ECONOMIC-ENVIRONMENTAL IMPACT ANALYSIS BASED ON THE CHANGES OF ECONOMIC STRUCTURES OF HOCHIMINH CITY (HCMC) AND THE REST OF VIETNAM (ROV)

(2000 - 2007)

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Abstract:*From time to time, Input-Output model have been applied in estimating economic - environment linkages. However, the approach is limited to the regional/national environmental feedback effect only. In the other hand, the structure of inter-regional linkages have been common topics of discussion in regional analysis; attention has been directed to problems of inter-regional feedback effects and the degree to which change originating in one region has capacity to influence activity levels in another region, in turn, will effect activity back in the region of origin.*

Rather than trying to to get a handle on the various depatures from inter-regional feedback effect or environmental feedback effect independently, this paper attempts to measure impacts on residuals generated by inter-regional economic activities. The paper presents the conceptual framework of the inter-regional input-output model in inter-regional economic impact analysis. In this paper, the special attention is paid of the Miyazawa system in the decomposition of the economic multiplier effects. The IRIO-2000 is represented to the period of 2000-2007 and the IRIO-2007 is represented to the period of 2007-2012. By comparing between 2 periods, we could measure the inter-regional/inter-industrial interdependencies as well as the consequent environmental effects of pollution emissions due to economic activities in HoChiMinh City and the Rest of Vietnam in a case study.

Key words*:*inter-regional input-output analysis, environmental input-output analysis, inter-industry analysis, economic-environment linkage.

1. Introduction

The structure of inter-regional linkages have been common topics of discussion in regional analysis; attention has been directed to problems of inter-regional feedback effects and the degree to which change originating in one region has capacity to influence activity levels in another region, in turn, will effect activity back in the region of origin.Earlier, Miller (1966, 1969) proposed a formulation of the feedback process to handle this problem, Miyazawa (1968) suggested an innovative way of partitioning the system of regions that resulted in the identification of what are now referred to as internal, external multipliers inter-regional feedback effects. In the means time, input–output model have been applied in estimating economic – environment linkages. The input–output approach of Miller and Blair (1985) is to measure the feedback effect of an environment. However, the approach is limited to the regional/national environmental feedback effect only.

Rather than trying to get a handle on the various departures from inter-regional feedback effects or environmental feedback effectsindependently, this paper attempts to measure impacts on residuals generated by inter-regional economic activities between Hochiminh city and the Rest of Vietnam.

The first part of this paper presents the conceptual and accounting framework of the inter-regionalinput-output model in inter-regional economic impact analysis. In this paper, special attention is paid to the Miyazawa system in the decomposition of the economic multiplier effects. For the purpose of this study, the input-output model is being extended to be able to measure economic-environmental linkages. The second part is a case study for HoChiMinh City (HCMC) and the Rest of Vietnam (ROV) based on inter-regional input output approach by using the 2000& 2007inter-regional input-output tables prepared by one of the authors (Kim, K. M., Secretario, F. T and Trinh B., 2000 - 2007). The objective of this study is to measure the inter-regional, inter-industrial interdependencies as well as the consequent environmental effects of pollution emissions due toeconomic activities. An analysis of the empirical results on the economic-environmental multipliers is shown in the last part of this case study.

The Vietnam inter-regional input output table constructed by the hybrid approach from National competitive input output tables and HoChiMinh competitive input output tables in 2000 and 2007. The national input-output tables was compiled by Vietnam General Statistical Office (GSO) and published in 2003 and 2007, The HoChi Minh input-output table was compiled as a joint undertaking between HCMC Provincial statistical Office and GSO with financial assistance provided by the HCMC'speople and Provincial committee. This particular study was made possible with the availability of the just-completed research project on the compilation of the 2000& 2007 Bi-region inter-regional input-output (IRIO) table for the Vietnamese economy, with HoChiMinh City as the area of interest. As such, this two-region tables specifically divided the country into: Region 1 – HoChiMinh City, and Region 2 – the Rest of Viet Nam. The resulting IRIO table shows, in its compact form, the intra- as well as the inter-regional economic transactions at the two-region level of spatial delineation.

The main theoretical contributions of our paper are two,firstly, we demonstrate that the environment input-output approach reconciles the structure of inter-regional linkage. The reconciliation is mutually beneficial. As mentioned, the environmental input-output analysis is bounded by a regional/national approach. The inter-regional input-output approach has potential of determining environmental feedback effects. Conversely, the Miyazawa's internal, external multipliers inter-regional feedback effects lack of economic-environmental linkages. The second theoretical contribution of our paper is that we propose the variant of inter-regional input-output model of Miyazawa by decompose economic-environmental multipliers inter-regional feedback effects into regional final demand, regional foreign export and regional domestic export.

The last contribution of our paper is of an applied nature. As shown in the case study, we apply the two-region model for HoChiMinh city and the Rest of Vietnam. However, the multi-regional model could be applied for international input-output model. One of the consequents could bethe import-export strategy could be proposed for each economic region

(such as European Union or Japan and the rest of the World).

The paper is organized as follows;the model proposes the inter-regional economic impact analysis for calculating environmental impacts based on inter-regional input-output model. In section 3, we present the data of Vietnamese input-output tables and inter-regional input-output tables. Section 4 presents a case study for HoChiMinh City (HCMC) and the Rest of Vietnam (ROV) and the last section concludes.

2. The Model

2.1. Enlarged Leontief Inverse and Internal and External Multipliers

As in national input-output model, the basic relationship in intra-regional input-output model is:

$$AX + Y = X \quad \text{or} \quad (I - A).X = Y \tag{1}$$

Assume there is two–fold division of a national economy into a region 1 and rest of national economy(region 2), Miyazawa's internal and external multipliers were directed to partition the standard Leontief inverse into the internal propagation and external propagation activities. In the case of a two-region input-output system, the direct coefficients can be represented by the following block sub-matrix:

$$A = \begin{pmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{pmatrix} \tag{2}$$

where: A_{11} and A_{22} are the quadrate matrices of direct inputs within region 1 and region 2 (i.e. intra-regional), respectively;

A_{12} and A_{21} are the inter-regional matrices representing direct inputs connections from region 1 to region 2 and from region 2 to region 1 (i.e. inter-regional), respectively. Final demand (Y) and gross output (X) vectors are partitioned in a similar fashion:

$$X = \begin{pmatrix} X_1 \\ X_2 \end{pmatrix} \quad \text{and} \quad Y = \begin{pmatrix} Y_1 \\ Y_2 \end{pmatrix} \tag{3}$$

The Standard Leontief inverse matrix will have following form:

$$B = (I - A)^{-1} = \begin{pmatrix} B_{11} & B_{12} \\ B_{21} & B_{22} \end{pmatrix} \tag{4}$$

This can be further elaborated with the help of the Schur formula (Schur, 1917; Sonis and Hewings, 1993):

$$B = (I - A)^{-1} = \begin{pmatrix} B_1 & B_{11} \cdot A_{12} \cdot B_2 \\ B_{22} \cdot A_{21} \cdot B_1 & B_2 \end{pmatrix} \tag{5}$$

Where: $B_{11} = (I - A_{11})^{-1}$ and $B_{22} = (I - A_{22})^{-1}$ represent internal multipliers matrices of region 1 and region 2.

According to Sonis and Hewings(1999) we have:

$B_1 = (I - A_{11} - A_{12}.B_{22}.A_{21})^{-1}$ (6) and:

$B_2 = (I - A_{22} - A_{21}.B_{11}.A_{12})^{-1}$ (7)

B_{11} and B_{22} defined as Enlarged Leontief Inverse matrices. From (3) and (5) yields:

$$X_1 = B_{11} \cdot (Y_1 + A_{12} \cdot B_2 \cdot Y_2) \tag{8}$$

$$X_2 = B_{22} \cdot \left(Y_2 + A_{21} \cdot B_1 \cdot Y_1\right) \quad (9)$$

From (8) and (9) showed that the enlarged Leontief inverse matrix contain elements which are larger than elements of internal matrix multiplier, because they include extra output requirements to meet intermediate inputs of another region induced output effects. These extra output requirements as external matrix multipliers, so the enlarged Leontief inverse of region 1 and 2 can be obtained:

$$B_{11} = \Delta_{11} \cdot B_1 \quad (10)$$

$$B_{22} = \Delta_{22} \cdot B_2 \quad (11)$$

Where: Δ_{11} and Δ_{22} are external multipliers of region 1 and 2; B_1 and B_2 are internal multipliers of region 1 and 2.

2.2. The Calculating Emission impacts based on inter-regional input output model.

The general economic input-output model system can be extended to encompass emissions from each sector. These consequences can only be estimated if the framework includes information on the environmental consequences of production within the various economic sectors, this is done by estimating a number of emission coefficients for each sectors indicating the amount of various substances emitted per output value.

The sectorial emission coefficients only relate to emission resulting directly from the production process. However, the production process also places an input demand on other sectors, thereby raising their production and emissions. The sum of these direct and indirect emissions can be calculated by Leontief inverse matrix indicating for each sector the emission coefficients for the total direct and indirect environmental consequences.

Direct emission coefficients matrix V^* can be represented by the following block matrix:

$$V^* = \begin{pmatrix} V_1^* & 0 \\ 0 & V_2^* \end{pmatrix} \quad (12)$$

Where: V_1^* and V_2^* are net direct emissions coefficients matrix of first region and second region. Considering that there are abatement activity for each sector and absorption of residuals by industries as recycled products, V_{ik}^* (i=1,2; k is kind of residuals) can be expressed as:

$V_{ik}^* = Q_{ik} \cdot L_{ik} \cdot W_{ik}$ where

Q_{ik} is a diagonal matrix of pollutant emission rates =1 – pollution abatement rate

L_{ik} is a diaonal matrix of absorption rate = 1 – absorption rate

W_{ik} is a diagonal matrix of generation residual k's coefficients in reioni

And total emissions impact (V) generated by production will be divided as following:

$$\mathrm{V} = \begin{pmatrix} V_1 \\ V_2 \end{pmatrix} \quad (13)$$

From equation (8) and (9) yields:

$$V_1 = V_1^* \cdot X_1 = V_1^* \cdot B_{11} \cdot Y_1 + V_1^* \cdot B_{11} \cdot A_{12} \cdot B_2 \cdot Y_2 \quad (14)$$

$$V_2 = V_2^* \cdot X_2 = V_2^* \cdot B_{22} \cdot Y_2 + V_2^* \cdot B_{22} \cdot A_{21} \cdot B_1 \cdot Y_1 \quad (15)$$

Using an explicit hierarchical order among the regions with this matrix decomposition technique, Sonis and Hewings (1993) identified the following multiplicative structure of Leontief inverse and Miyazawa partitioned multipliers:

$$B=(I-A)^{-1}=\begin{pmatrix}\Delta_{11} & 0\\ 0 & \Delta_{22}\end{pmatrix}\cdot\begin{pmatrix}I & B_1\cdot A_{12}\\ B_2\cdot A_{11} & I\end{pmatrix}\cdot\begin{pmatrix}B_1 & 0\\ 0 & B_2\end{pmatrix} \quad (16)$$

From (13), (14), (15), and (16) yield:

$$V=V^*\cdot B\cdot Y \quad (17)$$

Further, the matrix A is know as the direct requirements coefficients matrix and B is the open Leontief inverse which frequently referred to as the total; requirement coefficients matrix. In an "open" input-output model where only the productive sectors of the economy are assumed to be endogenous (determined by factors inside the productive system), all final demand are assumed to be determined by factors outside the productive system. The model, however, can be closed with respect to households by including in the matrix A one more column and row, for household consumption and value added, respectively. This will form a new matrix denoted by C and $(I-C)^{-1}$ is termed the closed inverse matrix. This inverse matrix has one more column and row than the open matrix B, the last column of the closed inverse matrix is interpreted as the consumption multiplier (the effect on the output of each sector of an additional unit of consumption) and last row as the income multiplier (income created by each unit of sales of each sector).

The remaining rows and columns of the closed inverse (denoted by C^*), the C^* contain elements which are larger than those of the open inverse, because they include extra output required to meet consumption induced output effects, as a result of closed the model with respect to household. The matrix C^* is also enlarged Leontief inverse type. Hence, the residual impacts generated by production and consumption can be estimated yield:

$$U=V^*\cdot C^*\cdot Y \quad (18)$$

where: U is total residual impact generated by production and consumption.

Substitute equation (5) into (16) and defining $Y=F+E$; where

F is matrix that include F_{11} is sub-matrix present domesic final demands of region 1; sub-matrix F_{22} is domestic final demands of region 2; sub-matrix F_{12} is final demands of region 1 that use products from production of region 2; sub-matrix F_{21} is final demands of region 2 that use products from production of region 1; E is vector that include E_1 and E_2, With E_1 is vector of foreign export of region 1 and E_2 is vector of foreign export of region 2. We obtain region 1's output that are necessary to satisfy domestic and foreign final demands:

$$X_1=\Delta_{11}\cdot B_1\cdot(F_{11}+E_1+F_{12})+\Delta_{11}\cdot B_1\cdot A_{12}\cdot B_2\cdot(F_{21}+F_{22}+E_2) \quad (19)$$

$$X_2=\Delta_{22}\cdot B_2\cdot(F_{22}+E_2+F_{21})+\Delta_{22}\cdot B_2\cdot A_{21}\cdot B_1\cdot(F_{11}+F_{12}+E_1) \quad (20)$$

By combining (17), (19) and (20), we can identify some components in the emissions of pollutant in region 1 which are induced to satify intra regional and other region final demands:

1. Emission of a pollutant induced to satisfy final demands of regional 1:

   $V_{1k}^*\cdot\Delta_{11}\cdot B_1\cdot F_{11}$;where F_{11} is a vector of region 1's final demands for goods and services produced in region 1. V_{1k}^* is a diagonal matrix of residual type k of region 1

2. Emission of a pollutant induced to satisfy foreign export of regional 1:

$V_{1k}^{*} \cdot \Delta_{11} \cdot B_1 \cdot E_1$;where E_1 is foreign export of region 1

3. Emission of a pollutant induced to satisfy domestic export of regional 1:

   $V_{1k}^{*} \cdot \Delta_{11} \cdot B_1 \cdot F_{12}$; Where F_{12} is a vector region 2's final demands for goods and services produced in region 1

4. Emission of a pollutant induced to satisfy domestic export of regional 1 of intermediate inputs to region 2 to support region 2's outputs, which are to meet region 1's final demands for region 2's goods

   $V_{1k}^{*} \cdot \Delta_{11} \cdot B_1 \cdot A_{12} \cdot B_2 \cdot F_{21}$; Where F_{21} is a vector region 1's final demands for goods and services produced in region 2

5. Emission of a pollutant induced to satisfy domestic export of regional 1 of intermediate inputs to region 2 to support region 2's outputs, which are to meet region 2's final demands for region 2's goods

   $V_{1k}^{*} \cdot \Delta_{11} \cdot B_1 \cdot A_{12} \cdot B_2 \cdot F_{22}$; Where F_{22} is a vector region 2's final demands for goods and services produced in region 2

6. Emission of a pollutant induced to satisfy domestic export of regional 1 of intermediate inputs to region 2 to support region 2's outputs, which are to meet region 2's foreign export

   $V_{1k}^{*} \cdot \Delta_{11} \cdot B_1 \cdot A_{12} \cdot B_2 \cdot E_2$; Where E_2 is a vector region 2's foreign export.

7. In these components, the emissions of a pollutant in components 1) through 6) are induced to satisfy region 1's domestic exports to region 2, in which 3) is induced by the domestic export of final goods to region 2. While components 4), 5) and 6) are induced by the domestic exports of intermediate goods to region 2. In the text, components 4), 5), 6) are combined to form forth component $V_{1k}^{*} \cdot \Delta_{11} \cdot B_1 \cdot A_{12} \cdot B_2 \cdot E_2 \cdot \left(F_{21} + F_{22} + E_2\right)$.

The above equations are applied similarly for region 2.

3. The Data

3.1. Major Socio-Economic Indicators

The following are some of the major socio-economic indicators at the national and sub-national level of geographic classification:

Table 1. Major Socio-Economic Indicators: Viet Nam

Major Indicators	YEAR					
		1990	1995	1996	2000	2007
AREA (Sq. Km.)						
VIET NAM	330,991					
HO CHI MINH	2,095					
REST OF VIET NAM	328,896					
POPULATION (000 Persons)						
VIET NAM		66,016	71,995	73,157	77,635	85,154.9
HO CHI MINH		4,118	4,640	4,749	5,175	6,347.0
REST OF VIET NAM		61,898	67,355	68,408	72,460	78,807.9
POPULATION DENSITY (Per/Sq Km)						
VIET NAM		199.4	217.5	221	234.6	257.0
HO CHI MINH		1,965.60	2,214.80	2,266.80	2,470.20	3,024.00
REST OF VIET NAM		188.2	204.8	208	220.3	239.61
EMPLOYMENT (000 Persons)						
VIET NAM		29,412	33,030	33,761	36,702	44,172
HO CHI MINH		1,529	1,821	1,895	2,237	3,625
REST OF VIET NAM		27,883	31,209	31,866	34,465	40,547
GDP (Billion Dong at Current Prices)						
VIET NAM		41,955	228,892	272,036	441,646	1,143,715
HO CHI MINH		6,770	36,975	45,545	75,444	229,197
REST OF VIET NAM		35,185	191,917	226,491	366,202	914,518
GDP (Bill. Dong At Constant 1994 Prices)						
VIET NAM		131,968	195,567	213,833	273,666	461,344
HO CHI MINH		17,993	32,596	37,380	52,228	112,271
REST OF VIET NAM		113,975	162,971	176,453	221,438	349,073
PER CAPITA GDP ('000 Dong, current prices)						
VIET NAM		635.5	3,179.30	3,718.50	5,688.70	13,431.0
HO CHI MINH		1,644.00	7,968.80	9,590.40	14,578.60	36,111.1
REST OF VIET NAM		568.4	2,849.30	3,310.90	5,053.90	11,604.4

Source: General Statistic Office of Vietnam

3.2. Overview of National, Regional and Input-Output Accounts Compilation in Viet Nam

3.2.1. National Accounts

In line with Vietnam's transition to market economy in 1986, the General Statistical Office of Vietnam (GSO) shifted its framework of compiling the country's economic accounts from the Material Product System (MPS) to the United Nations' System of National Accounts (SNA). As shown in Table 1, the GSO through its National Accounts Department (NAD) started compiling the country's annual national accounts on the basis of the SNA in the early 1990s. This initial activity was made possible with technical and financial assistance provided by the United Nations Development Program (UNDP). Later on, Asian Development Bank (ADB) provided a long-term technical assistance grant to help improve the compilation of the national accounts including the construction of I-O tables. Currently available are national accounts time-series data from 1986 onwards.

Lately, the GSO has embarked on the compilation of quarterly national accounts,available quarterly time-series Gross Domestic Product (GDP) data are for 1998 onwards.

Table 2. History of National & Regional Accounts and I-O Compilation in Viet Nam

Type of Economic Account	Started Compiling	Frequency of Compilation	Available Time Series Data	Compiler
National Accounts				
a) Annual	1992	annual	1986 onwards	NAD, GSO
b) Quarterly	1998	quarterly	1998-2012	NAD, GSO
Sub-National GDP				
a) Provincial GDP	1993	annual	available*	PSO
b) Regional GDP	1993	annual	available*	NAD, GSO
National IO Tables				
a) Benchmark	1992	Every 4-7 years	1989; 1996; 2000; 2007	NAD, GSO
b) I-O Update	1993	Annual	1990-1995	NAD, GSO

* unofficial data available upon request

3.2.2. National Input-Output Tables

Compilation of SNA-based national I-O tables started in the early 1990s with the compilation of the 1989-benchmark I-O table. The second national I-O table relates to 1996 with 97 production sectors. Between 1989 and 1996, annual I-O updating had been also undertaken to provide users with more current I-O data. The latest national I-O table is the 2007 one, which is based on almost the same structure as the one from 2000, however, its sector dimension now comprises of 138 production sectors.

Table 3. SNA-Based I-O Compilation in Vietnam

Kind / Reference Year	Size	Type	Methodology
National Benchmark Tables			
1) 1989	54x54	Competitive/Current price	Direct Full Survey
2) 1996	97x97	Competitive/Current price	Direct Full Survey
3) 2000	112x112	Competitive/Current price	Direct Full Survey
4) 2007	138x138	Competitive/Current price	Direct Full Survey

National Updated Tables			
1) 1990	54x54	Competitive/Current price	RAS Method
2) 1991	20x20	Competitive/Current price	RAS Method
3) 1992	20x20	Competitive/Current price	RAS Method
4) 1993	20x20	Competitive/Current price	RAS Method
5) 1994	43x43	Competitive/Current price	RAS Method
6) 1995	45x45	Competitive/Current price	RAS Method

3.2.3 National I/O Tables

Compilation of national I/O tables started also in the early 1990s with the compilation of the 1989 benchmark I/O table. The latest national I/O table relates to CY 2007 with dimension of 138 production sectors, 6 final demand and 4 primary input (or value added) components. In between 1989, 1996, 2000 and 2007, annual I/O updating had been also undertaken to provide users with more current I/O data.

3.2.4 Regional GDP

At the regional level, the NAD started compiling regional GDP in 1993 based on data provided by Provincial Statistical Offices (PSO). Currently, the country is divided into 8 economic regions as shown as bellow: Red river Delta, North East, South Central Coast, Central highlands, North East South, North West, North Central Coast, and Mekong River Delta.

3.2.5 Regional and inter-regional I/O Tables

So far, two (2) regional I/O tables have been compiled since the new SNA was adopted by the Vietnam statistical system. One was a small (11-sector) table for the Red River region that was compiled by an independent group that was mainly utilized in an environmental impact project study. The other was for HoChiMinh (HCM) City that was compiled with financial assistance from the HCM Economic Institute. The HCM table is an intra-regional table that was constructed based primarily on survey data. From these results, the inter-regional IO table of 1996; 2000 and 2007 has been compiled by private research groups (Kim, Trinh, Secretario) sponsored by NISSAN Science Foundation).

The inter-regional tables are constructed by hybrid approach. A hybrid approach was adopted in compiling the bi-region inter-regional IO table. It is essentially an alternative method used whenever available data could not fully sustain the rigid data demands of IO accounting. It therefore takes into consideration the usage of survey-generated data, complemented by non-survey techniques of constructing IO tables. The choice of this mixed approach was based on the inventory and assessment made of relevant data available within Vietnam's statistical system.

While a survey-based IO table would be the most suitable analytical instrument in term of data quality, it has been observed that, as in most developing economics, Vietnam's existing data limitations, particularly on regional commodity trade flows, has precluded the use of the "pure" survey method of conducting the IO research project. Due to budget and time constraints, the conduct of a trade flow survey had been ruled out in this research project. Hence, the hybrid method, as the trade – off between survey – based and non – survey techniques of regional IO compilation, was adopted.

Table 4. History of National Accounts and I/O Compilation in Viet Nam

Type of Economic Account	Start of Compilation (based on SNA)	Frequency of Compilation	Compiler
Regional I/O Tables			
HO CHI MINH	1996	2000; 2007	Economic Institute of HCM, HCM PSO
Red River Delta Region	1996	one-time	Project Staff, LOICZ Project
Inter-regional I/O Tables			

HO CHI MINH City-The rest of Vietnam	1996	2000; 2007	Private researcher group, NISSAN project

(*) Private research group and NISSAN project's research team include Dr.KimKwang Moon (Toyohashi University of Technology, Japan), Mr.Francisco T. Secretario (Former ADB Expert, Philippine) and Bui Trinh (GSO, Vietnam),Hoang Tri (CERE, Vietnam);Dr.KimKwang Moon is team leader

3.3. HoChiMinh City status

3.3.1. HoChiMinh City as Viet Nam's Principal Trading Center

HoChiMinh city is one of the biggest cities in Viet Nam with a large area and crowded population, lies between the Mekong River Delta and Eastern Nam Bo. HoChiMinh city is the most important commercial center and the second most important political center of the country next to the capital of Hanoi.

This city has good conditions on transportation, especially for airway and seaway, for example, Tan Son Nhat airport. So it is very convenient to undertake trading or exchange relations with the rest of Viet Nam (ROV) and the rest of the World (ROW) too. There are a lot of economic activities taking place in Ho Chi Minhcityeveryday.

Like other places, HoChiMinh citydoes not only use its own products but also products from other provinces and from the rest of the World for its intermediate and final consumption demands. It means that this city import products from other places and export products to the rest of the economy as well as to the rest of the World. It imports products not only for its own use but also for other provinces. In short, HoChiMinh City is the main transit point for imports required by other provinces. Similarly, HoChiMinh city is the principal transit point for exports coming from other provinces to foreign countries and to other provinces as well. The reason for choosing HoChiMinh city as the principal intermediate transit point in Viet Nam is because HoChiMinh City has the best transportation facilities, whether by sea or air, to carry out export-import economic activities.

3.3.2. Current status of water pollution in Ho Chi Minh City.

Ho Chi Minh city is an important center for culture, economy and trade and international exchange. It also faces a big water pollution problem due to domestic and industrial wastewater. Ho Chi Minh city is located in the transitional zone of the east southern region and the Cuu Long River Delta. The river and canal system in Ho Chi Minh city is influenced by the semidiurnal solar tide. The level of tides is highest in October-November and lowest in June-July. Intrusion of saline water by tide influences the whole river and canal system.

The population of Ho Chi Minh City is more than 6.3 million inhabitants, accounting for about 7.45% of the country's total population. On the other hand, the industrial production of the city accounts for third of the whole country's industrial production.

Ho Chi Minh city has more than 680 factories/plants of which 500 are in the inner city. It has approximately 22 industrial zones: the main industries include; textile, paper, food, chemical, sugar, soap, detergent, beverages, plastic, rubber, machines. In addition,Ho Chi Minh city has almost 24.000 small-scale industrial companies, of which 89% are located in the residential areas of the inner city.

There is no wastewater treatment plant in almost all existing factories. All the wastewater is discharged directly into the sewerage system of the city or into the receiving bodies. The flow rate of industrial wastewater is smaller than that of domestic wastewater but the pollutant concentration of the former is much higher and more dangerous. The factories and small scale industries in the city contribute significantly to the economy, but they also significantly pollute the environment. The water pollution can be classified into seven types: (1) Organic pollution, (2) Bacterial pollution, (3) Suspended solid pollution, (4) Nutrient pollution, (5) Pesticide pollution, (6) Heavy pollution, and (7) Oil pollution.

4.Empirical Study of Environmental impacts

Analogous to the concept of the output multiplier is that of residual multiplier. The residual multiplier matrix V is given as: $V = V^{*} \cdot (I - A)^{-1}$ (Using equation (17)) and based on direct coefficients to wastewater as TSS, BOD, COD, NH4 and total N (annex A, B) by sectors (kg/million Vietnam dong), these consequences estimated based on "Survey in enterprise to get information for wastewater charge calculation – National environment agency, 2000 & 2007" and study result of Institute of tropical Technology and Environmental Protection. As an example, in order to service a one unit.In the table 5.1 presented, one unit is one million Vietnam dongs in the year of 2000, (equivalent to about $70U.S.) increase in final demand, approximately 1.7 kg of TSS, 2 kg of TSS will be discharged into Ho Chi Minh City and the rest of Vietnam wastewater.

Table 5.1 Residual impacts generated by production(year - 2000) (kg/million VND)

	Ho Chi Minh City			**Rest of Vietnam**		
	Internal propagation	inter-regional feedback	Total impact	Internal propagation	inter-regional feedback	Total impact
TSS	0.856	0.027	**0.883**	0.990	0.186	**1.176**
BOD	0.501	0.022	**0.523**	0.555	0.140	**0.695**
COD	1.765	0.043	**1.808**	1.601	0.280	**1.881**
NH4-N	0.082	0.002	**0.084**	0.134	0.032	**0.166**
Total N	0.301	0.007	**0.308**	0.376	0.087	**0.464**

Comparing with the year of 2007 (table 5.2), one unit is one million Vietnam dongs (year-2007), equivalent to about $90U.S.) increase in final demand, approximately 1.9 kg of TSS, 2.35 kg of TSS will be discharged into Ho Chi Minh City and the rest of Vietnam wastewater.

Table 5.2 Residual impacts generated by production (year - 2007) (kg/million VND)

	Ho Chi Minh City			**Rest of Vietnam**		
	Internal propagation	inter-regional feedback	Total impact	Internal propagation	inter-regional feedback	Total impact
TSS	0.935	0.034	**0.969**	1.152	0.194	**1.346**
BOD	0.631	0.028	**0.659**	0.664	0.147	**0.811**
COD	1.842	0.058	**1.900**	1.733	0.336	**2.069**
NH4-N	0.097	0.004	**0.101**	0.141	0.045	**0.186**
Total N	0.338	0.011	**0.349**	0.428	0.096	**0.524**

From final demand by sectors in 2000 and 2007, we can estimate total residuals by type of HCMC city and the rest of Vietnam as bellow:

Table 6.1 Value of residual (kg)(year - 2000)

	Ho Chi Minh City	**Rest of Vietnam**	**Vietnam**
TSS	8,646,940	62744787	71,391,036

BOD	5,956,252	37490822	44,155,063
COD	15,489,343	71847117	88,637,013
NH4-N	654,945	9895414	10,550,360
Total N	2,508,596	27916010	30,424,606

Table 6.2 Value of residual (kg) (year - 2007)

	Ho Chi Minh City	Rest of Vietnam	Vietnam
TSS	9,275,367	65,834,766	76,263,428
BOD	6,388,935	39,162,367	46,440,668
COD	16,860,511	75,462,015	95,316,304
NH4-N	713,347	10,404,756	11,260,887
Total N	2,750,473	29,575,291	32,414,631

The table 5.1; 5.2 and table 6.1; 6.2 are residual impact generated by production between the year of 2000 and 2007; the equation (21) shows the residual impact generated by production and household consumption represented as bellow:

Table 7.1 Residual impacts generated by production and household consumption (kg/VND)(year 2000)

	Ho Chi Minh City			Rest of Vietnam		
	Internal propagation	inter-regional feedback	Total impact	Internal propagation	inter-regional feedback	Total impact
TSS	1.059	0.202	**1.261**	2.149	1.536	**3.685**
BOD	0.655	0.154	**0.809**	1.379	1.099	**2.478**
COD	2.123	0.350	**2.473**	3.000	1.910	**4.911**
NH4-N	0.099	0.017	**0.116**	0.365	0.301	**0.666**
Total N	0.367	0.063	**0.430**	1.052	0.874	**1.926**

Table 7.2 Residual impacts generated by production and household consumption (kg/VND) (year - 2007)

	Ho Chi Minh City			Rest of Vietnam		
	Internal propagation	inter-regional feedback	Total impact	Internal propagation	inter-regional feedback	Total impact
TSS	1.154	0.254	**1.408**	2.257	1.642	**3.899**
BOD	0.783	0.175	**0.958**	1.398	1.164	**2.562**
COD	2.341	0.452	**2.793**	3.254	2.176	**5.430**
NH4-N	0.128	0.029	**0.157**	3.769	0.411	**4.180**

Total N	0.435	0.074	**0.509**	1.142	0.989	**2.131**

Table 8.1 Value of residual (VND)(year - 2000)

	Ho Chi Minh City	Rest of Vietnam	Vietnam
TSS	17,495,697	121,519,799	139,015,496
BOD	12,658,533	79,961,690	92,620,223
COD	31,069,597	144,141,595	175,211,192
NH4-N	1,411,596	21,618,320	23,029,916
Total N	5,369,340	62,172,659	67,541,998

Table 8.2 Value of residual (VND) (year - 2007)

	Ho Chi Minh City	Rest of Vietnam	Vietnam
TSS	18,563,936	126,601,665	146,673,196
BOD	13,550,956	84,403,577	98,490,977
COD	33,676,000	154,041,079	189,041,238
NH4-N	1,482,487	22,452,607	24,073,071
Total N	5,753,364	65,975,795	71,785,691

As shown in part 2.2, In a inter regional IO framwork between HCMC and ROV, HCMC's residuals can be decomposed into: (1) Residuals emissions induced to satisfy HCMC's domestic final demands (HH); (2) Residuals emissions induced to satisfy HCMC's foreign exports (HE); (3) Residuals emissions induced to satisfy HCMC's domestic exports of final goods to ROV (HRF); (4) Residuals emissions induced to satisfy HCMC's domestic exports of intermediate goods to ROV (HRM).

Similarly, ROV's residuals can be decomposed into: (1) Residuals induced to satisfy ROV's domestic final demand (RH); (2) residuals induced to satisfy ROV's foreign exports (RE); (3)residuals induced to satisfy ROV's domestic exports of final goods to HCMC (RRF); (4) residuals induced to satisfy ROV's domestic exports of intermediate goods to HCMC (RRM).

Tables 9.a1; 9.a2 and 9.b1 and 9.b2 present the composition results for Ho Chi Minh City and the Rest of Vietnam. Total industrial TSS emissions was 8.647 tons in 2000, increased to 9.275 tons in 2007 in Ho Chi Minh city.It accounted for 12.58 percent in the year of 2000 and increased to 12.67 percent in the year of 2007 of total industrial TSS emission in country. Due to an exceptionally rare emission coefficient, in the year of 2000, the other consumer & industrial goods sector had the largest emissions of 3.928 tons, accounting for almost 45.42 percent of total industrial TSS emissions; in the year of 2007, this sector still had the largets emissions of 4.267 tons and accounting for 46% of total industrial TSS emissions. Food,beverage & tobacco manufactures products and trade sectors had the second and third largest in the year of 2000: 1.837 tons and 1.298 tons in the year of 2000; and increased to 1.961 tons and 1.394 tons in the year of 2007, respectively. These two sectors in the year of 2000 accounted for about 21.24% and 15.01% of total industrial TSS emission, compared with 21.15% and 15.02% in the year of 2007. While, Total industrial TSS emission in 2000 was 62.745 tons in ROV, and increased to 65.835 tons in 2007 (table 9.b1 and table 9.b2). The Argiculture, fishery & forestry goods sector had the largest TSS emission of 18.167 tons, accounting for almost 29 percent of total industrial TSS emissions in 2000; in 2007, the TSS emission in this sector was 19.509 tons, equivalent to 29.63% of total industrial TSS emissions.Two sectors had the second and third largest to be also Food,beverage & tobacco manufactured products and other consumer & industrial goods products sectors: 11.026 tons and 10.350 tons in the year of 2000; and 11.675 tons and 10.783 tons in the year 2000; these two sectors accounted for about 17,6% and 16,5% in 2000 and 17.73% and 16.38% in the year of 2007 of total industrial TSS emission of region ROV.

Tables 10.a1; 10.a2 and 10.b1; 10.b2 present the composition results for Ho Chi Minh City and the Rest of Vietnam in the year of 2000 and 2007. Total industrial BOD emissions was 5.980 tons in 2000 in Ho Chi Minh city (Table 10.a1); increased to 6.389 tons to 2007, accounting for about 13.5% in 2000 and 13.8% in 2007 of total industrial BOD emission for the whole country. Due to an exceptionally rare emission coefficient, in 2000, the other consumer & industrial goods sector had the largest emissions of 4.048 tons and accounting for almost 68% of total industrial BOD emissions of HCMC; compared with 4.142 tons and 64.83% in 2007. Food,beverage & tobacco manufactured products sectors had the second largest in 2000 and 2007: 1.384 tons and 1.618 tons, respectively. These sectors accounted for about 23% in 2000 and 25% in 2007 of total industrial BOD emission of HCMC. While, total industrial BOD emission was 37.491 tons in ROV in 2000; increased to 39.162 tons in 2007(table 10.b1 and table 10.b2). The Argiculture, fishery & forestry goods sectors had the largest BOD emission of 12.974 tons and 13.572 tons, accounting for almost 34.61% and 34.65% of total industrial BOD emissions of ROV in 2000 and 2007, respectively.Two sectors had the second and third largest to be also Food,beverage & tobacco manufactured products and other consumer & industrial goods products sectors: 7.840 tons and 11.885 tons in 2000; and 8.066 tons and 12.568 tons in 2007; these two sectors accounted for about 20.9% and 31.7% in 2000 and 20.6% and 32.1% in 2007of total industrial BOD emission of region ROV.

Tables 11.a1; 11.a2 and 11.b1; 11.b2 present the composition results for Ho Chi Minh City and Rest of Vietnam on COD emissions. Total industrial COD emissions was 15.489 tons in 2000; increased to 16.859 tons in 2007 in Ho Chi Minh city (Table 11.a1 and 11.a2), accounting for about 17.5% in 2000 and 17.7% in 2007 of total industrial COD emission of

whole country. Due to an exceptionally rare emission coefficient, the other consumer & industrial goods sector had the largest emissions of 5.942 tons in 2000 and 6.536 tons in 2007, accounting for almost 38.36% in 2000 and 38.77% in 2007 of total industrial COD emissions of HCMC. Food,beverage & tobacco manucfatured products and capital goods sectors had the second and third largest: 2.360 tons and 2.257 tons tons in 2000; 2.532 tons and 2.419 tons in 2007, respectively. These sectors accounted for about 15.2% and 14,6% in 2000; and 15.5% and 14.3% in 2007 of total industrial COD emission of HCMC. While, Total industrial COD emission was 71.847 tons in 2000 increased to 75.464 tons in 2007 in ROV (table 11.b1 and 11.b2). The Argiculture, fishery & forestry goods sectors had the largest COD emission of 17.205 tons in 2000 and 18.126 tons in 2007; accounting for almost 23.94%in 2000 and 24.02% in 2007 of total industrial COD emissions of ROV; three sectors had the second and third and fourth largest to be Food,beverage & tobacco manufactured products and other consumer & industrial goods products sectors and construction: 13.772 tons and 10.941 tons and 7.256 tons in 2000; and 14.458 tons and 11.489 tons and 7.556 tons in 2007; these sectors accounted for about 19.2%, 15.2% and 10.1% in 2000; and19.1%, 15.2% and 10.0% in 2007 of total industrial COD emission of region ROV.

Tables12.a1; 12.a2 and 12.b1 and 12.b2 present the composition results for Ho Chi Minh City and the Rest of Vietnam on NH4 emissions. Total industrial NH4 emissions was 655 tons in 2000, increased to 713 tons in 2007 in Ho Chi Minh city (Table 12.a1 and 12.a2), accounting for about 6.21% in 2000 and 6.33% in 2007 of total industrial NH4 emission of whole country. Due to an exceptionally large emission coefficient, the other consumer & industrial oods sector had the largest emissions of 274 tons in 2000; and 302 tons in 2007, accounting for almost 41.78% of total industrial NH4 emissions of HCMC in 2000; and 42.32% in 2007. Food,beverage & tobacco manufactured products had the second largest: 222 tons in 2000; and 239 tons in 2007. This sector accounted for about 33.86% in 2000 and 33.58% in 2007 of total industrial NH4 emission of HCMC. While, Total industrial NH4 emission was 9.895 tons in ROV in 2000; increased to 10.405 tons in 2007(table 14.b1 and 14.b2). The Argiculture, fishery & forestry goods sector had the largest NH4 emission of 7.223 tons in 2000; and 7.592 tons in 2007; accounted for almost 72.99% in 2000and 72.96% in 2007 of total industrial NH4 emissions of ROV; three sectors had the second and third and fourth largest to be mining and quarrying. Food,beverage & tobacco manufactured products and other consumer & industrial goods products sectors: 931 tons and 783 tons and 623 tons in 2000; and 988 tons and 818 tons and 658 tons in 2007; these sectors accounted for about only 9.41%. 7.9% and 6.29% in 2000; and 9.5%, 7.87% and 6.33% in 2007of total industrial NH4 emission of region ROV, respectively.

Tables 13.a1; 13.a2 and 13.b1; 13.b2 present the composition results for Ho Chi Minh City and the Rest of Vietnam on Total N emissions. Total industrial Total N emissions was 2.509 tons in 2000 and 2.750 tons in 2007 in Ho Chi Minh city (Table 13.a1 and 13.a2), accounting for about 8.25% in 2000 and 8.49% in 2007 of total industrial Total N emission of whole country. Due to an exceptionally large emission coefficient, the other consumer & industrial goods sector had the largest emissions of 1.208 tons in 2000; increased to 1.360 tons in 2007;and accounted for almost 48.16% in 2000 and 49.46% in 2007 of total industrial Total N emissions of HCMC. Food,beverage & tobacco manufactured products and agricuture had the second largest: 709 tons and 299 tons in 2000; and 756 tons and 322 tons in 2007, respectively. These sectors accounted for about 28.27% and 11.93% in 2000; and 27.47% and 11.70% in 2007 of total industrial NH4 emission of HCMC. While, total industrial Total N emission was 27.916 tons in 2000 and 29.575 tons in 2007 in ROV (table 13.b1 and 13.b2). The Argiculture, fishery & forestry goods sector had the largest Total N emission of 19.980 tons in 2000 and 21.213 tons in 2007, accounting for almost 71.57% in 2000 and 71.73% in 2007 of total industrial total N emissions of ROV; the sector had the second largest to be food,beverage & tobacco manufactured products: 3.229 tons in 2000 and 3.382 tons in 2007; this sector accounted for about only 11.57% in 2000 and 11.43% in 2007 of total industrial Total N emission of region ROV.

From these results between the period of 2000-2007, we can see the argiculture, fishery & forestry; food,beverage & tobacco manufactured products and other consumer &

industrial goods had the largest waste water emission in Vietnam.Especialy, two sectors are food,beverage & tobacco manufactured products and other consumer & industrial goods sectors had the largest waste water emission in Ho Chi Minh City.

More Deeply analysis for Ho Chi Minh city: Tables from 9.a1; 9.a2 to 13.b1; 13b2, we can see the decomposition results for HCMC; In the year of 2000,according to the decomposition analysis, 44.1%,52.7%, 43.5%, 40.3%,43.4% of HCMC's total industrial TSS,BOD,COD,NH4,total N emissions was induced by HCMC's total export include foreign exports and domestic exports to ROV (HE+HRF+HRM), in which 6,9 percent of BOD emissions was due to the exports of final demand to ROV (HRF) and 18,9 percent of BOD emissions was due to the exports of intermediategoods to ROV (HRM). In other year of 2007, 46.4%, 43.3%, 43.6%, 41.5% and 45.4% were the percentages of HCMC's total industrial TSS, BOD, COD, NH4, total N emissions was induced by HCMC's total export include foreign exports and domestic exports to ROV (HE+HRF+HRM), in which 5.25 percent of BOD emissions was due to the exports of final demand to ROV (HRF) and 14.56 percent of BOD emissions was due to the exports of intermediategoods to ROV (HRM).

Tables 14.a1; 14.a2 and 14.b1; 14.b2 present total waste water emission impact by type of final demand for Ho Chi Minh city and the Rest of Vietnam in the period of 2000-2007. In the year of 2000, 63.48 percent of waste water emissions in the largest sector (other consumer & industrial goods) was induced by HCMC's total exports (foreign and domestic exports to ROV).Meanwhile only 36.52 percent of waste water emissions in this sector was induced by HCMC's domestic final demands (compared with 64.65% and 35.35% in the year of 2007, respectively).

Total industrial waste water emission in ROV was 209.894 tons in 2000; and 220.443 tons in 2007. The Agricuture, fishery and forestry had waste water emission largest, accounting about 36.0% in 2000 and 36.6% in 2007 of total emission, that means 90.7% and 90.19% of waste water emissions in 2000 and 2007 was induced by ROV's domestic final demands and foreign exports. The Food,beverage & tobacco manufactured products and other consumer & industrial goods sectors had the second and third largest emissions: 33.819 tons and 38.592 tons in 2000; and 36.217 tons and 41.356 tons in 2007, these two sectors accounted for about: 16.1% and 18.4%% in 2000; and 16.4% and 18.8% in 2007. ROV's domestic final demands and foreign exports accounted for about: 95.1% and 90.8% in 2000; and 93.74% and 89.42% in 2007 in total waste water emission of these sectors.

5. Conclusion

Miyazawa's framework provides a valuable analytical method for impact assessment of an unscheduled event. After all, the central concern of an impact analysis and any economic analysis is the estimation of internal, external multipliers changes. These changes may become significant both in a regional context and in an inter-regional context. But there are some limitations on economics and environmental data in Vietnam such as:

+To summarize, the hybrid approach, as the trade-off between survey-based and non-survey methods of intra and inter-regional IO compilation, was adopted in this research mainly because of inadequacy of hard data on commodity trade flows.

+ The environmental data of Vietnam is very difficult for collecting and processing.

To conclude, the following general areas of concerns are presented for consideration, given the observed limitations of this study:

- Improvement of data adequacy and quality at the sub-national level;
- Development and maintenance of framework for generation of commodity flow statistics useful in inter-regional Io compilation.
- Enhancing scope and coverage of HCM IO compilation by taking into consideration such typical phenomena in urban economic as the contribution of the informal sector, environmental effects, the economic role of head office activities, etc.
- Continuing efforts on IO based applied researches; CGE analysis,

Miyazawa model, policy evaluation, etc.., given fiscal and technical resources and

- Strengthening the country's professional/technical capability in IO compilation and analysis

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Table 9.a1. TSS emissions in Ho Chi Minh City by type of Final Demand (year - 2000)

		HH		HE		HRF		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*160664*		*20316*		*7024*		*16389*		*204393*
2	Mining and quarrying	*5022*		*1096*		*284*		*949*		*7351*
3	Food, beverage & tobacco manufactures	*1298906*		*393235*		*116220*		*28464*		*1836826*
4	Other consumer & industrial goods	*1434280*		*1207542*		*255804*		*1030144*		*3927770*
5	Capital goods	*158774*		*72156*		*9091*		*14532*		*254552*
6	Electricity, gas & water	*62161*		*9134*		*5658*		*16597*		*93549*
7	Construction	*941339*		*0*		*0*		*0*		*941339*
8	Trade	*721418*		*150002*		*139447*		*286841*		*1297709*
9	Transportation & communication	*101*		*71*		*8*		*12*		*192*
10	Finance, real estate & business services	*7361*		*1145*		*3258*		*3846*		*15609*
11	Government services	*22211*		*64*		*12481*		*1394*		*36150*
12	Personal, community & household services	*22756*		*409*		*6032*		*2309*		*31505*
	Total	4,834,993	55.9%	1,855,169	21.5%	555,307	6.4%	1,401,477	16.2%	8,646,945

Table 9.a2. TSS emissions in Ho Chi Minh City by type of Final Demand (year - 2007)

		HH		HE		HRF		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*165283*		*23144*		*8892*		*17366*		*214685*
2	Mining and quarrying	*5166*		*1249*		*360*		*1006*		*7781*
3	Food, beverage & tobacco manufactures	*1336246*		*447981*		*147122*		*30160*		*1961509*
4	Other consumer & industrial goods	*1475512*		*1375654*		*323820*		*1091527*		*4266513*
5	Capital goods	*163338*		*82201*		*11508*		*15398*		*272445*
6	Electricity, gas & water	*63948*		*10406*		*7162*		*17586*		*99102*
7	Construction	*968400*		*0*		*0*		*0*		*968400*

8	Trade	*742157*		*170885*		*176525*		*303933*		*1393500*
9	Transportation & communication	*104*		*81*		*10*		*13*		*208*
10	Finance, real estate & business services	*7573*		*1304*		*4124*		*4075*		*17076*
11	Government services	*22850*		*73*		*15800*		*1477*		*40200*
12	Personal, community & household services	*23410*		*466*		*7636*		*2447*		*33959*
	Total	4,973,987	53.63%	2,113,444	22.79%	702,959	7.58%	1,484,988	16.01%	9,275,378

Table 9.b1. TSS emissions in ROV by type of Final Demand (year - 2000)

		RH		*RE*		*RRF*		*RRM*		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*10709142*		*5785164*		*953997*		*718382*		*18166684*
2	Mining and quarrying	*489794*		*6391660*		*25171*		*137610*		*7044235*
3	Food, beverage & tobacco manufactures	*7112149*		*3375926*		*341705*		*196501*		*11026281*
4	Other consumer & industrial goods	*3901377*		*5498848*		*366580*		*582708*		*10349514*
5	Capital goods	*429135*		*340846*		*47203*		*34217*		*851401*
6	Electricity, gas & water	*211277*		*143736*		*41564*		*54311*		*450887*
7	Construction	*7961945*		*0*		*0*		*0*		*7961945*
8	Trade	*3063024*		*3399339*		*87395*		*95404*		*6645161*
9	Transportation & communication	*136*		*246*		*3*		*4*		*389*
10	Finance, real estate & business services	*24066*		*27099*		*522*		*735*		*52422*
11	Government services	*84033*		*5773*		*136*		*39*		*89980*
12	Personal, community & household services	*58076*		*44358*		*2797*		*655*		*105887*
	Total	34,044,155	54.3%	25,012,993	39.9%	1,867,072	3.0%	1820565	2.9%	62744787

Table 9.b2. TSS emissions in ROV by type of Final Demand (year - 2007)

		HH		**HE**		**HRF**		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*11511037*		*5517389*		*1563097*		*918450*		*19509973*
2	Mining and quarrying	*526470*		*6095812*		*41242*		*175934*		*6839458*
3	Food, beverage & tobacco manufactures	*7644703*		*3219666*		*559874*		*251226*		*11675469*
4	Other consumer &	*4193510*		*5244325*		*600631*		*744991*		*10783457*

	industrial goods									
5	Capital goods	*461268*		*325069*		*77341*		*43746*		*907424*
6	Electricity, gas & water	*227097*		*137083*		*68101*		*69436*		*501717*
7	Construction	*8558131*		*0*		*0*		*0*		*8558131*
8	Trade	*3292382*		*3241995*		*143194*		*121974*		*6799545*
9	Transportation & communication	*146*		*235*		*5*		*5*		*391*
10	Finance, real estate & business services	*25868*		*25845*		*855*		*940*		*53508*
11	Government services	*90325*		*5506*		*223*		*50*		*96104*
12	Personal, community & household services	*62425*		*42305*		*4583*		*837*		*110150*
	Total	36,593,362	55.58 %	23,855,230	36.24 %	3,059,146	4.65 %	2,327,589	3.54 %	65,835,327

Table 10.a1. BOD emissions in Ho Chi Minh City by type of Final Demand (year - 2000)

		HH		HE		HRF		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*160773*		*20329*		*7029*		*16400*		*204531*
2	Mining and quarrying	*1627*		*355*		*92*		*308*		*2382*
3	Food, beverage & tobacco manufactures	*978381*		*296198*		*87541*		*21440*		*1383561*
4	Other consumer & industrial goods	*1478290*		*1244594*		*263653*		*1061753*		*4048290*
5	Capital goods	*87694*		*39853*		*5021*		*8026*		*140594*
6	Electricity, gas & water	*410*		*60*		*37*		*110*		*617*
7	Construction	*0*		*0*		*0*		*0*		*0*
8	Trade	*763*		*159*		*147*		*303*		*1372*
9	Transportation & communication	*50*		*36*		*4*		*6*		*96*
10	Finance, real estate & business services	*27006*		*4199*		*11952*		*14109*		*57266*
11	Government services	*51643*		*148*		*29021*		*3240*		*84052*
12	Personal, community & household services	*41743*		*749*		*11065*		*4235*		*57793*
	Total	2828381	47.3%	1606682	26.9%	415561	6.9%	1129931	18.9%	5980555

Table 10.a2. BOD emissions in Ho Chi Minh City by type of Final Demand (year - 2007)

		HH		**HE**		**HRF**		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*206073*		*18951*		*5672*		*13505*		*244201*
2	Mining and quarrying	*2085*		*331*		*74*		*254*		*2744*
3	Food, beverage & tobacco manufactures	*1254053*		*276121*		*70642*		*17656*		*1618472*
4	Other consumer & industrial goods	*1894818*		*1160231*		*212757*		*874359*		*4142165*
5	Capital goods	*112403*		*37152*		*4052*		*6609*		*160216*
6	Electricity, gas & water	*526*		*56*		*30*		*91*		*703*

7	Construction	*0*		*0*		*0*		*0*	*0*
8	Trade	*978*		*148*		*119*		*250*	*1495*
9	Transportation & communication	*64*		*34*		*3*		*5*	*106*
10	Finance, real estate & business services	*3`4615*		*3914*		*9645*		*11619*	*59793*
11	Government services	*66194*		*138*		*23419*		*2668*	*92419*
12	Personal, community & household services	*53505*		*698*		*8929*		*3488*	*66620*
	Total	3,625,314	56.74%	1,497,774	23.44%	335,342	5.25%	930,504	14.56%	6,388,934

Table 10.b1. BOD emissions in ROV by type of Final Demand (year - 2000)

		HH		**HE**		**HRF**		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*7648175*		*4131605*		*681318*		*513048*		*12974146*
2	Mining and quarrying	*261454*		*3411899*		*13437*		*73457*		*3760247*
3	Food, beverage & tobacco manufactures	*5056967*		*2400392*		*242963*		*139718*		*7840041*
4	Other consumer & industrial goods	*4480085*		*6314516*		*420957*		*669143*		*11884701*
5	Capital goods	*200123*		*158950*		*22013*		*15957*		*397043*
6	Electricity, gas & water	*1444*		*982*		*284*		*371*		*3082*
7	Construction	*0*		*0*		*0*		*0*		*0*
8	Trade	*2705*		*3002*		*77*		*84*		*5869*
9	Transportation & communication	*68*		*123*		*2*		*2*		*194*
10	Finance, real estate & business services	*89847*		*101168*		*1951*		*2744*		*195710*
11	Government services	*216592*		*14880*		*349*		*100*		*231922*
12	Personal, community & household services	*108527*		*82892*		*5226*		*1224*		*197869*
	Total	18065988	48.2%	16620408	44.3%	138576	3.7%	141585	3.8%	37490822

Table 10.b2. BOD emissions in ROV by type of Final Demand (year - 2007)

	HH		**HE**		**HRF**		HRM		
	Amount	Share	Amount	Share	Amount	Shar	Amount	Shar	Total

							e		e	
1	Agriculture, fishery & forestry	*7705288*		*4232475*		*794679*		*839292*		*13571734*
2	Mining and quarrying	*263406*		*3495198*		*15673*		*120168*		*3894445*
3	Food, beverage & tobacco manufactures	*5094730*		*2458996*		*283388*		*228564*		*8065678*
4	Other consumer & industrial goods	*4513540*		*6468680*		*490998*		*1094647*		*12567865*
5	Capital goods	*201617*		*162831*		*25676*		*26104*		*416228*
6	Electricity, gas & water	*1455*		*1006*		*331*		*607*		*3399*
7	Construction	*0*		*0*		*0*		*0*		*0*
8	Trade	*2725*		*3075*		*90*		*137*		*6027*
9	Transportation & communication	*69*		*126*		*2*		*3*		*200*
10	Finance, real estate & business services	*90518*		*103638*		*2276*		*4489*		*200921*
11	Government services	*218209*		*15243*		*407*		*164*		*234023*
12	Personal, community & household services	*109337*		*84916*		*6096*		*2002*		*202351*
	Total	18,200,894	46.48 %	17,026,184	43.48 %	1,619,616	4.14 %	2,316,177	5.91 %	39,162,871

Table 11.a1. COD emissions in Ho Chi Minh City by type of Final Demand (year - 2000)

		HH		**HE**		**HRF**		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*208748*		*26396*		*9126*		*21294*		*265563*
2	Mining and quarrying	*5102*		*1114*		*288*		*964*		*7469*
3	Food, beverage & tobacco manufactures	*1668635*		*505168*		*149302*		*36567*		*2359672*
4	Other consumer & industrial goods	*2169944*		*1826908*		*387010*		*1558520*		*5942382*
5	Capital goods	*1407803*		*639789*		*80603*		*128847*		*2257042*
6	Electricity, gas & water	*423508*		*62228*		*38549*		*113079*		*637364*
7	Construction	*1367890*		*0*		*0*		*0*		*1367890*
8	Trade	*0*		*0*		*0*		*0*		*0*
9	Transportation & communication	*740895*		*522522*		*60383*		*88754*		*1412554*

10	Finance, real estate & business services	*182635*		*28400*		*80826*		*95420*	*387281*
11	Government services	*187013*		*536*		*105090*		*11733*	*304372*
12	Personal, community & household services	*395636*		*7102*		*104872*		*40142*	*547752*
	Total	8757810	56.5%	3620163	23.4%	1016049	6.6%	209532	13.5% 15489343

Table 11.a2. COD emissions in Ho Chi Minh City by type of Final Demand (year - 2007)

		HH		HE		HRF		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*226767*		*26389*		*10384*		*26124*		*289664*
2	Mining and quarrying	*5542*		*1114*		*328*		*1183*		*8167*
3	Food, beverage & tobacco manufactures	*1812671*		*505039*		*169875*		*44862*		*2532447*
4	Other consumer & industrial goods	*2357252*		*1826440*		*440337*		*1912062*		*6536091*
5	Capital goods	*1529324*		*639625*		*91710*		*158075*		*2418734*
6	Electricity, gas & water	*460065*		*62212*		*43861*		*138730*		*704868*
7	Construction	*1485966*		*0*		*0*		*0*		*1485966*
8	Trade	*0*		*0*		*0*		*0*		*0*
9	Transportation & communication	*804849*		*522388*		*68703*		*108887*		*1504827*
10	Finance, real estate & business services	*198400*		*28393*		*91963*		*117066*		*435822*
11	Government services	*203156*		*536*		*119571*		*14395*		*337658*
12	Personal, community & household services	*429787*		*7100*		*119323*		*49248*		*605458*
	Total	9,513,779	56.43%	3,619,236	21.47%	1,156,055	6.86%	2,570,632	15.25%	16,859,702

Table 11.b1. COD emissions in ROV by type of Final Demand (year - 2000)

		HH		HE		HRF		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*10142227*		*5478911*		*903494*		*680352*		*17204984*
2	Mining and quarrying	*439111*		*5730268*		*22567*		*123371*		*6315317*
3	Food, beverage & tobacco manufactures	*7057457*		*3349965*		*339077*		*194990*		*10941488*
4	Other consumer & industrial goods	*5191349*		*7317016*		*487788*		*775377*		*13771530*
5	Capital goods	*3223678*		*2560447*		*354594*		*257037*		*6395756*
6	Electricity, gas & water	*1490719*		*1014164*		*293263*		*383205*		*3181351*

7	Construction	*7256324*		*0*		*0*		*0*	*7256324*
8	Trade	*0*		*0*		*0*		*0*	*0*
9	Transportation & communication	*981417*		*1778581*		*22360*		*27059*	*2809418*
10	Finance, real estate & business services	*587216*		*661204*		*12749*		*17934*	*1279103*
11	Government services	*807191*		*55453*		*1302*		*374*	*864320*
12	Personal, community & household services	*1002357*		*765592*		*48266*		*11309*	*1827525*
	Total	38179047	53.1%	28711601	40.0%	2485461	3.5%	2471008	3.4% 71847117

Table 11.b2. COD emissions in ROV by type of Final Demand (year - 2007)

		HH		**HE**		**HRF**		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*10559598*		*5755536*		*1161502*		*649177*		*18125813*
2	Mining and quarrying	*457181*		*6019584*		*29011*		*117718*		*6623494*
3	Food, beverage & tobacco manufactures	*7347884*		*3519102*		*435906*		*186055*		*11488947*
4	Other consumer & industrial goods	*5404982*		*7686446*		*627084*		*739847*		*14458359*
5	Capital goods	*3356338*		*2689722*		*455855*		*245259*		*6747174*
6	Electricity, gas & water	*1552065*		*1065368*		*377009*		*365646*		*3360088*
7	Construction	*7554935*		*0*		*0*		*0*		*7554935*
8	Trade	*0*		*0*		*0*		*0*		*0*
9	Transportation & communication	*1021804*		*1868380*		*28745*		*25819*		*2944748*
10	Finance, real estate & business services	*611381*		*694588*		*16390*		*17112*		*1339471*
11	Government services	*840408*		*58253*		*1674*		*357*		*900692*
12	Personal, community & household services	*1043606*		*804246*		*62049*		*10791*		*1920692*
	Total	39,750,182	52.68%	30,161,225	39.97%	3,195,225	4.23%	2,357,781	3.12%	75,464,413

Table 12.a1. NH4 emissions in Ho Chi Minh City by type of Final Demand (year - 2000)

		HH		HE		HRF		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*63344*		*8010*		*2769*		*6462*		*80584*
2	Mining and quarrying	*369*		*80*		*21*		*70*		*539*
3	Food, beverage & tobacco manufactures	*156831*		*47480*		*14032*		*3437*		*221780*
4	Other consumer & industrial goods	*99923*		*84127*		*17821*		*71768*		*273640*
5	Capital goods	*4563*		*2074*		*261*		*418*		*7316*
6	Electricity, gas & water	*2850*		*419*		*259*		*761*		*4289*
7	Construction	*58327*		*0*		*0*		*0*		*58327*
8	Trade	*1865*		*388*		*360*		*741*		*3354*
9	Transportation & communication	*2417*		*1705*		*197*		*290*		*4609*
10	Finance, real estate & business services	*239*		*37*		*106*		*125*		*507*
11	Government services	*0*		*0*		*0*		*0*		*0*
12	Personal, community & household services	*0*		*0*		*0*		*0*		*0*
	Total	390728	59.7%	144319	22.0%	35828	5.5%	84071	12.8%	654945

Table 12.a2. NH4 emissions in Ho Chi Minh City by type of Final Demand (year - 2007)

		HH		HE		HRF		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*67614*		*8456*		*3566*		*7520*		*87156*
2	Mining and quarrying	*394*		*84*		*27*		*81*		*586*
3	Food, beverage & tobacco manufactures	*167402*		*50121*		*18069*		*4000*		*239592*
4	Other consumer & industrial goods	*106658*		*88806*		*22948*		*83517*		*301929*
5	Capital goods	*4871*		*2189*		*336*		*486*		*7882*
6	Electricity, gas & water	*3042*		*442*		*334*		*886*		*4704*
7	Construction	*62258*		*0*		*0*		*0*		*62258*
8	Trade	*1991*		*410*		*464*		*862*		*3727*
9	Transportation & communication	*2580*		*1800*		*254*		*337*		*4971*
10	Finance, real estate & business services	*255*		*39*		*136*		*145*		*575*
11	Government services	*0*		*0*		*0*		*0*		*0*
12	Personal, community & household services	*0*		*0*		*0*		*0*		*0*
	Total	417,065	58.47%	152,347	21.36%	46,134	6.47%	97,834	13.71%	713,380

Table 12.b1. NH4 emissions in ROV by type of Final Demand (year - 2000)

		HH		HE		HRF		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*4258000*		*2300205*		*379313*		*285631*		*7223149*
2	Mining and quarrying	*64745*		*844902*		*3327*		*18190*		*931165*
3	Food, beverage & tobacco manufactures	*504855*		*239640*		*24256*		*13949*		*782700*
4	Other consumer & industrial goods	*234681*		*330774*		*22051*		*35052*		*622558*
5	Capital goods	*9980*		*7927*		*1098*		*796*		*19800*
6	Electricity, gas & water	*10868*		*7394*		*2138*		*2794*		*23193*
7	Construction	*267816*		*0*		*0*		*0*		*267816*
8	Trade	*6613*		*7339*		*189*		*206*		*14347*
9	Transportation & communication	*3123*		*5659*		*71*		*86*		*8939*
10	Finance, real estate & business services	*802*		*903*		*17*		*25*		*1747*
11	Government services	*0*		*0*		*0*		*0*		*0*
12	Personal, community & household services	*0*		*0*		*0*		*0*		*0*
		5361483	54.2%	3744743	37.8%	432460	4.4%	356728	3.6%	9895414

Table 12.b2. NH4 emissions in ROV by type of Final Demand (year - 2007)

		HH		HE		HRF		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*4388098*		*2441140*		*433908*		*329706*		*7591852*
2	Mining and quarrying	*66723*		*896670*		*3797*		*20997*		*988187*
3	Food, beverage & tobacco manufactures	*520280*		*254323*		*27683*		*16101*		*818387*
4	Other consumer & industrial goods	*241851*		*351041*		*25167*		*40461*		*658520*
5	Capital goods	*10285*		*8413*		*1253*		*919*		*20870*
6	Electricity, gas & water	*11200*		*7847*		*2440*		*3225*		*24712*
7	Construction	*275999*		*0*		*0*		*0*		*275999*
8	Trade	*6815*		*7789*		*216*		*238*		*15058*
9	Transportation & communication	*3218*		*6006*		*81*		*99*		*9404*
10	Finance, real estate & business services	*827*		*958*		*19*		*29*		*1833*
11	Government services	*0*		*0*		*0*		*0*		*0*
12	Personal, community & household services	*0*		*0*		*0*		*0*		*0*
	Total	5,525,29	53.10	3,974,18	38.20	493,5	4.74	411,77	3.96	10,404,8

	6	%	7	%	64	%	5	%	22

Table 13.a1.Total N emissions in Ho Chi Minh City by type of Final Demand (year - 2000)

	HH		HE		HRF		HRM		
	Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1 Agriculture, fishery & forestry	*235209*		*29742*		*10283*		*23993*		*299226*
2 Mining and quarrying	*745*		*163*		*42*		*141*		*1090*
3 Food, beverage & tobacco manufactures	*501442*		*151808*		*44867*		*10989*		*709106*
4 Other consumer & industrial goods	*441178*		*371435*		*78684*		*316868*		*1208165*
5 Capital goods	*36447*		*16563*		*2087*		*3336*		*58433*
6 Electricity, gas & water	*10925*		*1605*		*994*		*2917*		*16442*
7 Construction	*169014*		*0*		*0*		*0*		*169014*
8 Trade	*4153*		*864*		*803*		*1651*		*7471*
9 Transportation & communication	*18836*		*13284*		*1535*		*2256*		*35912*
10 Finance, real estate & business services	*478*		*74*		*212*		*250*		*1014*
11 Government services	*731*		*2*		*411*		*46*		*1190*
12 Personal, community & household services	*1108*		*20*		*294*		*112*		*1534*
Total	1420266	56.6%	585560	23.3%	140211	5.6%	362559	14.5%	2508596

Table 13.a2.Total N emissions in Ho Chi Minh City by type of Final Demand (year - 2007)

	HH		HE		HRF		HRM		
	Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1 Agriculture, fishery & forestry	*248599*		*34178*		*8546*		*30431*		*321754*
2 Mining and quarrying	*787*		*187*		*35*		*179*		*1188*
3 Food, beverage & tobacco manufactures	*529989*		*174450*		*37286*		*13938*		*755663*
4 Other consumer & industrial goods	*466294*		*426833*		*65390*		*401891*		*1360408*
5 Capital goods	*38522*		*19033*		*1734*		*4231*		*63520*
6 Electricity, gas & water	*11547*		*1844*		*826*		*3700*		*17917*
7 Construction	*178636*		*0*		*0*		*0*		*178636*
8 Trade	*4389*		*993*		*667*		*2094*		*8143*
9 Transportation & communication	*19908*		*15265*		*1276*		*2861*		*39310*
10 Finance, real estate & business services	*505*		*85*		*176*		*317*		*1083*
11 Government services	*773*		*2*		*342*		*58*		*1175*
12 Personal, community & household services	*1171*		*23*		*244*		*142*		*1580*
Total	1,501,120	54.58%	672,893	24.46%	116,522	4.24%	459,842	16.72%	2,750,377

Table 13.b1. Total N emissions in ROV by type of Final Demand (year - 2000)

	HH		HE		HRF		HRM		
	Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1 Agriculture, fishery & forestry	*11777887*		*6362508*		*1049203*		*790074*		*19979672*
2 Mining and quarrying	*106809*		*1393820*		*5489*		*30008*		*1536126*
3 Food, beverage & tobacco manufactures	*2082528*		*988514*		*100056*		*57538*		*3228636*
4 Other consumer & industrial goods	*740148*		*1043211*		*69546*		*110548*		*1963452*
5 Capital goods	*76162*		*60493*		*8378*		*6073*		*151105*
6 Electricity, gas & water	*42331*		*28799*		*8328*		*10882*		*90340*
7 Construction	*854779*		*0*		*0*		*0*		*854779*
8 Trade	*14729*		*16346*		*420*		*459*		*31954*
9 Transportation & communication	*24031*		*43551*		*548*		*663*		*68793*
10 Finance, real estate & business services	*1604*		*1807*		*35*		*49*		*3495*
11 Government services	*3156*		*217*		*5*		*1*		*3380*
12 Personal, community & household services	*2347*		*1792*		*113*		*26*		*4278*
	15726512	56.3%	9941058	35.6%	1242119	4.4%	1006321	3.6%	27916010

Table 13.b2. Total N emissions in ROV by type of Final Demand (year - 2007)

	HH		HE		HRF		HRM		
	Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1 Agriculture, fishery & forestry	*12063893*		*6693907*		*1329037*		*1126165*		*21213002*
2 Mining and quarrying	*109403*		*1466419*		*6953*		*42773*		*1625548*
3 Food, beverage & tobacco manufactures	*2133099*		*1040002*		*126742*		*82014*		*3381857*
4 Other consumer & industrial goods	*758121*		*1097548*		*88095*		*157574*		*2101338*
5 Capital goods	*78011*		*63644*		*10613*		*8656*		*160924*
6 Electricity, gas & water	*43359*		*30299*		*10549*		*15511*		*99718*
7 Construction	*875536*		*0*		*0*		*0*		*875536*
8 Trade	*15087*		*17197*		*532*		*654*		*33470*
9 Transportation & communication	*24615*		*45819*		*694*		*945*		*72073*
10 Finance, real estate & business services	*1643*		*1901*		*44*		*70*		*3658*
11 Government services	*3233*		*228*		*6*		*1*		*3468*
12 Personal, community & household services	*2404*		*1885*		*143*		*37*		*4469*
Total	16,108,404	54.47%	10,458,849	35.36%	1,573,408	5.32%	1,434,400	4.85%	29,575,061

Table 14.a1. Total emissions in HCMC by type of Final Demand (year - 2000)

		HH		HE		HRF		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*828737*	78.6%	*104792*	9.9%	*36230*	3.4%	*84538*	8.0%	*1054297*
2	Mining and quarrying	*12865*	68.3%	*2808*	14.9%	*727*	3.9%	*2432*	12.9%	*18831*
3	Food, beverage & tobacco manufactures	*4604196*	70.7%	*1393890*	21.4%	*411962*	6.3%	*100897*	1.5%	*6510945*
4	Other consumer & industrial goods	*5623616*	36.5%	*4734606*	30.7%	*1002973*	6.5%	*4039052*	26.2%	*15400246*
5	Capital goods	*1695281*	62.4%	*770435*	28.3%	*97063*	3.6%	*155158*	5.7%	*2717937*
6	Electricity, gas & water	*499854*	66.4%	*73446*	9.8%	*45498*	6.0%	*133464*	17.7%	*752261*
7	Construction	*2536571*	100.0%	*0*	0.0%	*0*	0.0%	*0*	0.0%	*2536571*
8	Trade	*728199*	55.6%	*151412*	11.6%	*140758*	10.7%	*289537*	22.1%	*1309907*
9	Transportation & communication	*762300*	52.5%	*537618*	37.0%	*62127*	4.3%	*91318*	6.3%	*1453363*
10	Finance, real estate & business services	*217719*	47.2%	*33855*	7.3%	*96353*	20.9%	*113749*	24.6%	*461677*
11	Government services	*261599*	61.4%	*749*	0.2%	*147003*	34.5%	*16413*	3.9%	*425764*
12	Personal, community & household services	*461242*	72.2%	*8280*	1.3%	*122262*	19.1%	*46799*	7.3%	*638584*
		18232178	54.8%	7811892	23.5%	2162956	6.5%	5073358	15.2%	33280383

Table 14.a2. Total emissions in HCMC by type of Final Demand (year - 2007)

		HH		HE		HRF		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*871768*	76.46%	*116909*	10.25%	*72549*	6.36%	*78876*	6.92%	*1140102*
2	Mining and quarrying	*14936*	73.35%	*3127*	15.35%	*663*	3.25%	*1638*	8.04%	*20364*
3	Food, beverage & tobacco manufactures	*4997996*	70.99%	*1564836*	22.23%	*377642*	5.36%	*100454*	1.43%	*7040928*
4	Other consumer & industrial goods	*5886392*	35.35%	*4887204*	29.35%	*1244805*	7.47%	*4635238*	27.83%	*16653639*
5	Capital goods	*1773648*	60.35%	*850472*	28.94%	*186526*	6.35%	*128344*	4.37%	*2938990*
6	Electricity, gas & water	*533670*	65.60%	*86029*	10.58%	*60811*	7.48%	*132984*	16.35%	*813494*
7	Construction	*2742989*	100.00%	*0*	0.00%	*0*	0.00%	*0*	0.00%	*2742989*
8	Trade	*787458*	55.59%	*163733*	11.56%	*152212*	10.75%	*313099*	22.10%	*1416502*
9	Transportation & communication	*790883*	50.32%	*540099*	34.37%	*84312*	5.36%	*156271*	9.94%	*1571565*
10	Finance, real estate & business services	*226390*	45.35%	*42324*	8.48%	*97640*	19.56%	*132881*	26.62%	*499235*
11	Government services	*274532*	59.63%	*4669*	1.01%	*162744*	35.35%	*18476*	4.01%	*460421*
12	Personal, community & household services	*504636*	73.08%	*14795*	2.14%	*127312*	18.44%	*43812*	6.34%	*690555*
	Total	19405298	58.31%	8274197	24.86%	2567216	7.71%	5742073	17.25%	35988784

Table 14.b1. Total emissions in ROV by type of Final Demand (year - 2000)

		HH		HE		HRF		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*44535430*	58.9%	*24058392*	31.8%	*3967325*	5.3%	*2987488*	4.0%	*75548635*
2	Mining and quarrying	*1361914*	7.0%	*17772548*	90.7%	*69991*	0.4%	*382637*	2.0%	*19587090*
3	Food, beverage & tobacco manufactures	*21813957*	64.5%	*10354436*	30.6%	*1048056*	3.1%	*602696*	1.8%	*33819146*
4	Other consumer & industrial goods	*14547640*	37.7%	*20504365*	53.1%	*1366922*	3.5%	*2172827*	5.6%	*38591755*
5	Capital goods	*3939078*	50.4%	*3128663*	40.0%	*433286*	5.5%	*314079*	4.0%	*7815106*
6	Electricity, gas & water	*1756640*	46.9%	*1195074*	31.9%	*345577*	9.2%	*451563*	12.0%	*3748853*
7	Construction	*16340864*	100.0%	*0*	0.0%	*0*	0.0%	*0*	0.0%	*16340864*
8	Trade	*3087071*	46.1%	*3426027*	51.2%	*88081*	1.3%	*96153*	1.4%	*6697332*
9	Transportation & communication	*1008775*	34.9%	*1828161*	63.3%	*22984*	0.8%	*27813*	1.0%	*2887732*
10	Finance, real estate & business services	*703537*	45.9%	*792180*	51.7%	*15274*	1.0%	*21487*	1.4%	*1532477*
11	Government services	*1110972*	93.4%	*76323*	6.4%	*1792*	0.2%	*514*	0.0%	*1189601*
12	Personal, community & household services	*1171307*	54.8%	*894635*	41.9%	*56402*	2.6%	*13216*	0.6%	*2135559*
		111377185	53.1%	84030803	40.0%	7415689	3.5%	7070473	3.4%	209894150

Table 14.b2. Total emissions in ROV by type of Final Demand (year - 2007)

		HH		HE		HRF		HRM		
		Amount	Share	Amount	Share	Amount	Share	Amount	Share	Total
1	Agriculture, fishery & forestry	*48284478*	59.85%	*24481333*	30.34%	*3604388*	4.47%	*4313467*	5.35%	*80683666*
2	Mining and quarrying	*1919434*	9.15%	*18271396*	87.07%	*263070*	1.25%	*532053*	2.54%	*20985953*
3	Food, beverage & tobacco manufactures	*23790170*	65.69%	*10161855*	28.06%	*1498153*	4.14%	*766537*	2.12%	*36216715*
4	Other consumer & industrial goods	*15864979*	38.36%	*21114456*	51.06%	*1752034*	4.24%	*2624907*	6.35%	*41356376*
5	Capital goods	*3868727*	48.35%	*3366695*	42.07%	*507841*	6.35%	*258889*	3.24%	*8002152*
6	Electricity, gas & water	*1565552*	47.35%	*1089400*	32.95%	*275979*	8.35%	*375783*	11.36 %	*3306714*
7	Construction	*14769426*	100.00 %	*0*	0.00%	*0*	0.00%	*0*	0.00%	*14769426*
8	Trade	*2443918*	44.35%	*2869917*	52.08%	*96296*	1.75%	*101107*	1.83%	*5511238*
9	Transportation & communication	*1106531*	35.85%	*1895746*	61.43%	*38502*	1.25%	*45236*	1.47%	*3086015*
10	Finance, real estate & business services	*764437*	43.35%	*944106*	53.54%	*22497*	1.28%	*32561*	1.85%	*1763601*
11	Government services	*1729471*	91.23%	*140999*	7.44%	*25334*	1.34%	*0*	0.00%	*1895804*
12	Personal, community & household services	*1532219*	53.47%	*1192919*	41.63%	*98482*	3.44%	*41963*	1.46%	*2865583*
	Total	117639342	56.05%	85528822	40.75%	8182576	3.90%	9092503	4.33%	220443243

Annex A. Residual coefficient matrix for waste water of HCMC (kg/million VND):

	1	2	3	4	5	6	7	8	9	10	11	12
TSS	0.0810122	0.101106	0.081	0.07952	0.02714	0.02879	0.07101214	0.08510899	0.00002	0.00154	0.00243	0.00308
BOD	0.08106708	0.03276	0.061012	0.08196	0.01499	0.00019	0	0.00009	0.00001	0.00565	0.00565	0.00565
COD	0.10525752	0.102725	0.10405637	0.120307	0.240643	0.19615	0.10319	0	0.14711	0.03821	0.02046	0.05355
NH4-N	0.03194	0.00742	0.00978	0.00554	0.00078	0.00132	0.0044	0.00022	0.00048	0.00005	0	0
Total N	0.1186	0.01499	0.03127	0.02446	0.00623	0.00506	0.01275	0.00049	0.00374	0.0001	0.00008	0.00015

Annex B. Residual coefficient matrix for waste water of ROV (kg/million VND):

	1	2	3	4	5	6	7	8	9	10	11	12
TSS	0.11353	0.11877	0.10143	0.07564	0.02451	0.0278	0.107025	0.101899	0.00002	0.0015	0.00213	0.00297
BOD	0.08108	0.0634	0.07212	0.08686	0.01143	0.00019	0	0.00009	0.00001	0.0056	0.00549	0.00555
COD	0.10752	0.10648	0.10065	0.10065	0.18412	0.19615	0.09754	0	0.14457	0.0366	0.02046	0.05126
NH4-N	0.04514	0.0157	0.0072	0.00455	0.00057	0.00143	0.0036	0.00022	0.00046	5.00E-05	0	0
Total N	0.12486	0.0259	0.0297	0.01435	0.00435	0.00557	0.01149	0.00049	0.00354	0.0001	0.00008	0.00012