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LINKS BETWEEN WATER ACCOUNTING AND UNSD/UNEP AND OECD/EUROSTAT QUESTIONNAIRES ON WATER RESOURCES – TOWARDS THE HARMONIZATION OF WATER STATISTICS AND ACCOUNTING

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[1] The views expressed in this paper reflect the opinions of the authors only and do not necessarily reflect those of the United Nations. The paper was also presented at the Work Session on Water Statistics (Vienna, 20-22 June 2005).

Abstract

With the international mandate to align environmental accounting and environment statistics and the on-going work on the handbook on "Integrated Environmental and Economic Accounting for Water Resources", the United Nations Statistics Division (UNSD) has undertaken an analysis of the commonalities and differences between the information required in water accounting and that collected the UNSD/UNEP and OECD/Eurostat Questionnaires on water resources. The analysis focused on two main questions: (a) the consistency of concepts and definitions; and (b) the information overlaps and gaps between water statistics and accounting. The results of this analysis showed that the information on water resources collected by the two Questionnaires is in general conceptually consistent with that in water accounts albeit with some minor differences in terminology and definitions. This consistency is largely the result of the effort to align environment statistics and accounting during the last revision of the OECD/Eurostat Questionnaire.

One of the reasons why water statistics and accounting have been developed in an independent manner has been the consideration that water statistics covers a larger range of statistics as compared to water accounting. The analysis showed that there is very little additional information collected by the water statistics questionnaires which is not included in the accounting tables. Moreover, to address this issue and to design a framework which meets the users needs, the handbook on Integrated Environmental and Economic Accounting for Water Resources, which is currently being finalized by UNSD in cooperation with the London Group, introduced supplementary tables to present water statistics not directly related to the accounting framework (e.g. information on the access to water and sanitation) without violating the concepts and classification of the accounts. Presenting all water-related information in a common framework would allow for consistent analyses and scenario modelling. For example, an analysis of the impact of investing in water infrastructure on the number of people having access to safe drinking water could be easily undertaken if the information is organized according to the accounting framework. The analysis also showed that with some additional information simplified accounting tables can be compiled.

Aligning water statistics and accounting has analytical and statistical advantages for countries at different stages of development of environment statistics. For countries in the process of establishing a programme in water statistics compiling water statistics using water accounting as the guiding framework would minimize future efforts of integrating water statistics with economic accounts. For countries with an already established water statistics programme, the alignment of water statistics and water accounting would reduce duplication of data gathering, improve data quality and be more responsive to users' needs. Aware of these facts and urged by countries' requests, the UNSD's strategy is to mainstream water accounting.

1. Introduction

Environmental accounting and environment statistics have developed in parallel tracks and have often been considered separate areas of statistics using different concepts and definitions and responding to different policy objectives. Although both environment statistics and environmental accounting are two new and emerging areas of statistics, environment statistics has a much longer history than environmental-economic accounting. Many countries started compiling environment statistics as early as 1970s and OECD started data collection activities through questionnaires in the 1980s. Environment statistics are often collected with a particular regulatory or administrative purpose in mind. They are usually developed in individual sets and often their definition and classification respond to specific policy concerns.

Environmental-economic accounting is a much newer area of statistics which has come to the attention of statisticians in the early 1990s. In 1993 the handbook of national accounting *Integrated Environmental and Economic Accounting* was published as an interim report and as a result, countries started experimenting with the implementation of environmental accounting. Since 1993 a lot of experience through country case studies was gathered and consensus on best practices for selected SEEA modules was reached. The revision of the handbook of national accounting *Integrated Environmental and Economic Accounting*[2], commonly referred to as SEEA-2003, resulted in a convergence of methodologies and describes best practices in environmental accounting. Selected modules are now fairly well developed in OECD and some developed countries and are compiled on regular basis. Limited data collection is carried out by Eurostat on selected standard tables (e.g. hybrid accounts for air emissions, also referred to as NAMEA Air, etc.) in parallel to the environment statistics data collection carried out through the OECD/Eurostat questionnaire.

The SEEA-2003 has identified the need for bringing the development of basic environment statistics closer to the concepts, definitions and classifications of environmental-economic accounting, which would allow for the incorporation of the environment statistics directly into the accounting framework. Linking the environment statistics to the accounting framework would introduce checks and balances in the data and produce a consistent data system from individual sets of environment statistics. In addition, the implementation of such an integrated system achieves consistency across time. This is of outmost importance in developing comparable time series estimates which are necessary for the policy process. The consistency of environmental information with the economic information of the SNA adds considerable value to both the environmental and economic information as it improves the quality of both environment and economic statistics. Lastly, it significantly improves the likelihood that environmental information is considered more fully in economic decision-making process. The SEEA should thus be regarded as a guiding framework for the development of environmental information systems compatible with economic statistics (SEEA-2003 para 1.108).

After the finalization of the SEEA-2003, countries felt that it was timely to focus efforts on elevating environmental accounting to the level of official statistics, mainstream it in national statistical offices and promote its uses in the users' community. In 2005, the UN Statistical Commission approved the creation of the UN Committee on Environmental-Economic Accounting, a strategic body responsible for brining forward the above objectives. The following five main elements of work identified for the UN Committee include:

[2] The handbook of National Accounting *Integrated Environmental and Economic Accounting*, SEEA-2003 will be jointly published by the United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, and the World Bank. It is available, as final draft prior to official editing, on-line at http://unstats.un.org/unsd/envAccounting/seea2003.pdf.

(a) *Coordination*: It was felt that a stronger coordination, in particular among the international agencies active in the environmental field, would be necessary in order to raise the profile of environmental accounting;

(b) *Promotion of the accounts:* Since environmental accounting is a new area of statistics, the United Nations Statistical Commission underscored the need for raising awareness of the uses of the accounts through the promotion of environmental-economic analysis and formulating international priorities based on canvassing users' needs.

(c) *Methodological research:* The SEEA 2003 is a handbook of best practices. When a consensus could not be reached, a list of options, rather than a single recommendation, was presented. The UN Committee should develop a research agenda to reach a consensus on those issues where enough experience exist and to further research on more controversial issues.

(d) *Technical Cooperation:* With the publication of the SEEA, it was considered timely to develop an implementation strategy in countries. The Committee would play a role in coordinating development of training material and foster exchanges of best practices as well as maintaining a list of on-going country projects so as to avoid duplication of efforts.

(e) *Harmonization of data collection activities with environmental accounting concepts and definitions*. It was considered important that environment statistics becomes firmly aligned with environmental accounting.

The international mandate to align environment statistics and accounting and the on-going work on the handbook on *Integrated Environmental and Economic Accounting for Water Resources* have prompted UNSD to undertake an analysis of the links between water statistics questionnaires and water accounting. .

As a first step, the analysis focused on the UNSD/UNEP and the OECD/Eurostat Questionnaires on water resources. The two Questionnaires were analysed together as they have similar objectives and coverage and use very similar concepts and definitions. The UNSD/UNEP questionnaire is, in fact, a simplification of the OECD/Eurostat questionnaire. It is intended for non-OECD countries, which often do not have a well established programme of environment statistics. The results of this analysis are presented in this paper. In a second stage, also information collected by other international water questionnaires will be compared with that required in the water accounting framework. Similar analyses linking other topics in the environment statistics questionnaires with the accounting tables would be undertaken in the future.

The analysis presented in this paper focuses on two questions:

(a) Consistency of definitions. Are the definitions used water statistics consistent with those used in water accounting?

(b) Information overlaps and gaps. Can the water accounting tables be compiled with information directly derived from the environment statistics questionnaires of UNSD/UNEP and OECD/Eurostat? Do the water statistics questionnaires collect information which is not included in the water accounting framework? And if yes, what variables? Conversely, do water accounting tables require additional information that is not currently complied by the water statistics questionnaires? What variables?

Section 2 of this note describes briefly the water accounting framework and the activities of UNSD in this area. Section 3 addresses the issue of consistency between the concepts and definitions used in water accounting and the Questionnaires. Section 4 presents the results of the analysis of overlaps and gaps of information. In particular, this section presents simplified water accounting tables showing the

part that can be compiled with the information derived from the Questionnaires. Section 5 will discuss the conclusions of this analysis.

2. Water resource accounting

Integrated environmental and economic accounting for water resources (SEEAW) is an information system which organizes hydrological and economic information related to water according to the framework of the System of National Accounts (SNA) while not violating the fundamental concepts of hydrology.

Organizing hydrologic and economic information according to the SNA has several statistical and analytical advantages. It allows for

- Performing checks and balances on the information on water;
- Mainstreaming water issues into economic policies;
- Enabling policy makers to formulate integrated water resource management plans which take into consideration competing uses including the environmental requirements;
- Evaluating the impact of economic policies on water resources and the impact of water policies on the economy;
- Deriving mutually consistent indicators which can be used for monitoring water resources and their uses.

UNSD is currently finalizing a handbook on *Integrated Environmental and Economic Accounting for Water Resources*[3], commonly referred to as SEEAW, which represents a major step forward in the harmonization of the methodologies in water accounting. As opposed to other handbooks of national accounting, the SEEAW presents a set of standard simplified tables which reflect priority areas for countries which are implementing the accounts. The tables can be further disaggregated according to countries' data availability and policy concerns.

Once the handbook is finalized, UNSD's activities will focus on the promotion and implementation of water accounts in as many countries as possible.

The SEEAW consists of the following set of accounts:

(a) Supply and use tables in physical and monetary units

Physical supply and use table provide information on the volumes of water exchanged between the environment and the economy (abstractions and returns) and within the economy (supply and use within the economy).

Monetary supply and use tables provide information on the costs associated with water use and supply such as water abstraction, purification, distribution, treatment etc. They also provide information on financing that is on the extent users pay for the services of access to and treatment of water and on the extent these services are subsidized by the government. They are particularly useful for cost-recovery policies and water-allocation policies. These accounts can also be compiled for activities aimed at the protection and management of water resources so as to obtain information on the expenditures by industries, households and the government on protecting and managing water resources.

[3] The handbook has been prepared in cooperation with the London Group on Environmental Accounting.

(b) Emission Accounts

Emission accounts provide information by industry and households on the amount of pollutants which are added to or removed from (by treatment processes) water during use. Even though they are usually compiled in physical units, they can also be compiled in monetary units using the maintenance cost approach to obtain information on the cost that one would have had to incur during the accounting period in order to avoid current and future environmental deterioration from the impacts caused during the accounting period.

(c) Asset accounts

Asset accounts measure stocks at the beginning and end of the accounting period and record the changes in stocks that occur during the period. They describe all increases and decreases of the stock due to natural causes (e.g. precipitation, evapo-transpiration, inflows and outflows) and human activities (e.g. abstraction and returns). They are particularly useful as they link water abstraction and return to the availability of water in the environment thus allowing measurements of physical water pressure induced by the economy. The value of the stock of water can be calculated, similarly to other natural resources, as the net present value of the future income stream generated from the sale of the asset. Since water is often an open access resource, the resource rent is often zero. Increasingly water is being treated as an economic good, it is therefore expected that in the future the resource rent for water would be positive and thus value of the water stocks would be included in the balance sheets of a nation.

(d) Quality accounts

They are asset accounts that instead of describing water resources in terms of quantity, they describe them in terms of quality. They show stocks of water of a certain quality at the beginning and end of an accounting period. Since it is in general difficult to link changes in quality to the causes that affect it, quality accounts describe only the total change in an accounting period without further specifying the causes.

The modular structure of the water accounts allows for a step-by-step compilation. Countries may wish to start with the compilation of those modules of the accounts which are more relevant to their policy concerns and data availability.

Selected modules of the accounts have been compiled by approximately 25 countries including Australia, the Republic of Moldova, South Africa, Chile, Namibia, Botswana, Morocco and most of European countries. European countries have benefited from the support of Eurostat, which has developed and collected pilot standard tables compiled by many EU countries. The results of the pilot case studies have been published in *Water Accounts – Results of Pilot Studies* (Eurostat 2002).

In general, countries have started the implementation of water accounts with those modules which are more related to their policy concerns and their data availability. For example, countries facing severe water scarcity often have started with the compilation of asset accounts and physical supply and use tables to identify sources of pressure on the environment and possibly design allocation strategy between competing uses of water. On the other side, resource based rich countries facing problems with water pollution have often started with emission accounts, monetary supply and use tables which allow for the formulation of policies aimed at reducing the emission to water resources and evaluate the costs for their reductions.

3. Consistency of definitions

The concepts used in the UNSD/UNEP and OECD/Eurostat Questionnaires on water resources are in general consistent with those used in water accounts. This is mostly due to two parallel initiatives

aimed at the reconciliation of the Questionnaires with water accounting. One was undertaken by Eurostat during the last revision of the OECD/Eurostat Questionnaire, and the other was undertaken by UNSD during the preparation of the handbook on *Integrated Environmental and Economic Accounting for Water Resources (SEEAW).*

In particular, the UNSD's effort to reconcile the water statistics and accounting started during the preparation of the section of water accounts for the SEEA-2003 and, more recently, of the handbook on water accounting. Both initiatives revealed the need for a precise and well-defined terminology. The review of existing literature on water accounts and more in general on water issues, demonstrated that the terminology related to water is not used consistently. The same term is often used to refer to different concepts, and same concept is referred to with different terms. In addition to these problems, the lack of glossaries accompanying publications makes it difficult to interpret unambiguously the terms used.

In particular for water accounting, which is multidisciplinary and spans across different fields such as hydrology, national accounting, and environment statistics, it is of great importance to use a clear terminology which is consistent with the specific terminologies of each field. Hydrologists, national accountants and environment statisticians need to be able to communicate using a common language.

The result of the extensive review of terms and definitions used in hydrology, water statistics and accounting[4] is the glossary of the SEEAW. In 2001, an Electronic Discussion Group (EDG) on Terms and Definitions used in Water Accounting prepared in cooperation with the United Nations Division for Sustainable Development was launched with the objectives to agree on terms and definitions relevant to water accounts.

The EDG mostly focused on hydrological terms and definitions used in the physical flow and hybrid flow accounts as the terms and definitions used in national accounts are standardized and available in the 1993 SNA on-line glossary[5]. The EDG contained for each term a suggested definition and a list of other definitions from international questionnaires (including the UNSD/UNEP and OECD/Eurostat Questionnaires), international glossaries and selected country reports on water accounts. Wherever possible the suggested definition coincided with an existing one so as not to create additional definitions. In those cases in which it was not possible to use existing definitions, the reasons for introducing new ones were explained. In addition, the EDG included for each terms a definition a section entitled "Points for discussion" which compared the definitions used and raised issues for comments.

Table 1 presents a selected list of terms for which the most significant differences between water accounting and water statistics still exists. For each term, the table presents the definitions from the questionnaires and water accounting and a brief explanation of the differences. A complete and detailed list of terms and definitions used in water accounts and in the UNSD/UNEP and OECD/Eurostat questionnaires has also been prepared and is available upon requested from the authors of the paper.

[4] The EDG was based in particular on the review of the following glossaries: 2001 UNSD Questionnaire on Water Resources, 2002 Joint OECD/Eurostat Questionnaire on Water Resources, 2001 FAO/AQUASTAT Questionnaire, UNESCO/WMO International glossary of hydrology, 2nd edition, 1992, FAO/AQUASTAT On-line Glossary, Working copy of the Terminology of Water Management: Flood Protection TERMDAT, United Nations, 1997. Glossary of Environment Statistics. Studies in Methods, Series F, No. 67.

[5] www.unstat.un.org.

Table 1: Differences in terms and definitions used in UNSD/UNEP and OECD/Eurostat questionnaires and in water accounts

Term and definition in the UNSD/UNEP Questionnaire	Term and definition in the OECD/Eurostat Questionnaire	Term and definition in water accounting	Difference
Total Water abstraction Water removed from any source, either permanently or temporarily, during a specified period of time. Mine water and drainage water are included. Water abstractions from ground water resources in any given time period are defined as the difference between the total amount of water withdrawn from aquifers and the total amount charged artificially or injected into aquifers. The amounts of water artificially charged or injected are attributed to abstractions from that water resource from which they were originally withdrawn. Water used for hydroelectricity generation is an in-situ use and should be excluded.	**Gross water abstraction (= water withdrawal)** Water removed from any source, either permanently or temporarily. Mine water and drainage water are included. Water abstractions from groundwater resources in any given time period are defined as the difference between the total amount of water withdrawn from aquifers and the total amount charged artificially or injected into aquifers. Water abstractions from precipitation (e.g. rain water collected for use) should be included under abstractions from surface water. The amounts of water artificially charged or injected are attributed to abstractions from that water resource from which they were originally withdrawn. Water used for hydroelectricity generation is an in-situ use and should be excluded.	**Total abstraction** Amount of water removed from any source either permanently or temporarily in a given period of time for consumption and production activities. Water used for hydroelectricity generation is considered as part of water abstraction. Total water abstraction can be broken down according to the type of source (i.e. Water Resources and Other sources) and the type of use.	1) In water accounts abstraction from groundwater is NOT defined as the difference between water abstracted and that artificially recharged into the aquifer as these flows are recorded separately. The artificial recharge of water into aquifer is considered as a flow from the economy to the environment hence is recorded as a return flow. 2) In water accounts abstraction include the amount of water used for hydroelectric power generation as this is often a competing use of water which need to be taken into consideration for allocation purposes. This quantity is explicitly identified so as to avoid over overshadowing the total water use with water used for hydroelectric power generation, given its magnitude as compared to other flows. Water used in hydroelectric power generation is considered abstracted and immediately returned into the environment. 3) Water abstraction from precipitation is NOT recorded in the accounts abstraction from surface water (except in the case of rainfed agriculture), but in the abstraction from other sources.
Total reuse of fresh water Fresh water that has undergone waste water treatment and is deliverable to a user as reclaimed waste water. This means the direct supply of treated effluent to the user. Excluded is waste water discharged into a watercourse and used again downstream. Recycling within industrial sites is excluded.	**Reused water** Water that has undergone wastewater treatment and is delivered to a user as reclaimed wastewater. This means the direct supply of treated effluent to the user. Excluded is waste water discharged into a watercourse and used again downstream. Recycling within industrial sites is excluded.	**Reused Water** Wastewater delivered to a user for further use with or without prior treatment. Recycling within industrial sites is excluded.	Water accounts include in the definition of reused water the case when wastewater is delivered without treatment to a user.
Self-supply Abstraction of water for own final use. Includes	**Self-supply** Abstraction of water by the user for own final use.	**Abstraction for own use** Abstraction of water for own use	The difference mainly resides in the terminology as abstraction for own use is not considered as a supply in water accounting (see *water supply*)

water drawn from village wells.			
Other supply Any supply of water not specified elsewhere. In particular, supplies from commercial and industrial establishments, whether marketed or not. Also included is supply of reusable water.	**Other supply** The part of water supply to agriculture which was not included under 'Public water supply' or 'self supply' (that means all system operation for agricultural irrigation which are not individual irrigation systems). This might also include some water from self supply distributed to other users.	This concept corresponds to the supply of water from an economic activity other than ISIC 41.	
Total public water supply Water supplied by economic units engaged in collection, purification and distribution of water (including desalting of sea water to produce water as the principal product of interest, and excluding system operation for agricultural purposes and treatment of waste water solely in order to prevent pollution.) It corresponds to ISIC division 41. Deliveries of water from one public supply undertaking to another are excluded.	**Public water supply** Water supplied by economic units engaged in collection, purification and distribution of water (including desalting of sea water to produce water as the principal product of interest, and excluding system operation for agricultural purposes and treatment of waste water solely in order to prevent pollution). It corresponds to division 41 (NACE/ISIC). Deliveries of water from one public supply undertaking to another are excluded.	Supply to other economic units by ISIC 41 (which is recorded net of losses in distribution).	Terminology. The use of the term 'public' seems to refer to the institutional unit - the government - engaged in the activities of collection, purification and distribution. This is not, however, reflected in the definitions of 'public water supply' in the questionnaires. In water accounting this definition simply corresponds to the supply within the economy by ISIC 41 independently from the institutional sector which owns the industry.
Total water supply Delivery of water to users and abstraction for own final use. Total water supply excludes water used in hydropower generation. (Total public water supply + Self-supply + Other supply)	**Supply of water** Delivery of water to final users including abstraction for own final use (self-supply).		Inconsistency of the concept. In water accounting which takes the perspective of the economy, the supply of water only refers to that originating from the economy. It thus includes the supply of water from an economic unit (industries, households and the rest of the world) (a) to another economic unit and (b) to the environment. The latter case consists of discharges of water to the environment. What is called in the questionnaires "self-supply" is indeed considered as a use in water accounting and is NOT part of the total supply of water. The two definitions of the Questionnaires correspond to the concept of total water use in water accounting.
Waste water treated in public treatment plants All treatment of waste water in municipal treatment plants by official authorities, or by private companies for local authorities, whose main purpose is waste water treatment.			Similarly to the case of public water supply, the term seems to imply the type of ownership of the treatment plants, while the definition does not. In accounting terms, 'public' refers to the case when the government owns finances or controls a company.

4. Overlap and gaps of information

Since the UNSD/UNEP and OECD/Eurostat Questionnaires on water resources focus on the physical aspects of water resources, the accounting tables that can be compiled with such information are: physical supply and use tables, emission accounts and asset accounts. Table 2-5 show the part of the accounting tables which can be populated with information resulting from the UNSD/UNEP and OECD/Eurostat Questionnaires. These tables are a slightly modified version of the standard simplified tables which are presented in the current handbook on water accounting. They have been modified following a recent meeting of the sub-group of the London Group on Water Accounting (New York, 11-13 May 2005).

The cells which can be obtained by both the Questionnaires are labelled as UU and a reference number. The cells which can be obtained by the OECD/Eurostat Questionnaires only are labelled as OE and a reference number.

4.1 Physical supply and use tables

UU.1 corresponds to *Self-supply* from Table W3 of the UNSD/UNEP Questionnaire and Table 3.1 of the OECD/Eurostat Questionnaire.

OE.5 corresponds to the disaggregation of *Self-supply* from Table 3.1 of the OECD/Eurostat Questionnaire according to the user: ISIC[6] 01-05, ISIC 10-45, ISIC 15-37, ISIC 40, Other activities (ISIC 50-93) and Households. Note that in Table 3.2 of the OECD/Eurostat Questionnaire the use of water supplied by ISIC 41 is further disaggregated at a finer level of detail of user (ISIC 10-14, 15, 17-19, 21, 23-24, 25, 35, 45).

UU.2 corresponds to the *Total fresh surface water abstracted* and *Total fresh groundwater abstracted* by ISIC 01-05, ISIC 15-37, ISIC 40, ISIC 41, other economic activities and Households from Table W2 of the UNSD/UNEP Questionnaire and Table 2.1 of the OECD/Eurostat Questionnaire.

OE.1 corresponds to *Total gross abstraction from surface and groundwater abstracted* by ISIC 01-05, ISIC 15-37, ISIC 40, ISIC 41, other economic activities and Households from Table 2.1 of the OECD/Eurostat Questionnaire. Total abstraction by ISIC 01-05 is in parentheses as it is part of the total abstraction from Water resources recorded in the accounts which includes also the use of water during rainfed agriculture as abstraction from soil water.

UU.3 corresponds to *Non-fresh water abstraction* (which includes abstraction from sea water and transitional water, such as brackish swamps, lagoons and estuarine areas) from Table W2 of the UNSD/UNEP Questionnaire and *Total gross abstraction from non fresh water sources* from Table 2.2 of the OECD/Eurostat Questionnaire. Attention must be paid when using this information in water accounts as water resources include both fresh and brackish. However, if the accounts are compiled only for fresh water resources, the information from the questionnaires can be used without separating abstraction from the sea and brackish water.

OE.2 corresponds to the breakdown of *Total gross abstraction from non fresh water sources*, from Table 2.2 of the OECD/Eurostat Questionnaire, according to ISIC 01-05, ISIC 15-37, ISIC 40 and other activities.

UU.4 corresponds to the *Total public water supply by user* (ISIC 01-05, ISIC 15-37, ISIC 40 other economic activities and Households) from Table W3 of the UNSD/UNEP Questionnaire and Table 3.1 of the OECD/Eurostat Questionnaire. This quantity corresponds to part of the *Use of water received from other economic units* in the use table (row U2 in Table 2) as there might be (and usually there

[6] International Standard Industrial Classification of all Economic Activities (ISIC) rev 3. Available on-line at http://unstats.un.org/unsd/cr/registry/default.asp

are) economic activities other than ISIC 41 which supply water within the economy (these are referred to as ancillary activities in accounting terms). Note that in Table 3.2 of the OECD/Eurostat Questionnaire the use of water supplied by ISIC 41 is further disaggregated at a finer level of detail of user (ISIC 10-14, 15, 17-19, 21, 23-24, 25, 35, 45).

UU.5 and UU.7 corresponds to the *Exports* and *Imports* respectively from Table W2 of the UNSD/UNEP Questionnaire and from Table 2.1 of the OECD/Eurostat Questionnaire.

UU.6 corresponds to *Other supply* from Table W3 of the UNSD/UNEP Questionnaire and Table 3.1 of the OECD/Eurostat Questionnaire. Note that this quantity should be disaggregated by user and supplier in the accounts in order to record better of the total use of water within the economy (row U2 of Table 2) as well as the supply within the economy (row S1 of Table 2). This can also be seen from the matrix of transfers within the economy, Table 3, which would be only partially compiled by the information from the Questionnaires.

OE.6 corresponds to information on the use of *Other supply by ISIC 01-05* from Table 3.1 of the OECD/Eurostat Questionnaire.

UU.8 corresponds to *Desalinated water* from Table W2 of the UNSD/UNEP Questionnaire and Table 2.2 of the OECD/Eurostat Questionnaire. This quantity is part of the supply of water within the economy (row S1 of Table 2). Here Table 2 shows explicitly this quantity as an *of-which* category of row S1.

OE.3 corresponds to the breakdown of *desalinated water* Table 2.2 of the OECD/Eurostat Questionnaire according to the producer: ISIC 41 and ISIC 50-93.

UU.9 corresponds to *Total reuse of fresh water* from Table W2 of the UNSD/UNEP Questionnaire and to *Reused water* from Table 2.1 of the OECD/Eurostat Questionnaire.

OE.4 corresponds to the breakdown of *Reused water* from Table 2.1 of the OECD/Eurostat Questionnaire according to the supplier which in the questionnaire is grouped into the following: ISIC 01-05, ISIC 15-37, ISIC 40 and Other activities (ISIC 50-93).

UU.10 corresponds to *Water returns without use* from Table W2 of the UNSD/UNEP Questionnaire and from Table 2.1 of the OECD/Eurostat Questionnaire. This quantity is part of the *Total returns* in the supply table (row S2 of Table 2). The returns in the simplified supply table are disaggregated according to the receiving media. However, in the more detailed tables, the returns are disaggregated according to the type of water such as mine water (which is included in *Water returns without use*), water losses during transport, urban runoff, etc.

UU.11 corresponds to *Total wastewater generated* by economic unit (ISIC 01-05, ISIC 10-14, ISIC 15-37, ISIC 40, ISIC 45, other economic activities and Households) from Table W4A of the UNSD/UNEP Questionnaire and Table 7 of the OECD/Eurostat Questionnaire. This information is disaggregated in the accounts according to the destination of wastewater: if wastewater is supplied to other economic units, it is recorded as a use of water within the economy (reuse of water); if wastewater is discharged into the environment is recorded as a return flow.

Table 2: Physical supply and use table

Use table

		ISIC					Households	Rest of the world	Total
		ISIC 01-05	ISIC 15-37	ISIC 40	ISIC 41	Other			
From the environment	U1 - Total Abstraction (= b.1+b.2 = a.1+a.2):								
	b.1- *Abstraction for own use*	OE.5	OE.5	OE.5		OE.5	OE.5		UU.1
	b.2- *Abstraction for distribution*								
	a.1- From Water resources:	(OE.1)	OE.1	OE.1	OE.1	OE.1	OE.1		(OE.1)
	Surface water	UU.2	UU.2	UU.2	UU.2	UU.2	UU.2		UU.2
	Groundwater	UU.2	UU.2	UU.2	UU.2	UU.2	UU.2		UU.2
	Soil water								
	a.2- From Other sources								
	Collection of precipitation								
	Abstraction from the sea	OE.2	OE.2	OE.2		OE.2			UU.3
Within the economy	U2 - Use of water received from other economic units							UU.5	
	Supplied by ISIC 41	UU.4	UU.4	UU.4		UU.4	UU.4		UU.4
	Supplied by others	OE.6							UU.6
U=U1+U2 - **Total use of water**									

Supply table

		ISIC							Households	Rest of the world	Total
		ISIC 01-05	ISIC 15-37	ISIC 40	ISIC 41	ISIC 10-14	ISIC 45	Other			
Within the economy	S1 - Supply of water to other economic units				UU.4					UU.7	
	of which: Desalinated water				OE..3			OE..3			UU.8
	Reused water	OE.4 ~~UU.11~~	OE.4 ~~UU.11~~	OE.4 ~~UU.11~~		~~UU.11~~	~~UU.11~~	OE.4 ~~UU.11~~	~~UU.11~~		UU.9 ~~UU.11~~
From the economy	S2 - Total returns (= d.1+d.2)										(UU.10)
	d.1- To Water resources										OE.7
	d.2- To Other sources (e.g. Sea water)										OE.8
	[Treated wastewater]										UU.12
	[Untreated wastewater]										UU.12
S=S1+S2 - **Total supply of water**											
Consumption (U - S)											

Number of persons with sustainable access to an improved water source	Urban
	Rural
	Total
Number of persons with access to improved sanitation	Urban
	Rural
	Total
Total number of persons	

UU corresponds to information collected by the UNSD/UNEP and OECD/Eurostat Questionnaires. OE corresponds to information collected by the OECD/Eurostat Questionnaires only. When in parentheses, it corresponds to information collected by Questionnaire which is part of the corresponding category in water accounts.

Shaded cells indicate structural empty cells.

OE.7 and OE.8 correspond to *Total discharges to inland waters* and *Total discharges to the sea* from Table 7 of the OECD/Eurostat Questionnaire. In the accounts this information is disaggregated according to the economic unit responsible for the discharge.

The OECD/Eurostat Questionnaire collects detailed information on the volumes of wastewater discharged by type of collecting system. This information could be organized into an accounting framework by disaggregating the economic activity involved in the collection, treatment and disposal of wastewater, namely ISIC 90, according to the type of treatment. The matrix of transfer within the economy, presented in Table 3, would show the amount of wastewater which is delivered to ISIC 90 from the other economic activities.

UU.12 corresponds to information on the amount of *treated* and *untreated wastewater* which is collected in table W4B of the UNSD/UNEP Questionnaire. Note that detailed information on the type of treatment plants is often the basis for the compilation of emission accounts as it allows for the calculation of pollutants removed during treatment processes. This information can be made explicit also in the supply table.

Table 3: Matrix of transfers

Destination: / Origin:	ISIC					Households	Total use from other economic units
	ISIC 01-05	ISIC 15-37	ISIC 40	ISIC 41	Other		
ISIC 01-05							
ISIC 15-37							
ISIC 40							
ISIC 41	UU.4	UU.4	UU.4		UU.4	UU.4	UU.4
Other							
Households							
Total supply to other economic units							UU.6+UU.4

UU corresponds to information collected by the UNSD/UNEP and OECD/Eurostat Questionnaires.

4.2 Emission Accounts

Emission accounts describe the generation and removal (though the process of treatment and purification) of pollutants by an economic activity and Households. The information on emission is organized in a supply and use table: the supply table describes the amount of pollutants contained in the supply of water. Except for the case of ISIC 41, the supply table consists mainly in the pollutant load contained in the wastewater generated by an economic activity and Households. A distinction is made between the supply within the economy (which include for example, wastewater supplied to a treatment plant – ISIC 90) and a supply directly into the environment (which include wastewater discharged directly into water resources and seas). The use table records the amount of pollutant removed by an economic activity and Households. The removal of pollutants occurs primarily during water purification and wastewater treatment processes.

Emission accounts are compiled for a number of pollutants. Those included in the OECD/Eurostat Questionnaire include: BOD, COD, Suspended Solids, etc.

OE.9 corresponds to the emission of pollutants in the *wastewater generated*, Table 7 of the OECD/Eurostat Questionnaire. In the Questionnaire this information is disaggregated by source,

namely ISIC 01-05, ISIC 10-14, 15-37, ISIC 40, ISIC 45, Other activities (ISIC 50-93) and Households.

OE.10 and OE.11 correspond respectively to the *Total discharges to inland waters* and *to the sea* of a certain pollutant from Table 7 of the OECD/Eurostat Questionnaire.

UU.13 corresponds to *Total sludge production* from Table W4B of the UNSD/UNEP Questionnaire and Table 6 of the OECD/Eurostat Questionnaire. This information is recorded as supplementary information in the emission accounts (see Table 4). Information on the *Number of wastewater treatment plants* and on the *Design capacity of wastewater treatment plants* could be made explicit in the emission accounts.

Table 4: Emission accounts

Supply table

		Pollutant	ISIC							Households	RoW	Total
			ISIC 01-05	ISIC 10-14	ISIC 15-37	ISIC 40	ISIC 45	ISIC 90	Other Total			
Within the economy		A										
To the environment	To Water resources:	A										OE.10
	To the sea	A										OE.11
Total (Gross emissions)			OE.9	OE.9	OE.9	OE.9	OE.9		OE.9	OE.9		OE.9

Use table

	Pollutant	ISIC							Households	RoW	Total
		ISIC 01-05	ISIC 10-14	ISIC 15-37	ISIC 40	ISIC 45	Other ISIC 90	Other Total			
From the environment	A										
Within the economy	A										
Total	A										
Net emission	A										
Total sludge production											UU.13
Number of people connected to the sewage network											

UU corresponds to information collected by the UNSD/UNEP and OECD/Eurostat Questionnaires. OE corresponds to information collected by the OECD/Eurostat Questionnaires only.

4.3. Asset accounts

Physical asset accounts records the volumes of water resources at the beginning and end of the accounting year and the changes that are brought about by human activities, through abstraction and return flow, and by natural processes such as precipitation, evapotranspiration, etc. Asset accounts correspond to the hydrological water balance.

The information collected by the UNSD/UNEP and OECD/Eurostat Questionnaires refers to renewable water resources and can populate the asset accounts as presented in Table 5. In particular,

the following quantities are collected by the UNSD/UNEP Questionnaire: *Precipitation, Actual external inflow of surface and ground waters, Actual Evapotranspiration,* and *Outflow of surface and ground waters* from table W1 of the UNSD/UNEP Questionnaire and Table 1 of the OECD/Eurostat Questionnaire which corresponds respectively to UU.14, UU.15, UU.16 and UU.17 in Table 5.

In particular, OE.12 and OE.13 correspond to *actual outflow into the sea* and *into neighbouring countries* from Table 1 of the OECD/Eurostat Questionnaire.

OE.14 corresponds to the *Recharge into aquifer* from Table 1 of the OECD/Eurostat Questionnaire. In Table 5 it is split between *Returns from the economy* and *Inflows from other resources in the territory* as the definition of recharge in the Questionnaire seems to include both artificial recharge (which is recorded in accounting as a return flow from the economy) and natural recharge (which is recorded in accounting as a inflow from other resources in the environment).

Table 5: Asset accounts for fresh water resources

			EA.131 Surface water				EA.132 Groundwater	EA.133 Soil water	Total
			EA.1311 Reservoirs	EA.1312 Lakes	EA.1313 Rivers	EA.1314 Snow, Ice and Glaciers			
Opening Stocks									
Changes due to human activities	Abstraction		UU.2				UU.2		(OE.1)
	of which sustainable use								
	Returns from the economy						OE.14		OE.7
Changes due to natural processes	Precipitation								UU.14
	Inflows from upstream territories								UU.15
	Inflows from other resources in the territory	Natural transfers					OE.14		
		Man-made transfers							
	Evaporation/Actual evapotranspiration								UU.16
	Outflows to downstream territories								OE.12
	Outflows to the sea								UU.17 OE.13
	Outflows to other resources in the territory	Natural transfers							
		Man-made transfers							
Other volume changes									
Closing Stocks									

UU corresponds to information collected by the UNSD/UNEP and OECD/Eurostat Questionnaires. OE corresponds to information collected by the OECD/Eurostat Questionnaires only.

Shaded cells indicate structural empty cells.

5. Conclusions

The investigation of the links between water statistics collected by the UNSD/UNEP and OECD/Eurostat Questionnaires and water accounting was prompted by the decision of UNSD to align water statistics and water accounting and using the water accounting framework as overarching framework for the organization of water statistics. The results of this investigation showed that the information needs for these areas of statistics are very close and that information on water resources collected at the international level by the two Questionnaires can be organized into an accounting framework.

As a general consideration, we can conclude that the information collected by the water statistics questionnaires can be organized in an accounting framework. In order to align the two areas and

ensure full consistency of concepts and definitions, some modifications of the Questionnaire would be necessary. For example, the differences include:

(a) Boundaries of water abstraction: while the water accounting tables record water abstraction from groundwater resources gross, that is the total water abstracted, the water statistics questionnaires record it net of artificial recharges. In the water accounting tables, artificial recharge is recorded as a return back to the environment

(b) Water used in hydroelectric power generation: while water accounts records water used for hydroelectric power generation as abstraction and returns of water, the questionnaires do not record it.

(c) The use of the term "public' used in the questionnaires is not consistent with the terminology used in national accounts. "Public" in the national accounts refers to the government ownership or control and financing of an economic activity, in the case of activities for collection, purification and distribution of water, the government may or may not own (or control and finance) the industry. With increasing public-private partnership in the area of water, less and less companies would be classified in the government sector of the national accounts.

(d) The concept total supply is inconsistent with the national accounts terminology. It appears more a total use rather than total supply.

(e) Recording the use of precipitation. The questionnaires do not separately record direct use of precipitation, whether the accounting tables record it as abstraction from soil water in the case of water use in rainfed agriculture and as abstraction from other sources (e.g. atmosphere) in the case, for example, of roof water harvest.

It should be mentioned that the Questionnaires collect some additional information which does not explicitly appear in the simplified accounting tables. However, the accounting system is a flexible system which allows the presentation of information not directly related to the accounting framework through supplementary tables. For example, information on discharge of wastewater by type of treatment plants can be presented in supplementary tables which further disaggregate activities by ISIC 90, "Sewage and refuse disposal, sanitation and similar activities", on the basis of the type of treatment. This information would be extremely useful also for the water accounting, especially when linking the physical tables with the monetary ones. Different treatment facilities bear different costs as well as can eliminate different types of pollutants. Having information disaggregated by type of treatment plant would improve the estimates also in the water accounting tables.

Collecting additional information to fully compile basic supply and use tables, for example, would have the advantages of creating additional internal consistency checks and balances which are inherent to the accounting framework and increasing the analytical use of the information collected by the Questionnaires. For example, water consumption by groups of economic activities, an important indicator of water efficiency, could be easily calculated from the tables.

When the water statistics questionnaires will be revised, it is essential that the questionnaires are brought in line with the water accounting framework. This process would strengthen cooperation between statisticians and accountants and would be a significant step forward for both environment statistics and accounting.

Table 6 shows an example of simplified physical supply and use tables. It shows those cells that can be compiled using the information collected by the Questionnaires (denoted with the letter **Q**) and those for which information would need to be collected in order to fully compile the tables (identified with the letters **X** and **R**). The inclusion of this additional information, would allow the calculation of water consumption by industry, which is a very important indicator of water efficiency.

Required additional information (indicated by the letter **X**) includes:

- Direct collection of precipitation (except in rain fed agriculture) disaggregated by users (industries or households). In some countries precipitation collected through tanks may be a significant source of water;
- Volume of water used for rain fed agriculture (recorded as abstraction from soil water);
- Supply of water within the economy disaggregated by supplier. This would cover supply of water not carried out but by other industries as an ancillary activity;
- Abstraction by ISIC 41 for own use (e.g. for cleaning pipes, etc.).

Further disaggregation of information already collected by the questionnaires (indicated by the letter **R)** includes:

- Use of water received by industries other than ISIC 41 disaggregated by user (row c.1);
- Supply of desalinated water disaggregated by supplier (to include the cases where desalination is carried out as an ancillary activity, rare but possible);
- Returns of treated and untreated wastewater disaggregated by sector (households or industries discharging wastewater) (rows d.1 and d.2).

The letter **D** denotes the cells which would be derived from the rest of the table.

Table 6: Example of possible additional information to be colleted in the Questionnaires

Use table

			ISIC					Households	Rest of the world	Total
			ISIC 01-05	ISIC 15-37	ISIC 40	ISIC 41	Other**			
From the environment	U1 - Total Abstraction	= a.1+a.2	**D**	**D**	**D**	**D**	**D**	**D**		**D**
	b.1- *Abstraction for own use*		Q	Q	Q	**X**	Q	Q		Q
	b.2- *Abstraction for distribution*	=U1-b1	**D**	**D**	**D**	**D**	**D**	**D**		**D**
	a.1- From Water resources:		Q	Q	Q	Q	Q	Q		Q
	Surface water		Q	Q	Q	Q	Q	Q		Q
	Groundwater		Q	Q	Q	Q	Q	Q		Q
	Soil water		**X**							**X**
	a.2- From Other sources	=a.21+a.22	**D**	**D**	**D**	**D**	**D**	**D**		**D**
	a.21- Collection of precipitation		**X**	**X**	**X**	**X**	**X**	**X**		**X**
	a.22- Abstraction from the sea		Q	Q	Q	X	Q	-		Q
Within the economy	U2 – Use of water received from other economic units	= c.1+c.2	**D**	**D**	**D**	**D**	**D**	**D**	Q	**D**
	c.1- Supplied by ISIC 41		Q	Q	Q		Q	Q		Q
	c.2- Supplied by others		Q	**R**	**R**	**R**	**R**	**R**	Q	Q
U- **Total use of water**		=U1+U2	**D**	**D**	**D**	**D**	**D**	**D**		

Supply table

			ISIC					Households	Rest of the world	Total
			ISIC 01-05	ISIC 15-37	ISIC 40	ISIC 41	Other**			
Within the economy	S1 – Supply of water to other economic units		**X**	**X**	**X**	Q	**X**	**X**	Q	**X**
	of which: Desalinated water		**R**	**R**	**R**	Q	Q	-		Q
	Reused water		Q	Q	Q	-	Q	-		Q
From the economy	S2 - Total returns	=d.1+d.2	**D**	**D**	**D**	**D**	**D**	**D**		Q
	d.1- Treated wastewater		**R**	**R**	**R**	**R**	**R**	**R**		Q
	d.2- Untreated wastewater		**R**	**R**	**R**	**R**	**R**	**R**		Q
S- **Total supply of water**		=S1+S2	**D**	**D**	**D**	**D**	**D**	**D**		
Consumption		= U-S	**D**	**D**	**D**	**D**	**D**	**D**		

Number of persons with sustainable access to an improved water source	Urban
	Rural
	Total
Number of persons with access to improved sanitation	Urban
	Rural
	Total
Total number of persons	

Q information already collected in the questionnaires; **X** additional information to the questionnaires; **D** information derived from other cells in the accounts

- It is most likely a negligible quantity

Shaded cells indicate structural empty cells

** ISIC 90 should be explicitly identified.