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INTEGRATING INDICATORS IN A NATIONAL ACCOUNTING MATRIX INCLUDING ENVIRONMENTAL ACCOUNTS (NAMEA):

an application to the Netherlands

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Abstract

In this paper, five environmental indicators are conceptually and numerically integrated into a National Accounting Matrix including Environmental Accounts (NAMEA) for 1989. As a consequence, these estimates are directly comparable with outcomes of major macro-economic aggregates in the conventional accounts.

In the NAMEA, emissions of all kinds of polluting agents are recorded by industry and by consumption purpose. Subsequently, these agents are grouped into five environmental themes: greenhouse effect, ozone layer depletion, acidification, eutrophication and waste accumulation. The contributions of agents to certain themes are expressed in theme-related environmental stress equivalents. Per theme, these stress equivalents are confronted with policy norms set by the Netherlands government for the year 2000.

This results in a statistical framework at a meso-level from which integrated economic and environmental indicators are derived. The NAMEA may also serve as a data base and analytical device for modelling interactions between the national economy and changes in the environment.

Contents

1. Introduction

The standard System of National Accounts (SNA) is an integrating framework for the description of economic transactions and balance sheets. This system does not pretend to account for all events that influence social welfare. However, broadening the scope of the SNA by an introduction of large-scale imputations for the use of the environment, unpaid household services and so on would obscure the largely financial parameters such as GDP. A solution to this dilemma has been found in the development of so-called modules in connection with the national accounts. Their purpose is to enable more detailed analyses while maintaining both the internal coherence of the overall system and an explicit link to monetary data. A major advantage of this approach is that the results of detailed studies can be put in the perspective of the full financial economy.

The aim of the environmental module is to provide a complete account of all linkages between changes in the environment and the transactions recorded in the main national accounts. De Boo et al. (1991) give a description of this module, that is also called: the National Accounting Matrix including Environmental Accounts (NAMEA). The advantages of this approach have been spelled out by Keuning (1992a). The present paper contains an application of the NAMEA-framework to the Netherlands. Our objective is to present a framework for monitoring and analyzing environmental and economic policies. Therefore a connection is made with current environmental policy in the Netherlands (VROM, 1989) through the selection of similar 'environmental themes' and a similar classification of production and consumption activities in 'target groups'. From the NAMEA-framework inter-related economic ánd environmental indicators can be derived. The economic indicators are the well-known macro-figures such as Gross Domestic Product, Net National Income and the current external balance. The environmental indicators used in this paper have been designed at the Netherlands Ministry of Physical Planning and the Environment (VROM, 1992a). These are pressure indicators, expressed as the quotient of current emission levels and policy targets in the year 2000. The selection of these indicators was mainly motivated by the availability of data. In addition, the computation of the indicators is subject to further research, and therefore one or more of the present indicators will possibly be revised in future NAMEA-publications. For the time being, the module focuses on emissions of a number of important environmentally hazardous substances and waste. At the present stage neither stench, noise and toxic substances nor the use of natural resources have been incorporated.

The environmental indicators are directly comparable with the major macro-economic aggregates from the national accounts. While others have suggested to make this comparison by monetizing environmental flows (e.g. Repetto, 1991 and Hueting et al., 1992), the conceptual difficulties of valuation are completely avoided in the present approach.

The NAMEA does not only serve to derive aggregate indicators from a consistent meso-level information system. Because of its set-up as a system of accounting matrices, it also provides data in the required format for all kinds of analyses. This can vary from the very simple calculations presented in section 4 of this paper or 'quick and dirty' multiplier experiments based on the matrix inverse to advanced general equilibrium model simulations. Such simulations can then also serve to explore the trade-offs between economic, social and environmental objectives at the macro-level.

General features of the environmental module are reviewed in Section 2[1]. In section 3, environmental themes are introduced as a practical solution to the aggregation problem. Subsequently, in this section the compilation of environmental indicators is further explained. Section 4 continues with an analysis of the contribution of each economic activity to environmental problems. The paper winds up with some conclusions in section 5.

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1. For a more extensive discussion we refer to de Boo et al. (1991) and Keuning (1992a).

2. Design of a NAMEA for the Netherlands

2.1 General features

In table 1, an aggregate NAMEA is presented. From this matrix, the interrelations between various types of monetary and physical flows and their impact on each balancing item (Net Domestic Product, Saving, environmental indicators) can be read. All balancing items have been doubly framed. For each account, the origin of flows is presented in the row while the destination is presented in the column. Emissions are expressed in physical units (e.g. in row-vectors #2,9 and #3,9). As a consequence, this matrix contains only statistics, that is, economic balancing items are not influenced by emissions. The separate registration of physical and monetary data is emphasized in table 1 by placing physical data and monetary data at slightly different positions in the rows and columns. The equality of row and column totals also applies to the physical accounts. However, sometimes weighted aggregation procedures have been used (see section 3).

More detailed information will be presented in additional tables, whereby a single cell in table 1 is expanded into a submatrix. The linkages with table 1 are then maintained via a coding system. Annex A contains the complete detailed NAMEA.

2.2 Conventional accounts[2]

The first row and column of table 1 contain the 'traditional' goods and services account. The row presents the upper part of a consolidated Use Matrix split into intermediate, household and government consumption, gross capital formation and exports. All these elements are valued at purchasers' prices and therefore trade and transport margins add up to zero, row-wise.

In the first column, the third cell contains the consolidated domestic supply matrix (in basic prices). A more detailed table would show the value of all commodities generated by each production activity (cf. block #3,1 in

2. These accounts are discussed in more detail in Keuning (1991) and in chapter XX of the 1993 SNA (United Nations, 1992).

Table 1. A NAMEA illustrated for the Netherlands, 1989 (account 1 - 8 in billion guilders)

ACCOUNT (Classification)	Goods & Services (Prod. Groups) 1	Consumption (Purposes) 2	Production (Production Activities) 3	Income Generation (Prim.Inp.Cat.) 4	Income Distribution and Use (Nat. Sectors) 5	Capital 6	Rest of the World Current 8a	Rest of the World Capital 8b	Emissions (in million kg, CFCs and halons in 1000 kg) CO_2 9a	N_2O 9b	CH_4 9c	CFCs & Halons 9d	NO_x 9e	SO_2 9f	NH_3 9g	P 9h	N 9i	Waste 9j	Themes Greenhouse 10a	Ozone Depl. 10b	Acidificat. 10c	Eutrphic. 10d	Waste 10e	Depositions Acidification PAE 11	TOTAL
Goods & Services (Product Groups) 1	Trade and Trans.Margins 0.00	Household Consumpt. 284.49	Intermediate Consumption 460.19		Government Consumption 71.77	Gross Capital Formation 108.54	Exports 267.68																		Commodity Use 1192.66
Consumption (Purposes) 2					Household Consumption 284.49				'Free' Emissions, Consumption 32133	2	13	3157	151	4	10	13	103	7226							Consumption Use 284.49
Production (Production Activities) 3	Output (basic prices) 903.81								'Free' Emissions, Production 125886	31	557	12626	425	207	238	153	1213	18239							Output (basic prices) 903.81
Income Generation (Primary Input Categories) 4			NDP (basic prices) 388.74				Wages from ROW 1.12																		Generated Income 389.86
Income Distribution and Use (National Sectors) 5	Product Taxes - Subsidies 40.09			NGI (market prices) 388.59	Property Income, Current Transfers 948.43	Net Investment Taxes 0.97	Property Inc& Transf.fr.RO 60.33																		Current Income 1438.41
Capital 6			Consumption of Fixed Capital 54.88		Net Saving 71.54	Capital Transfers 86.01		Cap.Transfers fr. RO 0.93																	Fin.of Gross Worth Accum. 213.36
Financial Balance 7						Net Lending from ROW 15.62		Net Lending to ROW -15.62																	Financial Balance 0.00
Rest of the World (ROW) Current 8a	Imports 248.76			Wages to ROW 1.26	Property Income, Transfers to RO 62.19				'Free' Emissions from ROW				109	101	24	a)	a)	-							Current Payments to ROW 312.21
Rest of the World (ROW) Capital 8b						Capital Transfers to ROW 2.22	Bal. Payments Curr.Acc.Def -16.91																		Capital Payments to ROW -14.69
Emissions (in mln kg, CFCs and halons in 1000 kg)			Incineration				'Free' Emission to ROW												Allocation to Themes						Absorption of Emissions
CO_2 9a																			158019						158019
N_2O 9b																			33						33
CH_4 9c																			570						570
CFCs and Halons 9d																				15783					15783
NO_x 9e							504														181				685
SO_2 9f							166														146				312
NH_3 9g							146														126				272
P 9h							a)															166			166
N 9i							a)															1316			1316
Waste 9j			10728				-																14737		25465
Themes						Emission-Indicators																		Depositions	Stress Equivalents
Greenhouse Effect (GWP) 10a						1.02																			173199
Ozone Depletion (ODP) 10b						1.56																			12451
Acidification (PAE) 10c																								15918	15918
Eutrophication (PEE) 10d						2.83																			298
Waste Production (mln KG) 10e						2.94																			14737
Deposition Account Acidification (PAE) 11						Deposition Indicator 1.95																			Depositions 15918
TOTAL	Commodity Supply (market prices) 1192.66	Household Consumption 284.49	Input (basic prices) 903.81	Allocation of Generated Income 389.86	Current Outlays 1438.41	Gross Worth Accumulation 213.36	Current Receipts from ROW 312.21	Capital Receipts from ROW -14.69	Supply of Emissions (1000 KG) 158019	33	570	15783	685	312	272	166	1316	25465	Stress Equivalent Conversions 173199	12451	15918	298	14737	Depositions 15918	

a) These data are available but not recorded in the NAMEA because the concomitant policy objectives have been formulated for emissions and not for depositions

-: Data are not available

Annex A). Imports (at c.i.f. prices) originate from the current account for the rest of the world. Taxes on products less subsidies (excise taxes etc.) are put on the income distribution and use account. The total of the first column now corresponds with domestic commodity supply at market prices and this is equal to the concomitant row sum which represents the value of total use.

The production account (#3) registers output as receipts of production activities, and intermediate consumption, consumption of fixed capital and net value added as their outlays. In addition to the output for sale, most production processes also generate less wanted 'by-products' in the form of substances which are dumped into the environment (vector #3,9).

It is generally felt that the pollution caused by final consumption should also be taken into account. In account 2, household consumption is reclassified by consumption purpose[3]. This account serves to connect consumption activities with the concomitant emissions. In the row of this account (#2,9), the emissions that result from household consumption are registered.

According to VROM (1992a), environmental policy in the Netherlands focuses on activities of the following 'target groups': agriculture (1a), oil refineries (1b), Manufacturing (1c, 1d and 1e), energy generation (1f), construction (1g), traffic and transport (1h and 2a) and retail trade and consumers (1i and 2b). The codes in parentheses refer to the classification of activities in table 2 below. In the module, the classifications of production and consumption activities have been tailored to these target groups.

The balancing item of the production account in each industry equals value added. Since indirect taxes less subsidies on products have already been subtracted, this item is measured at basic prices. In sub-matrix #6,3 depreciation is recorded. Hence, the sum of net value added, that is Net Domestic Product (NDP), is booked on the income generation account (#4). In this account, primary income from production activities is classified by primary income categories (wages and salaries, employers' social contributions and

3. In the full matrix shown in Annex A, consumption related to private transportation is separated from other consumption.

operating surplus). Further, the balance of wages received from abroad and wages paid to abroad is added to NDP. This results in Net Generated Income (NGI) at market prices.

Table 2. The classification of production and consumption activities

Production Activities	SBI-Code (Dutch Standard industrial Code)
1a. Agriculture	01.1 and 01.2
1b. Oil refineries	28.1
1c. Chemical industry	29 and 30
1d. Basic metal industry	33
1e. Other manufacturing	2 excl. 28.1 and 29, 3 excl. 30 and 33
1f. Electricity generation	40.1
1g. Construction	5
1h. Transport	7 excl. 77
1i. Services and Other	01.3-01.5, 02, 03, 1, 40.2, 40.3, 6, 77, 8 and 9
Consumption Activities	**Goods and Services**
2a. Transport	Refined petroleum products and Transport equipment
2b. Other purposes	Other goods and services

In the 'income distribution and use account' (#5), property income and current transfers flow from and to abroad (#5,8a and #8a,5) and also among resident institutional units (#5,5). This account also records how income is spent. The government and household groups have outlays on consumption and the balance, (net) saving, is put on the capital account.

The capital account describes the generation of net worth due to saving and the balance of capital transfers received and paid. Like ordinary saving, the environmental effects which are not absorbed during the present period should be transferred to a 'changes in balance sheet account'. However, actual changes in ecosystems (quality of trees, the disappearance of species) are seldom referable to current emissions. Therefore, the potential threat of current emissions is visualized in the capital account with the help of indicators.

Subsequently, the financial balance (#7) is presented. In the row both net lending of the nation and net lending of the rest of the world are placed. Obviously, these two balancing items cancel out. Therefore the column of this account is deleted.

The rest of the world account is divided into a current and a capital account. Current receipts of the rest of the world appear in the row and current outlays in the column. The national deficit on current account of the balance of payments is transferred to the capital account of the rest of the world (cell #8b,8a). The NAMEA also accommodates physical flows of pollutants across the border. In row #8 acidifying substances that were emitted abroad, float into the national territory (vector #8a,9). Conversely, pollutants are exported too, as shown in vector #9,8a. Trans-boundary flows of greenhouse and ozone depleting gases are not shown because such flows are irrelevant for global environmental problems (#9a-9d). For trans-boundary waste flows data are not yet available. Imports and exports of phosphorus and nitrogen are known but not incorporated in the NAMEA because the concomitant policy objectives have been formulated for emissions (that is, disgarding imports and exports).

2.3. Environmental accounts

In the emission account, total supply of polluting agents is given in kilograms. In general, three sources are responsible for this supply. First, this concerns the emissions from production processes (vector #3,9). Secondly, there are agents that are disposed of during the consumption of products by households[4]. This is shown in vector #2,9. Finally, the quality of our environment is also influenced by imports of agents from abroad. This also also concerns emissions from foreign vehicles in our country[5]. Table 3 details the emissions by source and by environmental agent.

Table 4 registers the absorption of these emissions. In sub-matrix #9,3, the share of total waste production that is incinerated is recorded as an input into incineration plants (these are part of services and other production activities). If sufficient data become available, this can also be done for the use of waste as input into composting plants, separating installations or other uses. In this way, the NAMEA allows for the transformation of pollu-

4. Emissions from government consumption are supposed to take place during the production of government services and are therefore registered as emissions from production activities.
5. No information is available on emissions of Dutch vehicles abroad. While these emissions have not been added in the emission account, emissions from foreign vehicles in the Netherlands have not been subtracted. It is thus assumed that these inaccuracies in our data cancel out.

tants by means of an economic activity. The environmental impact of waste incineration is here reflected by the emission of air pollutants and the disposal of combustion waste by the industry concerned.

Table 3. The supply of emissions, column #9 (#2,9, #3,9 and #8a,9) in the NAMEA (mln KG; CFCs and halons in 1000 KG)

year 1989	CO2	N2O	CH4	CFCs+halons	NOx	SO2	NH3	P	N	Waste(net)
	mln kg			1000 kg	mln kg					
Household Consumption										
o.w. Transport	12833	0	4	0	132	3	0	0	39	162
Other Purposes	19300	2	9	3157	19	1	10	13	64	7064
Total (#2,9)	32133	2	13	3157	151	4	10	13	103	7226
Production										
Agriculture	7511	24	393	0	13	1	230	127	1067	962
Manufacturing	50582	1	6	6786	121	125	8	26	61	7381
o.w. Oil Refineries	10732	0	1	0	21	70	0	0	6	40
Chemical Industry	19981	0	4	6313	44	27	8	19	25	3167
Basic Metal Industry	6636	0	0	0	13	15	0	0	4	150
Other Manufacturing	13233	0	0	473	44	13	0	6	26	4024
Electricity Generation	38452	1	2	0	78	43	0	0	23	146
Construction	958	0	0	3157	9	1	0	0	3	3782
Transport	7876	1	2	789	125	23	0	0	36	2294
Services and Other	20507	5	155	1894	78	14	0	1	23	3674
Total (#3,9)	125886	31	557	12626	425	207	238	153	1213	18239
Total Inland Supply	158019	33	571	15783	576	211	248	166	1316	25465
Import of Foreign Emissions (#8a,9)					109	101	24	.a)	.a)	.
Total Supply (Column Sum #9)	158019	33	570	15783	685	312	272	166	1316	25465

a) These data are available but not recorded because the concomitant policy objectives have been formulated for emissions and not for depositions.

Sources: CO_2, NO_x, SO_2, Waste, P (Phosphorus) and N (Nitrogen) emission data from CBS;
NO_x, SO_2 and NH_3 import data based on information from RIVM;
P (Phosphorus) and N (Nitrogen) import data from CBS;
NH_3, N_2O and CH_4 emission data from RIVM; and
CFC/halon emission data are intrapolations based on VROM-data.

In sub-matrix #9,10 all agents are allocated to a smaller number of so-called 'environmental themes'. Distinguishing environmental themes is a fairly new approach in the Dutch environmental policy. A growing need for integration over environmental compartments (soil, water and air) led to the selection of environmental themes. These themes concern the effects of environmental changes on people, plants and animals, grouped in the following broad categories: climate change (greenhouse effect and depletion of the ozone layer), acidification, eutrophication, disposal of waste (including sewerage and soil clean-up), nuisance (including external safety), pollution with toxic and hazardous substances and fresh water deficit. These categories can be considered as broad environmental problems. Due to a lack of data the last three themes in this list have not yet been incorporated in the Netherlands' NAMEA.

Table 4. The absorption of emissions, row #9 (#9,3 #9,8a and #9,10) in the NAMEA (mln KG; CFCs and halons in 1000 KG)

year 1989	CO2	N2O	CH4	CFCs+halons	NOx	SO2	NH3	P	N	Waste(net)
	mln kg			1000 kg	mln kg					
Incineration (#9j,3)										10728
Export of Emissions (#9,8a)					504	166	146	.a)	.a)	.
Allocation to Theme (#9,10)	158019	33	570	15783	181	146	126	166	1316	14737
Total Absorption (Row Sum #9)	158019	33	570	15783	685	312	272	166	1316	25465

a) These data are available but not recorded because the concomitant policy objectives have been formulated for emissions and not for depositions.
Sources: CO_2, NO_x, SO_2, Waste, P (Phosphorus) and N (Nitrogen) emission data: CBS (1991b)
P (Phosphorus) and N (Nitrogen) export data: CBS
NO_x, SO_2 and NH_3 export data based on information from RIVM
NH_3, N_2O and CH_4 emission data: RIVM
CFC/halon emission data are interpolations based on VROM-data

The column-wise clustering of agents in sub-matrix #9,10 of table 1 shows their relationship with an environmental theme. In some cases an agent is connected to more than one theme. For instance, NO_x and NH_3 emissions are related to both acidification and eutrophication. Theoretically, these successive contributions should be expressed in the 'allocation to themes' matrix (#9,10). In cell #9e,10d of this matrix, the contribution of NO_x to the eutrophication problem should then be shown. However, recording the nitrogen contents of NO_x emissions twice in a single row would lead to inconsistent row and column totals for account #9e. Therefore a separate nitrogen (N) emission account has been inserted (#9i); as a consequence, the nitrogen contents of NO_x emissions are expressed twice in the rows recording the emissions (cf.

e.g. cells #2,9e and #2,9i), but these emissions are anyhow not added up row-wise.

The column totals of account #10 cannot be computed by an ordinary summation. An aggregation of agents per environmental theme requires that the contents of each cell are expressed in so-called 'environmental stress equivalents'. In this way, the contribution of all agents involved in a certain environmental theme is transformed from kilograms into theme-related environmental stress equivalents. These equivalents express the potential environmental burden of each agent in relation to a particular environmental problem. This is further elaborated in the next section.

Ideally, a NAMEA summarizes its description of changes in environmental quality within the borders of a country by means of environmental quality indicators. Unfortunately, the linkages between emissions and effects are still unclear in many instances. Therefore we had to stop at an earlier stage and present environmental pressure indicators instead. Such theme-related indicators may pertain to emissions or to depositions. In general, pressure indicators measure the deviation of current emission or deposition levels from certain standards. These standards should in fact reflect sustainability levels, but only in a few cases such threshold levels have already been converted into maximum emission or deposition levels. In this NAMEA, a second-best solution is found by using policy targets formulated in documents of the Environment Ministry. Hence, the indicators in this article reveal environmental pressures within the borders of the Netherlands in relation to policy targets for the year 2000.

For one theme, acidification, the indicator is not based on emissions but on depositions in the Netherlands, that is emissions plus imports minus exports and re-intake in the economic system. Since environmental quality is more closely related to depositions than to emissions, deposition indicators should be designed if sufficient information is available (including policy norms for depositions instead of emissions, see #10,11 and #11,6). In this case, no emission indicator is presented as that would amount to double-counting. In addition, it would be possible to give a regional subdivision of deposited agents and environmental quality indicators in account #11. This is elaborated in sub-section 3.2 below for acidification. For the other themes, only emission indicators could be constructed - cf. vector #10,6.

3. Compiling environmental indicators by environmental theme

3.1 Environmental themes in the NAMEA

In the NAMEA, available information on environmental 'stressors' and 'effects' is brought together under the heading 'environmental themes', as designed by the Netherlands Ministry of Physical Planning and Environment (VROM, 1992a). Table 5 presents the environmental themes used in this article. In the second column, the agents that correspond to each theme are given. To enable an addition of agents, the themes are expressed in environmental stress equivalent units. Each of the themes is reviewed below.

Table 5. Environmental agents and themes taken into account in this article

Environmental Themes	Agents	Environmental Stress Equivalents
Greenhouse Effect	CO_2, N_2O and CH_4	Global Warming Potentials (GWP)
Depletion of the Ozone Layer	CFC's and halons	Ozone Depletion Potentials (ODP)
Acidification	SO_2, NO_x and NH_3	Acidification Equivalents (PAE)
Eutrophication	N and P	Eutrophication Equivalents (PEE)
Accumulation of Waste	waste	Kilograms (mln KG)

Greenhouse effect

Among the expected consequences of atmospheric pollution are global climate changes. The changes in concentration of so-called greenhouse gases in the atmosphere will probably affect the climate, due to e.g. a rise of surface temperatures. Significant human-related emissions of greenhouse gases in the Netherlands concern carbon dioxide (CO_2), methane (NH_4) and nitrous oxide (N_2O). CFCs and halons have also been mentioned as greenhouse gases but their contribution to the greenhouse effect is inconclusive (IPCC, 1992). The relative contribution of each gas to the greenhouse effect can be expressed in CO_2-equivalents; these are also called Global Warming Potentials (GWP). This is the CO_2 concentration that would have about the same effect on the radiative properties of the atmosphere as the concentrations of the greenhouse gas concerned. In this paper, the conversions into GWPs have been based on IPCC (1992). Table 6 covers approximately 88 percent of all greenhouse gases emitted in the Netherlands, assuming that CFCs and halons are not greenhouse gases (calculated from van den Born et al., 1991).

Table 6. Conversion of greenhouse gas emissions into GWP, 1989 (# 9a-9c,10a)

	Emission in mln kg	Global Warming Potential GWP/kg	Emission in GWP
CO_2	158019	1	158019
N_2O	33	270	8910
CH_4	570	11	6270
Total (#10a)			173199

Source: CO_2 emission: CBS; N_2O and CH_4 emission: RIVM; global warming potential: IPCC (1992).

Depletion of the Ozone Layer

Oxides of hydrogen, nitrogen, chlorine and bromine can act as catalyst in the reaction chains that lead to the depletion of stratospheric ozone. Ozone in the stratosphere is a filter for solar UV-radiation. A decreasing ozone concentration leads to a higher exposure to UV-B-radiation, with effects on human health and possibly on ecosystems too.

Chlorofluorocarbons (CFCs) and halons are supposed to be important gases in this process. The use of CFCs and halons is regulated by the Montreal Protocol as recently adjusted in Kopenhagen. The protocol now aims at a complete ban of CFCs in the year 1996 while the production and use of halons is banned by the beginning of 1994. The European Community countries plan to issue a regulation banning CFCs from 1995 onwards (Second Chamber, 1993). In the Netherlands, there is no direct information available about the yearly release of CFCs and halons in the atmosphere. However, the *use* of CFCs and halons is registered because of the Montreal protocol. In the NAMEA this indirect information is used by way of emission data. The rationale is that eventually all use of products containing CFCs or halons will cause emissions, namely when the depreciated commodities are discarded. Besides, the purchase of these products will also lead to emissions in the reference period in so far as they replace worn out products (e.g. refrigerators) of the same type. The practice of recovering CFCs and halons from discarded products was still very limited in 1989. It should, however, be realized that the NAMEA figures do not provide an exact estimate of present emissions.

In addition to the substances mentioned in table 7, HCFCs and methylbromide are supposed to contribute to the depletion of the ozone layer. However, their relative contribution is problably smaller. A conversion into Ozone Depletion Potentials is shown in table 7. The ODP-value is an indication of the degree to which a specific gas influences ozone concentrations relative to CFC-11.

Table 7. Conversion of the use of ozone depleting gases into ODPs, 1989

	Use in kg	Ozone Depletion Potential ODP/kg	Use in ODP
CFC-11	5747	1	5747
CFC-12	1477	1	1477
CFC-13	3	1	3
CFC-113	1222	0.8	978
CFC-114	85	1	85
CFC-115	101	0.6	60
halon-1211	250	3	751
halon-1301	191	10	1907
carbontetrachloride	754	1	754
1,1,1-trichloroethane	5633	0.1	563
Total (#9d and #10b)	15783		12451

Source: VROM (1992b); use: interpolation of 1986-1990 data.

In order to keep table 1 and annex A within manageable limits, only the total and not each individual ozone gas is shown there. The indicator presented here differs from VROM (1992a) by the inclusion of carbontetrachloride and 1,1,1-trichoroethane. Data on HCFCs and methylbromide were too scarce to allow for their incorporation in this NAMEA.

Acidification

Deposition of acid substances has lead to changes in the composition of soil and surface waters in the Netherlands. This process will cause large-scale disturbance of ecosystems, deterioration of ground water quality, and damage to materials and crops. The most important agents leading to acidification are nitrogen oxides (NO_2), sulphur dioxide (SO_2) and ammonia (NH_3). The potential contribution to acidification of each of these substances can be expressed in

Potential Acid Equivalents (PAE). This measure reflects the amount of an agent that is necessary to form an acid with a certain amount of H^+-ions. One acid equivalent equals 1/2 mol (32 grams) SO_2, or 1 mol (46 grams) NO_2, or 1 mol (17 grams) NH_3 (Schneider and Bresser, 1988).

Emissions as well as depositions can be expressed in potential acid equivalents. Because the transformation of ammonia into HNO_3 requires a number of reactions, involving bacteria in soil and water, ammonia emissions expressed in potential acid equivalents may somewhat overestimate the contribution of NH_3 to the actual acidification. In table 8, the conversion from kilograms of acidifying substances into PAE is further specified. Emissions as well as depositions are presented.

Table 8. Conversion of acidifying emissions into PAE,1989 (#9d-9f, 10b)

	Emissions in the Netherlands (mln kg)	Potential Acid Equivalent (PAE/kg)	Emissions in 1000 PAE
NO_x	576	1/46	12522
SO_2	211	1/32	6594
NH_3	248	1/17	14588
Total			33704
	Depositions in the Netherlands (mln kg)	Potential Acid Equivalent (PAE/kg)	Depositions in 1000 PAE
NO_x	181	1/46	3937
SO_2	146	1/32	4548
NH_3	126	1/17	7433
Total (#11c)			15918

Source: Emissions: CBS; depositions: RIVM; PAE: Schneider and Bresser, 1988.

The dispersion of acid-forming substances plays an important role in the cause/effect chain. A major part of total emissions in the Netherlands floats into other countries while the damage from acidification in the Netherlands is the result from Dutch as well as foreign emissions. In the NAMEA these trans-boundary exchanges are included (table 1). Combination of data on emissions within the Netherlands and on the inflow and outflow across the border results in the deposition on the Dutch territory. It is possible to provide more details underlying cell #10,11, for instance concerning the depositions by province (see table 9). In turn, these depositions can be juxtaposed with indicators on changes in environmental conditions such as the vitality of forests.

Table 9. Depositions and vitality of forests by province in the Netherlands

	Depositions 1989			Forest Area 1989		Vitality of Forests: Good 1989	1990	1991	Reasonable 1989	1990	1991	Bad 1989	1990	1991
	PAE	%	PAE/ha.	100 ha	%	%								
Drenthe	1115	6.9	4200	264	8.8	42.0	55.2	62.6	40.3	29.3	25.8	17.7	15.5	11.6
Overijssel	1655	10.3	4955	352	11.7	34.8	52.5	54.9	34.3	32.2	29.2	30.9	15.3	15.9
Gelderland	3421	21.2	5319	863	28.7	48.0	48.0	47.6	34.6	31.4	33.3	17.4	20.6	19.1
Utrecht	666	4.1	5000	179	6.0	48.2	49.9	45.5	24.4	33.6	39.7	27.4	16.5	14.8
N-Brabant	2915	18.1	5893	659	21.9	57.1	45.5	45.6	25.9	27.1	29.4	17.0	27.4	25.0
Limburg	1276	7.9	5881	285	9.5	63.7	67.8	59.1	24.6	20.2	24.2	11.7	12.0	16.7
Other provinces	5098	31.6	3902	401	13.4	n.a			n.a.			n.a.		
The Netherlands	15918	100.0	4757	3003	100.0	50.1	52.5	52.0	30.7	28.7	30.2	19.2	18.8	17.8

Note: The sample size in the other provinces is too small to enable comparisons.
Sources: Depositions: Heij and Schneider (1991);
Vitality of forests: Bosbouwvoorlichting (Netherlands Ministery of Agriculture, Fishery and Nature Protecting 1992)

Evidently, this relationship is a complicated one, as the health status of forests in the Netherlands depends on more factors than deposition of acid substances. Variations in soil quality, weather conditions, occurrence of pests and management of the forests also cause differences among provinces.

Eutrophication

Eutrophication occurs when an abnormal amount of nutritious substances for plants disturbs ecological processes. Among the effects are: loss of species, algae bloom in surface water leading to impoverishment of other species and a decreasing quality of drinking water. The most important eutrophicating substances are nitrogen (N), phosphorus (P) and potassium (K). In this article we focus on nitrogen and phosphorus because of data availability. Phosphorus and nitrogen are present in emitted substances like manure, fertilizers, ammonia and waste water and in some air emissions (NO_x and NH_3). In the NAMEA these emissions have been converted into kilograms P and N.

A common unit linked to the (potential) effects of both substances does not yet exist. Nevertheless a preliminary equation factor is introduced here: see VROM (1992a). Based on the average appearance of nitrogen and phosphorus in natural circumstances, a 1 to 10 ratio between nitrogen and phosphorus is assumed to arrive at Potential Eutrophication Equivalents (PEE) (table 10).

Table 10. Conversion of eutrophying emissions and depositions into PEE (#9h-9i, 10d)

Emissions	(mln kg)	Potential Eutrophication Equivalent (PEE/kg)	(mln PEE)
Phosphorus (P)	166	1	166
Nitrogen (N)	1316	0.1	132
Total (#10d)			298
Imports, exports and depositions	(mln kg)	Potential Eutrophication Equivalent (PEE/kg)	(mln PEE)
Imports of foreign emissions			
Phosphorus (P)	20	1	20
Nitrogen (N)	417	0.1	42
Total			62
Exports of emissions			
Phosphorus (P)	25	1	25
Nitrogen (N)	584	0.1	58
Total			83
Depositions			
Phosphorus (P)	161	1	161
Nitrogen (N)	1149	0.1	115
Total			276

Source: Emissions and depositions: CBS (1990b)
PEEs: VROM (1992a)

The depositions (or immission) into the Netherlands is the net result of emissions plus the inflow minus outflow across the borders. In the case of both nutrients, borders are crossed via rivers, mainly the Rhine. Trans-boundary phosphorus and nitrogen flows are also presented in table 10. As the policy targets were only formulated for emissions and not for depositions, eutrophication has not been incorporated in the deposition account of this NAMEA.

Accumulation of Waste

How to get rid of waste without damaging the environment is a major problem in the Netherlands. Dumping waste requires not only space but also facilities at waste dumps to prevent leakage of environmentally hazardous substances. Dutch environmental policy thus focuses on reducing the amount of generated waste (VROM, 1989). Of the many aspects of waste, such as composition and toxicity, only one is covered in the indicator as developed by VROM (1992a): the amount of waste that is dumped.

A further delimitation is the exclusion of waste that results from clean-up actions. This concerns for example polluted dredging spoil for which separate dumping facilities have been created. Apart from the practical argument, this waste cannot be seen as presently generated waste because the pollution is not the result from current economic activities. Excess manure is also excluded. As the limited capacity of waste dumping sites is our main point of interest, the common unit for all types of waste is the kilogram (cf. cells #9j,10e and Total #10e). A volume measure (m^3) would perhaps be preferable, but for some types of waste such data are lacking.

Dumped waste should be presented in the NAMEA as total waste production minus the amount of waste that is re-inserted into the economic system (e.g. recycled, composted or incinerated waste)[6]. Because it is not yet possible to present re-used and recycled amounts by utilizing industry, these amounts have been subtracted from gross emissions. In addition, a complete specification of transboundary flows of waste cannot yet be given. In the NAMEA, waste emissions only contain waste that is incinerated or dumped and these emissions are called 'net waste'. On the other hand, the transformation of incinerated waste is incorporated in this NAMEA (cf. cell #9j,3).

3.2 The compilation of environmental indicators by environmental theme

Among the objectives of the NAMEA is the derivation of a limited number of environmental indicators from a consistent national accounting framework.

6. Recycling of waste within the same establishment is not shown in this NAMEA, as it is concerned with outputs that can be delivered or provided to other units (including the environment) only (see: UN 1992, Chapter VI, page 2 and De Boo et al (1991)).

These indicators are derived from the physical accounts in the module. In theory, these indicators can be formulated at different levels: emissions, depositions or changes in environmental quality. Obviously, for each environmental effect not more than one indicator should be specified. For instance, if a deposition indicator is computed this means that a separate indicator for the concomitant emissions is not incorporated, in order to avoid double-counting.

Table 11. The confrontation of emission/deposition levels and policy targets

Emissions:	**1989**	**Policy Goal 2000**	**Indicator Value**
Greenhouse Effect (GWP)			
CO_2	158019	150494	1.05
N_2O	8910	10800[a)]	0.83
CH_4	6270	9258[a)]	0.68
	173199	**170552**	**1.02**
Depletion of the Ozone Layer (ODP)	**12451**	**8000[b)]**	**1.56**
Eutrophication (PEE)			
P	166	47	3.53
N	132	58[c)]	2.27
	298	**105**	**2.83**
Accumulation of Waste (mln KG)	**14737**	**5000**	**2.94**
Depositions:			
Acidification (PAE)	**15918**	**8146**	**1.95**
(PAE/Ha*10^3)	4757	2400	1.95

Note: Only the indicators printed in bold are implemented in the NAMEA.
a) These policy targets are slightly corrected to account for adjusted GWP-conversions in comparison with VROM (1992a), see section 3, greenhouse effect.
b) Intrapolated policy target for 1989, in this case based on a complete ban of CFCs and halons in 1995.
c) This policy target is slightly corrected in comparison with VROM (1992a): in addition to emissions into water and soils it encompasses nitrogen containing air emissions.
Source of policy goals: VROM (1989, 1992a and 1992c).

The indicators in this article are mainly related to emissions because most policy targets have been formulated at that level. Only for acidification the indicator refers to depositions. In order to denominate all indicators into a common dimension, they are expressed as the quotient of the current level of the environmental burden and a concomitant policy target set for the year

2000. In table 11, actual emissions and depositions in 1989 are compared with these targets[7].

An alternative approach has been used in the compilation of a CFC/halon indicator. The scheduled complete ban of CFCs and halons in 1995 forces us to formulate a different target value. In the CFC/halon indicator a comparison is made between the actual and the planned CFC/halon use in 1989, assuming a linear reduction pattern between 1980 and 1995.

7. This procedure is very similar to the presentation of environmental indicators and targets in VROM (1992a), as copied in the annual government budget report (Netherlands Ministry of Finance, 1992). However, a few of the themes presented there could not yet be put in our comprehensive national accounting framework, due to lack of data.

4. The potential impact of economic activities on the environment

This section contains an analysis concerning the potential impact of economic activities on the environment. This analysis is based on the data contained in the NAMEA. In table 12, the emission data in table 3 have been converted into environmental stress equivalents and subsequently aggregated by themes. In this way the contributions of consumption purposes and production activities to specific themes are illustrated[8]. These contributions are connected to other information derived from the same NAMEA: net domestic product per production activity and private consumption per purpose. Besides, employment figures are presented in column 2. It applies to each theme that at least 80% of production-related emissions originate from production activities which generate only 36% of total value added and 35% of total employment. Comparatively little pollution is caused by services etc. (excluding transport), and by 'other' manufacturing, that is, excluding oil refineries, chemical and basic metal industries.

Manufacturing contributes most to the global warming problem. In relative terms however, electricity generation is far more important (1% of value added versus 22% of the emissions). More than 40% of the emissions of acid substances are caused by agriculture (4% of value added). This is due to the substantial agricultural emissions of NH_3. The largest emittors of waste are manufacturing and households with contributions of 29 and 28 percent, respectively. It is not surprising that the eutrophication problem is largely caused by agriculture while chemicals manufacturing contributes most to the ozone depletion problem.

Among household consumption expenditures, 'other purposes' cause most of the emissions of global warming gases while almost all acid emissions come from 'transport'. Only a small part of total waste generation by consumers is related to transport because a major part of discarded car wrecks is recycled and therefore subtracted from our waste data (see section 3.1 above).

8. Only a rough estimate of total CFC/halon use by activity (VROM, 1991a) is available. These data have been used whereby it is assumed that the distribution of ODPs equals the distribution of total CFC/halon use in table 3.

Table 12. The contribution of emissions by production and consumption activities to environmental themes, 1989 (%).

	Net Domestic Product	Employment	Private Consumption	Greenhouse effect	Ozone layer depl.	Acidification	Eutrophication	Waste	Weighted average contribution			
									All themes	excl. ODPs	excl. PEEs	excl. OPDs&PEEs
	1	2	3	4	5	6	7	8	9a	9b	9c	9d
Production activities	100	100		81	80	88	92	72	84	85	81	81
Agriculture	4	3		11	0	41	79	4	36	42	18	24
Manufacturing	20	19		29	43	21	10	29	23	20	28	25
Refineries	0	0		6	0	8	0	0	3	3	4	5
Chemical Industries	3	2		12	40	7	7	12	14	9	16	9
Basic Metals	1	1		4	0	2	0	1	1	1	1	2
Other Manufacturing	16	16		8	3	4	3	16	6	7	7	8
Electricity Generation	1	1		22	0	9	1	1	5	6	7	9
Construction	6	8		1	20	1	0	15	6	3	8	5
Transport	5	5		5	5	10	1	9	6	6	8	9
Services and Other Activities	64	65		14	12	6	1	14	8	7	11	10
Consumption			100	19	20	12	8	28	16	15	19	19
Transport			6	7	0	11	1	1	4	5	5	7
Other Purposes			94	12	20	1	7	28	11	10	14	12
Total	100	100	100	100	100	100	100	100	100	100	100	100

Of course, an overall indication of environmental pressure per consumption purpose and production activity is even more desirable. Policy goals for emissions have been used to transform emission data from environmental stress equivalents into dimensionless indices. Next the indices have been averaged to arrive at a single environmental index per production activity or consumption purpose. The procedure is as follows:

$$C_i = \sum_j \left[\left[\frac{E_{ij}}{E_{total,j}} * \frac{E_{total,j}}{E_{target,j}} \right] / \sum_j \left[\frac{E_{total,j}}{E_{target,j}} \right] \right]$$

$$= \sum_j \left[\left[\frac{E_{ij}}{E_{target,j}} \right] / \sum_j \left[\frac{E_{total,j}}{E_{target,j}} \right] \right]$$

C_i = The overall relative environmental contribution per production activity or consumption purpose, i

E_{ij} = The contribution of activity i to theme j (in theme equivalents)

$E_{total,j}$ = Total contribution to theme j (in theme equivalents)

$E_{target,j}$ = Emission policy target for theme j (in theme equivalents)

The overall relative contribution per activity (C_i) is a function of the relative contributions of this activity to each of the environmental themes and the policy targets per theme. A greater distance between total emissions and the policy target implies a larger weight of the theme concerned in the overall aggregation.

Emission goals have been used in all cases, that is, including the themes acidification and waste. In table 13 it is shown that concerning acidification, the policy goals for the concomitant emissions are stricter than for the eventual depositions. Concerning waste, the policy goal for waste generation is less strict than for waste that is eventually dumped. Concerning the other themes, emission policy goals were implemented both in the core NAMEA-framework and in this analysis. In conclusion, different purposes lead to the use of different indicators for acidification and for waste in this case. The core NAMEA-framework attempts to reflect the "state of the environment" in so far as this can be done with the presently available data. Depositions of acid substances and dumped waste come closer to this objective than the concomitant emissions. On the other hand, for the analysis in this section, all weights should be based on one common underlying principle; the distance between emissions and the corresponding policy targets for these emissions.

Table 13. A comparison of two types of indicators for acidification and waste.

	1989	Policy Goal 2000	Indicator Value	
Acidification				
Emissions				
NO_x (mln KG)	425	238	2.42	
SO_2 (mln KG)	207	75	2.81	
NH_3 (mln KG)	238	83	3.02	
Total (PAE)	33704	12342	2.73	(indicator used in the analysis)
Depositions (PAE)	15918	8146	1.95	(NAMEA-framework indicator)
Waste				
Generation of (mln KG)	25465	14500	1.76	(indicator used in the analysis)
Accumulation (mln KG)	14737	5000	2.94	(NAMEA-framework indicator)

Sources: Acidification emission policy targets : VROM 1990
Waste generation policy targets : VROM 1992c

Evidently, the relative contributions to environmental pressure presented in table 12 should be interpreted with care, in view of the incomplete coverage of themes and the various assumptions used (stress equivalent conversions, policy targets). Nevertheless, these figures do provide a preliminary indica-ion of the relative environmental burdens caused by production and consumption activities as the themes included are certainly among the most serious ones. In order to illustrate the sensitivity of this indicator to the inclusion or exclusion of themes, four aggregation patterns are presented in table 12 (columns 9a-9d). In column 9b, ODPs are left out because of the limited data for ozone depletion. The overwhelming contribution of agriculture to the eutrophication problem (79 percent) and the acidification problem (41 percent) is naturally also reflected in the aggregation over themes (table 12, column 9a). As mentioned earlier, this is largely due to the agricultural NH_3 emissions. Even if the PEEs are left out (column 9c), the relative contribution of agriculture to total environmental pressure substantially exceeds the contribution to total value added and employment in the Netherlands.

Similarly, the contribution of oil refineries, chemical industries and electricity generation to the overall environmental indicator is larger than the direct economic weight of these activities. The reverse applies to 'other' manufacturing and services. For a complete analysis, the indirect economic effects of production activities should be incorporated as well.

5. Summary and conclusions

The preliminary NAMEA for the Netherlands (1989) presented in this paper serves to demonstrate that economic and environmental data can be placed into a single information framework in which monetary and physical units are combined. In particular, this matrix shows the relationship between production and consumption activities and all kinds of environmental problems, grouped into a limited set of themes. No specific assumptions are needed at this stage, apart from a harmonization of classifications (Table 2).

The emission data have been converted into theme equivalents (see Tables 4-9) and finally into theme indicator values. This yields five aggregate environmental indicators which fit into the macro-framework presented in Table 1. This table thus provides an integrated presentation of economic indicators, like NDP and the current external balance, and environmental indicators on the following themes: greenhouse effect, depletion of the ozone layer, acidification, eutrophication and waste disposal. The value of these environmental indicators can directly be related to the levels of economic activity in the reference year, or, in other words, the macro-indicators in table 1 are consistent, both conceptually and numerically.

If a NAMEA became available at regular intervals, this would mean that the rates of change in economic and environmental macro-indicators can be juxtaposed and that one can see at a glance in which direction the economy has been heading. On the economic side, a further extension to issues like unemployment and income distribution is conceptually simple and numerically feasible (Keuning, 1992b).

Moreover, the procedure followed in this paper is in itself not dependent on the exact conversion of emissions into environmental stress equivalents. The current presentation of environmental themes being somewhat limited, additional information on other environmental problems can be inserted, without a change in methodology, as soon as the data become available. The presentation of environmental themes in this paper can still be extended in two ways:

1. A broadening of themes:
   - Incorporation of emission and dispersion of toxic substances
   - Incorporation of resource extraction (cf. de Boo et al., 1991: Table 10)
2. A deepening of themes:
   - A more complete description of some physical flows (e.g. waste)
   - Exploring the linkages between environmental themes and changes in environmental quality, with the aim of constructing or showing effect indicators
   - Use of sustainability levels instead of policy targets in the formulation of environmental indicators

The robustness of the NAMEA-design to advances in knowledge on environmental issues and improvements in basic data collection implies that a regular compilation and publication can already start. When more or better data become available or a consensus is reached on an amendment of aggregation functions, this can then be implemented with the help of a revision strategy similar to the one followed in the core national accounts.

References

Boo A.J. de, P.R. Bosch, C.N. Gorter and S.J. Keuning, 1991, An environmental module and the complete system of national accounts. National Accounts Occasional Paper no. 46 (Netherlands Central Bureau of Statistics, Voorburg).

Born G.J. van den, A.F. Bouwman, J.G.J. Olivier and R.J. Swart, 1991, The emission of greenhouse gases in the Netherlands. National institute of public health and environmental protection report no 222901003. (RIVM, Bilthoven).

CBS, 1990a, Van gemeentewege ingezameld afval 1989 [Waste gathered by municipality 1989]. (Netherlands Central Bureau of Statistics, Voorburg).

CBS, 1990b, Environmental Statistics of the Netherlands 1990. (Netherlands Central Bureau of Statistics, SDU-publishers, Den Haag).

CBS, 1990c, Afvalstoffen voertuigwrakken 1989 [Waste from car wrecks 1989]. (Netherlands Central Bureau of Statistics, Voorburg).

CBS, 1990d, Het bezit en gebruik van bedrijfsvoertuigen 1989 [Ownership of vehicles for business purposes 1989]. (Netherlands Central Bureau of Statistics, Voorburg).

CBS, 1991a, Milieufacetten, cijfers bij de tweede nationale milieuverkenning 1991 [Environmental Data supporting the Second National Environmental Survey 1991]. (Netherlands Central Bureau of Statistics, Voorburg).

CBS, 1991b, Luchtverontreiniging procesemissies 1988 [Air pollution process emissions 1988]. (Netherlands Central Bureau of Statistics, Voorburg).

CBS, 1992a, Luchtverontreining, emissies privégebruik auto 1980-1990 [air pollution from passenger car use]. (Netherlands Central Bureau of Statistics, Voorburg).

CBS, 1992b, Luchtverontreiniging door wegverkeer 1980-1990 [air pollution from traffic 1980-1990]. (Netherlands Central Bureau of Statistics, Voorburg).

Heij G.J., T. Schneider, 1991, Dutch priority programme on acidification. (RIVM rapport no. 200-09).

Houghton, J.T., G.J. Jenkins and J.J. Ephraums, 1990. Climate Change, the IPCC Scientific Assessment. (Cambridge University Press, Cambridge/London).

Hueting R., P.R. Bosch, B. de Boer, 1992, Methodology for the calculation of sustainable national income. (The Netherlands Central Bureau of Statistics, Statistische Onderzoekingen M44, Voorburg).

IPCC, 1992. The supplementary reports to the IPCC Scientific Assessment. J.T. Houghton, B.A. Callander and S.K. Varney [eds]. (Cambridge University Press, Cambridge/London).

Keuning S.J., 1991, A proposal for a SAM which fits into the next System of National Accounts. Economic systems Research, Vol. 3, No 3.

Keuning S.J., 1992a, National Accounts and the environment, the case for a system's approach. National Accounts Occasional Paper no. 53 (Netherlands Central Bureau of Statistics, Voorburg).

Keuning S.J., 1992b, National Accounts, SAMs and SESAME: a System of Economic and Social Accounting Matrices and Extensions with an application tot the case of Indonesia. Paper presented at the Tenth International Conference on Input-output Techniques Sevilla, Spain.

Keuning S.J. and J. de Gijt, 1992, A National Accounting Matrix for the Netherlands. National Accounts Occasional Paper no. 59 (Netherlands Central Bureau of Statistics, Voorburg).

Netherlands Ministry of Agriculture, Fishery and Nature Protection, 1990, Bosbouwvoorlichting [forestry information] nr. 9 november 1990. (Ministerie van Landbouw, Visserij en Natuurbeheer, Den Haag).

Netherlands Ministry of Finance, 1992, Miljoenennota 1992 [Government Budget 1992]. (Ministerie van Financiën, Den Haag).
OECD, 1993, Environmental Indicators, In-depth analysis of Individual Indicators: Greenhouse Gas and CO_2 emissions [Draft]. (OECD, Environment Directorate, Environmental Policy committee, Paris).
Repetto R., and W. Cruz [eds], 1991, Accounts overdue, Natural Resource Depreciation in Costa Rica. (World Resources Institute, Washington).
Schneider T. and A.H.M. Bresser, 1988, Acidification research 1984-1988, Summary Report, Dutch Priority Programme on Acidification. (RIVM, Bilthoven; nr. 00-06).
Second Chamber, 1993, CFK's, Brief van de Minister van VROM (CFCs, Letter from the Minister of the Netherlands Ministry of Physical Planning and Environment). (Tweede Kamer [Second Chamber], Den Haag 1992-1993, 22835 nr. 2).
United Nations (UN), 1992, A revised system of National Accounts. (UN, New York).
VROM (Netherlands Ministry of Physical Planning and Environment), 1986, Indicatief meerjaren Programma Milieubeheer [Indicative environmental policy programme] 1987-1991. (VROM, Den Haag).
VROM, 1989, Nationaal milieubeleidsplan [National Environmental Policy Plan]. (VROM, Den Haag).
VROM, 1990, Nationaal Milieubeleidsplan-plus [Extended National Environmental Policy Plan]. (VROM, Den Haag).
VROM, 1991a, Essential Environmental Information. (VROM, Den Haag).
VROM, 1991b, Milieuprogramma 1991-1994, voortgangrapportage [Report on the progress of achieving environmental policy goals]. (VROM, Den Haag).
VROM, 1992a, Thema-Indicatoren voor het milieubeleid nr. 1992/9 [Theme related indicators supporting environmental policy 1992/9]. (VROM, Den Haag).
VROM, 1992b, CFC-Actionprogramme, Cooperation between government and industry, Annual Report 1991. (VROM, Den Haag). VROM, 1992c, Milieuprogramma (Environmental programme) 1993-1996, voortgangrapportage. (VROM, 's Den Haag).

ANNEX A. A disaggregated NAMEA 1989 (account 1-8 is billion guilders)

			1. GOODS AND SERVICES													2. CONSUMPTION		3. PRODUCTION							
			Product groups													Purposes		Production Activities							
			1a	1b	1c	1d	1e	1f	1g	1h	1i	1j	1k	1l	1m	2a	2b	3a	3b	3c	3d	3e	3f	3g	3h
1. GOODS AND SERVICES	Food, Beverages, Tobacco, Ores & Minerals	1a														0.00	47.27	15.20	0.01	0.74	0.01	49.97	0.08	0.11	0.28
	Textiles, Clothing & Leatherwear	1b														0.00	22.99	0.04	0.01	0.15	0.04	3.70	0.00	0.10	0.09
	Wood, Building Material, Paper, Printing & Publishing	1c														0.00	15.75	0.28	0.05	1.59	0.17	21.97	0.04	11.54	0.59
	Petroleum & Petroleum Products	1d														8.27	0.00	0.38	15.46	4.72	0.04	1.02	0.05	1.09	1.93
	Other Chemical Products	1e														0.00	10.50	1.22	0.03	14.81	0.20	11.25	0.10	2.39	0.07
	Metal and Other Manufacturing Products	1f														0.00	16.44	0.88	0.19	1.15	4.10	30.06	0.44	10.26	0.71
	Transport Equipment	1g														9.74	0.00	0.00	0.00	0.00	0.00	3.28	0.00	0.12	0.93
	Electricity, Gas, Water and Coal	1h														0.00	9.33	1.18	0.16	2.39	1.09	2.86	3.06	0.13	0.39
	Construction	1i														0.00	1.87	0.35	0.06	0.26	0.18	1.05	0.15	15.57	1.04
	Hotel, Restaurant & Repair Services	1j														0.00	20.07	0.03	0.04	0.18	0.02	1.01	0.04	0.64	0.97
	Transport and Storage Services	1k														0.00	5.14	0.00	0.06	0.11	0.01	0.51	0.00	0.29	1.78
	Other Goods and Services	1l														0.00	117.13	1.75	1.30	4.88	1.02	24.20	1.56	4.32	10.11
	Trade and Transport Margins	1m	23.30	9.92	12.48	2.87	11.27	24.03	4.85	0.17	0.00	0.00	0.00	0.00	-88.89										
2. CONSUMPTION	Transport	2a																							
	Other Purposes	2b																							
3. PRODUCTION	Agriculture	3a	39.43	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10										
	Refineries	3b	0.00	0.00	0.00	18.64	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.69	0.00										
	Chemical Industries	3c	0.19	1.58	0.28	0.78	42.27	0.10	0.00	0.11	0.00	0.00	0.00	1.31	0.77										
	Basic Metals	3d	0.00	0.01	0.02	0.06	0.04	10.42	0.01	0.15	0.00	0.00	0.00	0.36	0.05										
	Other Manufacturing	3e	74.32	8.18	41.69	0.70	8.08	49.79	16.43	0.16	2.60	0.00	0.00	11.28	4.05										
	Electricity Generation	3f	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.95	0.00	0.00	0.00	1.51	0.00										
	Construction	3g	0.00	0.00	0.06	0.00	0.00	0.06	0.05	0.00	70.62	0.00	0.20	1.04	0.44										
	Transport	3h	0.01	0.00	0.11	0.00	0.00	0.00	0.44	0.00	0.19	0.27	31.38	1.46	9.67										
	Services and Other Activities	3i	4.12	1.06	7.92	1.39	0.29	3.94	0.24	22.39	1.60	24.98	0.21	300.55	73.81										
4. INCOME GENERATION	Wages and Salaries	4a																1.46	0.54	5.44	1.70	35.39	1.50	13.96	11.76
	Employers' Social Contributions	4b																0.38	0.13	1.35	0.47	9.36	0.29	5.06	3.03
	Operating Surplus (Incl. Other Net Taxes on Production)	4c																13.67	0.56	6.76	1.32	16.70	0.72	5.38	4.20
5. INCOME DISTRIBUTION AND USE	Non-Financial Corporations	5a																							
	Financial Intermediairies	5b																							
	Insurance Corporations and Pension Funds	5c																							
	Government Including Social Security Funds	5d	4.77	3.78	2.83	6.20	1.87	5.39	4.51	1.63	7.26	2.56	-3.07	2.36											
	Households (Including Unincorporated Enterprises)	5e																							
6. CAPITAL		6																2.87	0.77	2.85	0.76	4.97	2.42	1.49	5.65
7. FINANCIAL BALANCE		7																							
8. REST OF THE WORLD	Current	8a	31.72	15.55	20.78	20.80	28.58	72.59	21.87	2.58	0.01			34.27											
	Capital	8b																							
9. EMISSIONS	CO2	9a																							
	N2O	9b																							
	CH4	9c																							
	CFCs and Halons	9d																							
	NOx	9e																							
	SO2	9f																							
	NH3	9g																							
	P	9h																							
	N	9i																							
	Waste	9j																							
10. THEMES	Greenhouse Effect (GWP)	10a																							
	Ozon Depletion (ODP)	10b																							
	Acidification (PAE)	10c																							
	Eutrophication (PEE)	10d																							
	Waste (mln KG)	10e																							
11. DEPOSITIONS	Acidification (PAE)	11																							
TOTAL			177.87	40.23	86.17	51.43	92.39	166.32	48.39	36.19	82.29	27.61	28.73	354.84	0.00	18.01	266.48	39.68	19.37	47.37	11.12	217.29	10.46	72.47	43.53

a) These data are available but not recorded in the NAMEA because the concomitant policy objectives have been formulated for emissions and not for depositions.

-: Data are not available.

3b	3i	4. INCOME GENERATION			5. DISTRIBUTION AND USE					6. CAPITAL	8. REST OF THE WORLD		9. EMISSIONS (in million kg, CFCs and halons in thousand kg)										10. THEMES					11. DEPOSITIONS	TOTAL
		Primary Income Categories			National Sectors						Current	Capital	CO2	N2O	CH4	CFCs & Halons	NOx	SO2	NH3	P	N	Waste	Greenhouse GWP	Depletion Ozone layer OPD	Acidification PAE	Eutrophication PEE	Waste mln KG	Acidification PAE	
3b	3i	4a	4b	4c	5a	5b	5c	5d	5e	6	8a	8b	9a	9b	9c	9d	9e	9f	9g	9h	9i	9j	10a	10b	10c	10d	10e	11	
0.28	8.75							0.12		-0.45	55.77																		177.87
0.09	1.07							0.00		0.83	11.20																		40.23
0.59	15.93							0.00		4.86	13.40																		86.17
1.93	2.36							0.00		-0.33	16.42																		51.43
0.07	5.46							0.00		1.52	44.85																		92.39
0.71	10.88							0.14		30.06	61.02																		166.32
0.93	5.08							0.00		15.11	14.14																		48.39
0.39	9.83							0.00		0.23	5.54																		36.19
1.04	12.02							0.00		48.43	1.31																		82.29
0.97	4.82							0.00		0.00	0.00																		27.81
1.78	1.60							0.01		0.00	19.21																		28.73
10.11	83.99							71.49		8.28	24.83																		354.84
																													0.00
									18.01				12833	0	4	0	132	3	0	0	39	162							18.01
									266.48				19300	2	9	3157	19	1	10	13	64	7064							266.48
													7511	24	393	0	13	1	230	127	1067	962							39.68
													10732	0	1	0	21	70	0	0	6	40							19.37
													19981	0	4	6313	44	27	8	19	25	3167							47.37
													6636	0	0	0	13	15	0	0	4	150							11.12
													13233	0	0	473	44	13	0	6	26	4024							217.29
													38452	1	2	0	78	43	0	0	23	146							10.46
													958	0	0	3157	9	1	0	0	3	3782							72.47
													7876	1	2	789	125	23	0	0	36	2294							43.53
													20507	5	155	1894	78	14	0	1	23	3674							442.50
11.76	127.03										1.12																		199.88
3.03	34.02																												54.09
4.20	86.56																												135.88
				83.10	38.18	6.37	0.82	0.25	1.11		11.67																		141.50
				-9.43	19.30	5.98	0.42	9.31	14.70		31.70																		71.98
				1.48	9.02	10.68	2.61	12.76	3.86		3.57																		43.98
				2.57	28.36	4.46	0.67	101.59	143.86	0.97	10.70																		333.28
		198.62	54.09	58.16	4.06	13.26	37.44	130.00	349.36		2.69																		847.68
5.65	33.10				25.33	4.95	1.95	-8.69	48.00	86.01		0.93																	213.36
										15.62		-15.62																	0.00
		1.26			17.25	26.28	0.07	16.29	2.30								109	101	24	a)	a)	-							312.21
										2.22	-16.91																		-14.69
																							158019						158019
																							33						33
																							570						570
																								15783					15783
											504														181				685
											166														146				312
											146														126				272
											a)															166			166
											a)															1316			1316
	10728										-																14737		25465
										1.02																			173199
										1.56																			12451
																												15918	15918
										2.83																			298
										2.94																			14737
										1.95																			15918
43.53	442.50	199.88	54.09	135.88	141.50	71.98	43.98	333.28	847.68	213.36	213.21	-14.69	158019	33	570	15783	685	312	272	166	1316	25465	173199	12451	15918	298	14737	15918	

Annex B. Compiling environmental data for the NAMEA

This annex presents an overview of data compilation procedures. References are provided for all (CBS and non-CBS) data used in this NAMEA.

1. Air emissions

Emission statistics for CO_2, SO_2 and NO_x have been derived from CBS publications. Most of the figures in CBS publications (e.g. CBS 1991b) are classified according to the Dutch standard industrial classification (SBI). These air polluting emissions are published on a regular basis and are divided into three categories:

1. **Process emissions** are only related to production activities and directly implementable in the NAMEA.
2. **Emissions from the combustion of fossil fuels** in stationary stations are caused by both production and consumption activities. Emissions from consumption activities are classified as 'other consumption purposes'.
3. **Mobile emissions** are related to a diversity of sources (household consumption and many production activities) and are not directly implementable in our module, because only part of the mobile emissions from production can be related to the production activity 'Transport' (SBI 7 excl. 7.7). A large proportion of all transportation occurs in the course of other production activities. Moreover, mobile emissions from private transport (household consumption) has to be separated from business related mobile-emissions. For emissions from mobile sources, the classification used is presented in table B.1.

Table B.1. Mobile sources.

Passenger Cars (emissions can be separated in those for production, consumption and foreign use)
Pick-up trucks
Lorries, Tractors and Buses
Special vehicles, Motor Cycles and Mopeds
Other Mobile Sources (inland navigation, railroad transport and air transport)

Emissions from mobile sources have to be re-arranged according to a SBI-classification. In the CBS-statistic 'air pollution from passenger car use' (CBS, 1992a) the emissions from passenger car use are divided into private- and business related. A further allocation of emissions due to business related passenger car use is based on a rough estimate, namely by using data concerning the destination of investments by type of asset. As data on Dutch emissions abroad were missing, foreign emissions have not been subtracted from Dutch emissions. It is thus assumed that these emissions cancel out[8].

With the help of the CBS publication 'Air pollution from road traffic' (CBS, 1992b), it is possible to allocate the emissions of CO_2, SO_2 and NO_x from passenger cars, pick-up trucks, lorries, tractors, special vehicles and buses to production activities (SBI-1 digit). The CBS-publication 'Ownership of vehicles for business purposes' (CBS, 1990d) gives the distribution among production activities of the ownership and average mileage of lorries, tractors, pick-ups, buses and special vehicles. Multiplying average mileage by the number of vehicles per category and per production activity gives us the mileage per vehicle category per production activity. With the help of this information, total emissions per vehicle type have been distributed among production activities. Mopeds and motor cycles are supposedly used for consumption purposes only, while the emissions from other mobile sources are assumed to be used by the production activity 'transport'. In tables B.2, B.3 and B.4 the allocation of mobile emissions is presented.

8. This could understate total Dutch emissions because foreign emissions from passenger cars in the Netherlands are probably less than Dutch emissions from passenger cars abroad.

Table B.2. An allocation of stationary and mobile CO_2 emissions to production activities and consumption purposes, 1989.

	Stationary	Mobile				Total
		Lorries and Tractors	Special Vehicles and Buses	Passenger Cars Pick Up Trucks And Other	Total	
	mln kg					
Agriculture	7000	193	2	316	511	7511
Manufacturing	49200	640	34	709	1382	50582
o.w. Oil Refineries	10700	15	1	16	32	10732
Chemical Ind.	19900	38	2	42	81	19981
Basic Metal Ind.	6600	17	1	18	36	6636
Other Manufacturing	12000	571	30	632	1233	13233
Electricity Generation	38400	3	4	46	52	38452
Construction	0	279	17	662	958	958
Transport	0	2725	461	4690	7876	7876
Services and Other	15700	1604	299	2904	4807	20507
Households	19300	0	0	12833	12833	32133
Total	129600	5444	816	21520	28419	158019

Table B.3. An allocation of stationary and mobile NO_x emissions to production activities and consumption purposes, 1989.

	Stationary	Mobile				Total
		Lorries and Tractors	Special Vehicles and Buses	Passenger Cars Pick Up Trucks And Other	Total	
	mln kg					
Agriculture	7	3	0	3	6	13
Manufacturing	104	11	0	6	17	121
o.w. Oil Refineries	20	0	0	0	0	21
Chemical Ind.	43	1	0	0	1	44
Basic Metal Ind.	12	0	0	0	0	13
Other Manufacturing	29	9	0	5	15	44
Electricity Generation	77	0	0	1	1	78
Construction	0	5	0	4	9	9
Transport	0	51	8	66	125	125
Services and Other	20	28	5	25	58	78
Households	19	0	0	132	132	151
Total	227	97	14	235	349	576

Table B.4. An allocation of stationary and mobile SO_2 emissions to production activities and consumption purposes, 1989.

	Stationary	Mobile				Total
		Lorries and Tractors	Special Vehicles and Buses	Passenger Cars Pick Up Trucks And Other	Total	
	mln kg					
Agriculture	1	0	0	0	0	1
Manufacturing	124	1	0	0	1	125
o.w. Oil Refineries	70	0	0	0	0	70
Chemical Ind.	27	0	0	0	0	27
Basic Metal Ind.	15	0	0	0	0	15
Other Manufacturing	12	1	0	0	1	13
Electricity Generation	43	0	0	0	0	43
Construction	0	0	0	1	1	1
Transport	0	3	0	20	23	23
Services and Other	10	2	0	2	4	14
Households	1	0	0	3	3	4
Total	179	6	1	26	32	211

The emission of greenhouse gases is largely determined by CO_2 emissions and in turn these originate from the use of carbon containing fuels (coal, gasoline and gas). This use can be divided into energetic and non-energetic use. Energetic use always leads to emissions, while non-energetic use only partly causes CO_2 emissions. The CBS statistics on CO_2 emissions are solely based on emissions from energetic use and the expected emissions of non-energetic use of carbon containing fuels, e.g. process emissions (CBS 1991b). On the other hand, the policy targets formulated by VROM are related to emission data in which all carbon containing fuels are translated into CO_2 emissions.

As the policy goal for the year 2000 is a 5 percent reduction of the 1989 emission level, this procentual reduction is used in the compilation of the indicator for the greenhouse effect. This implies that in the NAMEA for 1989, the indicator value for CO_2 is 1.05 by definition (cf. table 11 above).

Emissions of NH_3, N_2O and CH_4 are not yet published by the CBS. The emission data of ammonia (NH_3) are based on the allocation to target groups in VROM (1991a). Data from RIVM have been used for N_2O and CH_4 (Born et al., 1991). A re-classification of these data was needed for their implementation in the NAMEA. In the case of biogenic sources, natural emissions have been removed from our data.

2. CFCs, halons, carbon tetrachloride and 1,1,1-trichlorethane

Data on the direct emission of CFCs, halons, carbon tetrachloride and 1,1,1-trichlorethane in the Netherlands are not available, because only the use of these pollutants is restricted by the Montreal protocol.

Naturally, this use is strongly related to (future) emissions in the Netherlands; part of the use directly leads to emissions and another part is related to the replacement of fully depreciated CFC containing commodities (refrigerators, etc.). Therefore, the use of CFCs etc. has been utilized as a proxy for the emissions. The CFC-committee of the Ministry of Housing, Physical Planning and Environment registers the use of CFCs. Unfortunately, these data are not classified by production activities and only partly by goods and services. Because it was not possible to allocate each of the various types of CFCs, halons, etc. separately, only aggregate use was allocated. When converting these data into ozone depletion potentials it has been assumed that the share of each type was the same for all users. Moreover, these data are only available for the years 1986, 1990 and 1991 (VROM, 1992b). Data for the year 1989 were computed as an intrapolation of the figures for these years, and scaled to the ODP-totals for 1989 as given by VROM (1992a).

3. Acid-depositions

Information from RIVM on acid depositions (Trend-model, see Heij and Schneider, 1991) has been used for the compilation of acid-deposition data for the Netherlands. In order to make a calculation of acid exports in 1989, the export/emission quotas applied in a projection of deposition data by RIVM have been used. The import of acidifying substances was derived as a residual.

4. Eutrophication: P and N

N and P flows are strongly related to other emission data in the NAMEA. For instance, the P and N contents of waste (i.a. sewage sludge) are separately presented in the N and P emission data. The same is done for the N contents of some air pollutants: NO_x and NH_3.

Table B.5. The compilation of Eutrophication data

	Phosphorus Purific. Sludge	Other	Total	Nitrogen NOx	NH_3	Sewage Sludge	Other	Total
	mln kg P			mln kg N				
Agriculture	0	127	127	4	85	0	978	1067
Manufacturing	3	22	26	35	5	2	19	61
o.w. Oil Refineries	0	0	0	6	0	0	0	6
Chemical Ind.	1	18	19	12	5	1	7	25
Basic Metal Ind.	0	0	0	4	0	0	0	4
Other Manufact.	2	4	6	12	0	2	12	26
Electricity Generation	0	0	0	23	0	0	0	23
Construction	0	0	0	3	0	0	0	3
Transport	0	0	0	36	0	0	0	36
Services and Other	0	0	1	23	0	0	0	23
Consumption	4	9	13	45	0	2	56	103
Total	7	158	166	168	90	5	1053	1316

	Phosporus Other		Nitrogen Other	
	mln kg P		mln kg N	
Agriculture	Manure	94	Waste Water	3
	Fertilizer	33	Pesticides	3
			Crop remains	22
			Other	9
			Manure	529
			Fertilizer	412
Chemical Industry	Waste Water	15.5	Waste Water	7
	Chemical Waste	2.5		
Other Manufacturing			Food and Beverages Manufacturing	12
Services and Other	Waste Water	4		
Consumption	Waste (Water)	9	Waste (Water)	56
Total		158		1053

Eutrophicating substances are registered by the CBS (1990b) in Phosphorus and Nitrogen balance sheets that record the yearly accumulation of N and P. From these balance sheets the anthropogenic emission data were derived. The allocation of the N contents of NO_x and NH_3 has been based on NO_x and NH_3 emissions. The N-contents of NH_3 agricultural emissions have been corrected for double-counting because a part is already reflected in the Nitrogen balance sheets, namely in NH_3 emissions from manure.

5. Waste

The collection of data on waste occurs on a bi-annual basis. Therefore, several reference years have been used in the compilation of waste data. Most data on waste are gathered by CBS and RIVM.

Not all disposals can directly be registered as emissions from current consumption or production activities. A large amount of yearly generated waste comes from dredging sludge that is more or less polluted. Because this cannot be related to production or consumption activities in the reference year, dredging sludge is not incorporated in the module. Manure production from livestock is also excluded because it is not dumped on land-fill sites. The potential environmental impact of manure production is already reflected in other environmental themes (acidification and eutrophication). Only incinerated or dumped waste (net waste) is specified in the emission data (Table B.6). Waste that was recycled has been subtracted from the emission data because information concerning the absorption of these waste flows is not available by activity. Besides, these flows do not contribute to the waste accumulation problem.

Table B.6. Re-classification of (net) waste-data.

	Chemical Waste	Household Waste	Sewage Sludge*) Private	Sewage Sludge*) Public	Process Waste	Other Waste	Waste from Mobile Sources	Total Waste
mln kg								
Agriculture	0	0	0	0	0	960	2	962
Manufacturing	245	0	207	43	4312	2568	6	7381
o.w. Refineries	40	0	0	0	0	0	0	40
Chemical Ind.	180	0	51	9	359	2568	0	3167
Basic Metal Ind.	25	0	4	2	119	0	0	150
Other Manufact.	0	0	152	32	3834	0	5	4024
Electricity Generation	0	0	0	0	0	146	0	146
Construction	0	0	0	2	0	3774	6	3782
Transport	0	0	0	0	0	0	2294	2294
Services and Other	0	2040	12	25	638	939	20	3674
Households	0	6810	0	254	0	0	163	7226
Total	245	8850	219	324	4950	8387	2490	25465

*) Dry solids

Netherlands Central Bureau of Statistics
National Accounts Occasional Papers

NA/01 **Flexibility in the system of National Accounts**, Van Eck, R., C.N. Gorter and H.K. van Tuinen (1983).
This paper sets out some of the main ideas of what gradually developed into the Dutch view on the fourth revision of the SNA. In particular it focuses on the validity and even desirability of the inclusion of a number of carefully chosen alternative definitions in the "Blue Book", and the organization of a flexible system starting from a core that is easier to understand than the 1968 SNA.

NA/02 **The unobserved economy and the National Accounts in the Netherlands, a sensitivity analysis**, Broesterhuizen, G.A.A.M. (1983).
This paper studies the influence of fraud on macro-economic statistics, especially GDP. The term "fraud" is used as meaning unreporting or underreporting income (e.g. to the tax authorities). The conclusion of the analysis of growth figures is that a bias in the growth of GDP of more than 0.5% is very unlikely.

NA/03 **Secondary activities and the National Accounts: Aspecccts of the Dutch measurement practice and its effects on the unofficial economy**, Van Eck, R. (1985).
In the process of estimating national product and other variables in the National Accounts a number of methods is used to obtain initial estimates for each economic activity. These methods are described and for each method various possibilities for distortion are considered.

NA/04 **Comparability of input-output tables in time**, Al, P.G. and G.A.A.M. Broesterhuizen (1985).
It is argued that the comparability in time of statistics, and input-output tables in particular, can be filled in in various ways. The way in which it is filled depends on the structure and object of the statistics concerned. In this respect it is important to differentiate between coordinated input-output tables, in which groups of units (industries) are divided into rows and columns, and analytical input-output tables, in which the rows and columns refer to homogeneous activities.

NA/05 **The use of chain indices for deflating the National Accounts**, Al, P.G., B.M. Balk, S. de Boer and G.P. den Bakker (1985).
This paper is devoted to the problem of deflating National Accounts and input-output tables. This problem is approached from the theoretical as well as from the practical side. Although the theoretical argument favors the use of chained Vartia-I indices, the current practice of compilating National Accounts restricts to using chained Paasche and Laspeyres indices. Various possible objections to the use of chained indices are discussed and rejected.

NA/06 **Revision of the system of National Accounts: the case for flexibility**, Van Bochove, C.A. and H.K. van Tuinen (1985).
It is argued that the structure of the SNA should be made more flexible. This can be achieved by means of a system of a general purpose core supplemented with special modules. This core is a fully fledged, detailed system of National Accounts with a greater institutional content than the present SNA and a more elaborate description of the economy at the meso-level. The modules are more analytic and reflect special purposes and specific theoretical views.

NA/07 **Integration of input-output tables and sector accounts; a possible solution**, Van den Bos, C. (1985).
The establishment-enterprise problem is tackled by taking the institutional sectors to which the establishments belong into account during the construction of input-output tables. The extra burden on the construction of input-output tables resulting from this approach is examined for the Dutch situation. An adapted sectoring of institutional units is proposed for the construction of input-output tables.

NA/08 **A note on Dutch National Accounting data 1900-1984**, Van Bochove, C.A. (1985).
This note provides a brief survey of Dutch national accounting data for 1900-1984, concentrating on national income. It indicates where these data can be found and what the major discontinuities are. The note concludes that estimates of the level of national income may contain inaccuracies; that its growth rate is measured accurately for the period since 1948; and that the real income growth rate series for 1900-1984 may contain a systematic bias.

NA/09 **The structure of the next SNA: review of the basic options**, Van Bochove, C.A. and A.M. Bloem (1985).
There are two basic issues with respect to the structure of the next version of the UN System of National Accounts. The first is its 'size': reviewing this issue, it can be concluded that the next SNA should contain an integrated meso-economic statistical system. It is essential that the next SNA contains an institutional system without the imputations and attributions that pollute the present SNA. This can be achieved by distinguishing, in the central system of the next SNA, a core (the institutional system), a standard module for non-market production and a standard module describing attributed income and consumption of the household sector.

NA/10 **Dual sectoring in National Accounts**, Al, P.G. (1985).
Following a conceptual explanation of dual sectoring, an outline is given of a statistical system with complete dual sectoring in which the linkages are also defined and worked out. It is shown that the SNA 1968 is incomplete and obscure with respect to the links between the two sub-processes.

NA/11 **Backward and forward linkages with an application to the Dutch agro-industrial complex**, Harthoorn, R. (1985).
Some industries induce production in other industries. An elegant method is developed for calculating forward and backward linkages avoiding double counting. For 1981 these methods have been applied to determine the influence of Dutch agriculture in the Dutch economy in terms of value added and labour force.

NA/12 **Production chains**, Harthoorn, R. (1986).
This paper introduces the notion of production chains as a measure of the hierarchy of industries in the production process. Production chains are sequences of transformation of products by successive industries. It is possible to calculate forward transformations as well as backward ones.

NA/13 **The simultaneous compilation of current price and deflated input-output tables**, De Boer, S. and G.A.A.M. Broesterhuizen (1986).
A few years ago the method of compiling input-output tables underwent in the Netherlands an essential revision. The most significant improvement is that during the entire statistical process, from the processing and analysis of the basic data up to and including the phase of balancing the tables, data in current prices and deflated data are obtained simultaneously and in consistency with each other.

NA/14 **A proposal for the synoptic structure of the next SNA**, Al, P.G. and C.A. van Bochove (1986).

NA/15 **Features of the hidden economy in the Netherlands**, Van Eck, R. and B. Kazemier (1986).
This paper presents survey results on the size and structure of the hidden labour market in the Netherlands.

NA/16 **Uncovering hidden income distributions: the Dutch approach**, Van Bochove, C.A. (1987).

NA/17 **Main national accounting series 1900-1986**, Van Bochove, C.A. and T.A. Huitker (1987).
The main national accounting series for the Netherlands, 1900-1986, are provided, along with a brief explanation.

NA/18 **The Dutch economy, 1921-1939 and 1969-1985. A comparison based on revised macro-economic data for the interwar period**, Den Bakker, G.P., T.A. Huitker and C.A. van Bochove (1987).
A set of macro-economic time series for the Netherlands 1921-1939 is presented. The new series differ considerably from the data that had been published before. They are also more comprehensive, more detailed, and conceptually consistent with the modern National Accounts. The macro-economic developments that are shown by the new series are discussed. It turns out that the traditional economic-historical view of the Dutch economy has to be reversed.

NA/19 **Constant wealth national income: accounting for war damage with an application to the Netherlands, 1940-1945**, Van Bochove, C.A. and W. van Sorge (1987).

NA/20 The micro-meso-macro linkage for business in an SNA-compatible system of economic statistics, Van Bochove, C.A. (1987).

NA/21 Micro-macro link for government, Bloem, A.M. (1987).
This paper describes the way the link between the statistics on government finance and national accounts is provided for in the Dutch government finance statistics.

NA/22 Some extensions of the static open Leontief model, Harthoorn, R.(1987).
The results of input-output analysis are invariant for a transformation of the system of units. Such transformation can be used to derive the Leontief price model, for forecasting input-output tables and for the calculation of cumulative factor costs. Finally the series expansion of the Leontief inverse is used to describe how certain economic processes are spread out over time.

NA/23 Compilation of household sector accounts in the Netherlands National Accounts, Van der Laan, P. (1987).
This paper provides a concise description of the way in which household sector accounts are compiled within the Netherlands National Accounts. Special attention is paid to differences with the recommendations in the United Nations System of National Accounts (SNA).

NA/24 On the adjustment of tables with Lagrange multipliers, Harthoorn, R. and J. van Dalen (1987).
An efficient variant of the Lagrange method is given, which uses no more computer time and central memory then the widely used RAS method. Also some special cases are discussed: the adjustment of row sums and column sums, additional restraints, mutual connections between tables and three dimensional tables.

NA/25 The methodology of the Dutch system of quarterly accounts, Janssen, R.J.A. and S.B. Algera (1988).
In this paper a description is given of the Dutch system of quarterly national accounts. The backbone of the method is the compilation of a quarterly input-output table by integrating short-term economic statistics.

NA/26 Imputations and re-routeings in the National Accounts, Gorter, Cor N. (1988).
Starting out from a definition of 'actual' transactions an inventory of all imputations and re-routeings in the SNA is made. It is discussed which of those should be retained in the core of a flexible system of National Accounts. Conceptual and practical questions of presentation are brought up. Numerical examples are given.

NA/27 Registration of trade in services and market valuation of imports and exports in the National Accounts, Bos, Frits (1988).
The registration of external trade transactions in the main tables of the National Accounts should be based on invoice value; this is not only conceptually very attractive, but also suitable for data collection purposes.

NA/28 The institutional sector classification, Van den Bos, C. (1988).
A background paper on the conceptual side of the grouping of financing units. A limited number of criteria are formulated.

NA/29 The concept of (transactor-)units in the National Accounts and in the basic system of economic statistics, Bloem, Adriaan M. (1989).
Units in legal-administrative reality are often not suitable as statistical units in describing economic processes. Some transformation of legal-administrative units into economic statistical units is needed. This paper examines this transformation and furnishes definitions of economic statistical units. Proper definitions are especially important because of the forthcoming revision of the SNA.

NA/30 Regional income concepts, Bloem, Adriaan M. and Bas De Vet (1989).
In this paper, the conceptual and statistical problems involved in the regionalization of national accounting variables are discussed. Examples are the regionalization of Gross Domestic Product, Gross National Income, Disposable National Income and Total Income of the Population.

NA/31 **The use of tendency surveys in extrapolating National Accounts**, Oudde-ken, Frank and Gerrit Zijlmans (1989).
This paper discusses the feasibility of the use of tendency survey data in the compilation of very timely Quarterly Accounts. Some preliminary estimates of relations between tendency survey data and regular Quarterly Accounts-indicators are also presented.

NA/32 **An economic core system and the socio-economic accounts module for the Netherlands**, Gorter, Cor N. and Paul van der Laan (1989).
A discussion of the core and various types of modules in an overall system of economy related statistics. Special attention is paid to the Dutch Socio-economic Accounts. Tables and figures for the Netherlands are added.

NA/33 **A systems view on concepts of income in the National Accounts**, Bos, Frits (1989).
In this paper, concepts of income are explicitly linked to the purposes of use and to actual circumstances. Main choices in defining income are presented in a general system. The National Accounts is a multi-purpose framework. It should therefore contain several concepts of income, e.g. differing with respect to the production boundary. Furthermore, concepts of national income do not necessarily constitute an aggregation of income at a micro-level.

NA/34 **How to treat borrowing and leasing in the next SNA**, Keuning, Steven J. (1990).
The use of services related to borrowing money, leasing capital goods, and renting land should not be considered as intermediate inputs into specific production processes. It is argued that the way of recording the use of financial services in the present SNA should remain largely intact.

NA/35 **A summary description of sources and methods used in compiling the final estimates of Dutch National Income 1986**, Gorter, Cor N. and others (1990).
Translation of the inventory report submitted to the GNP Management Committee of the European Communities.

NA/36 **The registration of processing in make and use tables and input-output tables**, Bloem, Adriaan M., Sake De Boer and Pieter Wind (1993).
The registration of processing is discussed primarily with regard to its effects on input-output-type tables and input-output quotes. Links between National Accounts and basic statistics, user demands and international guidelines are examined. Net recording is in general to be preferred. An exception has to be made when processing amounts to a complete production process, e.g. oil refineries in the Netherlands.

NA/37 **A proposal for a SAM which fits into the next System of National Accounts**, Keuning, Steven J. (1990).
This paper shows that all flow accounts which may become part of the next System of National Accounts can be embedded easily in a Social Accounting Matrix (SAM). In fact, for many purposes a SAM format may be preferred to the traditional T-accounts for the institutional sectors, since it allows for more flexibility in selecting relevant classifications and valuation principles.

NA/38 **Net versus gross National Income**, Bos, Frits (1990).
In practice, gross figures of Domestic Product, National Product and National Income are most often preferred to net figures. In this paper, this practice is challenged. Conceptual issues and the reliability of capital consumption estimates are discussed.

NA/39 **Concealed interest income of households in the Netherlands; 1977, 1979 and 1981**, Kazemier, Brugt (1990).
The major problem in estimating the size of hidden income is that total income, reported plus unreported, is unknown. However, this is not the case with total interest income of households in the Netherlands. This makes it possible to estimate at least the order of magnitude of this part of hidden income. In this paper it will be shown that in 1977, 1979 and 1981 almost 50% of total interest received by households was concealed.

NA/40 **Who came off worst: Structural change of Dutch value added and employment during the interwar period**, Den Bakker, Gert P. and Jan de Gijt (1990).
In this paper new data for the interwar period are presented. The distribution of value added over industries and a break-down of value added into components is given. Employment by industry is estimated as well. Moreover, structural changes during the interwar years and in the more recent past are juxtaposed.

NA/41 **The supply of hidden labour in the Netherlands: a model**, Kazemier, Brugt and Rob van Eck (1990).
This paper presents a model of the supply of hidden labour in the Netherlands. Model simulations show that the supply of hidden labour is not very sensitive to cyclical fluctuations. A tax exempt of 1500 guilders for second jobs and a higher probability of detection, however, may substantially decrease the magnitude of the hidden labour market.

NA/42 **Benefits from productivity growth and the distribution of income**, Keuning, Steven J. (1990).
This paper contains a discussion on the measurement of multifactor productivity and sketches a framework for analyzing the relation between productivity changes and changes in the average factor remuneration rate by industry. Subsequently, the effects on the average wage rate by labour category and the household primary income distribution are studied.

NA/43 **Valuation principles in supply and use tables and in the sectoral accounts**, Keuning, Steven J. (1991).
In many instances, the valuation of transactions in goods and services in the national accounts poses a problem. The main reason is that the price paid by the purchaser deviates from the price received by the producers. The paper discusses these problems and demonstrates that different valuations should be used in the supply and use tables and in the sectoral accounts.

NA/44 **The choice of index number formulae and weights in the National Accounts. A sensitivity analysis based on macro-economic data for the interwar period**, Bakker, Gert P. den (1991).
The sensitivity of growth estimates to variations in index number formulae and weighting procedures is discussed. The calculations concern the macro-economic variables for the interwar period in the Netherlands. It appears, that the use of different formulae and weights yields large differences in growth rates. Comparisons of Gross Domestic Product growth rates among countries are presently obscured by the use of different deflation methods. There exists an urgent need for standardization of deflation methods at the international level.

NA/45 **Volume measurement of government output in the Netherlands; some alternatives**, Kazemier, Brugt (1991).
This paper discusses three alternative methods for the measurement of the production volume of government. All methods yield almost similar results: the average annual increase in the last two decades of government labour productivity is about 0.7 percent per full-time worker equivalent. The implementation of either one of these methods would have led to circa 0.1 percentage points higher estimates of economic growth in the Netherlands.

NA/46 **An environmental module and the complete system of national accounts**, Boo, Abram J. De, Peter R. Bosch, Cor N. Gorter and Steven J. Keuning (1991).
A linkage between environmental data and the National Accounts is often limited to the production accounts. This paper argues that the consequences of economic actions on ecosystems and vice versa should be considered in terms of the complete System of National Accounts (SNA). One should begin with relating volume flows of environmental matter to the standard economic accounts. For this purpose, a so-called National Accounting Matrix including Environmental Accounts (NAMEA) is proposed. This is illustrated with an example.

NA/47 **Deregulation and economic statistics: Europe 1992**, Bos, Frits (1992). The consequences of deregulation for economic statistics are discussed with a view to Europe 1992. In particular, the effects of the introduction of the Intrastat-system for statistics on international trade are investigated. It is argued that if the Statistical Offices of the EC-countries do not respond adequately, Europe 1992 will lead to a deterioration of economic statistics: they will become less reliable, less cost effective and less balanced.

NA/48 **The history of national accounting**, Bos, Frits (1992). At present, the national accounts in most countries are compiled on the basis of concepts and classifications recommended in the 1968-United Nations guidelines. In this paper, we trace the historical roots of these guidelines (e.g. the work by King, Petty, Kuznets, Keynes, Leontief, Frisch, Tinbergen and Stone), compare the subsequent guidelines and discuss also alternative accounting systems like extended accounts and SAMs.

NA/49 **Quality assessment of macroeconomic figures: The Dutch Quarterly Flash**, Reininga, Ted, Gerrit Zijlmans and Ron Janssen (1992). Since 1989-IV, the Dutch Central Bureau of Statistics has made preliminary estimates of quarterly macroeconomic figures at about 8 weeks after the end of the reference quarter. Since 1991-II, a preliminary or "Flash" estimate of GDP has been published. The decision to do so was based on a study comparing the Flash estimates and the regular Quarterly Accounts figures, which have a 17-week delay. This paper reports on a similar study with figures through 1991-III.

NA/50 **Quality improvement of the Dutch Quarterly Flash: A Time Series Analysis of some Service Industries**, Reininga, Ted and Gerrit Zijlmans (1992). The Dutch Quarterly Flash (QF) is, just like the regular Quarterly Accounts (QA), a fully integrated statistic based on a quarterly updated input-output table. Not all short term statistics used to update the QA's IO-table are timely enough to be of use for the QF, so other sources have to be found or forecasts have to be made. In large parts of the service industry the latter is the only possibility. This paper reports on the use of econometric techniques (viz. series decomposition and ARIMA modelling) to improve the quality of the forecasts in five parts of the service industry.

NA/51 **A Research and Development Module supplementing the National Accounts**, Bos, Frits, Hugo Hollanders and Steven Keuning (1992). This paper presents a national accounts framework fully tailored to a description of the role of Research and Development (R&D) in the national economy. The framework facilitates to draw macro-economic conclusions from all kinds of data on R&D (also micro-data and qualitative information). Figures presented in this way can serve as a data base for modelling the role of R&D in the national economy.

NA/52 **The allocation of time in the Netherlands in the context of the SNA; a module**, Kazemier, Brugt and Jeanet Exel (1992). This paper presents a module on informal production, supplementing the National Accounts. Its purpose is to incorporate informal production into the concepts of the SNA. The relation between formal and informal production is shown in the framework of a Social Accounting Matrix (SAM). To avoid a controversial valuation of informal production, the module constists of two SAMs. One expressed in actual prices with informal labour valued zero, and one which expresses the embedded informal labour input measured in terms of hours worked.

NA/53 **National Accounts and the environment: the case for a system's approach**, Keuning, Steven J. (1992). The present set of main economic indicators should be extended with one or a few indicators on the state of the environment. This paper lists various reasons why a so-called Green Domestic Product is not suitable for this purpose. Instead, a system's approach should be followed. A National Accounting Matrix including Environmental Accounts (NAMEA) is presented and the way to derive one or more separate indicators on the environment from this information system is outlined.

NA/54 **How to treat multi-regional units and the extra-territorial region in the Regional Accounts?**, De Vet, Bas (1992).
This paper discusses the regionalization of production and capital formation by multi-regional kind-of-activity units. It also examines the circumstances in which a unit may be said to have a local kind-of-activity unit in the extra-territorial region and what should be attributed to this "region".

NA/55 **A historical Social Accounting Matrix for the Netherlands (1938)**, Den Bakker, Gert P., Jan de Gijt and Steven J. Keuning (1992).
This paper presents a Social Accounting Matrix (SAM) for the Netherlands in 1938, including related, non-monetary tables on demographic characteristics, employment, etc. The distribution of income and expenditure among household subgroups in the 1938 SAM is compared with concomittant data for 1987.

NA/56 **Origin and development of the Dutch National Accounts**, Den Bakker, Gert P. (1992).
This paper describes the history of national accounting in the Netherlands. After two early estimates in the beginning of the nineteenth century, modern national accounting started in the 1930s on behalf of the Tinbergen model for the Dutch economy. The development spurred up after World War II to provide data to the government for economic planning purposes. In the 1980s, the development was towards a flexible and institutional approach.

NA/57 **Compiling Dutch Gross National Product (GNP); summary report on the final estimates after the revision in 1992**, Bos, Frits (1992).
This summary report describes the sources and methods used for compiling the final estimate of Dutch Gross National Product after the revision of the Dutch National Accounts in 1992. Attention is focused on the estimation procedures for 1988. A more extensive report is also available.

NA/58 **Major changes and results of the revision of the Dutch National Accounts in 1992**, Department of National Accounts (1992, forthcoming).
The revision in 1992 has improved the Dutch National Accounts in three ways. First, new and other data sources have been used, like Production statistics of service industries, the Budget Survey and Statistics on fixed capital formation. Secondly, the integration process has been improved by the use of detailed make- and use-tables instead of more aggregate input-output tables. Thirdly, several changes in bookkeeping conventions have been introduced, like a net instead of a gross registration of processing to order.

NA/59 **A National Accounting Matrix for the Netherlands**, Keuning, Steven and Jan de Gijt (1992).
Currently, the national accounts typically use two formats for presentation: matrices for the Input-Output tables and T-accounts for the transactions of institutional sectors. This paper demonstrates that presently available national accounts can easily be transformed into a National Accounting Matrix (NAM). This may improve both the transparency and analytic usefulness of the complete set of accounts.

NA/60 **Integrated indicators in a National Accounting Matrix including environmental accounts (NAMEA); an application to the Netherlands**, De Haan, Mark, Steven Keuning and Peter Bosch (1993).
In this paper, environmental indicators are integrated into a National Accounting Matrix including Environmental Accounts (NAMEA) and are put on a par with the major aggregates in the national accounts, like National Income. The environmental indicators reflect the goals of the environmental policy of the Dutch government. Concrete figures are presented for 1989. The NAMEA is optimally suited as a data base for modelling the interaction between the national economy and the environment.

NA/61 **Standard national accounting concepts, economic theory and data compilation issues; on constancy and change in the United Nations-Manuals on national accounting (1947, 1953, 1968 and 1993)**, Bos, Frits (1993).
In this paper, the four successive guidelines of the United Nations on national accounting are discussed in view of economic theory (Keynesian analysis, welfare, Hicksian income, input-output analysis, etc.) and data compilation issues (e.g. the link with concepts in administrative data sources). The new guidelines of the EC should complement those of the UN and be simpler and more cost-efficient. It should define a balanced set of operational concepts and tables that is attainable for most EC countries within 5 years.

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