भारतीय मानक

Indian Standard

IS/ISO 14008 : 2019

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Monetary Valuation of Environmental Impacts and Related Environmental Aspects

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NATIONAL FOREWORD

This Indian Standard which is identical to ISO 14008 : 2019 ‘Monetary valuation of environmental impacts and related environmental aspects’ issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Environmental Management Sectional Committee and approval of the Environment and Ecology Division Council.

The text of ISO standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words ‘International Standard’ appears referring to this standard, they should be read as ‘Indian Standard’; and

b) Comma (,) has been used as a decimal marker, while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Introduction

Private and public organizations are facing risks and opportunities due to the beneficial or adverse environmental impacts and related environmental aspects of their activities. The monetary valuation of these environmental impacts and related aspects supports organizations in developing business models and practices that are more sustainable. Using monetary valuation does not mean that money is the only metric of value.

This document is for all organizations that wish to undertake monetary valuation studies or review, compile or use the results. Organizations often have experience in assessing at least some environmental aspects and environmental impacts resulting from their activities in physical units. To further integrate this information in decisions, it is useful to determine the monetary values of these environmental impacts and/or of related environmental aspects. Monetary valuations enable comparisons and trade-offs between different environmental issues and between environmental and other issues. This is useful in, for example, organizational strategy and investment considerations, product and service design, management accounting, performance evaluation, environmental monitoring and reporting, legislation or environmental policy and regulation.

Monetary valuation methods determine monetary values of changes in the environment and not the absolute value of the environment.

This document supports environmental and risk management methods, such as cost-benefit analysis, risk and life cycle assessments.

The main purpose of the document is to increase the awareness, comparability and transparency of the monetary valuation of environmental impacts and related environmental aspects. It demonstrates the benefits that monetary valuation methods offer to users. To achieve this purpose, standardized and transparent documentation of the methods, data and assumptions used to derive monetary values is essential. The multiplicity of monetary values, methods to determine monetary values, and ethical perspectives on money requires careful consideration and prudent communication.

This document provides a framework that includes principles, requirements and guidance for the monetary valuation of environmental impacts and related environmental aspects, following the principles of welfare economics. Monetary valuation methods in this document can also be used to value actual or potential impacts on natural capital, for example, abiotic resources, biodiversity, ecosystems and ecosystem services. The impacts valued could result from environmental aspects and from the dependencies of organizations on the environment. Environmental impacts can occur on the stocks and quality of natural capital, affecting associated flows of benefits (including for human health).

This document focuses on valuation methods and not on costing methods. This means that requirements and guidance on assessing costs are only given if costs are used as measures of monetary values.

In this document, many methodological requirements or recommendations are intended for people assessing monetary values. Following these requirements and recommendations enables good practice of monetary valuation. The requirements in the reporting clause can assist the user of monetary values in assessing the quality of the monetary valuation study.

This document addresses the planning of a monetary valuation (see Clause 5), the monetary valuation itself (see Clause 6), the way in which links between environmental impacts valued in monetary terms and related environmental aspects are established (see Clause 7), checking the quality of the monetary valuation (see Clause 8) and reporting (see Clause 9).

Indian Standard

MONETARY VALUATION OF ENVIRONMENTAL IMPACTS AND RELATED ENVIRONMENTAL ASPECTS

1 Scope

This document specifies a methodological framework for the monetary valuation of environmental impacts and related environmental aspects. Environmental impacts include impacts on human health, and on the built and natural environment. Environmental aspects include releases and the use of natural resources.

The monetary valuation methods in this document can also be used to better understand organizations' dependencies on the environment.

During the planning of the monetary valuation, the intended use of the results is considered but the use itself is outside the scope of this document.

In this document, monetary valuation is a way of expressing value in a common unit, for use in comparisons and trade-offs between different environmental issues and between environmental and other issues. The monetary value to be determined includes some or all values reflected in the concept of total economic value. An anthropocentric perspective is taken, which asserts that natural environment has value in so far as it gives utility (well-being) to humans. The monetary values referred to in this document are economic values applied in trade-offs between alternative resource allocations, and not absolute values.

This document does not include costing or accounting, although some valuation methods have the term "cost" in their name. This document does not include the development of models linking environmental aspects to environmental impacts.

NOTE In this document, what is valued in monetary terms is either environmental impacts or environmental aspects. When valuing environmental impacts of an organization, it is important that links between environmental aspects and environmental impacts are established.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1 Environmental impacts and environmental aspects

3.1.1
environment
surroundings in which an organization operates, including air, water, land, *natural resources* (3.1.5), flora, fauna, humans and their interrelationships

Note 1 to entry: Environment includes natural capital, *ecosystem services* (3.2.11), climate, abiotic services and biodiversity.

Note 2 to entry: Natural resources include mineral resources.

[SOURCE: ISO 14001:2015, 3.2.1, modified — A new Note 1 and Note 2 to entry have replaced the original Notes 1 and 2 to entry.]

3.1.2
good
natural resource (3.1.5), *ecosystem service* (3.2.11), product or service, marketed or not, that satisfies human wants or needs

Note 1 to entry: In this document, the term "good" includes human health.

Note 2 to entry: In ISO 14040, the term "product" is defined as "any goods or service".

3.1.3
environmental impact
change to the *environment* (3.1.1), whether adverse or beneficial, wholly or partially resulting from an organization's *environmental aspects* (3.1.4)

[SOURCE: ISO 14001:2015, 3.2.4]

3.1.4
environmental aspect
element of an organization's activities or products or services that interacts or can interact with the *environment* (3.1.1)

Note 1 to entry: An environmental aspect can cause (an) *environmental impact(s)* (3.1.3). A significant environmental aspect is one that has or can have one or more significant environmental impact(s).

Note 2 to entry: Significant environmental aspects are determined by the organization applying one or more criteria. This process can be referred to as a "materiality assessment".

[SOURCE: ISO 14001:2015, 3.2.2, modified — Note 2 to entry has been extended.]

3.1.5
natural resource
part of nature that provides benefits to humans or underpins human well-being

3.1.6
ecosystem
dynamic complex of plant, animal and micro-organism communities, and their non-living *environment* (3.1.1) interacting as a functional entity

EXAMPLE Deserts, coral reefs, wetlands, rain forests, boreal forests, grasslands, urban parks, cultivated farmlands.

Note 1 to entry: Ecosystems can be influenced by human activity.

3.1.7
release
emission to air or discharge to water or soil

[SOURCE: ISO 14040:2006, 3.30, modified — The term has been changed to singular form.]

3.1.8
reference unit of monetary value
unit of environmental change for which the *monetary value* (3.2.3) is determined

3.1.9
environmental impact pathway
series of consecutive, causal relationships, ultimately starting at an *environmental aspect* (3.1.4) and ending at an *environmental impact* (3.1.3)

Note 1 to entry: A synonym for environmental impact pathway is “cause-effect chain”.

Note 2 to entry: It can be considered a system of interlinked environmental mechanisms.

3.1.10
environmental impact factor
quantity of *environmental impact* (3.1.3) per quantity of *environmental aspect* (3.1.4)

3.1.11
environmental baseline
state of *environment* (3.1.1) without the change(s) that is valued

3.2 Environmental economics

3.2.1
willingness to pay
WTP
maximum amount of money an individual is prepared to give up to secure an environmental improvement or to avoid an environmental loss

Note 1 to entry: In practice, WTP and *willingness to accept compensation* (*WTA*) (3.2.2) appear to diverge, often substantially, and with WTA > WTP. Hence, the choice of WTP or WTA can be of importance.

3.2.2
willingness to accept compensation
WTA
minimum amount of money an individual is prepared to accept as compensation to forgo an environmental improvement or to tolerate an environmental loss

Note 1 to entry: In practice, *willingness to pay (WTP)* (3.2.1) and WTA appear to diverge, often substantially, and with WTA > WTP. Hence, the choice of WTP or WTA can be of importance.

3.2.3
monetary value
amount of money representing *willingness to pay (WTP)* (3.2.1) or *willingness to accept compensation (WTA)* (3.2.2)

Note 1 to entry: What is valued in monetary terms by default is marginal changes in quality or quantity of *goods* (3.1.2). It is not the absolute value of any given good or service that is valued. The size of change depends on the context.

Note 2 to entry: Commonly, the WTP distribution in a given population is skewed. While mean WTP is the theoretically correct measure to use, for example, in cost-benefit analyses, median WTP can be argued to be the better predictor of what the majority of people would actually be willing to pay if the WTP distribution is skewed. This equally applies to WTA.

3.2.4
monetary valuation
procedure for determining *monetary value* (3.2.3)

3.2.5
use value
monetary value (3.2.3) of a *good* (3.1.2) in relation to its actual, planned or possible use

3.2.6
non-use value
monetary value (3.2.3) of a *good* (3.1.2) independent of its actual, planned or possible use

3.2.7
revealed preference
monetary value (3.2.3) placed by an individual on a market *good* (3.1.2) from which the individual's valuation of a non-market good is inferred

Note 1 to entry: The market of the market good is termed "surrogate market".

3.2.8
stated preference
monetary value (3.2.3) expressed by an individual through survey-based response for a *good* (3.1.2) in a constructed or hypothetical market

Note 1 to entry: The market of the good to be valued does not exist or exists but the change valued is not experienced. It is therefore termed "constructed" or "hypothetical".

3.2.9
value transfer
transfer of a *monetary value* (3.2.3) estimate from a primary *monetary valuation* (3.2.4) study to another context

3.2.10
affected human population
group of people whose well-being, utility or values are influenced directly or indirectly by the *environmental impact* (3.1.3)

3.2.11
ecosystem service
benefit people obtain from *ecosystems* (3.1.6)

Note 1 to entry: These are generally distinguished into provisioning, regulating, supporting and cultural services. Ecosystem services include the provisioning of *goods* (3.1.2) (e.g. food, fuel, raw materials, fibre), regulating services (e.g. climate regulation, disease control), and non-material benefits (cultural services) (e.g. spiritual or aesthetic benefits). The supporting services are necessary for the production of all other ecosystem services (e.g. soil formation, nutrient cycling, water cycling) and are also referred to as "ecosystem functions".

Note 2 to entry: Ecosystem services are sometimes called "environmental services" or "ecological services".

3.2.12
total economic value
net sum of all relevant *use values* (3.2.4) and *non-use values* (3.2.5)

Note 1 to entry: Total economic value does not encompass other kinds of values unrelated to human preferences.

3.2.13
discounting
process of calculating the present value of future *monetary values* (3.2.3)

3.2.14
discount factor
factor applied to future monetary amounts in order to compute their present value

3.2.15
equity weighting
procedure to modify the costs and benefits incurred by people in different social and economic contexts to reflect their loss of utility

Note 1 to entry: The effect of equity weighting is to make *willingness to pay* (3.2.1) or *willingness to accept compensation* (3.2.2) of different groups (e.g. income) comparable.

3.2.16
co-benefit
benefit accompanying the intended benefits

Note 1 to entry: Co-benefits can be termed “ancillary benefits”, “secondary benefits”, “spill-over benefits” or “indirect benefits”.

3.2.17
marginal utility
additional satisfaction a person gains from consuming one more unit of a *good* (3.1.2)

Note 1 to entry: In an environmental context, the term “consuming” does not necessarily involve a physical consumption, i.e. it can also imply a person enjoying a landscape.

3.2.18
elasticity
measure of the response of one variable to a change in another variable

Note 1 to entry: The elasticity of *marginal utility* (3.2.17) of income is the relative change of the marginal utility as a result of the relative change in income. The elasticity of marginal utility of consumption is the relative change of the marginal utility as a result of the relative change in consumption.

3.2.19
purchasing power parity
currency exchange rate between two countries at which the same bundle of *goods* (3.1.2) can be bought

4 Principles

4.1 General

These principles are fundamental and shall be followed when planning, conducting, documenting and reporting a monetary valuation of environmental impacts and related aspects.

4.2 Description of principles

4.2.1 Accuracy

Aim for accuracy by minimizing uncertainty and bias towards a particular perspective.

4.2.2 Completeness

Ensure that all significant information for the intended use is included, in such a way that no other relevant information needs to be added and, to the knowledge of those undertaking the study, no additional information will substantially change the results.

NOTE In this principle, “significance” includes, among others, environmental aspects, impacts or dependencies that are material to an organization.

4.2.3 Consistency

Ensure that assumptions, methods and data are, unless motivated by relevance, applied in the same way throughout the monetary valuation process to arrive at conclusions in accordance with the goal and scope of the monetary valuation.

4.2.4 Credibility

Conduct all steps of a monetary valuation in a transparent and fair manner, and ensure that the information provided to interested parties is truthful, accurate, substantive and not misleading.

4.2.5 Relevance

Ensure that selected environmental impacts and environmental aspects, data sources, assumptions, temporal and spatial boundaries and methods used are appropriate to the needs, and meet the known requirements, of the intended users as outlined in the goal and scope of a given monetary valuation study.

4.2.6 Transparency

Aim for transparency by ensuring that documentation and reports are available, comprehensive and understandable to allow the intended audience to use the monetary valuation results and/or facilitate replicability of the monetary valuation and potential value transfer.

5 Planning a monetary valuation

5.1 General

At the outset of a monetary valuation study, the goal and scope of the study shall be defined and documented. This includes identifying the environmental impacts or environmental aspects that are intended to be considered, the way and extent to which the associated monetary values are determined (see 5.2 to 5.6) and the way in which environmental impacts are linked to environmental aspects, if applicable. Monetary valuation may concern analysis of potential scenarios. The goal and scope may have to be refined during the study (iteration).

In a monetary valuation, the following shall be defined and documented for all monetary values:

a) the currency of the monetary value;

b) the base year of the monetary value;

c) the time period of the monetary value (annual for a given time-period or one-off);

d) reference unit of monetary value (e.g. per individual, household, community, population, property, business);

e) whether and how the monetary value is aggregated over time, space, people, environmental impacts or aspects;

f) whether and how a value transfer is carried out (see 6.5);

g) whether and how the monetary value is equity weighted (see 6.7);

h) whether and how the monetary value is discounted (see 6.8);

i) whether and how uncertainty and confidence intervals are quantified and sensitivity analysis is carried out;

j) whether the monetary value is a marginal, average or median measure based on a distribution over people, environmental impacts, space or time.

Any assumptions made shall be documented. For items e) to j), an explanation as to the choices made shall be provided in the documentation.

Annex A provides a flow chart showing the application of this document.

NOTE The choices made for each item in the above bulleted list can depend on the environmental impacts or aspects that are considered (see 5.3).

5.2 Goal of the monetary valuation and its intended audience

The goal of the monetary valuation, its intended use, audience and the way it is communicated shall be defined and documented.

The intended use may be for the organization's internal decision making or for communication with external interested parties. The intended audience can include management, investors, local communities, government, suppliers, citizens or customers.

EXAMPLE A corporation can use monetary valuation to provide information regarding risk and opportunities in strategic and operational decisions. A government can also use monetary valuation (e.g. to define and support public policies).

When the result of a monetary valuation is intended for public disclosure (e.g. in public policies, companies' environmental or financial reports), an independent review should be considered to enhance credibility.

NOTE For more guidance, see ISO 14044, ISO 14045 and ISO/TS 14071.

5.3 Specification of the environmental impact or aspect

When planning a monetary valuation, the environmental impact(s) or aspect(s) that will be valued shall be identified and documented. Criteria for the selection of the environmental impact(s) or aspect(s) should be provided.

Monetary valuation can include more than one environmental impact or aspect.

EXAMPLE 1 Monetary valuation of climate change related impacts could include impacts on both humans and ecosystems. Similarly, a monetary valuation that focuses on environmental impacts of transportation can take into account releases of several substances (environmental aspects).

When planning a monetary valuation of an environmental impact(s) or environmental aspect(s), the following shall be identified and documented for all monetary values:

a) whether an increase or a decrease in the environmental impact or aspect is valued, for example:

   1) a decrease in life-expectancy or an increase of soil fertility;

   2) a decrease of CO_2 emitted or an increase in water consumption.

b) the spatial extent and resolution of the environmental impact or aspect that the monetary value is to be valid for (e.g. an administrative unit or ecosystem with defined borders, including its spatial resolution);

c) the temporal extent and resolution of the environmental impact or aspect that the monetary value is to be valid for (e.g. year 2010 to 2100, including its temporal resolution);

d) the environmental impact pathway(s) included in the study and the model(s) used (see Clause 7);

e) the indicator(s) by which the environmental impact or aspect is measured (e.g. crop yield as an indicator for soil fertility);

f) the unit and quantity of environmental impact or aspect that the monetary value of the study is to be estimated for (e.g. 100 tonnes of topsoil lost by erosion, 1 kg of CO_2 emitted);

g) the context of the environmental impact or aspect, to the extent that it influences the monetary values obtained from the study, for example:

   1) the environmental baseline, potentially subject to change over time;

   2) if applicable, the name and type of the source(s) causing the environmental aspect, e.g. a specific activity (e.g. space heating and cooling) at a specific production site (e.g. a factory) of a specific organization (e.g. a name of a company);

3) the specific stages of a product's life cycle considered in the monetary valuation.

EXAMPLE 2 Documentation for environmental impacts can include the following:

— when valuing human health impacts: the health condition or disease, its duration, any associated reduction in life expectancy and the age, gender and risk group (e.g. asthmatics) of the affected people;

— when valuing ecosystem services impacts: the type of land or water body, its location and extension, and the duration of the environmental impact.

EXAMPLE 3 Documentation for environmental aspects can include the name and kind of release (e.g. substance, noise), its height (notably for air emissions), its temporal and spatial extent, and the recipient (e.g. air, sea water, soil, humans).

5.4 People whose preferences and perspectives are considered

In a monetary valuation, the affected human population (e.g. in terms of ages, genders, population sub-groups) and that part of the affected human population whose preferences and perspectives are considered shall be identified and documented. In cases where several environmental impacts are valued, several different populations can be affected and be affected differently.

EXAMPLE If a general tax is to be used to improve air quality in a city, the affected population is, for example, the inhabitants of the city who will benefit from the reduction in pollution and those in the rest of the country who will pay for it through their taxes.

5.5 Elements of the total economic value captured

The elements of total economic value that the monetary valuation study intends to capture shall be identified and documented. If the total economic value is not fully intended to be captured, then this shall be justified.

The total economic value concept (see Figure 1) details all elements of anthropocentric value that can be distinguished into use and non-use values.

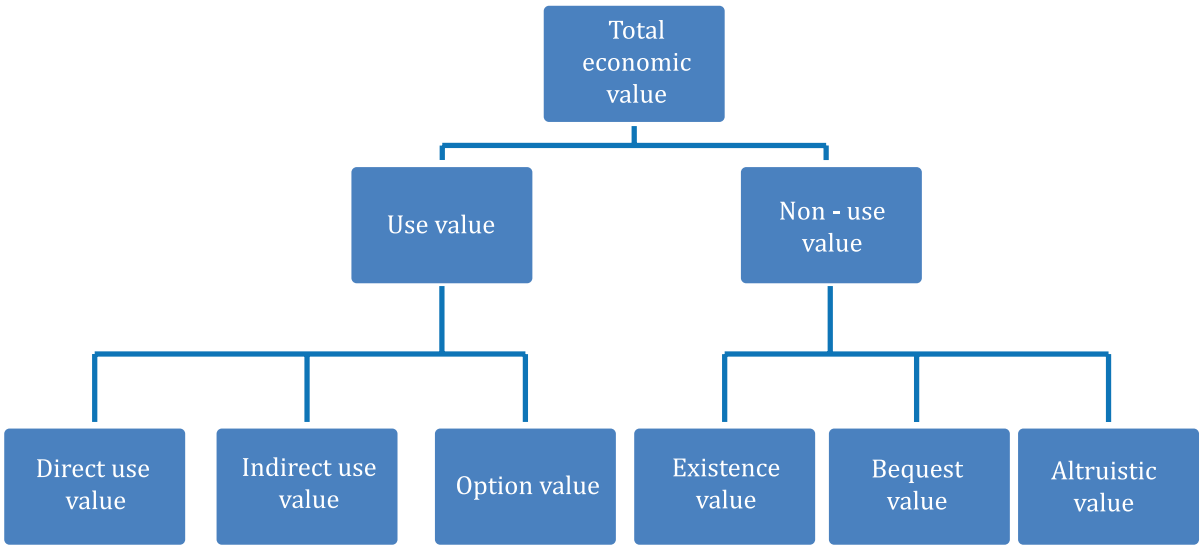


Figure 1 — Elements of the total economic value

Use values refer to the actual or potential, consumptive or non-consumptive, use of a good by a given individual. They are often divided into direct, indirect and option values:

— direct use values arise from the use of a good, which might or might not have a market price;

— indirect use values are benefits that humans derive from ecosystem services without direct intervention (e.g. the erosion or flood risk protection of a forest);

— option values consist of values attached by an individual to potential future uses of a good, even if not used now.

Non-use values refer to the values individuals place on a good independent of the actual or future use they make of it. Three different elements are generally distinguished.

— Existence value: The value an individual places on knowing that a good will continue to exist, regardless of the uses made by the individual (now or in the future). This includes biodiversity and many cultural, aesthetic and spiritual aspects of human life, for example, the deep seas, which might never be experienced by humans.

— Altruistic value: The value an individual places on knowing that a good exists, so that others alive today are able to enjoy it.

— Bequest value: The value an individual places on knowing that a good will continue to exist so that individuals yet to be born will be able to enjoy it in the future.

Human health values are part of direct use values and can be considered in terms of the following three cost components that are additive.

— Resource costs: Direct medical costs, such as treatments, and non-medical costs, such as childcare or housekeeping, associated with an adverse health impact. Resource costs can also comprise costs related to litigation or to processing claims.

— Opportunity costs: The costs associated with the loss of productivity or leisure time.

— Disutility costs: The value of suffering, i.e. pain, anxiety or discomfort, linked to an adverse health impact.

5.6 Monetary valuation method

The monetary valuation method(s) shall be chosen from those described in Clause 6. This choice shall be justified and documented.

Different monetary valuation methods have different capabilities to assess different environmental impacts and elements of the total economic value, and are therefore applicable to different contexts and objectives. When choosing between different methods for monetary valuation, the guiding principle should be to minimize the uncertainty of the results, comprehensively capturing the different elements of the total economic value (see 5.5) and avoiding double-counting.

Where a good is traded in an actual market, the price it fetches is a lower bound estimate (proxy) for the value that individuals place on it. It is a lower bound estimate based on the assumption that people would be willing to pay the price only if the benefit or value they receive from such purchase is deemed to be greater than the price paid.

EXAMPLE 1 Market goods include bottled water, double glazing, timber, fish, crops and medical treatments (see 6.2).

Where such markets do not exist, surrogate markets can be used. Methods that use this kind of data are collectively referred to as revealed preference methods (see 6.3).

EXAMPLE 2 Additional premium buyers are willing to pay for peace and quiet, or proximity to parks when purchasing a property; or the amount visitors spend on entrance fee, travel, accommodation, etc. to enjoy a recreational visit to an area.

The market price and revealed preference methods can estimate the values held by individual users. Users can hold both use and non-use values, which are captured but cannot be disaggregated through these methods.

Stated preference methods are the only methods that can estimate both use and non-use values jointly or separately. These methods create a hypothetical market by way of a survey (see 6.4).

Value transfer (see 6.5) can be an alternative to using the monetary valuation methods above if the resources to apply a revealed or stated preference method (see 6.3 and 6.4, respectively) are not available, or market prices (see 6.2) do not exist or are not sufficient for the goal of the study. The resulting monetary values are usually less reliable.

Monetary valuation may concern scenario analysis of future environmental aspects and impacts.

Further examples are provided in Table C.2.

6 Requirements and procedures for monetary valuation

6.1 General

This clause contains requirements and guidance on the procedures to obtain and document monetary values according to the plan (see Clause 5). The procedures can include equity weighting (see 6.7), discounting (see 6.8), value transfer (see 6.5) and aggregation or disaggregation (when the impact occurs at a different point in the environmental impact pathway than where the monetary value is obtained; see Clause 7).

For each monetary value, its value, base year, currency, reference unit, time period and environmental baseline shall be documented.

More guidance on how to determine a monetary value can be obtained from state-of-the-art guidelines and checklists.

6.2 Market price proxies

6.2.1 Market prices of traded goods and labour

When using market prices of traded goods (e.g. metals, minerals, oil and oil derivatives, timber, fibre, meat, fish, crops), whether and how the market prices are adjusted for any market distortions (e.g. taxes, subsidies) shall be documented.

EXAMPLE The value (cost) of degradation of the water purification function of a wetland can be estimated through market prices. The value of the loss of clean water would at least be the market price of water. The increase in pollution, leading to reduction in fish yield, can be valued through the real price of the lost fish catch.

NOTE In the above wetland example, the future ecosystem services provided are clean water and fish production, and the monetary value of the wetland as a natural resource can thus be valued as the net present value of the market value of the future streams of these services. Also to note is that the wetland might have additional use and non-use values that will not be captured by the market price method.

The monetary value of natural resources as a provider of current and future ecosystem services can be quantified as the resource rent, reflecting the net present value of the stream of services over time. If an abiotic resource (e.g. a mineral) is gradually depleted and becoming increasingly scarce, its price is expected to rise over time.

The market price of labour may be used to estimate premiums paid to compensate occupational risks (see 6.3.3) and the value of time for productivity loss calculations. When relying on the market price of labour for productivity loss calculations, the following items shall be documented:

a) the representativeness of market price of labour in terms of age, gender, employment status and skill level;

b) the amount of productive time lost or the change in occupational risk;

c) how income redistribution has been taken into account (e.g. for children, unemployed people, retired people);

d) any data adjustments.

If market prices are projected into the future, the assumptions made and models used shall be justified and documented.

6.2.2 Cost-of-illness method

The cost-of-illness method is a specific case of market-based monetary valuation. It includes treatment costs and can also include cost of housekeeping (resource costs) and loss of labour or leisure time (opportunity costs). The cost-of-illness method can sometimes include disutility costs, which are normally assessed by means of stated preference methods (see 6.4).

For the cost-of-illness method, the following items shall be documented:

a) the disease or health condition and its duration;

b) for each cost element considered:

   1) which kind of resource costs are valued: direct medical costs (e.g. those associated with physician services, medication, hospital stays), related non-medical costs (e.g. the cost of childcare and housekeeping due to the impossibility of the affected person in doing so) or costs related to litigation or to processing claims;

   2) whether or not opportunity or productivity costs (e.g. lost labour, leisure time) are included (see also 6.2.1);

c) the extent to which the costs are borne by the individual, the employer, the family, health insurances or government programmes;

d) the number of affected people;

e) whether the costs were derived in a prevalence-based or incidence-based study, since the former might need to be adjusted for the duration of the disease.

6.3 Revealed preference methods

6.3.1 General

In revealed preference methods, data from existing markets are analysed as a surrogate for non-existent markets. In these surrogate markets, consumer purchasing behaviour reflects their preferences for a non-market good. It shall be documented if and how the market prices are corrected for any market distortions (e.g. taxes, subsidies).

The representativeness of the sample shall be achieved through the choice of sampling method and data used. For any associated statistical analysis, variables included and their significance in explaining the variation in individuals' preferences shall be documented. Information on the spread of data (e.g. confidence intervals, variances) and the methods by which these have been obtained shall be documented.

6.3.2 Averting cost method

6.3.2.1 General

For the averting cost method, also referred to as "defensive or preventive expenditures method", a distinction is made between those costs that have accrued due to individual averting behaviour and those that were decided by public bodies.

EXAMPLE Averting costs include clean-up costs for contaminated sites (manufacturing or oil spills), costs needed to achieve national emission targets or expenditure on noise-reducing windows.

These costs shall only be used for monetary valuation after a spending or a commitment to spending has been made. Without evidence of such spending or commitment, the cost cannot be related to willingness to pay (WTP) or willingness to accept compensation (WTA). Spending can include substitute goods (e.g. replacement) or actions to avert environmental impacts (e.g. prevention, abatement, clean-up, restoration).

6.3.2.2 Individual averting cost method

For the averting cost method concerning behaviour of an individual, the following items shall be documented:

a) the avertive measure(s) implemented or committed;

b) the associated costs;

c) characteristics (e.g. income level) of the individuals to whom the costs accrue;

d) co-benefits, if any, and the extent to which these have been considered in the monetary valuation (e.g. improved window glazing that not only reduces road traffic noise penetration but also provides benefits in terms of reduced heating expenditures);

e) whether or not individuals change their behaviour (e.g. spending less time in the backyard and more time indoors) due to the defensive or preventive expenditures and the extent to which this is taken into account;

f) the extent to which the measure(s) provide the same functions as the original situation or the situation at which they are targeted.

6.3.2.3 Public averting cost method — Targets for specific sites

For the public averting cost method, applicable to remediation of pollution or land restoration at specific sites, the following items shall be documented:

a) the avertive measure(s) implemented or committed;

b) the associated costs of the measure(s);

c) whether or not it (they) can be assumed to be the lowest costs at which the remediation or land restoration can be achieved;

d) whether the costs accrue to individuals or to a specific public body; if costs accrue to more than one individual, how the total cost is distributed among them;

e) the authority that has decided on the measure(s);

f) the extent to which the measure(s) provide the same functions as the original situation or the situation at which they are targeted (e.g. the extent to which a replacement of wild salmon with stocked salmon is valued differently by anglers);

g) co-benefits, if any, and the extent to which these have been considered in the monetary valuation.

6.3.2.4 Public averting cost method — Targets at administrative levels

In the public averting cost method related to targets at administrative levels, an estimate is made of the cost of the last (most expensive) averting action to comply with a policy target. In this approach, averting actions are considered in a descending order of efficiency until the target has been reached.

NOTE The public averting cost method related to targets at administrative levels is also known as the "standard-price approach" and is a restricted form of marginal abatement cost methods.

For the public averting cost method related to targets at administrative levels, the following items shall be documented:

a) the policy or regulatory goal that is met by the last measure's cost taken for the monetary valuation, the time horizon and administrative unit for which it is valid and the date that this goal was legally enacted;

b) the environmental baseline;

c) assumptions about the future development of costs included in the monetary valuation, if applicable;

d) co-benefits, if any, and the extent to which these have been considered in the monetary valuation.

6.3.3 Hedonic pricing method

The starting point for the hedonic pricing method is the observation that market goods have different attributes, each of which influences the price of the good to a greater or lesser extent. The hedonic pricing method uses statistical methods to isolate the implicit "price" of each of these characteristics.

EXAMPLE 1 Changes in property prices can be used to reveal the monetary value associated with a non-market good such as proximity to green space or a decline in environmental quality such as air pollution. This can be done using a regression analysis on the property sale prices relative to characteristics of properties and their locations (including environmental conditions) and socio-economic characteristics of the population in the area. The statistical analysis reveals the influence of such individual factors on the property price.

EXAMPLE 2 Hedonic pricing can be applied to the labour market, as wages also reflect how occupational risks to human health (morbidity and mortality) affect the monetary value of labour. Hedonic pricing can be used to explain the variation in wages across occupations taking the different risks into account, and hence estimate the risk premium paid. This information can be used to estimate the monetary value of changes in mortality risks (also referred to as the value of a statistical life).

For hedonic pricing, the following items shall be documented:

a) the market (i.e. which kind of property or labour);

b) the value of change measured (i.e. property price or wage premium);

c) the hedonic price function;

d) size of the sample.

6.3.4 Travel cost method

The travel cost method values a good (e.g. a national park or heritage site, sites of clean water and fuelwood) based on a surrogate market, namely the cost of the journey to the destination in question including costs related to transport, time spent and entrance fees, if any. This method uses regression analysis on explanatory variables such as income, age or family size.

For the travel cost method, the following items shall be documented:

a) the destination site, including a brief description of its kind and importance, including the existence of substitute sites;

b) which elements have been included (e.g. time spent travelling to and on site, fuel, wear and tear, travel fares, accommodation, food, entertainment, entrance fees);

c) how these elements have been determined, for example, by questionnaires, number and characteristics of people asked, entrance fees, sampling method and (share of) wage rate (for the latter, see also 6.2.1);

d) whether and how visiting several sites (including by international tourists) has been dealt with;

e) whether and how the problem of multi-purpose trips has been dealt with (i.e. not all of the travel costs can be assigned to, for example, a recreational activity at a site if the travel to the site also had other motives);

f) the selection of the random utility model in terms of:

   1) the functional form of the indirect utility function (e.g. a simple linear combination of costs and attributes);

   2) the probability distribution of the random elements (e.g. binary, conditional or nested multinomial logit model, binary or multinomial probit model);

g) the travel cost function.

6.3.5 Data derived from public referendums

In this document, a referendum is regarded as public if it is initiated by a public body. Monetary valuation is not the purpose of public referendums and the results are not comparable to the monetary valuation methods in this document, which follow welfare economic principles. They can, however, be used to evaluate trade-offs between community and/or household costs (higher taxes, possibly job losses) and improvements to the environment (e.g. in terms of air or water quality, biodiversity protection).

When relying on data derived from public referendums, the following items shall be documented:

a) the subject that was voted on, the payment vehicle, and its relation to the reference unit of monetary value;

b) the number and representational characteristics of people who were invited to vote;

c) the percentage of votes in favour;

d) assumptions about the statistical distribution of the preferences across the respondents.

6.4 Stated preference methods

6.4.1 General

Stated preference methods are specifically designed surveys to create hypothetical markets in which respondents trade off environmental impact(s) and money, directly or indirectly. Stated preference-based monetary valuation methods can capture use and non-use values (see 5.5 and Annex C).

The stated preference method chosen shall be justified.

When performing a stated preference survey, the representativeness of the survey participants shall be achieved through the choice of sampling and adjustment methods.

In order to improve the accuracy of monetary valuation results when performing a stated preference survey:

— the change in the environment that is valued should be explained to the respondents as clearly as possible. This can be done by describing the environmental impact in terms that respondents can relate to and by using visual aids such as photographs and graphics;

— where the attributes of the environment that respondents attach a monetary value to is not known with certainty, various possibilities should be presented;

— the information and how it is presented should be tested through qualitative research (focus groups and cognitive interviews).

For any monetary value obtained by a stated preference method, the following items shall be documented:

a) the measure of change in well-being (i.e. WTP or WTA);

b) the valuation scenario describing the reference (status quo or environmental baseline) and alternative levels (state of the world with the proposed change) of each attribute of interest; if a reference level is not included this shall be justified;

c) the institutional context in which the good would be provided (e.g. by government, a local council, a non-governmental organization, a research institute, industry, a charity, an individual);

d) the payment vehicle and the period of that payment used in the survey to finance the change in provision of the good; it can be an explicit monetary value such as a tax, fee or charge, or a market good with an implicit monetary value (e.g. a reduction in one service that liberates the capacity to supply another service);

e) who is said to pay (i.e. the extent to which the costs are said to be borne by the individual, a household, an employer, health insurances or government programmes including taxes or subsidies);

f) the use of focus groups and pre-testing methods of the survey instrument;

g) the number and representational characteristics of people surveyed and the extent to which the sample can be considered representative and sufficiently large for the goal and scope of the monetary valuation study (i.e. not be limited to a small number of selected individuals such as experts or interested parties comprising only representatives from the local community and/or organization-internal personnel) and the analytical weights used to correct for a lack of representativeness, if any;

h) sampling method: the way in which the interviewed people were found (e.g. simple random, systematic, stratified or clustered sampling, volunteers from the general public or as part of professional survey companies' panels);

i) survey method: the way in which the questionnaire was administered (e.g. mail surveys, telephone interviews, face-to-face interviews, computer-assisted personal interview, computer-assisted web interview) and the way opt-outs were replaced or otherwise considered;

j) any associated statistical analysis;

k) the way in which known biases are avoided or treated, for example:

   1) the number of non-valid responses (e.g. unrealistically high or low responses also called "protest responses", people refusing to respond), the reason for considering non-valid responses and how these are dealt with;

   2) the content/face validity test and construct validity test conducted and their conclusions;

   3) whether and which particular guideline was followed, if applicable.

When performing a stated preference survey, a copy of the questionnaire shall be included in the documentation. A simplified econometric model that contains basic socio-economic variables should be documented to facilitate value transfer (see 6.5).

6.4.2 Contingent valuation

In contingent valuation, the good to be valued is presented in its entirety (as a bundle of its attributes). The respondents are asked for their WTP to avoid a deterioration in quality or quantity of the good or to secure an improvement. Alternatively, they are asked for their WTA to tolerate a deterioration or to forgo an improvement.

When monetary values determined by contingent valuation (within the monetary valuation or conducted before) are used, the following shall be documented:

a) the format of the preference elicitation method (e.g. open ended, discrete choice, payment card);

b) whether or not during the contingent valuation an additional type of preference elicitation method (e.g. standard gamble) was used and how;

c) the statistical measure provided (e.g. mean or median values from which kind of parametric or non-parametric model).

If a contingent valuation survey is carried out in the monetary valuation study, the following in addition to a) to c) above shall be documented:

— a constant only bid function model from which best mean and median WTP or WTA estimates are derived;

— all relevant econometric model(s) used including random utility models, if relevant (see 6.4.3);

— a measure of the overall fit of the econometric model(s) used;

— a discussion of the parameter estimates examining whether they conform with prior expectations;

— the number and percentage of people accepting each bid;

— the mechanics and validity for selecting the highest bid amount.

6.4.3 Choice experiment

In choice experiments, the good to be valued is presented in terms of its attributes. These attributes change across the choices presented to the respondents. Respondents are not asked for their WTP or WTA directly, but these are inferred through the choices they make about these scenarios.

NOTE The choice experiment method is the only kind of choice modelling or conjoint analysis method that follows welfare economic principles and therefore is included in this document.

When monetary values determined by a choice experiment (within the monetary valuation or conducted before) are used, the following shall be documented:

a) the attributes of the good in question that are distinguished and the way in which these were selected;

b) the levels or measures of those attributes;

c) potentially relevant attributes that have been omitted;

d) the number of alternatives offered beside the status quo option;

e) the number of choices that are presented to the respondents;

f) the statistical measure provided (e.g. mean or median values).

If a choice experiment survey is carried out in the monetary valuation study, the following in addition to a) to f) above shall be documented:

— choice of experimental design (i.e. type of efficient or orthogonal design);

— a non-parametric model used to derive lower bound estimates of mean and median WTP or WTA;

— the selection of the random utility model in terms of:

  — the functional form of the indirect utility function (e.g. a simple linear combination of costs and attributes);

  — the probability distribution of the random elements (e.g. binary, conditional or nested multinomial logit model, binary or multinomial probit model);

— tests for independence of irrelevant alternatives in conditional logit models;

— a measure of the overall fit of the model;

— a discussion of the parameter estimates examining whether they conform with prior expectations;

— utility estimates for defined programs and implicit prices and confidence intervals for the utility estimates.

6.5 Value transfer

6.5.1 General

Value transfer (also known as "benefit transfer") refers to the process of using a monetary value estimated in the context of a primary monetary valuation study in a different context. To adapt monetary value estimates from other studies, adjustments for spatial, temporal and other contextual differences should be made.

A monetary value that is intended to be transferred should be documented prior to the value transfer, according to the applicable requirements and guidance given in 6.1 to 6.4.

In a value transfer, the following items should be taken into account and documented:

a) select relevant primary monetary valuation studies, preferably of a human population and an environmental impact that have characteristics as close as possible to those in the application context (see Annex B);

b) assess the relevance and quality of primary monetary valuation study values for transfer with respect to

  1) scientific soundness: the transfer estimates are only as good as the methodology and assumptions employed in the primary monetary valuation studies;

  2) similarity: primary monetary valuation studies should be as close as possible to the application context, in terms of the good, the type and scale of change valued, the size and characteristics of the affected human population and any other factor deemed to have a significant effect on the monetary value;

  3) richness in detail: the selected primary monetary valuation studies should provide a detailed data set and accompanying information;

c) select the most relevant data available from the primary monetary valuation study on the basis of b);

d) transfer the monetary value estimate from the primary monetary valuation study to the application context, including

  1) determining the unit (e.g. value of a statistical life, WTP/household/year for a specified water quality decrement);

  2) applying value transfer method for spatial transfer (see 6.5.2);

  3) applying value transfer method for temporal transfer (see 6.5.3).

6.5.2 Spatial value transfer

Value transfer methods for spatial transfer include:

a) unit value transfer without income adjustments;

b) unit value transfer with income adjustments;

c) value function transfer (based on one primary monetary valuation study);

d) meta analytic function transfer (based on a meta-analysis of several primary monetary valuation studies).

When adjusting for currencies, the relevant methods described in 6.6 shall be applied.

If there is a difference in the attributes (e.g. scale, structure) of the environmental impact between the primary monetary valuation study and the application context, the monetary value should be adjusted. Adjustments shall be documented.

6.5.3 Temporal value transfer

For value transfer between different years, the relevant methods described in 6.6.3 shall be applied.

Spatial value transfer should be undertaken first according to 6.5.2 before temporal value transfer.

6.6 Currency and base year adjustments

6.6.1 General

The methods described in this subclause will normally be used in but are not limited to value transfer.

EXAMPLE An example of use beyond value transfer is the unit conversion of a monetary value of global climate change impacts assessed with an integrated assessment model whose unit is converted from US$ for the base year 2005 to another currency for another base year.

6.6.2 Currency adjustments

When an original monetary value is determined in a different currency than the one stated in the goal and scope of the monetary valuation study conducted, it shall be adjusted by means of purchasing power parity adjusted exchange rates. This kind of adjustment may also be needed if the original monetary value is determined for a specific country and is intended to be used in another country having the same currency (e.g. between Finland and Spain, both having the Euro). If an alternative method for currency adjustment is used, this shall be justified. The source and corresponding date of the exchange rates used shall be documented.

6.6.3 Base year adjustments

When an original monetary value is determined for a different base year than the one stated in the goal and scope, it shall be adjusted. If the necessary data are available, the adjustment shall be made by means of a consumer price index if only consumers are affected or by means of the gross domestic product implicit price deflator if producers are affected. When adjusting monetary values for which the necessary data are not available (e.g. future years), the relevant methods described in the previous sentence shall be applied up to the year for which data are available. Beyond this year, the expected increase in gross domestic product per capita and an income elasticity may be applied. If other adjustments or no adjustments are made relative to the base year, this shall be justified. The source and corresponding date of the data used for base year adjustment shall be documented.

6.6.4 Simultaneous adjustments of currency and base year

When an original monetary value is determined in a currency and for a base year that differ from those stated in the goal and scope of the monetary valuation study conducted, it is dependent on the good to be valued whether the original monetary value is first currency-adjusted according to 6.6.2 and then base year-adjusted according to 6.6.3 or vice versa. The sequence should be first base year-adjustment, according to 6.6.3 and then currency adjustment according to 6.6.2 unless there is good reason not to do so. A sensitivity analysis can provide additional information about the implications of this choice. The documentation requirements of 6.6.2 and 6.6.3 apply.

6.7 Equity weighting

Different individuals or populations can have different marginal utility of income or consumption. As a result, an additional amount of money does not provide the same increase in utility to a poor person as it does to a rich person.

In order to take such differences into account, monetary values may be equity weighted.

The use of equity weighting shall be documented and justified.

The equity weight is obtained using the Formula (1):

$$E_i = \left(Y_{\text{ref}} / Y_i\right)^e \tag{1}$$

where

E_i is the equity weight for group i;

Y_{ref} is the per capita income of a reference population group;

Y_i is the average per capita income of population group i;

e is the elasticity of social marginal utility of income.

Equity weighting is most simply performed on the purchasing-power corrected monetary values by multiplying these monetary values by the income ratio raised to the power of the elasticity of marginal utility of income. The applied income ratio is the ratio of the average income of the reference population group to the income of the target population group.

The applied elasticity of marginal utility of income shall be justified and documented. Also, when a zero elasticity is applied (i.e. no equity weighting) this should be documented.

If equity weighting is performed, monetary values, both before and after equity weighting, as well as the reference population, shall be documented.

6.8 Discounting

6.8.1 General

When the monetary values are applied to environmental impacts or aspects that occur at different points in time, discounting shall be performed. The process of discounting and the discount rates used, including when performed with a zero discount rate, shall be documented and justified. In line with the principles of welfare economics, social discount rates (as opposed to private discount rates normally used by businesses) are recommended. A typical justification may be the normative position of a decision-maker to give equal weight to the marginal utility of current and future populations. When there is economic growth, future populations will be richer and their marginal utility of consumption will therefore be lower. To give equal weight to the implications of environmental impacts and environmental aspects on the utility of current and future populations, the monetary values of the

future environmental impacts and environmental aspects are weighted by a discount factor calculated from a constant discount rate (see 6.8.2) or from temporally variable discount rates (see 6.8.3).

The timing of the environmental impacts (or their annual monetary values before discounting) shall be documented. Unless the base year for discounting is the same as for the currency, the base year for discounting shall be documented separately.

NOTE Monetary values before discounting can increase with economic growth and with increasing scarcity of resources.

6.8.2 Discounting at a constant rate

When discounting at a constant rate, the applicable discount factor for a specific year is obtained by Formula (2):

$$D_f = 1/(1+D_r)^t \quad (2)$$

where

D_f is the discount factor;

t is the number of years into the future;

D_r is the discount rate.

Due to the compounding effect, discount factors generally will be decreasing over time. The discount rate can be obtained using Formula (3):

$$D_r = d + g \cdot \mu \quad (3)$$

where

D_r is the discount rate;

d is the pure rate of time preference;

g is the growth rate of per capita consumption;

μ is the elasticity of social marginal utility of consumption.

For inter-generational (i.e. long-term) considerations from a societal perspective, the pure rate of time preference should be set to zero. Values different from zero shall be justified.

If used, the determining parameters for the applied discounting scheme (future maximum and minimum annual growth rates, elasticity of marginal utility) shall be documented.

If a different formula is used to derive a discount rate, this shall be justified and the formula and its constituents, including their monetary values, shall be documented.

6.8.3 Discounting at varying rates

Discount rates that decline over time are used to take future uncertainties into account. The time span for which the discount rates are valid shall be documented. If a formula is used to derive the discount rates, the formula and its constituents including their monetary values shall be documented. The annually applicable discount factors shall be documented.

When discounting at varying rates, the applicable discount factor for a specific year is obtained by Formula (4):

$$D_{\mathrm{f},t} = \prod_{i=1}^{t} \frac{1}{1 + D_{\mathrm{r},i}} \tag{4}$$

where

$D_{\mathrm{f},t}$ is the time-variable discount factor;

t is the number of years into the future;

$D_{\mathrm{r},i}$ is the time-variable discount rate;

i runs from 1 to t.

If possible, the time-varying growth rates and the certainty-equivalent discount rates should be documented.

6.9 Analysis of uncertainty and sensitivity

The uncertainty of the monetary values shall be documented. Confidence intervals and the factors to which the monetary value(s) are most sensitive should be documented.

7 Linking monetary values of environmental impacts to related environmental aspects

An environmental aspect can cause one or more environmental impacts. The monetary values of these environmental impacts shall be determined and documented as described in Clause 6 and according to the goal and scope of the monetary valuation study.

When linking monetary values of environmental impacts to related environmental aspects, an environmental impact factor shall be determined and documented for each environmental impact pathway analysed.

EXAMPLE Three priority environmental impact pathways have been identified for NOx emitted to air, leading to 1) premature mortality in humans due to secondary particulate matter, 2) asthma attacks in humans due to ozone formed, and 3) acidification of ecosystems due to nitric acid (acid rain). As a result, three different environmental impact factors are determined.

When relying on models and environmental impact factors with publicly available documentation, such documentation shall be referenced according to the principle of transparency. In other cases, the models, data and assumptions used to determine the environmental impact factors shall be documented. When there are long-term environmental impacts, such as those resulting from increased greenhouse gas emissions, more complex models integrating environmental and economic dynamics over time, space and populations may be used when determining environmental impact factors.

The extent to which the environmental impact factor deviates from the goal and scope (see 5.3) shall be documented.

NOTE 1 For cases where static modelling is applicable, characterization factors as described in ISO 14044:2006, Clause 4, can be used.

NOTE 2 The deviation can be temporal or spatial.

If the environmental impact pathway is analysed with the help of an integrated assessment model (e.g. related to climate change), the following items shall be documented:

— the model name;

— its version, publication year and issuing organization;

— the relevant environmental baseline and alternative scenarios used;

— which kinds of environmental impacts are distinguished;

— any other relevant information (e.g. spatial resolution and coverage, temporal resolution and coverage, Monte Carlo analysis and associated metric, such as average, median or trimmed average).

To obtain an environmental impact pathway-specific monetary value, the monetary value of an environmental impact is multiplied by an environmental impact factor. The environmental impact pathway-specific monetary value shall be documented.

When monetary values are aggregated, the individual monetary values per environmental impact or environmental aspect shall be documented.

When a monetary value of an environmental aspect is disaggregated into its constituent environmental impacts, the approach shall be justified and documented.

When unit conversions other than those described in 6.6 are conducted, these shall be documented.

NOTE 2 Conversion from C to CO_2 or from CH_4, N_2O, etc. to CO_2-equivalents are considered unit conversions.

The uncertainty of the environmental impact factors shall be documented.

8 Quality check

The quality check shall ensure:

a) the methods used to carry out the monetary valuation are consistent with this document;

b) the methods used to carry out the monetary valuation are appropriate in relation to the goal and scope of the monetary valuation study;

c) the data used and statistical and econometric analyses conducted are appropriate in relation to the goal and scope of the monetary valuation study;

d) there is no double counting;

e) the interpretations reflect the limitations identified and the goal of the monetary valuation study;

f) the documentation is transparent and consistent.

The results of the quality check shall be documented.

9 Reporting

For a monetary valuation study, the following shall be reported.

a) The goal, intended use and audience of the monetary valuation study.

b) The environmental impact(s) valued, and the direction of the impact (positive or negative).

c) The indicator(s) by which the environmental impact(s) are measured.

d) The unit(s) and quantity(ies) of environmental impact(s) that the monetary value(s) of the study is for.

e) The environmental aspects that cause the environmental impacts.

f) The environmental baseline.

g) The monetary valuation method(s) applied including any adjustments made.

h) The justification for the choice of monetary valuation method(s).

i) The obtained monetary value(s), its base year, currency, reference unit and time period, with indication of uncertainty.

j) The elements of total economic value captured by the monetary value(s).

k) The spatial coverage of the monetary value(s).

l) The temporal coverage of the monetary value(s).

m) The human population affected by the environmental impact(s).

n) The percentage of the affected human population whose preferences are reflected in the monetary value(s).

o) Limitations in applicability of the monetary value(s).

p) The transfer functions or calculations made for value transfer.

q) The equity weighting applied, indicating the reference population and the applied elasticity of marginal utility of income and its justification. Also, if a zero elasticity is applied (equivalent to no equity weighting).

r) Whether and how the monetary value has been aggregated over time, space, people, and environmental impacts and aspects.

s) Whether the monetary value is a marginal, average or median measure based on a distribution over people, environmental impacts, space or time.

t) The discounting scheme applied and the justification for using that scheme (e.g. recommended social rate of discount in the country), determining the parameters of the discount rate. Also, if a zero discount rate is applied. Unless the base year for discounting is the same as for the currency, the base year for discounting shall be reported separately.

u) Data sources and references used, including reference to any more detailed reporting or database.

v) Results of a sensitivity analysis, if conducted.

w) Other relevant assumptions made, and other relevant data processing performed in the monetary valuation.

x) The results of the quality check (see Clause 8).

In addition, when environmental aspects are concerned, the following shall be reported.

— The name and unit of the environmental aspect(s).

— The name and type of the source(s) causing the environmental aspects (e.g. a specific activity at a specific production site of a specific organization) or the life cycle stages concerned.

— In cases of releases, the receiving media or recipient (e.g. air, sea water, soil, humans).

— In cases of natural resources, the affected medium or media (e.g. water or trees taken from which source, minerals taken from which kind of reserve, and what kind of land use).

— The spatial location and the specific time including the extension of the releases or resource flows (e.g. point source at 57°43′54″N and 12°03′11″E, or anywhere on the globe, 2019).

— The environmental impacts of environmental aspects included in the study and their spatial and temporal extensions.

— Environmental impact pathways included in the study.

— The environmental impact factors for the environmental aspect with respect to each environmental impact included.

— The total aggregated monetary value for the environmental aspect.

— Any relevant assumptions made and sensitivity analysis performed.

The information can be organized in a database. An example of a database format is given in Annex D.

Annex A
(informative)

Flowchart on an application of this document

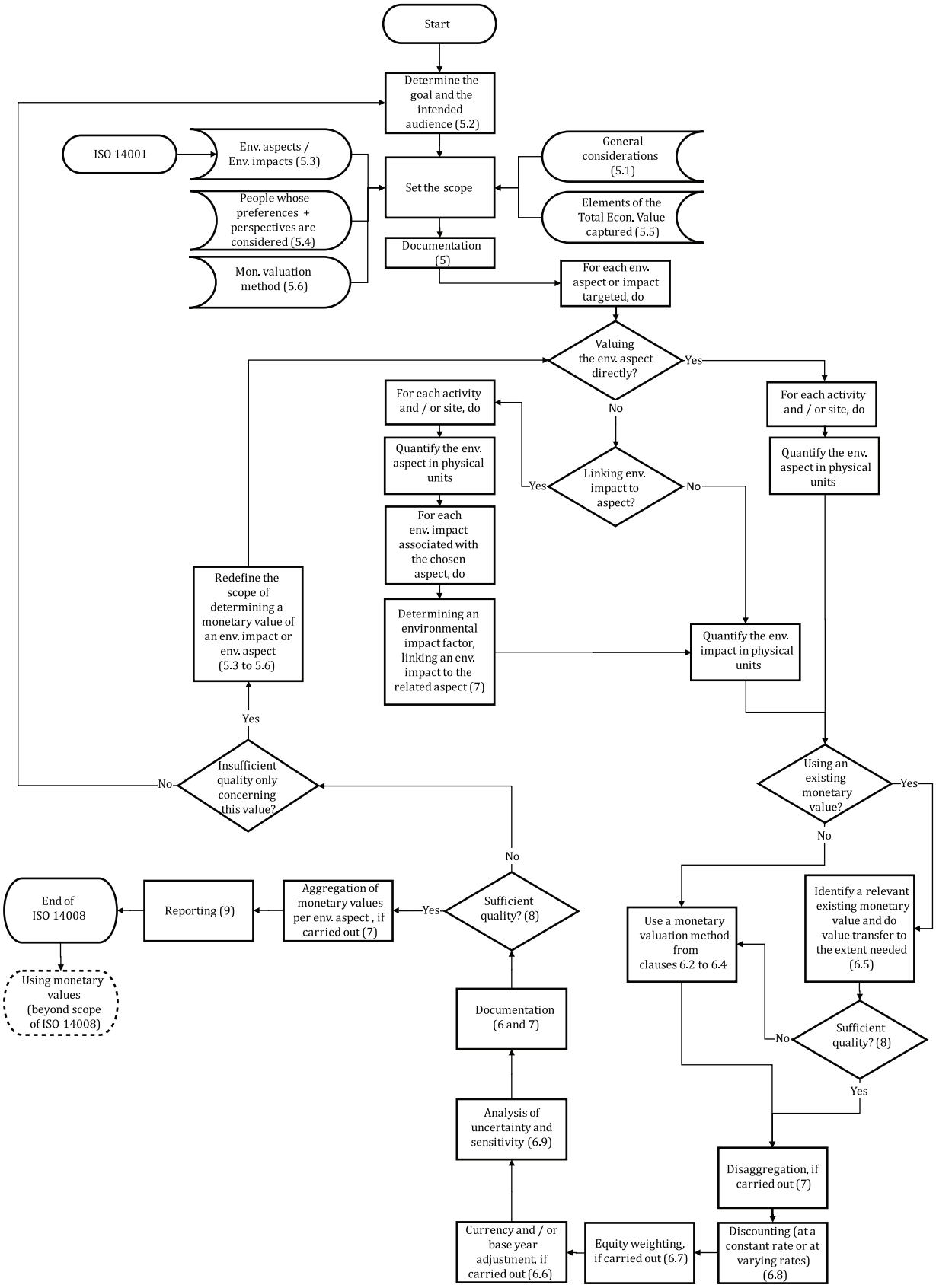


Figure A.1 — Flowchart on an application of this document

Annex B
(informative)

Assessing similarities in value transfer — Example of non-timber forest ecosystem services

This annex provides an example of assessing similarities between monetary values from a primary monetary valuation study and monetary value needed in the application context. Below is an example of an environmental impact/resource use in terms of change in non-timber forest ecosystem services.

When characterizing the good, similarity can be judged in terms of the following.

a) Similar good (i.e. similar types of forests, similar kinds of ecosystem services considered; when focus is put on providing recreational value, for example, whether similar recreational activities are considered).

b) Similar environmental baseline, size and direction of change in the good valued. To avoid scaling up and down values according to the size of the area, studies of a similar size from other countries could be considered rather than domestic study sites of a different size. The same applies to the environmental baseline and the direction of the change. However, the general recommendation is to choose a domestic study site as close as possible geographically to the application context.

c) Availability of substitutes: the monetary value of a good depends partly on substitutes that deliver the same use and/or non-use values. For example, for recreational values, the substitutes would be similar sites that provide similar activities with similar benefits or monetary values. A site with no substitutes would be more valuable than a site that is one of many similar sites in an area, and hence this difference should be reflected in the selection of appropriate studies for value transfer.

d) Similar natural resource management regimes affecting the delivery of ecosystem services.

Regarding population characteristics, similarity can be evaluated in terms of:

— similar average income level (and income distribution); if not, income adjustments should be made when performing the value transfer;

— similar gender, age and educational composition;

— similar size of affected population;

— similar rights to using natural areas for recreation;

— similar perceptions of nature preservation (attitudinal and cultural factors).

Annex C
(informative)

Monetary valuation in welfare economics

Following welfare economic principles (notably, those regarding being spatially and temporally explicit and looking at individual utility), the preferences of individuals (i.e. the members of society) are at the centre of monetary valuation. Individuals are perceived mostly, if not exclusively, in terms of their economic behaviour, i.e. consumers of final goods. Preferences are, thus, revealed in marketplaces through decisions to spend money: the individual spends money (or time) to increase (or at least maintain) his or her utility (welfare or well-being), for example, by paying more for a house in a cleaner environment, by paying to be cured from a disease or by making efforts to visit recreational sites. Preferences are measured through WTP, to avoid a deterioration in quality or quantity of the good or to secure an improvement, or WTA, to tolerate a deterioration or to forgo an improvement.

Monetary values of goods cannot always be observed in markets for two reasons. First, prices of market goods may not adequately reflect benefits or monetary value to the consumer due to, for example, market distortions (e.g. monopolies or external effects) and policy interventions (e.g. taxes and subsidies). Second, goods that are not traded in markets have no market price at all, but still have value.

The three main approaches to economic valuation are:

— using market prices (corrected for distortions, if necessary);

— revealed preference methods using data from markets for related goods (so-called surrogate markets);

— stated preference methods creating hypothetical markets to elicit individuals' values.

Estimating individuals' preferences on the basis of their WTP (or accept) in order to obtain (or be compensated for) a positively (negatively) perceived change is in line with the principles of welfare economics. The use of preferences from experts, politicians or social administrators has no basis in welfare economics for estimating economic value.

Table C.1 illustrates types of data used to estimate monetary values. Table C.1 distinguishes between who incurs or decides upon or regulates the expenditures.

Where there are no resources for a primary monetary valuation study to apply the above methods, or fast estimates are needed, value transfer can be used. Value transfer is the process of selecting an economic value estimate from an existing study and adapting it to the context of the monetary valuation (see 6.5).

Table C.2 mentions typical monetary valuation methods for selected environmental impacts organized according to the components of the total economic value (see 5.5).

Table C.1 — Classification of monetary valuation methods

Approaches	Individuals' WTP or WTA	Proxies for individuals' WTP and WTA
Principle for the derivation of individuals' preferences	Measuring individuals'/consumers' preferences	Spending made, committed or required by a public body on substitute goods (such as replacement) or actions to avert environmental impacts (such as prevention, abatement, clean-up or restoration)
Methods related to monetary valuation of market goods on existing markets	Monetary valuation by market prices (e.g. for crop, timber, fish, fibre and emission permits)	N/A
Methods related to monetary valuation of non-market goods on surrogate markets	Revealed preferences: a) hedonic pricing: 1) property market (e.g. houses); 2) labour market; b) travel cost method; c) individual averting costs (defensive or preventive expenditures); d) cost-of-illness (COI) to the extent that they are privately borne.	Revealed preferences: a) public averting cost method — targets at administrative levels (many synonyms exist, e.g. marginal avoidance, marginal control or abatement costs, shadow price/value approach, cost per life (year) saved, standard-price approach); b) replacement and restoration cost method (of which parts are termed "public averting cost method — targets for specific sites" in this document); c) cost-of-illness (COI) to the extent that they are borne by a mandatory health care system.
Methods related to monetary valuation of non-market goods on hypothetical (or constructed) markets	Stated preference methods: applied to general public or of the affected population: a) contingent valuation; b) choice experiments.	N/A

Table C.2 — Components of total economic value and typical monetary valuation methods

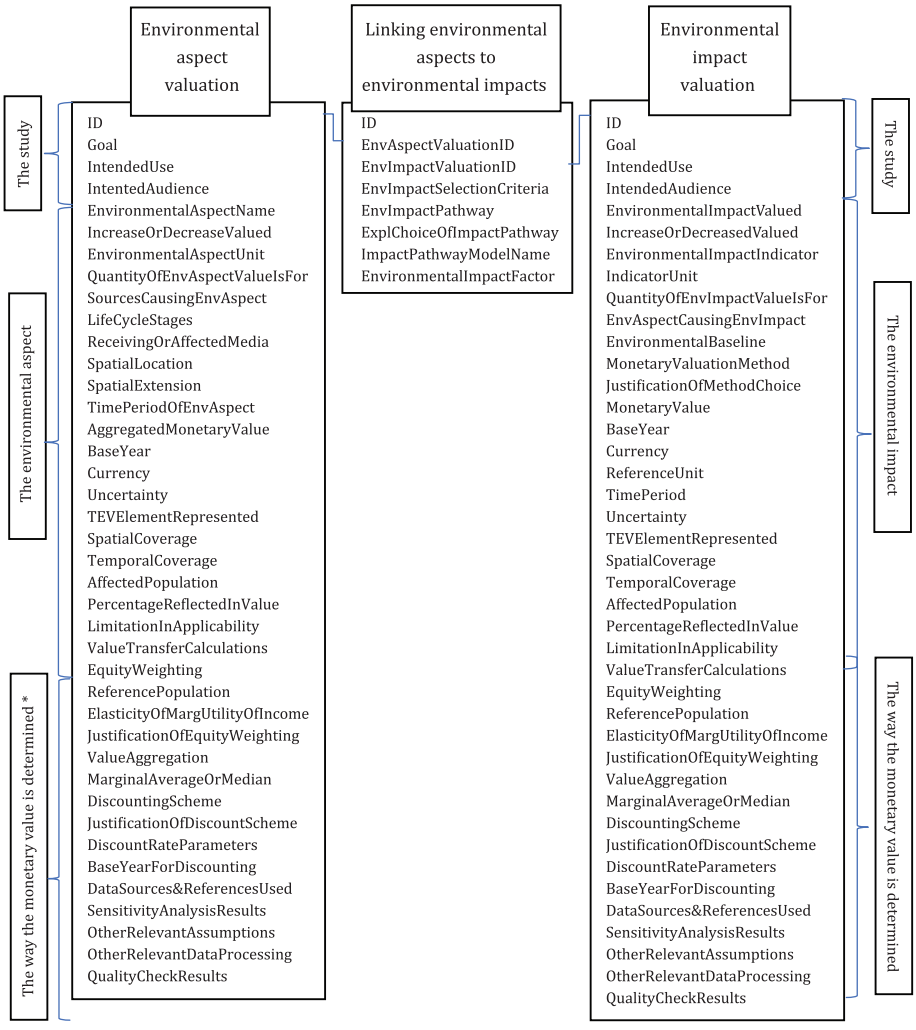
Component of total economic value (see Figure 1)	Examples of valued environmental impacts	Typical monetary valuation methods
Direct use value	Resource costs related to human health impacts: direct medical and non-medical costs (e.g. cost of childcare) associated with treatment for the adverse health impact	— Market prices of traded goods (notably cost-of-illness without opportunity costs) — Individual averting costs
	Opportunity costs related to human health impacts: loss of productivity or leisure time due to the adverse health impact (in general, individuals' forgone income)	— Hedonic pricing on labour markets — Stated preference methods
	Disutility costs related to human health impacts: pain, suffering, discomfort and anxiety linked to the adverse health impact	Stated preference methods
	Ecosystem service-related impacts: food, biomass, recreation, symbolic objects, disamenity Built environment related impacts: repair or maintenance costs for building materials	— Market prices of traded goods — Travel costs — Hedonic pricing — Stated preference methods
Indirect use value	Ecological functions (e.g. flood control, functions in biogeochemical cycles)	Any method in Table C.1 as appropriate
Option value	Use of not yet identified genetic potential for medical purposes	Stated preference methods
Existence value	Natural landscapes that give a benefit without being experienced directly	Stated preference methods
Bequest value	Natural resources that are left unaffected by the current generation borne out of concern for future generations	Stated preference methods
Altruistic value	Natural resources that are left unaffected by people of one country borne out of concern for people currently living	Stated preference methods

NOTE As can be seen from the examples in this table, different monetary valuation methods have different capabilities to assess different components of the total economic value. There will also be other, context specific, factors that would influence the choice of the monetary valuation method.

Annex D
(informative)

Example of a database format

For the user of monetary values of environmental impacts and related environmental aspects, it is practical to choose from different monetary values in a database. Finding relevant information in written reports can be a very time-consuming process. Figure D.1 presents an example of a simple relational database. It consists of three tables, one for a monetary valuation of an environmental impact, one for a monetary valuation of an environmental aspect, and one for impact assessment, i.e. relating environmental impacts and environmental aspects. The terms in the columns are column headings in the tables.



* If monetary valuation of an environmental aspect is made directly

NOTE Due to technical and layout reasons, the headings in the table are without spaces and some are abbreviations.

Figure D.1 — Example of a database format

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