Resource Consumption, Material Flow And Economic Growth in the Philippines

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Abstract
This study utilizes the method of Economy-wide Material Flow Analysis (EW-MFA) to examine the trends in the resource consumption, material flow and economic growth from 1985 – 2010 in an archipelagic, developing and newly industrialized country, the Philippines. Disaggregate presentation of EW-MFA indicators in terms of material categories such as fossil fuel, biomass, ore and industrial minerals, and construction minerals attempts to elucidate the consumption patterns and the impacts to the environment. Since only few studies on the EW-MFA were done in the developing countries, this research can be regarded as one of the first attempts to study the economic growth of the Philippines in terms of physical dimensions. Results show that the annual amount of per material category of DMC increased significantly with biomass (70%) and construction minerals (13%) as the most consumed materials in 1985, however, construction minerals increased to 41% while the biomass decreased to 42% in 2010. The IPAT (Impact (I) = Population (P) x Affluence (A) x Technology (T)) analysis shows that population (P) and affluence (A) are the key driving forces of resource consumption in the Philippines. The decoupling condition of resource consumption from economic development shows varying trends of non-decoupling and relative decoupling in a 25-year period reflecting the development plans and strategies implemented throughout the study period. The results of this research are intended to assist in the future development strategies towards the sustainable resource management and sustainable development in the Philippines.

Key Words: Material Flow, Consumption, Decoupling, Economic growth

1. Introduction

It is the ultimate goal of every economy to reach a certain degree of development and so for last decade, global efforts to improve the low-income economies had resulted to unprecedented growth of economies and uplifted the significant number of populations out of the poverty line all over the world. Tantamount to the growth of economies is rapid withdrawal and utilization of the materials and energy from the environment. While these resources provide the basic needs of the socio-economic system, the extraction, processing and utilization of these resources bring disturbance to the natural ecosystem affecting biodiversity, displacement, and wastes discharged to the environmental system. This environmentally unsustainable global consumption of natural resources resulted to the numerous environmental problems being experienced encompassing the developed and developing economies all over the world. The rate of resource consumption has been rapidly increasing, with the industrialized and developed countries consume greater amount of resources than the developing counterparts and more so if the developing countries would follow the trends of resource consumption in these developed regions.

The worldwide uneven distribution and the supply of the natural resources are also important factors to consider in the current trends of resource consumption. While the developed countries such as Japan and other European countries are now gearing towards utilizing technological innovations, putting institutional framework and policies in placed to de-link or decouple the resource consumption and economic growth, the developing economies at the early stage of economic growth should also consider growth patterns and strategies that promote sustainable resource consumption. The resource decoupling would occur when the growth in the resource consumption is lower than the economic growth, and while this concept is not a panacea to the current complex socio-economic and environmental issues, it is still important to look into as decoupling encourages the increase in the resource efficiency and productivity.

The Asia-Pacific region is regarded as not only the center of economic growth in the world in terms of financial production and consumption but at the same time, this region has the highest growth rates in the demand and utilization of materials and energy (Giljum et. al, 2010), registering the regional average of 85% per capita material use terms with that of the rest of the world. The fast phase of economic growth in this region has been considered to be unsustainable as characterized by the rapid growth of population; increased resource utilization and rapid urbanization challenge the region's sustainable development (UNEP, 2013). The current patterns of economic growth in Asia would later affect the global demand and consumption of materials and the subsequently affect the global environment such as increased emission of greenhouse gases and other forms of wastes.

To determine the resource consumption of the region or country, the development of physical accounts to quantify the flow of resources from environmental system to socio-economic system using the economy-wide material flow accounts (EW-MFA) is one of the important methods that gained popularity in providing useful information on the resource extraction, consumption patterns and growth of the economies that could be used and related to the global, regional, national and local socio-economic and environmental issues. The EW-MFA is well studied and adopted framework in the developed countries but not widely applied in the developing countries. Recently, comparative case study on assessment of economy-wide material flow accounts and implications was conducted for the developing countries such as Myanmar, Bangladesh and Philippines. Similarly, the study on driving factors of resource flows in Myanmar, the Philippines and Bangladesh have been undertaken (Kyaw, et. al, 2014). Studies incorporating resource consumption indicators with economic growth by utilizing the decoupling analysis were done for China, Russia, Japan and United States (Wang, et. al, 2013) and Czech Republic (Kovanda et. al, 2007).

The Philippines is one of the countries in Asia Pacific region that pledged commitment to the joint Asian policy called the Manila Declaration on Green Industry in Asia in 2009. This declaration called for the need to increase resource efficiency, inclusive economic growth in the developing countries and reduction of resource consumption in the high-consuming countries in the region. As a newly industrialized country, it is timely to look into the Philippines' scenario of resource consumption in disaggregated, per material flow and implications on economic growth. This study also attempts to determine the drivers of resource consumption and look into the pattern of economic growth and resource consumption in terms of decoupling analysis to provide basis for the sound resource management in the Philippines.

This research is organized as the following; Section 1 gives the introduction and background of this research, Section 2 presents the socio-economic system of the Philippines while the Section 3 presents the methodology in the calculation of EW-MFA indicators and identifying the driving factors and decoupling trends. Section 4 shows the discussion and analysis of trends of the indicators of EW-MFA. The driving factors of resource consumption and the decoupling trends in the national economy of the Philippines are also discussed in this chapter. Section 5 presents the conclusion and recommendations for future research.

2. The Philippine's Socio-Economic System

The Philippines is an archipelagic country lying in the southeastern coast of Asia composed of 7,107 islands stretching to an area of 300,000- square kilometer or 29.8 M hectares. Manila is the capital city and at center of economic activities in the country. Philippines is one of the member states of Association of South East Asian Nations.

2.1 Gross Domestic Product (GDP) and Population

The Philippine population is characterized by a high birth rate and gradually declining mortality rate. Since the international migration is relatively nil, the growth in population is greatly attributed to the natural increase or the excess of births over deaths (PSY, 2010). The population increased from 54 M in 1985 to 93 M in 2010 (Worldbank, 2014) with compounding annual growth rate of 2%. The disparity in the spatial distribution of the country's population maybe attributed to its geographical, socio-economic and climatic conditions. Similar to the global trend of urbanization, the urban population of Philippines rose from 48% in 2000 to 61% in 2007. It has population density of 308 per square kilometers in 2010 (PSY, 2010).

The performance of the Philippine economy has been characterized by a regular pattern of boom and bust growth cycle since the 1970's. Because of this, the GDP (constant, 2005) modestly increased from 49,277 Million US$ in 1985 to 131,131 Million US$ in 2010 (Worldbank, 2014) with compounding annual growth rate of 4%. The per capita GDP (constant 2005) also grew modestly from $912 in 1985 to

$1,406 in 2010. The potential growth of per capita GDP appeared to be significantly constrained by a high population growth rate.

2.2 Structural Economic Transformation

There is a gradual shift in the Philippines' economic structure changing from the high share of agriculture in the GDP to growing shares of industrial and service sectors. Table 1 shows the changes in the economic structure of the Philippines from 1985 to 2010. In 2010, the industry and service sectors comprised 88% of the shares to national GDP. In terms of per sector share in GDP, the share of agriculture showed decline from 24.6% in 1985 to 12.3% in 2010. Similarly, industry share decreased from 35 % in 1985 to 33% in 2010, while the services increased from 41% in 1985 to 55% in 2010.

Table 1. The Philippines' Key Socio-Economic Indicators from 1985 to 2010

Indicators	1985	1990	1995	2000	2005	2010
Population, million	54	62	70	78	86	93
Population density, (people/km^2)	182	208	233	260	288	308
GDP, million US$ (2005 constant)	49,277	62,100	69,125	82,354	103,066	131,131
GDP, US$ (2005 constant)/capita	912	1,002	993	1,061	1,201	1,403
Agriculture (value added, % of GDP)	25	22	22	14	13	12
Industry (value added, % of GDP)	35	34	32	34	34	33
Services (value added, % of GDP)	41	44	46	52	54	55

(Sources: Worldbank 2014 and Philippine Statistical Yearbook, various years)

3. Methodology

3.1. Sources of Data

The methods for the estimation of the indicators and the categorization of the major types of resources in this study of material flow accounting and analysis are based on the standardized and methodological guidebook released by Eurostat (2001, revised 2009). Table 2 shows the four major resource types or categories of the materials accounted for in this research and the sources of data. The data for indicators of material flow accounts are also presented at this level of disaggregation. The quantity of all material per categories is expressed in terms of their mass (weight in tonnes) per year. In this research, the physical material flow is determined with the focus on the direct material flow or the economically used resources only. This research does not consider the indirect material flows or unused materials associated to the exports or imports and the hidden material flows from the domestically extracted materials such as the mining overburden or unused byproducts from agricultural harvests.

Table 2. Data Sources and the Four Major Resource Categories of EW-MFA

Material Category	Sub categories	Data Sources
Biomass	From agriculture, forestry, and fishery	Philippine Statistical Yearbook Bureau of Agricultural Statistics Bureau of Fisheries and Aquatic Resources
Fossil Fuels	Fossil energy carriers such as coal, oil, natural gas, and others	Philippine Statistical Yearbook Department of Energy
Ores and Industrial Minerals	Precious metals and base metals ores, industrial mineral, and others	Philippine Statistical Yearbook
Construction Minerals	Sand and gravel, and others	Philippine Statistical Yearbook

3.2. Calculation of EW-MFA Indicators

3.2.1 Domestic extraction (DE)

DE refers to the amount of the materials obtained from the Philippine environment. It is estimated by using the equation below.

$$\mathrm{DE}_{(t)} = \sum_{x}^{y}\{\mathrm{B}_{x(t)} + \mathrm{F}_{x(t)} + \mathrm{M}_{x(t)} + \mathrm{C}_{x(t)}\} \qquad DE_{(t)} = \sum_{x}^{y}\{B_{x(t)} + F_{x(t)} + M_{x(t)} + C_{x(t)}\}$$

The $DE_{(t)}$ stands for domestic extraction at year *t* totaling of all types of material types from *x* to *y* for each type of categories. The material categories are: $B_{x(t)}$ refers to the extracted biomass of specific material *x* in specific year *t*, $F_{x(t)}$ is the amount of extracted fossil fuel *x* in specific year *t*, $M_{x(t)}$ refers to the extracted metal ores and industrial minerals type *x*, and while the $C_{x(t)}$ is amount of extracted construction minerals *x* in specific year *t*.

3.2.2 Direct material input (DMI)

DMI refers to the direct input of materials into the Philippine economy. It is estimated as equivalent to the sum of amount of domestically extracted materials and the imported materials per category as shown in the equation below:

$$\mathrm{DMI}_{(t)} = \mathrm{DE}_{(t)} + \sum_{x}^{y}\mathrm{I}_{x(t)} \qquad DMI_{(t)} = DE_{(t)} + \sum_{x}^{y} I_{x(t)}$$

In this equation, the $DMI_{(t)}$ is domestic inputs at specific year *t*, $DE_{(t)}$ is the domestic extraction at specific year *t*, and I_x is amount of imports *x* at that specific year *t*. Variety of imports material types varying from *x* to *y* are taken into account.

3.2.3. Domestic material consumption (DMC)

DMC refers to the amount of materials remained and utilized in the Philippine economy. It is calculated by subtracting the amount of exported materials to the amount of DMI as shown in the equation below.

$$\mathrm{DMC}_{(t)} = \mathrm{DMI}_{(t)} - \sum_{x}^{y}\mathrm{E}_{x(t)} \qquad DMC_{(t)} = DMI_{(t)} - \sum_{x}^{y} E_{x(t)}$$

The $DMC_{(t)}$ stands for direct material consumption at year t and $E_{x(t)}$ refers amount of exports type *x* at year *t*. Same as imports, all export types from *x* to *y* are taken into consideration in detail.

3.2.4. Physical trade balance (PTB)

PTB indicates the physical trade surplus or deficit of an economy. It is estimated by subtracting the quantity of the physical imports $I_{(t)}$ from the quantity of the physical exports $E_{(t)}$ in year *t* as shown in the equation below.

$$\mathrm{PTB}_{(t)} = \mathrm{I}_{(t)}\text{-}\mathrm{E}_{(t)} \quad PTB_{(t)} = I_{(t)} - E_{(t)}$$

3.3. Analysis of Data

The indicators of EW-MFA depict the physical magnitudes of the economy and show the general and overview of the quantitative picture to describe the material flows in the light of economic activities (Xu and Zhang, 2007). Using these indicators, further analysis can be done to elucidate the complex relationships between the environment and socio-economic systems.

3.3.1 IPAT Analysis: Drivers of Resource Consumption in the Philippines

This study utilized the method of IPAT model adapted as by Eurostat (2002), where the environmental impact (I) is the product of population (P), affluence (A), and technology (T), substituting the DMC to represent the environmental impact (Xu and Zhang, 2007). The driving factors of the resource consumption and economic growth in the Philippines for 25 years is determined with the IPAT expressed as follows,

$$DMC = \Delta P \times \frac{GDP}{P} \times \frac{DMC}{GDP} \mathrm{DMC} = \Delta \mathrm{P} \times \frac{\mathrm{GDP}}{\mathrm{P}} \times \frac{\mathrm{DMC}}{\mathrm{GDP}}$$

where *I* corresponds to the *DMC*, *P* is *Population*, *A* refers to the *GDP/capita*, and *T* denotes the *Material Intensity, MI* or equivalent to the *DMC/GDP*.

3.3.2. Decoupling Analysis

Based on the method introduced by the OECD (2002), decoupling factor is calculated as follows:

$$\text{Decoupling factor } (D_f) = 1 - \frac{({}^{EP}/_{DF})end\ of\ period}{({}^{EP}/_{DF})start\ of\ period}$$

where D_f refers to the decoupling factor, EP refers is the environmental pressures, and DF is the driving force. In this study, resource consumption or DMC is used to represent environmental pressure and GDP represents the economic driving force and the interpretation of the calculated decoupling factor is based on the table below (Wang et. al, 2013).

Table 3. Decoupling factors and corresponding degree of decoupling

Degrees of Decoupling	Decoupling factor, D_f
Absolute decoupling	$D_f \geq 1$
Relative decoupling	$0 < D_f < 1$
Non-decoupling	$D_f \leq 0$

4. Results and Analysis of Data

4.1. Indicators of EW-MFA in the Philippines

4.1.1 Domestic Extraction

Figure 1 shows the material domestic extraction (DE) in Philippines from 1985 to 2010. The quantity of DE was more than doubled in 25 years, from 116 million tonnes (Mt) in 1985 to 335 Mt 2010. Biomass and construction material were the two most extracted materials in the Philippines comprising 95% in 1985 and 90% in 2010, respectively. The amount of biomass grew from 94 Mt in 1985 to 157 Mt in 2010. The active construction activities in the economy resulted to the increase in the extraction of construction minerals from 17 Mt in 1985 to 146 Mt in 2010. In 1997, the significant increase in the amount of construction minerals was accounted to the sudden increase of sand and gravel extraction from an amount of 31 Mt in 1996 to 77 Mt in 1997, same year at which the construction industry grew to 21% (MTPDP, 2010), the highest growth from 2004 to 2010. Sand and gravel are the basic minerals utilized in the infrastructures required to support the needs of the growing economy of the Philippines.

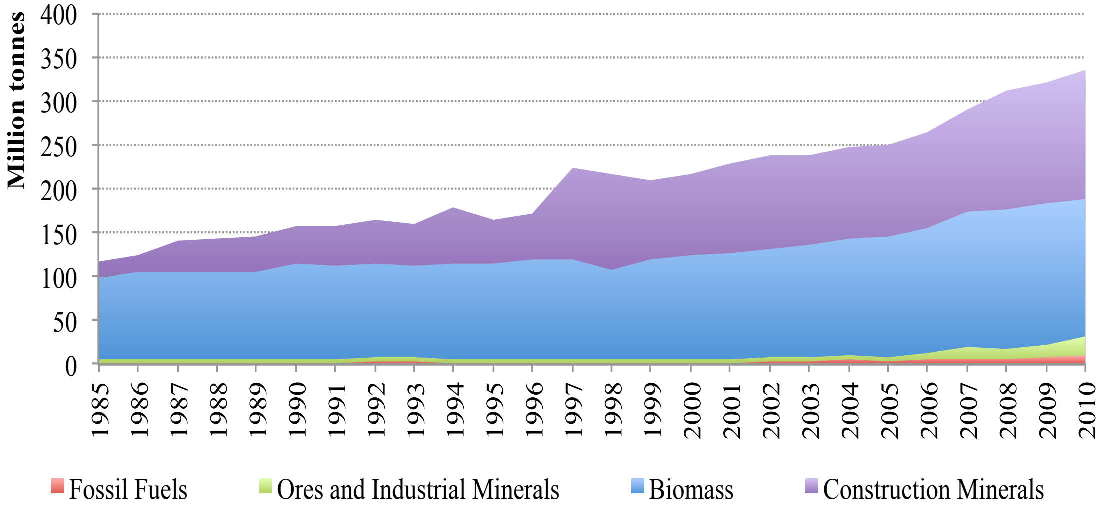

Figure 1. Domestic extraction in the Philippine economy from 1985 to 2010

4.1.2. Direct Material Input

Figure 2 illustrates the trends on the direct material input (DMI) in terms of the four major material types. DMI was estimated from the sum of DE and the quantity of import. The DMI doubled from 135 Mt in 1985 to 379 Mt in 2010. The biomass remained to be the highest material input for the 25-year period, comprising 44% of DMI. Both the input of fossil fuels and biomass were more than doubled, from 16 Mt and 96 Mt in 1985 to 32 Mt and 169 Mt in 2010, respectively. The ores and industrial materials increased from 6 Mt in 1985 to 29 Mt in 2010. The DMI of construction minerals rose significantly from 17 Mt in 1985 to 148 Mt in 2010. The majority of direct material input was attributed by the domestic extraction (from 86% in 1985 to 89% in 2010), while the share of imports in DMI varied from 9% to 17% in a 25-year period.

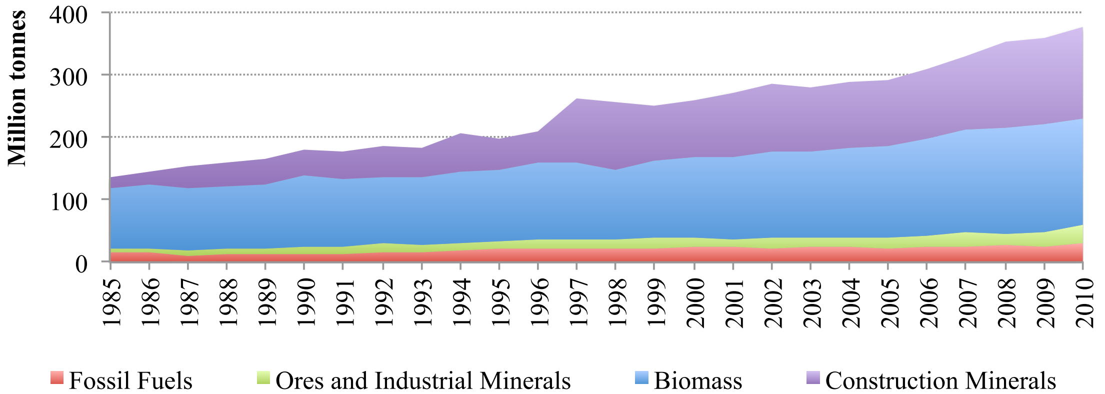

Figure 2. Direct material input in the Philippines from 1985 to 2010.

4.1.3. Domestic Material Consumption

The domestic material consumption (DMC) measured in this study refers to the natural materials (without water and air) obtained from the Philippine environment, used and remained in economy after the exported materials were deducted, and the quantity of the imported materials were added. The amount of the consumed resources in the Philippine economy increased from 128 Mt in 1985 to 353 Mt in 2010 as shown in Figure 3. The biomass had 72% share (92 Mt) and construction minerals had 13% (17 Mt) share of DMC in 1985. In 2010, however, the share of construction minerals rose to 42% (148 Mt), a share almost equivalent to biomass with 43% (152 Mt). While the ores and industrial mineral and fossil fuels grew continuously in amount, it remained within 15% of the annual DMC.

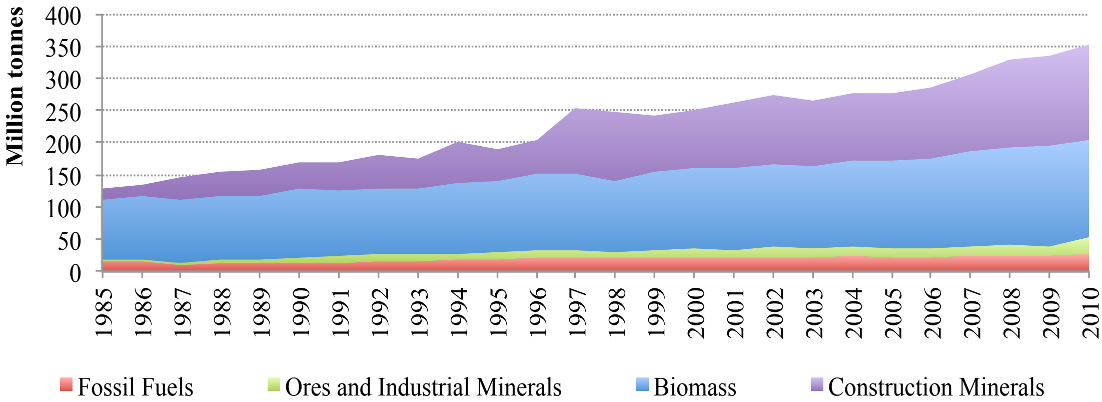

Figure 3. Domestic material consumption in the Philippines from 1985 to 2010.

The quantity of biomass remained to be the significant materials in the Philippine economy, but the quantity and the share of construction minerals in DMC began to increase in 1997. The growing amount of construction minerals shows the increasing important role of the construction industry in the Philippine economy. It is also indicated by the corresponding growth in the GDP in the construction industry with 10.5 % growth in 2010. The increasing quantity of construction minerals also shows that the Philippine economy is moving towards the increase dependence on the nonrenewable materials rather than the renewable materials or the biomass.

Such trends of material composition where the mostly consume materials are biomass and non-metallic minerals are the common characteristic of the low income developing countries while trend in high income developing and developed countries have high share of fossil fuels and metal ores due to shifting demands and consumption pattern and growing industrial demand (Giljum et. al, 2010).

The per capita DMC also increased slightly from 2.37 tonnes in 1985 to 3.78 tonnes in 2010. Figure 4 shows the material consumption per capita broken into major material categories in the Philippines. The higher per capita consumption of biomass is due to the significant agricultural and forestry sector in the Philippines.

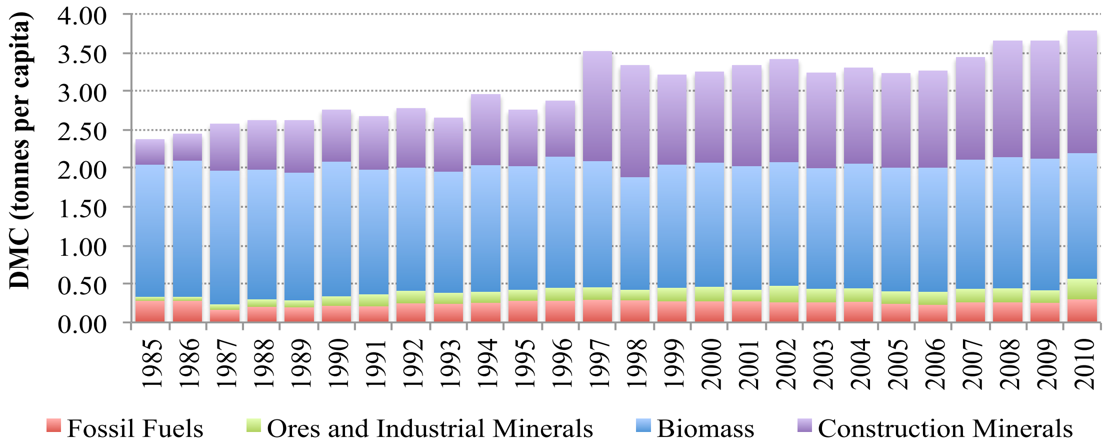

Figure 4. Trends on domestic material consumption (DMC) per capita in Philippines from 1985 to 2010

4.1.4. Physical Trade Balance

The PTB expresses the physical trade surplus or deficit of an economy. The surplus or a positive PTB value refers to the net import of biophysical resources and deficit or the negative PTB value refers to the net exports. PTB is estimated based on the amount of imports less than the exports. The quantity the imports, exports and PTB are shown in Figure 5. Both imported and exported materials increased significantly in 25 years, with the amount of imported material remained greater than the exported material. Imported materials rose from 19 Mt in 1985 to 43 Mt in 2010 while the exported materials rose from 7 Mt in 1985 to 26 Mt in 2010.

External trade is important to a developing economy like Philippines. It does not only open the agricultural products and manufactured goods of the Philippines to open market but the exchange of materials and open trade bring the needed materials and equipment to the country that are durable and necessary to propel industries into further productivity. Biomass consist of agricultural products comprised the highest amount of the exported materials while the Philippines continues to be dependent on the imported fossil fuels to supply the energy needs.

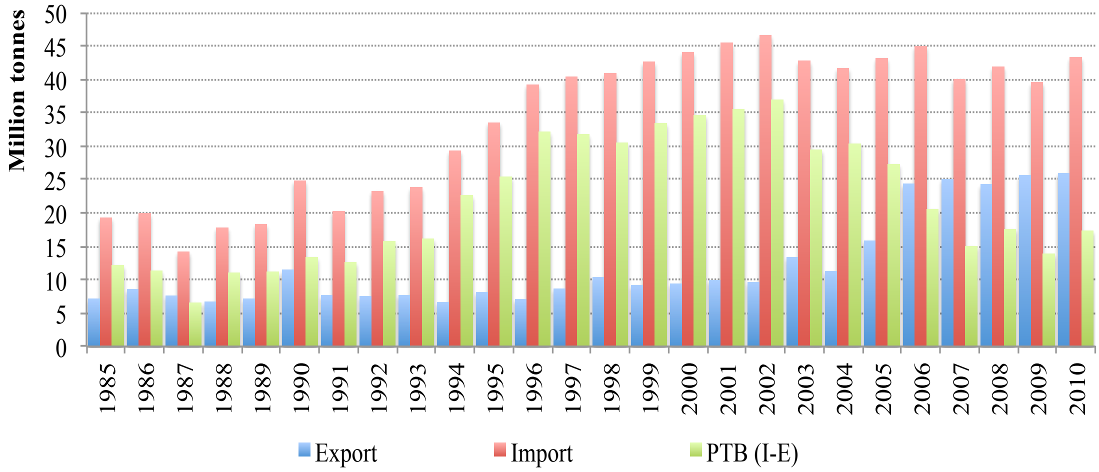

Figure 5. The trends on import, export and physical trade balance in the Philippines from 1985 to 2010.

4.2. Drivers of Resource Consumption and Resource Intensity in the Philippines

With the use of IPAT analysis, the drivers of consumption in the Philippines were determined in terms of the three important factors namely; population, affluence (GDP/capita), and technology expressed as material intensity (DMC/GDP). The 25-year period was divided in five equal periods to determine the drivers of resource consumption for every period as shown in the Table 4.

Table 4. Driving forces of the resource consumption in the Philippines from 1985 to 2010.

Period	$\Delta DMC_{(I)}$ (%)	ΔDMC (Mt)	ΔP (%)	ΔA (%)	$\Delta MI_{(T)}$ (%)	Share Contribution Using Log Transformation		
						P (%)	A (%)	$MI_{(T)}$ (%)
1985-1990	26	39.25	13	10	3	51	39	10
1990-1995	11	20.67	12	-1	1	103	-8	5
1995-2000	26	57.26	11	7	8	42	25	32
2000-2005	18	48.99	10	12	-5	57	69	-26
2005-2010	19	61.08	9	15	-6	47	83	-30

Note: DMC domestic material consumption, P population, A affluence, T technology = MI, Material Intensity

The change in the resource consumption from 1985 to 2000 was driven by the population growth, where the annual population growth rate in the Philippines from 1980 to 2000 was 2.35% and slightly decreased to 2.04% from 2000 to 2007, while the growth of the Philippine economy made the affluence to be the major driver of resource consumption in the last 10-year period of the study (2000 – 2010).

The Philippine economy grew at a respectable pace over the period of 2001 to 2004, with 3 percent in 2001 to 6.7 percent in the first semester of 2004, and expanded at its fastest rate in three decades in 2007, at 7.1% GDP growth. The global economic crisis in 2008 manifested its effect in the Philippines with the decline of GDP growth to 1.1% in 2009 but recovered and rebound to 7.35% in 2010. This growth of economy, driven the resource consumption showing that there is increasing part of the population who are improving in their lifestyles. Those who can afford to buy not only the basic daily needs but enjoy other material things and quality services also demand and consumed greater quantity resources.

The T (as expressed by material intensity measured from amount of material consumed per GDP (DMC/GDP) shows modest decrease in 2000 to 2010 as indicated by the decreasing values of -5% and -6%, respectively, but became negligible due to the increased in P and A. The material intensity needs to improve in a way that is related to the growth of GDP to compensate the extractive pressures of socio-economic activities to the environment. The material intensity is inversely related to the material efficiency, thus decreasing material intensity values means increasing efficiency in the consumption of the material or the resources.

The last decade of this study shows decrease in the material intensity showing the emerging awareness in the Philippine socio-economic system on the importance of efficiency on resource consumption. This awareness should be supported and improved with institutional framework, adequate policies and implementation in the

Philippines that will strengthen the resource efficiency both in the important sectors such as agriculture fishery and industries towards the goal of sustained economic development.

4.3. Decoupling of Resource Consumption and Economic Growth

In the decoupling analysis, it is aimed to depict the mutual relationship of the economic driving force and environmental pressure. The environmental pressure in this research is represented by the resource consumption expressed as DMC, while the gross domestic product (GDP) is taken as the proxy for the quality of life and as economic driving force. Similar to the IPAT analysis, the decoupling analysis was carried out in five equal years in the 25-year period of the study. Figure 6 shows the decoupling trend on the resource consumption and economic growth from 1985 to 2010.

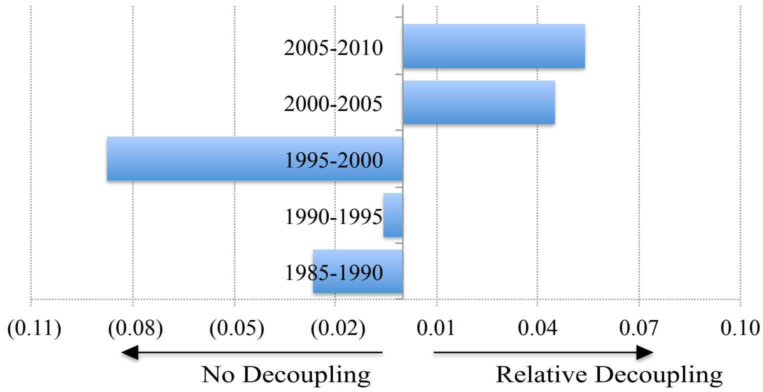

Figure 6. Decoupling of resource consumption (DMC) from economic growth (GDP) in the Philippines from 1985 to 2010

Based on this analysis, no decoupling occurred during the period of 1985 to 2000, as shown by the negative values of the decoupling factors. This indicates that for this period the growth in the resource consumption or DMC (188%) is higher than that of the GDP (167%). Relative decoupling occurred in the periods of 2000 to 2010 as shown by the positive values of the decoupling factors. Relative decoupling occurs when the growth rate of resource consumption (DMC) is lower than the growth rate of GDP. From 2000 to 2010, the GDP grew by 156% while the DMC grew at a lower percentage of 144%.

The relative decoupling in the Philippines is quite modest since the higher the value of decoupling factor ($0 \leq D_f \leq 1$), the greater the degree at which the DMC grows at significantly lower rate than that of the GDP. Nevertheless, it is important to recognize the beginning of the improvement in terms of resource consumption relative to the economic growth in the Philippines. While the Philippines continuously battles with the issues of poverty and inclusive economic growth and where resource extractive industries become the resort of economic growth, it is also important to look into other sectors to improved and be a catalyst to economic development. At the period at which the economy is expanding, the demand on materials such as construction minerals and fossil fuel are expected to grow at a rapid rate, the Philippine government should formulate policies that would develop other sectors and would balance the demands from industrial sectors that would include the promoting the growth from the service sectors such as tourism activities.

5. Conclusion and Recommendations for Future Studies

This research illustrated the trends in the resource consumption, the flow of materials and the economic growth in the Philippines from 1985 to 2010. The extraction of the natural resources (DE) in the Philippines increased to 289% along with the resource consumption (DMC) to 275% in the twenty-five year period of this study, while the economic growth (GD) grew at a lower phase at 266%. The socio-economic system is on transition from the renewable material consumption (biomass) in 1985 to the nonrenewable material consumption (construction mineral) in 2010. While this phenomenon is the usual trend in the growing economies, it is important for Philippines should take a thorough look to improve the current resource consumption with the developing patterns.

The resource consumption was driven by the population growth in 1985 to 2000, while the growing affluence became apparent in 2000 to 2010. The material intensity showed a modest decrease in 2000 to 2010. However, there is a need to improve the material intensity in the utilization of the natural resources. In the analysis of decoupling of resource consumption from economic indicator (GDP) showed relative decoupling from 2000 to 2010.

This study on the physical metabolism of the Philippines socio-economic system suggests that while the country is at the early stage of economic growth and with abundance of natural resources, the resource management should be geared towards resource efficiency to maximize the productivity in the utilization of these nonrenewable resources. Strong institutional framework, develop policies that would achieve the sustainable development in the Philippines.

The future research studies on the output indicators of EW-MFA and the quantifying the quantity of hidden material flow associated with the domestic extraction in the Philippines should be taken into considerations.

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