

Action Impact Matrix (AIM) **Application to Climate Change**

Mitigation – Users Guide

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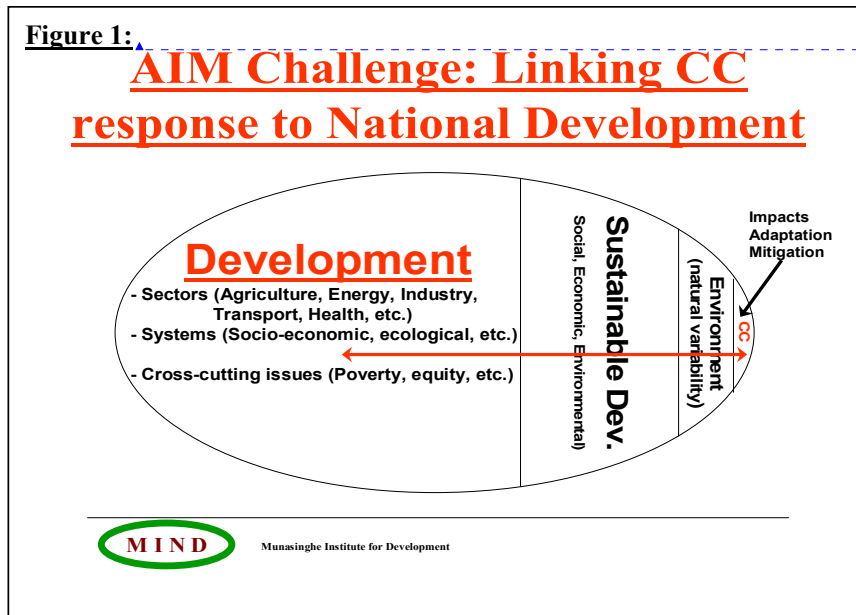
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References

1. INTRODUCTION



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Decision makers normally focus their attention on conventional development strategies like growth and poverty alleviation. As shown in Figure 1 above, sustainable development (SD) is considered a special (and rather obscure) subset of conventional development. The environment is only one aspect of SD, and finally climate change (including adaptation and mitigation or AM) is itself seen as a minor subset of the environment.

Need for Action Impact Matrix (AIM) Based Approach

Climate change mitigation measures ultimately must be implemented by nations, and will receive attention from decision makers only if they are successfully integrated into national sustainable development (SD) strategy. To facilitate this process, the guide describes how we use the Action Impact Matrix (AIM) methodology to better understand interactions among three key elements, at the country-specific level:

- (a) national development policies and goals;
- (b) key mitigation options; and
- (c) climate change

First, the two-way linkages between elements (a) and (b) are explored, in the context of natural climate variability. Then, we impose the additional impacts of element (c) on the interactions between elements (a) and (b).

The AIM approach analyses key economic-environmental-social interactions to identify potential barriers to making development more sustainable (MDMS) - including climate change. It also helps to determine the priority macro policies and strategies in economic, environmental and social spheres that facilitate the implementation of adaptation and mitigation to overcome the effects of climate change. Thus, such a matrix helps to promote an integrated view, meshing both development decisions and climate change effects.

Below, we break the AIM methodology into the following key steps, and explain how each one is carried out – see Figure 2:

- a) Determine the most important national goals and policies.
- b) Determine key mitigation options for climate change
- c) Identify how goals/policies might affect mitigation options (effect 1 in Figure 2)
- d) Identify how mitigation options might affect goals/policies (effect 2 in Figure 2)
- e) Identify impacts of climate change on mitigation options and on development goals and policies impacts 3 and 4 in Figure 2).
- f) Prioritize most important interactions and determine appropriate remedial policies and measures.
- g) Perform more detailed studies and analysis of key interactions and policy options identified in step (f) above.
- h) Update and refine steps (c) to (f) above.

Two matrices are derived as shown in Figure 2.

1. DEM – development effects on mitigation options (effect 1 + impact 3)
2. VED – mitigation options effects on development (effect 2 + impact 4)

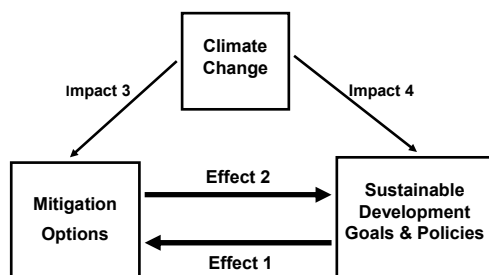


Figure 2. Interaction between climate change, mitigation options and development, showing derivation of DEM and MED Action Impact Matrices.

The preliminary matrix identifies broad relationships, provides a qualitative idea of the magnitudes of the key interactions, helps to prioritize the most important links, and facilitates integration of climate change adaptation and mitigation responses within the overall national sustainable development strategy.

The AIM methodology relies on a fully participative stakeholder exercise to generate the AIM itself. A minimum of 10 (to be divided into 2 working groups for adaptation and mitigation) experts are required, to be drawn from government, academia, civil society and the private sector - representing various disciplines and sectors relevant to both sustainable development and climate change. In the initial exercise, they usually interact intensively over a period of about two days, to build a preliminary AIM. This participative process is as important as the product (i.e.,

the AIM), since important synergies and cooperative team-building activities emerge. The collaboration helps participants to better understand opposing viewpoints, resolves conflicts, promotes cooperation and ownership across decision making agencies and ultimately facilitates implementation of agreed policy remedies. On subsequent occasions, the updating or fine-tuning of the initial AIM can be done within a few hours by the same group, since they are already conversant with the methodology.

Sustainomics Principles Underlying Action Impact Matrix (AIM)

The AIM methodology draws on the following basic principles of the sustainomics framework [Munasinghe 1992, 2002b]:

(a) **MDMS approach**

The step-by-step approach of “making development more sustainable” (MDMS) becomes the prime objective, while sustainable development is defined as a process (rather than an end point)¹. Although MDMS is incremental, it does not imply any limitation in scope (e.g., restricted time horizon or geographic area).

(b) **Sustainable development triangle**

SD requires integration of three main perspectives: social, economic and environmental (Figure 3). Each viewpoint corresponds to a domain (and system) that has its own distinct driving forces, objectives, and indicators. The economy is geared mainly towards improving human welfare, primarily through increases in the consumption of goods and services. The environmental domain focuses on maintaining the integrity and resilience of ecological systems. The social domain emphasizes the enrichment of human relationships and achievement of individual and group aspirations. The balance among the three domains will be location-specific -- depending on the stakeholders involved. The sides of the triangle also represent key interactions. For example, the economy-environment interface leads to valuation and internalization of environmental externalities, and trade-offs between economic and environmental goals.

(c) **Trans-boundary approach**

The analysis transcends conventional boundaries imposed by discipline, space, time, stakeholder viewpoints, and operability. The scope is broadened and extended in all domains, to ensure a comprehensive view.

(d) **Full cycle application of integrative tools**

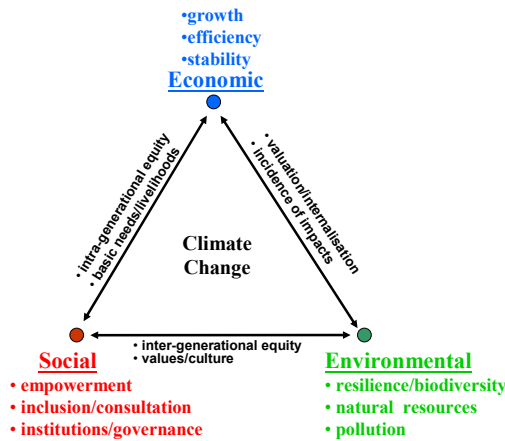
Two complementary approaches based on “optimality” and “durability” may be used to integrate across economic, social and environmental sub-models, within an integrated assessment modeling framework.

A policy mapping method would help to translate actions in the environmental and social domains, into the conventional national economic planning and implementing mechanisms within line ministries and departments.

¹ Sustainable development is defined as a “process for improving the range of opportunities that will enable individual human beings and communities to achieve their aspirations and full potential over a sustained period of time, while maintaining the resilience of economic, social and environmental systems” (Munasinghe 1992)

The Action Impact Matrix (AIM) process is the key link from initial data gathering to practical policy application and feedback. Ecosystems and their services are integrated into SD strategy in two main ways: an upward link where ecosystem concerns are embedded in the macro-strategy of a country via the medium- to long-term sustainable development path; and a downward link where ecosystem concerns are integrated into the national development strategy in the short- to medium-term, by carrying out sustainable development assessments (SDA) of micro-level ecosystem-related projects and policies.

Figure 3. Sustainable development triangle – key elements and interconnections (corners, sides, centre). Climate change affects all dimensions of sustainable development.



Source: Munasinghe [1992], Rio Earth Summit

2. ACTION IMPACT MATRIX (AIM) METHODOLOGY AND APPLICATIONS

The AIM is a strategic tool policy analysis, which helps to study the inter-linkages that exists among seemingly independent elements such as for example macro-economic policies, key mitigation options, and climate change.

At the national level, the linkage may be made in two complementary and interlinked ways:

- (a) Upward link: where mitigation options are embedded in the macro-level national development strategy of a country via the medium- to long-term sustainable development path, including building-up of adaptive capacity.
- (b) Downward link: where mitigation options are integrated into the subnational-level development strategy in the short- to medium-term, by carrying out sustainable development assessments aimed at making specific projects and policies more sustainable.

The AIM has been widely used since the early 1990s, and originally was presented as part of the Sustainomics methodological framework, at the 1992 Rio Earth Summit – see Annex 1 [Munasinghe, 1992]. Initially, it was used in Brazil, Chile, Ghana, Philippines, and Sri Lanka to integrate a range of environmental concerns into development planning [Munasinghe 1994, 1997, 2002a, 2005]. Subsequently, expanding and "adapting" the AIM approach to address ecosystem-SD interactions, was a logical next step [Munasinghe 2002b; MIND 2005, URL: <www.mindlanka.org>].

The AIM approach may be used to better understand two-way interactions between (a) development policies and goals; and (b) key mitigation options relevant to climate change. First, the effects of development policies and goals on mitigation are explored, and then the reverse effects of mitigation options on sustainable development prospects are identified. The AIM cells provide a qualitative idea of the magnitude of the row-column interactions, so that appropriate policy interventions could be formulated. Each AIM exercise would require **two** matrices in order to look at linkages flowing both ways (i.e., impacts of columns on rows and vice versa):

The AIM approach analyses key economic-environmental-social interactions to identify potential barriers to making development more sustainable (MDMS), including progressive degradation of already vulnerable areas. It also helps to determine the priority strategies, policies and projects in the economic, environmental and social spheres that facilitate implementation of measures to manage mitigations options and restore damaged ecosystem services. After completing a national level AIM exercise, it is possible to apply the process at a subnational or community level, to fine-tune the analysis.

For maximum effectiveness, the AIM meeting needs careful preparation in terms of trained instructors to conduct the exercise, documentation (e.g., AIM Guide), screening and pre-selection of a balanced group of participants, and advance gathering of relevant background data.

3. METHODOLOGY WITH A SAMPLE APPLICATION TO SRI LANKA AT THE NATIONAL LEVEL

We illustrate this approach by sketching out a very preliminary application to Sri Lanka at the national level. *The examples provided below are only indicative*, and need to be re-checked and validated by a full-blown AIM stakeholder exercise involving a variety of experts.

The AIM process involves several key practical steps:

3.1. Step (a): Determine the most important national goals and policies

The Millennium Development Goals [UNDP 2003] provide a generic starting list, but they need to be tailored on a country specific basis. In order to focus attention on key priorities, the list needs to be restricted to less than 10 items. In the case of Sri Lanka, a brief perusal of past and recent national development documents help to identify the following dominant national goals and policies [GOSL 2002, 2004]:

- economic growth,
- poverty alleviation,
- food security,
- employment,
- trade and globalization,
- budget deficit reduction,
- privatization.

3.2. Step (b): Determine mitigation options relevant to climate change

Columns will include the mitigation options for climate change. These need to be categorized according to the 3 main subheadings – electricity, transport and land use. Any number variables can be inserted under these subheadings, but it is advisable to restrict the total number of variables to about 10, as the matrix gets too complex if too many variables are included.

The broad areas identified by the TAR (IPCC 2001) provide a useful generic starting point. However, they need to be fine-tuned on a country specific basis. Again, in order to focus attention on key priorities, the list needs to be restricted to less than 10 items.

Some examples relevant to Sri Lanka include

Electricity – demand side management

- renewable energy

Transport – fuel substitution

Land use – forestry

3.3. Step (c): Identify how development goals/policies affect mitigation options (DEM-AIM)

The two lists determined by consensus in steps (a) and (b) above, may be put together to establish the basic AIM framework (see sample figure below, for Sri Lanka). For convenience of presentation, the row and column headings are given concisely, but the full spreadsheet will contain detailed notes describing each category in further detail. Thus, within each column, all relevant mitigation options would be considered as sub-categories (although not shown, for brevity of presentation).

Figure 4:

		Mitigation Options			
		Electricity		Transport	Land Use
		(1) Demand Side Management	(2) Renewable Energy	(3) Fuel Substitution	(4) Forestry
<u>Dev. Goals/Policies</u>					
(A)	Growth	-1			
(B)	Poverty alleviation		+2		
(C)	Food Security				
(D)	Employment				

Scoring Key

(Cells should contain one of the following values or be left blank if there is no linkage)

- 3 = High negative (undesirable) impact/effect
- 2 = Medium negative (undesirable) impact/effect
- 1 = Low negative (undesirable) impact/effect
- 0 = No impact/effect
- 1 = Low positive (desirable) impact/effect
- 2 = Medium positive (desirable) impact/effect
- 3 = High positive (desirable) impact/effect

We seek to identify the impacts of national goals and policies on mitigation options, as indicated by the direction of the arrows at the top left hand corner of the figure. As an example, a few shaded

cells have been selected to illustrate some key effects. The numbers are qualitative and represent net outcomes due to a variety of impacts, including trade-offs among different services. Brief explanations of the relevant linkages are provided for each cell.

Typical examples include:

Cell A1 : [+1]Gains: growth policies could provide an environment for more energy efficient products,
[-2] Losses: Growth could increase electricity demand

Cell B2 = [+2] Gains: Poverty alleviation policies would help promote renewable energy such as dendro & solar to be established in rural areas

Such summaries are usually supplemented by longer text descriptions (several pages), giving details of mechanisms involved, and citing relevant reports and research studies.

3.4. Step (e): Identify how mitigation options might affect development goals/policies (MED-AIM)

Next, we seek to identify the impacts of mitigation options on national goals and policies, as indicated by the direction of the arrows at the top left hand corner of Figure M4. Once again, a few shaded cells provide examples of key issues, and brief summaries of the relevant linkages are provided in each cell.

Examples include:

Cell B2: [+2] Gains: Promotion of renewable energy, especially solar and mini hydro, would allow poorer rural areas to have access to electricity that may have been too costly to be provided via the grid

Cell B4: [+2] Gains: Forestry projects would help in poverty alleviation by providing employment to the rural poor.
[-1] Losses: Forestry projects may take away valuable agricultural land which could also generate income for poor people

Figure 5:

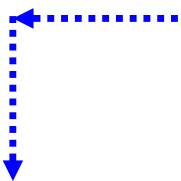
		Mitigation Options			
		Electricity		Transport	Land Use
		(1) Demand Side Management	(2) Renewable Energy	(3) Fuel Substitution	(4) Forestry
<u>Dev. Goals/Policies</u>					
(A)	Growth				
(B)	Poverty alleviation		+2		+1
(C)	Food Security				
(D)	Employment				

3.5. Step (f) Incorporating the impacts of Climate Change

The impacts of climate change can be included in the AIM. Climate change will impact on both the column and row components, i.e. the key mitigation options and the development goals and policies. Note that these values are an additional consideration that could be used for more detailed analysis and do not influence the main body of the AIM

Row A: [-1] Extreme events and natural disasters will increase costs of damage thereby hindering growth

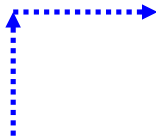
Figure 6: Impacts of climate change on development goals and policies



		Mitigation Options				Impacts of CC
		Electricity		Transport	Land use	
		(1) Demand Side Management	(2) Renewable Energy	(3) Fuel Substitution	(4) Forestry	
<u>Dev. Goals/Policies</u>						
(A)	Growth					-1
(B)	Poverty alleviation					
(C)	Food Security					
(D)	Employment					

Column 2: Renewable energy: [-1] rainfall variations would affect hydro availability and forest growth, thereby decreasing availability of fuelwood and minihydro power.

Figure 7: Impacts of climate change on mitigation options



		Mitigation Options				Impacts of CC
		Electricity		Transport	Land use	
		(1) Demand Side Management	(2) Renewable Energy	(3) Fuel Substitution	(4) Forestry	
<u>Dev. Goals/Policies</u>						
(A)	Growth					
(B)	Poverty alleviation					
(C)	Food Security					
(D)	Employment					
	Impacts of CC		-1			

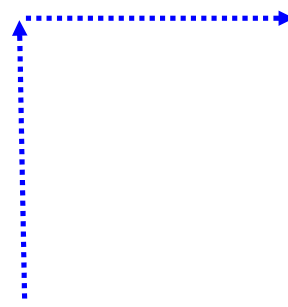
3.6 Step (f): Prioritize most important interactions and determine appropriate remedial policies and measures (preliminary AIM)

Both rows and columns represent a variety of attributes which are measured in terms of different units and indicators. Furthermore, the cell numbers are ordinal (rather than cardinal). Thus, the simple judgemental methods described above are often quite effective and sufficient for the purpose. Meanwhile, other more sophisticated prioritizing and ranking methods are available, but not explained here, since they fall outside the scope of this guide².

Once the cells, rows and columns which merit high priority attention have been identified, we move to the next stage of formulating remedial policies and measures. The next section will take you through a simple method of prioritizing areas that need to be analysed in depth by policy makers.

As an illustrative example, we select one priority linkage (among many) to identify a range of appropriate policy options for further analysis.

Figure 8: DEM Matrix – Effects of Development Goals & Policies on Mitigation Options

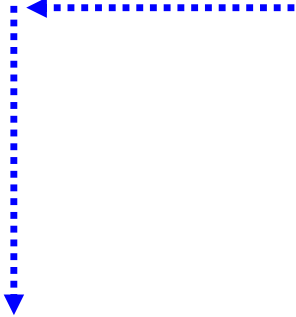


		Mitigation Options									
		Energy/ Electricity				Transport		Industry		Land use	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
		Renewable energy	Demand Side Management	Supply Side Management	Clean Technology	Efficient Technology	Mobility Management	Prevention/Control Technologies	Efficient Resource Utilisation	Reforestation	
Development Goals/Policies (without CC Impacts) =>		(A) Economic Growth	1	-1	1	-	1	1	1	-1	1
(B) Poverty alleviation /Rural development		1		-	-						-1
(C) Food security (self reliance)											-1
(D) Employment & education								1			0
(E) Infrastructure							2				
(F) Sustainable management of natural resources		-1	-	-	-	1		1			2
(G) Budget deficit reduction		-	-	-1	-2		-1				
(H) Good governance				-							
(I) Water and sanitation				-				1			
CC	CC Impacts =>	-1									-1

Effects that are beneficial (win-win for both CC and SD)
Effects that are harmful

² Impacts may be ranked and prioritized by more sophisticated methods, including multi-criteria analysis (MCA) and decision analysis -- see for example, Munasinghe (1992).

Figure 9. MED Matrix – Effects of Mitigation options on Development Goals and Policies



		Mitigation Options									Climate Change Impacts
		Energy/ Electricity				Transport		Industry		Land use (9)	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		
		Renewable energy	Demand Side Management	Supply Side Management	Clean Technology	Efficient Technology	Mobility Management	Prevention/Control Technologies	Efficient Resource Utilisation	Reforestation	
Development Goals/Policies (without CC Impacts) =>											
(A)	Economic Growth	-1	1	1	-2	-1	2	-1	1	1	-1
(B)	Poverty alleviation /Rural development	2		-	-					1	-1
(C)	Food security (self reliance)									2	-2
(D)	Employment & education	1	-	-	-1	1				1	-1
(E)	Infrastructure	-	-				1				-2
(F)	Sustainable management of natural resources	1	1	1	1	1	1	2	1	2	-2
(G)	Budget deficit reduction	-1	1	1	-2	-1	1			-1	-1
(H)	Good governance			-							
(I)	Water and sanitation	1		-	1	1	1	1	1		-2

Effects that are beneficial (win-win for both CC and SD)
Effects that are harmful

Based on the above example a few policy recommendations are listed below:

a) Mobility management

This includes Traffic management Quality and Service improvement of road networks, Public Transport, Non Motorized Transport, and Inter Modal Choice

- Mobility Management has positive impact on most of the development goals. The high costs to be offset by external funding for carbon benefits

b) Reforestation including Agro forestry

- Reforestation and agro forestry have positive impacts on food security and sustainable management of natural resources and most of the other development goals
- Poverty alleviation and rural development programmes should not undermine reforestation efforts and agro forestry

c) Renewable Energy

- Significant impact on poverty alleviation especially through employment creation in dendro power projects.
- Rural development through access to energy which improves the quality of life

- However in some cases sustainable management of natural resources is limiting the development of renewable energy resources, such as mini hydro in sensitive areas.
- High cost of renewable energy to be offset by external funding for carbon benefits.

Note: Clean Technologies such as LNG are good options for GHG mitigation. As the option is very costly it needs external funding.

3.7. Step (g): Perform more detailed studies and analyses of key interactions and policies options identified in step (e) above.

The critical issues, policy options and measures identified in step (f) may be subject to further analysis and research, to provide greater confidence to decision makers before they begin to implement such remedial measures. A variety of macro-, regional or local models are usually applied, that focus on the specific questions at hand (Munasinghe 1994, 1997, 2002a). This procedure helps us to evaluate appropriate country-specific mitigation options.

3.8. Step (h): Update and refine steps (c) to (f) above -- revised AIM

The results of the detailed research and analysis in step (f) are introduced into the AIM process, to update and refine the information in the cells, and begin the next stage of implementing remedial actions. A package of policies and projects would be assembled, based on modeling and detailed studies, to address the most important linkages in the AIM. When testing and validating policy alternatives, those that give rise to win-win outcomes (e.g., simultaneously addressing economic, social and environmental objectives), would have the highest priority. In other cases, trade-offs among conflicting objectives need to be carefully assessed. Finally, practical and political constraints need to be kept in mind.

References

Other Publications

1. GOSL (Government of Sri Lanka) (2002): *Regaining Sri Lanka: Vision and Strategy for Accelerated Development*, Govt. Press, Colombo, Sri Lanka.
2. GOSL (Government of Sri Lanka) (2004): *Rata Perata: Five Fold Vision for the future of our motherland*, Govt. Press, Colombo, Sri Lanka.
3. IPCC (2001c) *Climate Change 2001: Mitigation*, Third Assessment Report, Cambridge University Press, London, UK.
4. Munasinghe, M. 1992. *Environmental Economics and Sustainable Development*, Paper presented at the UNCED Earth Summit, Rio de Janeiro, Brazil, The World Bank, Washington DC, USA.
5. Munasinghe, M. (ed.). 1997. *Environmental Impacts of Macroeconomic and Sectoral Policies*, International Society for Ecological Economics and World Bank, Solomons, MD and Washington DC, USA.
6. Munasinghe, M. (ed). 2002a. *Macroeconomics and the Environment*, Edward Elgar Publ., Cheltenham, UK.
7. Munasinghe, M. 2002b. "The sustainomics trans-disciplinary meta-framework for making development more sustainable", Paper presented at the UN World Summit on Sustainable Development (WSSD), Johannesburg, *International Journal of Sustainable Development*, Vol.5 (1-2), pp.125-82.
8. Munasinghe, M. et al. 2005. *Macroeconomic Policies for Sustainable Growth - Analytical Framework and Policy Studies of Brazil and Chile*, Edward Elgar Publ., Cheltenham, UK.
9. Munasinghe, M., and W. Cruz. 1994. *Economywide Policies and the Environment*, The World Bank, Washington DC, USA.
10. MIND. 2005. *Readings on Climate Change and Sustainable Development*, Munasinghe Institute for Development, Colombo (URL: www.mindlanka.org).