered. • Accounting for LULUCF emissions.	

2. New methodologies for crop nutrition management

Case: New methodologies for crop nutrition management
• New methodology (but based on AMS-III.BF) ✓ Controlled release (coated) fertilizers. Improve efficiency of N use and reduce GHG emissions per unit of output. ✓ Precision agriculture techniques to increase efficiency of production and reduce fertilizer related emissions per unit of output. ✓ Nitrification inhibitors to reduce N2O emissions.

Included in other programs:

Alberta Offset Credit System Protocols

- Agricultural Nitrous Oxide Emission Reductions

Australia Emission Reduction Fund

- Fertiliser use efficiency in irrigated cotton

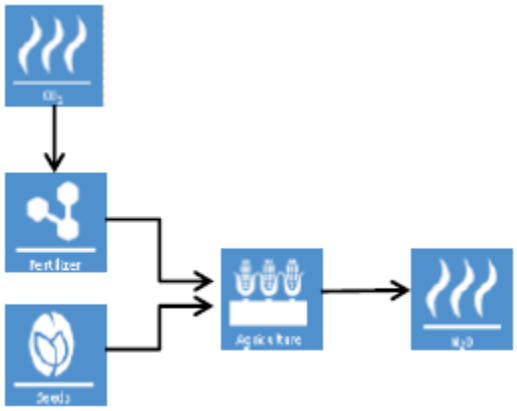
Climate Action Reserve

- Nitrogen Management Project Protocol Version 1.1

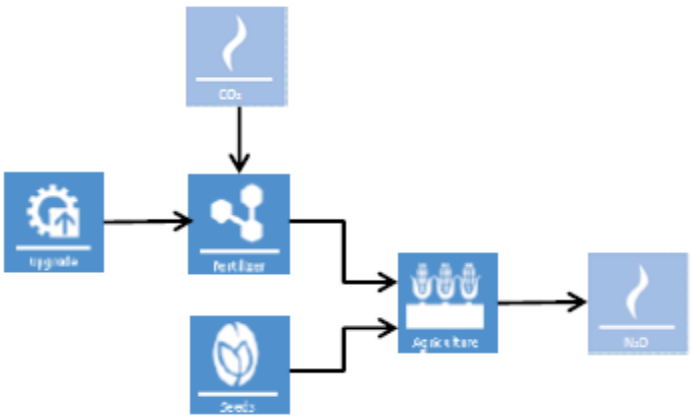
Basic details of the methodological approach proposed: baseline, project and leakage emissions

- Baseline emissions per unit of output. Emissions from fertilizer production and use as per AMS-III.BF
- In the case of nitrification inhibitors, monitoring of direct N2O emissions is not feasible. Inhibitors use and emission reductions factors would need to be developed.
- Issue to be considered:
  - ✓ Relation between N2O and CH4 emissions. AMS-III.BF includes applicability condition in order to ensure that CH4 emissions are not increased as a consequence of project implementation.
  - ✓ Implementation of other management practices. AMS-III.BF requires that no other new management practice is implemented during the crediting period. This condition may be revised but changes in the methodological approach will be needed.

Baseline Scenario



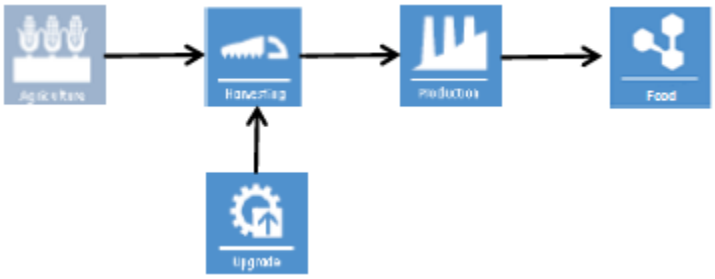
Project Scenario



List of key parameters to be monitored As per AMS-III.BF
Bibliography • Akiyama H., X. Yan, and K. Yagi (2010). Evaluation of effectiveness of enhanced efficiency fertilizers as mitigation options for N2O and NO emissions from agricultural soils: meta-analysis: Mitigation options for N2O and NO emissions. Global Change Biology. • Bruce A. Linquist et al. (2012) Fertilizer management practices and greenhouse gas emissions from rice systems: A quantitative review and analysis. Field Crops Research. http://linquistwp.plantsciences.ucdavis.edu/wp-content/uploads/2014/03/2012-Linquist-et-al-FCR-Review-GHG-fert.pdf
Estimation of potential for emission reduction (if available in the literature)
Consideration of negative environmental issues No negative issues identified.
Other issues

3. A new methodology for reducing food wastes through efficient processing and/or storage

Case: New methodology for reducing food wastes through efficient processing and/or storage
• The new methodology which may contain elements of other existing methodologies and tools. • Project activities may reduce food waste at processing and storage facilities. The objective will be to reduce the volume of agricultural input supplied to the facility for a given food output. • An example is a reduction in post-harvest losses of rice with a focus on storage and milling (drying, threshing improvements or specific technologies) at a rice mill. In the Philippines, a special bag for rice storage, which is made of multilayer polyethylene and protects rice from moisture, pest infestation and fungal growth, was developed by the International Rice Research Institute (IRRI). This bag contributes to avoiding the 10 percent of rice lost due to fungus and rodents. One simple approach could be to start with simple methodologies applicable to specific crops and their processing chain. Rice could be the first candidate.
Included in other programs: No
Basic details of the methodological approach proposed: baseline, project and leakage emissions • Baseline emissions will be derived from the quantity of raw material input to the processing plant and associated agricultural emissions for a given processed food output. The basic concept is to determine emission reductions based on: a) the specific amount of raw material per unit of processed food before and after project implementation and b) the emissions from some specific sources (e.g. not from soil carbon losses). • Agricultural emissions should be calculated on a sample basis from farms supplying a facility. The Methodological tool: Project and leakage emissions from biomass can serve as a source for the estimation of these emissions. • However, the tool is currently developed for project emissions and leakage, hence its use for baseline emissions may be not conservative. • Other issue to be addressed is that the Tool doesn't provide the formulae for CH4

	emissions, and therefore may not be useful for rice cultivation, but AMS-III.AU could be used instead. For N2O emissions from rice cultivation AMS-III.BF could be used as a basis.
Baseline Scenario	
Project Scenario	
List of key parameters to be monitored • N2O and CO2 emissions from fertilizer production and application • CO2 emissions from energy consumption in cultivation and transport • CH4 emissions from rice production can be calculated as per AMS-IIII.AU	
Bibliography • Food Wastage Footprint: Impacts on Natural Resources. FAO 2013. http://www.fao.org/docrep/018/i3347e/i3347e.pdf • Mitigation of Food Wastage: Social Costs and Benefits. FAO 2013 http://www.fao.org/3/a-i3989e.pdf	
Estimation of potential for emission reduction (if available in the literature) • Data from the FAO states that without accounting for GHG emissions from land use change, the carbon footprint of food produced and not eaten is estimated at 3.3 Gt CO2e. Wastage of cereals in Asia is a significant problem, with major impacts on carbon emissions and water and land use. Rice's profile is particularly noticeable, given its high methane emissions combined with a large level of wastage. • From IPCC AR5: "Reductions of losses in the food supply chain — Globally, rough estimates suggest that ~30–40% of all food produced is lost in the supply chain from harvest to consumption (Godfray et al., 2010). Energy embodied in wasted food is estimated at ~36 EJ/yr (FAO, 2011). In developing countries, up to 40% is lost on farm or during distribution due to poor storage, distribution, and conservation technologies and procedures."	
Consideration of negative environmental issues • A reduction of food waste is likely to have no significant negative environmental issues**.**	
Other issues • Monitoring and verification of such projects may be an issue in small and rural isolated projects.	

4. New methodologies for application of renewable energy and energy efficiency for agriculture

Case:
New methodologies for application of renewable energy and energy efficiency for agriculture

- New methodologies are needed.
- The specific cases identified are:
  - ✓ Solar powered water pumps
  - ✓ Crop and grain drying
  - ✓ Greenhouse Heating

Included in other programs:
No

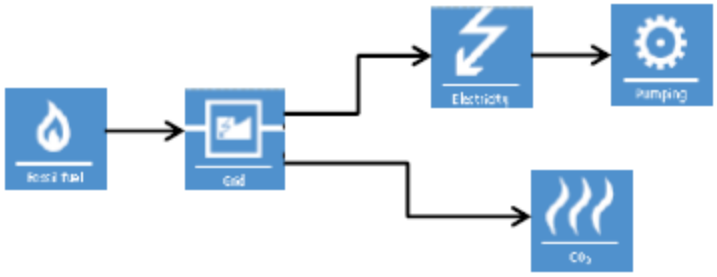
Basic details of the methodological approach proposed: baseline, project and leakage emissions

1) Solar powered water pumps
- Instead of developing a new methodology, it could be assessed if a revision of AMS-II.F and AMS-II.P could cover this case. One simple solution could be to use the baseline scenario of Greenfield and to eliminate the project emissions section. It would be needed to revise carefully the applicability conditions and allow for diesel generators in the baseline.

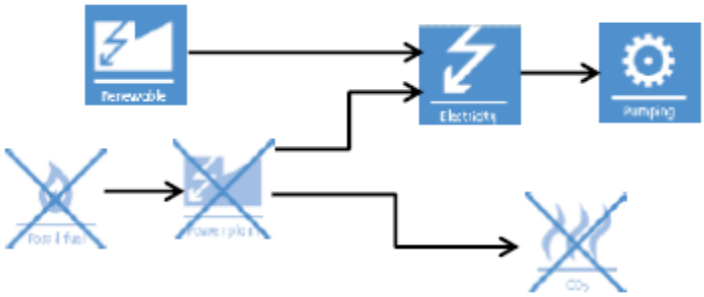
2) Crop and grain drying
- One possible solution here is to develop a new methodology based on a concept similar to AMS-IIII.Z: specific consumption in the baseline of fuel per unit of dried crop / grain.

3) Greenhouse heating
- In this case, the basis for the solution could be to adapt the methodology for energy efficiency and renewable energy in buildings (AMS-III. AE). It would be needed to collect information about greenhouses and also about how solar energy is applied in greenhouses.

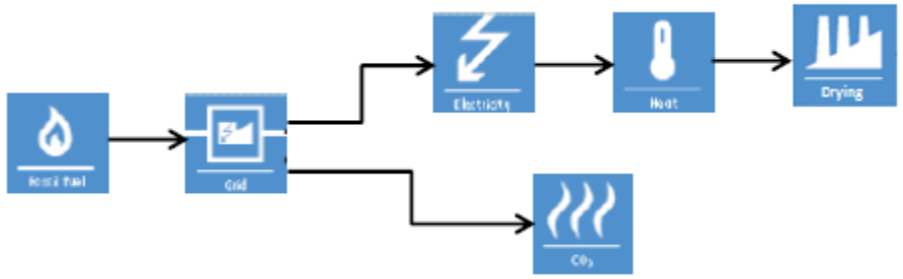
Baseline Scenario Solar powered water pumps



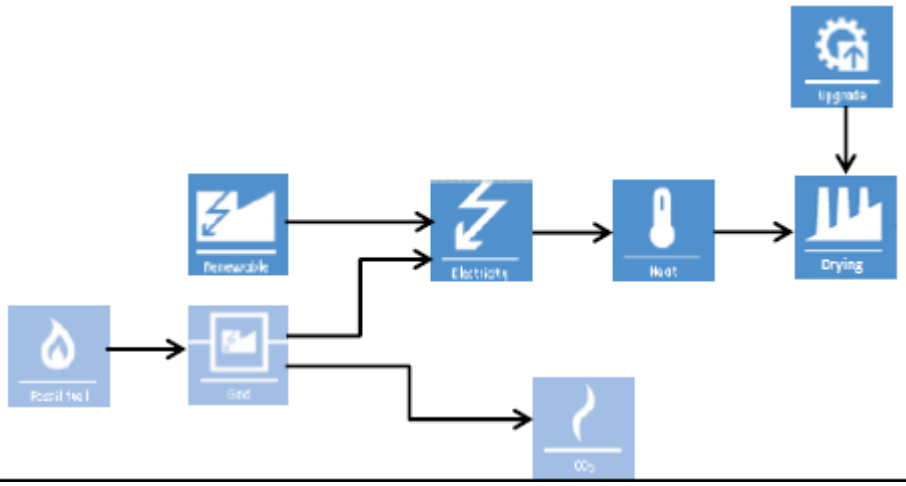
Project Scenario



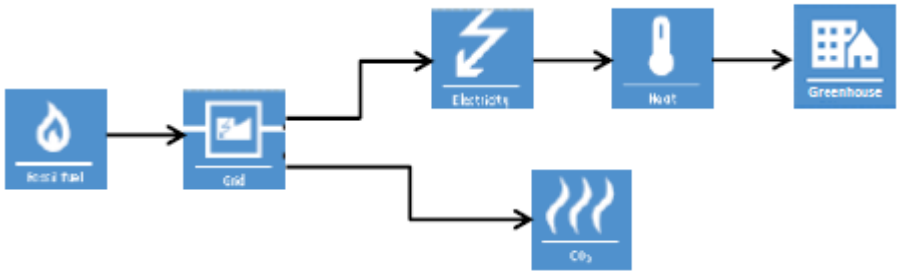
Baseline Scenario
Crop and grain drying

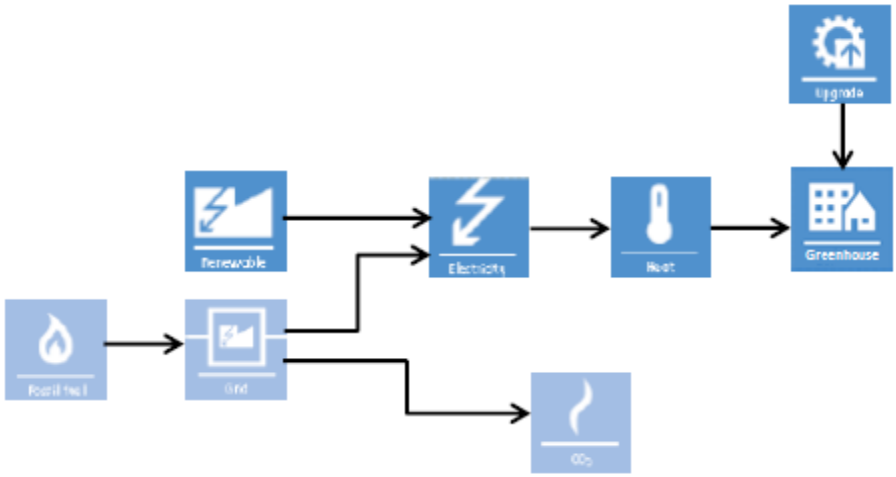


Project Scenario



Baseline Scenario
Greenhouse Heating



Project Scenario	
List of key parameters to be monitored • As per AMS-II.F and AMS-II.P with the addition of diesel generation powered baseline pumps.	
Bibliography • International Workshop: Prospects for solar-powered irrigation systems (SPIS) in developing countries (http://www.fao.org/nr/water/docs/FAO_GIZ_SOLAR_FINALREPORT.pdf)	
Estimation of potential for emission reduction (if available in the literature) • It has been estimated by Sun Edison that India has between 26 and 27 million irrigation pumps, of which seven to eight million run on liquid fuel. This fuel is typically diesel, but as many as a million pumps run on subsidized kerosene – originally meant for lighting usage. • Solar irrigation systems are mentioned in a number of INDCs, such as Bangladesh, Ghana, Yemen.	
Consideration of negative environmental issues • The impact of any additional irrigation on groundwater depletion should be considered.	
Other issues • Cost of the technology and its diffusion • The requirement for capacity building and technical advice to ensure efficient water application (see above).	

- - - - -

Document information

Version	*Date*	*Description*
01.0	17 October 2016	Published as an annex to the annotated agenda of EB92.

Decision Class: Regulatory
Document Type: Information note
Business Function: Methodology
Keywords: call for inputs, data collection and analysis, type (iii) projects, new methodology