

Environmental and Economic Sustainability Implications of the Major Trends in the Material Flow Accounts of the Philippines, 1981 to 2004

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Objective:

- To discuss the sustainability implications of the major trends in the MFA
 - Impacts of flows on the environment and its ability to produce more resources
 - Impacts of flows on the sustainability of real GDP levels

What is MFA?

- account of all physical inputs to and outputs of a firm, an industry, or a country
- started in 1969 with Ayres and Kneese
- They were concerned with externalities being released to the air and water.
- They concluded that environmental pollution is a materials balance problem for the economy.

Conceptual Framework

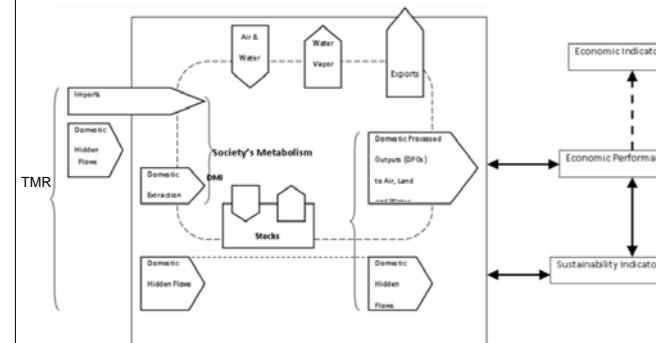


Figure 1. Schematic diagram of the relationship among economy-wide material flows and indicators of economic and environmental sustainability following Matthews et al. (2000)

Indicators from the framework

- Input (DMI, TDMI, TMR)
- Output (exports, DPO)
- Balance (imports, exports, NAS)
- Consumption indicators

Indicators for environmental sustainability

- Kind, volume and character of inputs and outputs
 - Hidden flows
 - Environmental impacts
 - Recyclability
 - Resource requirements

Indicators for economic sustainability

- correlation of flows with labor productivity and real GDP
- nature and kind of output (foreign exchange)
- trends in efficiency indicators

Structure of the Philippine MFA

Domestic Production

- Biomass
- Crude Minerals and Mineral Materials
- Crude Fossil and Energy Materials

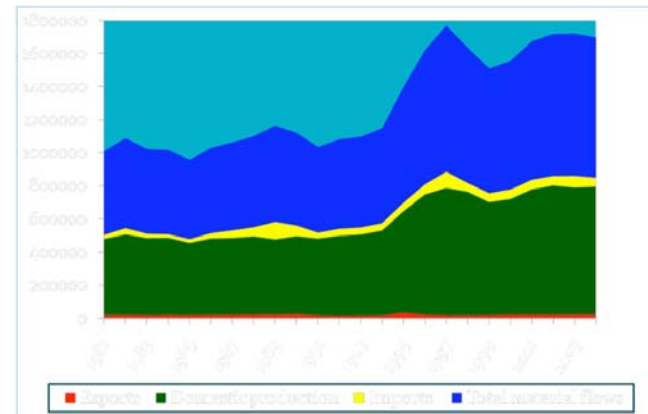
Imports and Exports (each)

- Biomass
- Crude Minerals and Mineral Materials
- Crude Fossil and Energy Materials
- Semi-manufactured/Final Products

Results

MATERIAL	VOLUME (1981 to 2004) (000 tons)	% OF TOTAL VOLUME
Domestic production	13,904,149	89
Imports	1,239,689	8
Exports	472,087	3
DMI	15,143,838	
Total Material Flows	15,615,927	

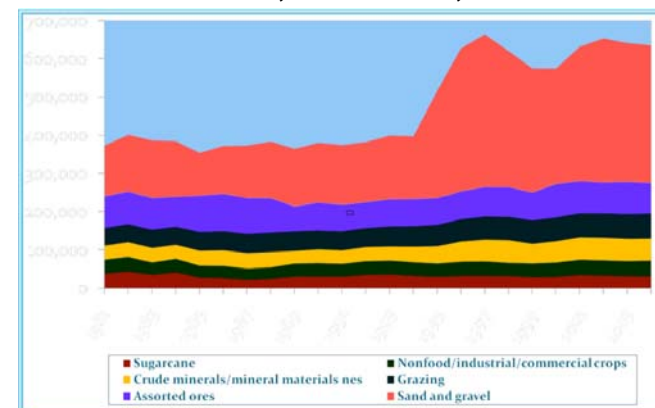
Total Material Flows, 000 tons



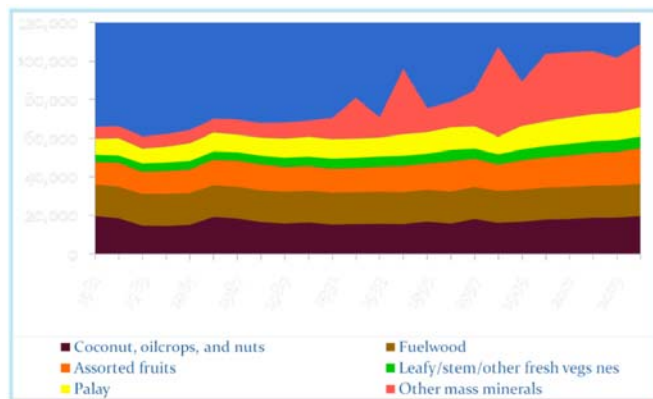
Domestically produced materials with highest volumes and their corresponding average annual growth rates, 1981 to 2004

MATERIAL	VOLUME (000 tons)	% of TOTAL DOMESTIC PRODUCTION	CUMULATIVE PERCENTAGE (%)	AVERAGE ANNUAL GROWTH RATE (%)
Sand and gravel	5,548,825.70	39.91	39.91	5.69
Ores, assorted	1,908,270.91	13.72	53.63	0.33
Grazing	1,314,462.79	9.45	63.09	1.49
Crude minerals/mineral materials	1,071,579.13	7.71	70.79	2.37
Nonfood/industrial/commercial crops	868,611.88	6.25	77.04	0.74
Sugarcane	757,667.87	5.45	82.49	0.10
Other mass minerals	421,089.37	3.03	85.52	20.44
Coconut, oilcrops, and nuts	411,335.15	2.96	88.48	0.46
Fuelwood	394,928.49	2.84	91.32	0.09
Asstd. Fruits (banana, pineapple, mango, etc.)	334,133.34	2.40	93.72	2.14
Palay	257,964.76	1.86	95.57	3.24
Leafy/stem/other fresh vegs nes	124,383.79	0.89	96.47	2.20

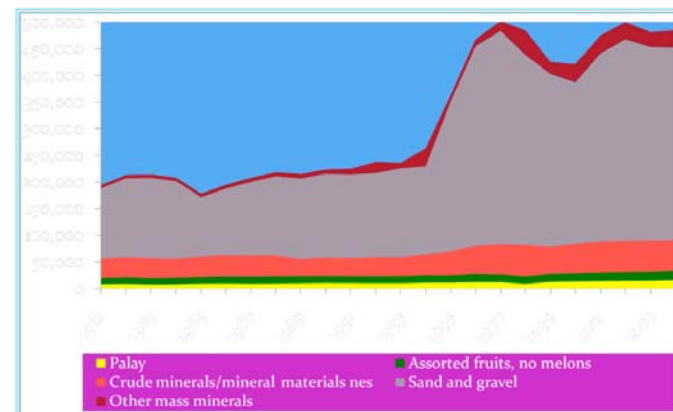
Domestically produced materials with highest total volumes, 1981 to 2004, '000 tons



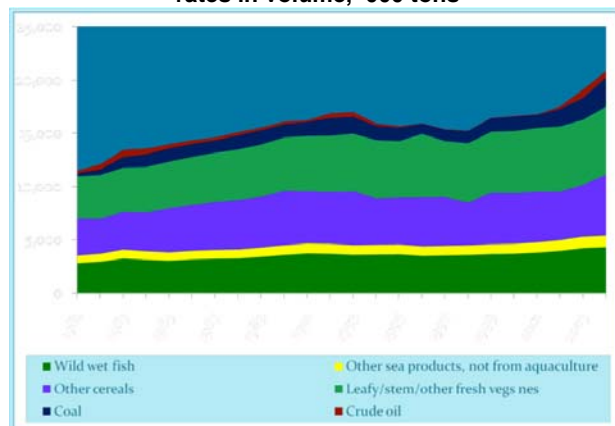
Domestically produced materials with highest total volumes, 1981 to 2004, '000 tons



Domestic materials with highest average annual growth rates in volume, '000 tons



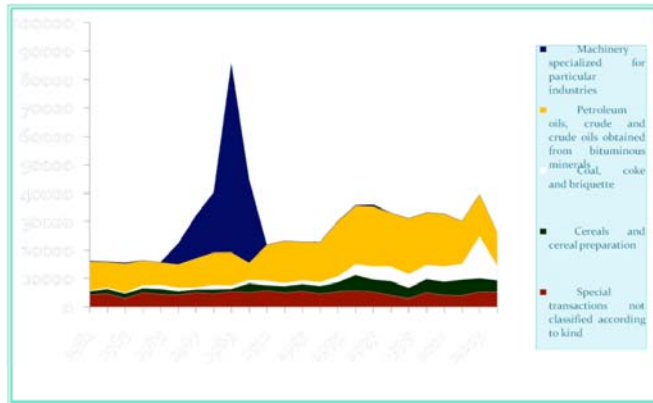
Domestic materials with highest average annual growth rates in volume, '000 tons



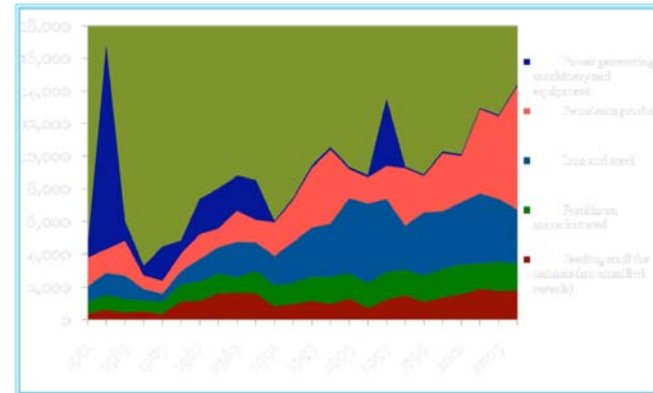
Imported materials into the Philippines with highest volumes and their corresponding average annual growth rates, 1981 to 2004

MATERIAL	VOLUME (000 tons)	% of TOTAL IMPORTS	CUMULATIVE PERCENTAGE (%)	AVERAGE ANNUAL GROWTH RATE (%)
Petroleum oils, crude and crude oils	324,196.93	26.15	26.15	3.95
Machinery specialized for particular industries	143,584.94	11.58	37.73	269.77
Special transactions not classified according to kind	116,159.40	9.37	47.10	4.03
Cereals and cereal preparation	73,062.76	5.89	53.00	12.83
Coal, coke and briquette	70,289.82	5.67	58.67	28.72
Iron and steel	62,333.27	5.03	63.70	10.90
Petroleum products	61,684.44	4.98	68.67	15.66
Power generating machinery and equipment	32,618.09	2.63	71.30	204.54
Fertilizers, manufactured	31,973.79	2.58	73.88	4.55
Feeding stuff for animals	27,565.07	2.22	76.11	15.89
Other crude materials	18,398.37	1.48	77.59	30.98
Other crude minerals (abrasives, pyrites)	15,126.71	1.22	78.81	14.16
Wood in the rough/roughly squared	12,158.05	0.98	79.79	282.26
Ores and concentrates	9,609.31	0.78	80.57	57.51

Imported materials constituting 60 percent of total imports, Philippines



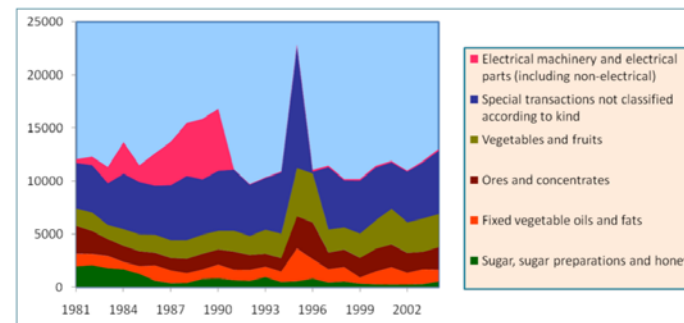
Other top imports, Philippines, 1981 to 2004



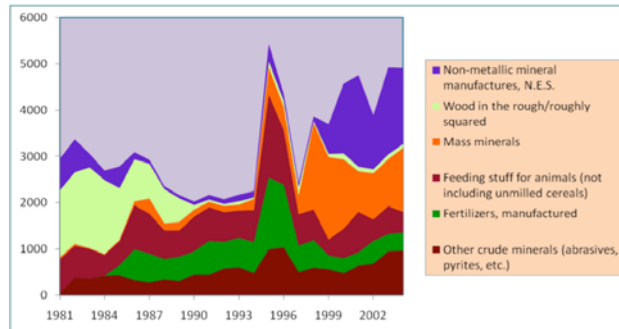
Top exports from the Philippines and their corresponding average annual growth rates in volume, 1981 to 2004

MATERIAL	VOLUME (000 tons)	% of TOTAL EXPORTS	CUMULATIVE PERCENT-AGE (%)	AVERAGE ANNUAL GROWTH RATE (%)
Special transactions not classified according to kind	123,501.61	26.16	26.16	138.95
Vegetables and fruits	56,006.33	11.86	38.02	5.77
Ores and concentrates	42,682.24	9.04	47.07	3.35
Electrical machinery and electrical parts (including non-electrical)	32,606.79	6.91	53.97	24.03
Fixed vegetable oils and fats	29,006.84	6.14	60.12	11.29
Sugar, sugar preparations and honey	19,166.93	4.06	64.18	0.79
Feeding stuff for animals (not including unmilled cereals)	17,134.32	3.63	67.81	6.48
Other crude minerals (abrasives, pyrites, etc.)	12,815.60	2.71	70.52	43.31
Non-metallic mineral manufactures,	12,801.00	2.71	73.23	34.27
Mass minerals	12,541.92	2.66	75.89	43.44
Fertilizers, manufactured	11,892.27	2.52	78.41	447.49
Wood in the rough/roughly squared	11,667.09	2.47	80.88	7.86

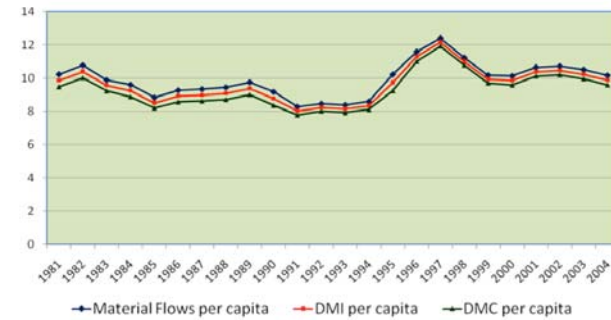
Top Exports with Highest Volumes



Other Top Exports with Highest Volumes



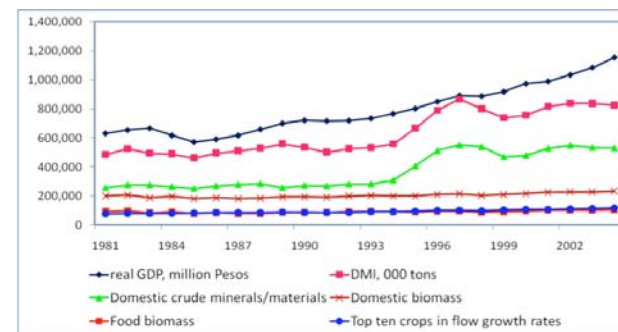
Material Input and Consumption per Capita, tons/capita



Correlation coefficients between real GDP and selected macro-economic indicators, 1981 to 2004

INDICATOR	REAL GDP
GVA, Manufacturing	0.995
GVA, Trade	0.993
GVA, Other Services	0.988
GVA, Total Agriculture	0.986
GVA, Electricity, Gas, Water	0.976
GVA, Dwellings & Real Estate	0.962
GVA, Durable Equipment	0.861
GVA, Mining	0.599
GVA, Construction	0.276

Trends in GDP and Major Flows



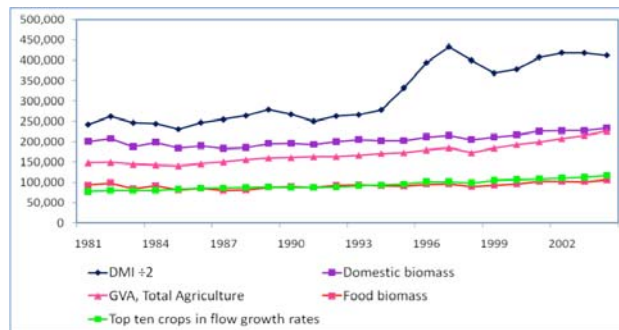
Correlation coefficients of major flows with major economic indicators

	DMI	DOMESTIC PRODUCTION	CRUDE MINERALS AND MATERIALS	TOTAL BIOMASS	FOOD BIOMASS	TOP 10 CROPS IN GROWTH RATES
Real GDP	0.92	0.93	0.91	0.92	0.79	0.97
GVA, Electricity etc.	0.96	0.96	0.95	0.89	0.74	0.98
GVA, Manufacturing	0.92	0.93	0.91	0.93	0.81	0.95
GVA, Other Services	0.91	0.91	0.90	0.87	0.73	0.98
GVA, Trade	0.91	0.91	0.89	0.89	0.76	0.98
GVA, Dwellings & Real Estate	0.92	0.91	0.90	0.84	0.69	0.96
GVA, Total Agriculture	0.89	0.89	0.86	0.91	0.80	0.97
GVA, Durable Eq'pment	0.81	0.80	0.78	0.82	0.75	0.76
GVA, Mining and Quarrying	0.42	0.42	0.40	0.50	0.43	0.61
GVA, Construction	0.30	0.33	0.32	0.41	0.45	0.09

Correlation coefficients among labor productivity and various domestic product flows, 1981 to 2004

LABOR PRODUCTIVITY	DMI	DOMESTIC PRODUCTION	CRUDE MINERALS AND MATERIALS	TOTAL BIOMASS	FOOD BIOMASS
Total	0.31	0.33	0.29	0.56	0.63
Agriculture	0.71	0.71	0.68	0.85	0.78
Mining & Quarrying	0.56	0.60	0.56	0.74	0.70
Manufacturing	0.24	0.27	0.24	0.45	0.52
Construction	0.51	-0.48	-0.49	-0.30	-0.13

Trends in Agricultural GVA and Major Flows



SUSTAINABILITY INDICATIONS

FLOWS	SIZE	CHARACTERISTICS	IMPACTS
Domestic Production	93% of DMI		
Sand, gravel, gold and silver ores, other ores, assorted crude minerals, other mass minerals (limestone)	65% of Domestic Production	Significant hidden flows – overburden, mine tailings, wastes, pollution to air, land, water; loss of lives and property (at least 20 in Mt. Diwalwal alone from 1999) Irreversibility on site and service site – landslides, cave ins, habitat and ecosystem alterations, fixed infrastructure Export commodities	Ecosystem integrity and self-renewal (-) Waste assimilative properties (-) Pollution (-) Natural environment's risk & uncertainty (-) Cost/Uncertainty of reversals and restorations (-) Subsidy on importing country's environment (-) Foreign exchange (+)

SUSTAINABILITY INDICATIONS

FLOWS	SIZE	CHARACTERISTICS	IMPACTS
Grazing, nonfood, sugarcane, coconut and oil crops, assorted fruits	25% of Domestic Production	Perennials in wide land tracts Tendency toward monoculture Heavy use of chemicals Export commodities	Competition for land (-) Crop lock-in (-) Threat to biodiversity and gene pool (-) Air, water, soil pollution Foreign exchange (+)
Fuelwood, palay, leafy/stem fresh vegetables, nes	3% of Domestic Production	Wide land tracts Heavy use of chemicals Scarcity of forest land and resource base Export commodities	Competition for land (-) Technology and crop lock-in Worsening of forest degradation (-) Foreign exchange (+)

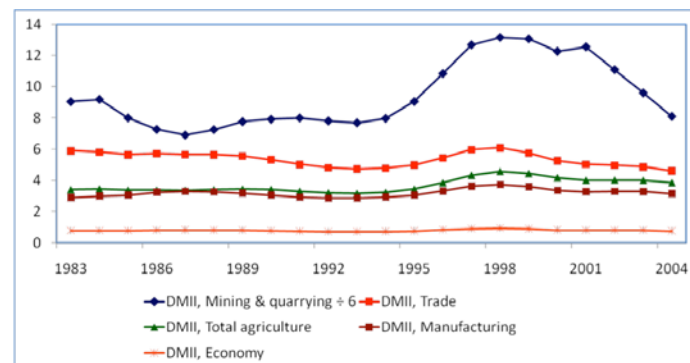
SUSTAINABILITY INDICATIONS

FLOWS	SIZE	CHARACTERISTICS	IMPACTS
Imports	7% of DMI		
Petroleum and crude oils Petroleum products Machinery for specific industries Coal and coke briquettes Power generation machinery Crude minerals Road vehicles Manufactured fertilizers		Pollutive in use Low recyclability and requires other inputs Hidden flows in exporting countries Dissipative use and zero recyclability	Air pollution from petroleum products and use of vehicles (-) Air pollution from industries (-) Increased DPOs in the future (-) Clean Air Act compliant (+) Increase in agricultural output (+) Requisite investments for industrialization (+)

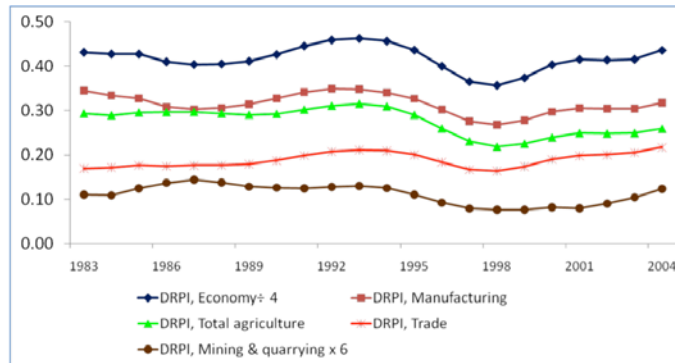
SUSTAINABILITY INDICATIONS

FLOWS	SIZE	CHARACTERISTICS	IMPACTS
Cereals and cereal preparations		Consumable, zero recyclability	Food sufficiency (+) Greater consumer choice (+)
Exports	3% of Total Flows		
Food biomass		Heavy use of chemicals Wide land tracts Monoculture regimes	Air, soil and water pollution (-) Crowding out of less valued but ethnically and environmentally sustainable species (-) Environmental subsidy for importing countries (-) Foreign exchange (+) Positive spillovers on domestic diets (+)
Crude minerals		Significant hidden flows	(Same as in previous entries.)

Trends in 3-year moving average direct material intensity index (DMII) of various economic sectors, 000 tons DMI/mil GDP



Trends in 3-year moving average direct resource productivity index (DRPI) of various economic sectors, mil GDP/000 tons DMI



CONCLUSIONS/RECOMMENDATIONS

1. DMI and real GDP trends are closely similar.
2. Trends of all major material flows are highly and positively correlated, statistically and graphically, with the trends in GVA of major sectors (manufacturing, agriculture and trade).
3. Major trends in material flows do not suggest environmental sustainability.
 - significant hidden flows, low recyclability
 - irreversibility
 - extensive land use, pollutive
 - crop and technology lock-in, monoculture

CONCLUSIONS/RECOMMENDATIONS

- DMI major elements are conducive toward economic sustainability. (High correlation coefficients with GDP; sources of major exports for foreign exchange)
- Composition of imports also conducive to economic sustainability. (Requisites for industrialization)
- Justifiable since exports of finished products are rising.
- But, overall, less and less real GDP for same volume of composite DMI.
- Made worse by unquantified hidden flows.

CONCLUSIONS/RECOMMENDATIONS

4. Trends in DMII and DRPI do not suggest environmental or economic sustainability.
 - 1981 and 2004 levels are not significantly different
 - labor productivity is not increasing significantly
 - total (0.14), mining (2.95), agriculture (0.76) and manufacturing (-0.03)
5. Trends in material flows are due to stage of development (industrializing, infrastructure, campaign for FDI) and the peculiar phenomenon of the OFW.
 - From 1997, 1/100 and 1/20HHs has one.

CONCLUSIONS/RECOMMENDATIONS

6. Sustainability of the environment and society's metabolism cannot come from direct adjustments to the material flows alone. Resource productivity, or its inverse, utilization efficiency, has to increase.
7. Amount and type of recycled materials should be increased significantly. Substitutes have to be found.
8. Need for IPM, environmental safety and pollution control
to better harness and preserve environmental and resource productivity
9. Organic farming

CONCLUSIONS/RECOMMENDATIONS

10. Demand for everything, including for land for housing and infrastructure, and TDO has to decrease.
11. Government should implement a more effective and definite population planning program.
12. The issue of resource rents for nonrenewables and pollutive flows; for equity with respect to importing countries

Future Directions

- Hidden flows of major domestic inputs
- Tighter estimates for sampling gaps and subsistence production and consumption
- Consistency with the conceptual framework

CREDITS

SEARCA for the grant
UPLB for the opportunity

(Please stay and watch how materials flow in other parts of the world.)