

Environmental Spend Analysis

– Description of a method for integrating environmental and climate impact into generic purchasing analyses

REPORT 2021:3



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Introduction

A spend analysis is a tool that can be used to improve an organisation's strategic purchasing. The method that the tool is based on allows general analyses to be conducted of an organisation's entire purchase volume, as well as analyses of specific purchasing areas or categories.

Amongst other, the method is used in purchasing based on category management, but it can also be used separately as a tool for analysing and prioritising in different stages of the purchasing process.

The UN climate panel's (IPCC's) compilation of scientific work on climate change has highlighted the importance of environmental issues. In combination with the latest international agreements and national objectives aiming to work against climate change, all sectors of society need to dramatically increase their contributions to bring about a change.

The consumption of natural resources and raw materials and different types of energy use all affect the environment. Since today's global economy is largely consumption-driven, changes in purchasing patterns and production are ways to alter the impact that consumption has on the climate.

We have therefore taken the spend analysis further and developed the Environmental Spend Analysis (ESA) method. It integrates environmental effects into a regular spend analysis. This makes it possible to quantitatively indicate the environmental impact of various purchases. The impact from different types of purchase can vary depending, not only on what is purchased, but also on how much. Different organisations purchase different quantities of different products, services and construction works. That being the case, how can an organisation use quantitative methods to assess in a reasonably simple manner which purchasing category should be prioritised in order to reduce the climate impact the most? The Environmental Spend Analysis helps to answer that question. It also points towards the necessity of providing more life-cycle-based information in electronic orders and in purchasing.

It is our hope that ESA will be able to contribute to the development of spend analyses, more life-cycle-based information in purchasing and that the use of these can contribute to sustainable development.

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Part 1 Background and synopsis

1. Background

The National Agency for Public Procurement promotes efficient and socially and environmentally sustainable procurement within the framework of public procurement laws. This for the benefit of public/governmental organizations, citizens and development of industry and trade. We produce and improve tools and methods in order for public procurement to implement environmental concerns. Previously, support for sustainable procurement was under the Swedish Environmental Management Council and the Swedish Competition Authority. For a long time, special efforts to reduce energy use and increase energy efficiency through public purchasing have been part-funded by the Swedish Energy Agency.

Integrating quantified environmental effects based on various uses of the life-cycle analysis (LCA and input/output analyses) into a generic spend analysis is part of an effort to develop support for procurement. In order to provide specific skills and to solve specific problems, expertise was procured from consultants.

The result has become the Environment Spend Analysis, or simply ESA.

2. Purpose

One purpose of ESA is to develop methods to integrate energy and environmental effects with general methods for strategic purchasing. A guiding principle in this work has been that it must be possible to apply the methods practically in regular spend analyses.

A regular spend analysis has an inherent potential to manage more than only the spending. The reason for integrating an environmental analysis into spend analyses is that aspects of sustainability shall be considered early on in strategic purchasing, and that the number of analysis tools should be kept to a minimum. The tool needs to be able to indicate the kind of purchase (i.e., purchasing categories) that have the largest environmental impact, which the organisation therefore should focus on reducing.

To attain this, the environmental effects must be quantified (put in numbers) (), as this allows for measurability. Things that can be measured are often ascribed greater importance than things that cannot be measured. Measurability is also connected with the very nature of purchasing, where purchase volumes and other financial aspects are calculated, allowing for results to be followed over time.

The quantified environmental effects should be based on methods with a scientific foundation and based on international standards to maintain a sufficiently high quality. They must not mix measurements that use different perspectives and boundaries. That the method shall be practically applicable means that, as a first step,

it must be possible to calculate the environmental impact based on the purchased volumes expressed in monetary value.

By integrating the environmental aspects into the spend analysis, the organisation's purchasing department is not burdened with more work than it would be for a regular spend analysis.

For the first stage, the objective was to develop a method to demonstrate that it is possible to make environmental spend analyses. After that, we conducted pilot studies to test the method in real organisations with actual purchases.

The next step is to propagate the method so that companies providing spend analysis services and other purchasing analysing tools hopefully can introduce ESA as a natural component of their services.

Future advancements will aim to connect the environmental spend analysis to electronic ordering systems at article level and integrate quantified environmental effect from LCA-based product declarations such as EPDs¹.

3. Summary

3.1 Environment Spend Analysis

A spend analysis is an accepted method for analysing all the purchases made by an organisation.

Spend analyses help us to obtain a fact-based overview of purchases, suppliers and much more. They also help us to structure purchasing efforts, to see where improvements need to be made, and to set priorities for such measures.

To make a spend analysis, we first need to divide our purchases into different types – different categories. Using these categories, we build a structure – a category tree – that we use as a basis to work from.

By environmentally integrated, we mean that for the first time we have incorporated an analysis of the environmental impact of purchases into spend analysis. The tool links environmental impact to purchase volumes. The values for life-cycle environmental impacts are collected from databases that collect such values and statistics. On our behalf, the IVL Swedish Environmental Research Institute has processed life cycle based environmental impact values so that they are set per SEK for different types of purchase instead of per mass or volume.

¹ See, for example, the International EPD System: <https://www.environdec.com/>

By entering purchases calculated in SEK into the tool, indicators can be obtained on the environmental effects of the purchases. To see indications of environmental effects, the user does not need to calculate mass (kilogrammes) or volume (litres).

Our method for an environmentally integrated spend analysis has shown that integrating environmental aspects into purchasing analyses is possible. This opens possibilities for more efficient and strategic efforts towards sustainable purchasing. From here on, we refer to the method as ESA.

3.2 Two versions of ESA

It became clear early in the work that it should be possible to develop two versions of the method with the right statistical data. The first of these is a general version that can be integrated into regular spend analyses and used by all purchasing organisations, whether publicly or privately owned. Environmental and energy aspects are then based on so-called accounting LCA². This is the method we describe in this report.

In this version of ESA, we have entered the CPV codes into the category structure (see below for more information about CPV codes). When advertising a procurement, CPV codes must be used to describe what is being procured. We have added environmental impact in terms of carbon dioxide equivalent emissions, which describes the effects of the selected CPV codes on climate change.

In the other version of ESA, quantified environmental and energy aspects are based on so-called input/output analyses according to environment statistics and models. Statistics on the public purchase are then analysed using key ratios for environmental effects. This provides an indication of the possible environmental effects of all public purchases in, for example, a region or on the national level. This, of course, along with the limitations imposed by the statistical data.

3.3 ESA gives indications, not precision

ESA is a guide showing approximate environmental effects that purchases can have within different purchasing categories. The method is based on the LCA values and statistics on prices that were available at the time the method was developed.

ESA therefore provides qualified numerical indicators of entire purchase volumes and indicative comparisons between different types of purchase.

² An accounting LCA determines what the actual environmental impact is, which can be linked geographically and temporally to a product, service or contract over its life cycle. It traces and keeps an account of the product's or service's environmental impact by following the value chain.

Precision in both methodology and supporting data can, and of course should, be improved in future versions. Therefore, the results must naturally be interpreted in the light of the method's shortcomings.

4. Regarding spend analyses

There are many ways of analysing an organisation's purchases. A spend analysis is one such method. There are often differences regarding what has been procured and what an organisation has purchased and paid for (the spend). In strategic purchasing, however, it is what an organisation purchases and is truly in need of that forms the basis of a spend analysis.

Spend analyses give us fact-based information by analysing payments that have been made. A spend analysis is based on similar types of products, services and contracts being placed in the same categories – purchasing categories. This provides the transparency needed to be able to analyse and work strategically with purchases.

Construction contracts are one example. This is a type of industry that includes services such as crafts, carpentry and building installations. Offers from contractors and suppliers are similar.

Many environmental aspects are also similar within a single industry. Since suppliers have similar offers and are active on the same market, the buyer can use the same approach and follow the same strategy in purchasing.

The spend analysis forms the basis of the methodology within purchasing termed "category management", which is a way of working methodically and strategically with purchases. For those who wish to have more detailed descriptions of spend analyses and category management, we refer to other publications.³

The National Agency for Public Procurement plans to publish a guide for spend analyses. To provide an understanding of the ESA, here follows a brief overview of a spend analysis.

4.1 An important part of strategic work

A purchasing department provides its organisation with the products, services and contracts needed for its operations and the production of other products and services. Purchasing departments should also work in such a way that they contribute to the organisation being able to achieve its objectives. These objectives could be of a general

³ For example, O'Brien, Jonathan (2014) Category management för inköp [English title: Category Management in Purchasing]. Studentlitteratur AB, Lund. Pandit K., Marmanis H. (2008) Spend analysis J. Ross Publishing. Fort Lauderdale, USA. Other literature and sources can also be found on <https://tools.effso.se/>

nature, or they could deal with only parts of the organisation or what is produced. The following questions may then arise:

- For which activities and purchases is security of supply most important?
- For which activities and purchases is quality more important than lowest cost?
- For which purchases should we try to learn from the supplier's knowledge and experience, and for which purchases is it not important?
- Which purchases have the largest impact on our expenses?

The emerging climate crisis is going to place greater demands on organisations knowing which purchases should be given a high priority with regards to the environmental and social aspects.

Purchasing should, of course, also be done efficiently. The objectives that the purchasing department is intended to contribute towards should also be of such a nature that the department can really make difference.

Spend analyses assist purchasing departments in prioritising which purchasing categories should be given time and resources in order to improve purchasing work. These analyses can sometimes also highlight areas in which the entire organisation needs to improve – improvements that contribute to achieving the relevant objectives that have been identified. For the actual work of purchasing, this may involve setting priorities in market research, procurement, following up of contracts, management and collaboration with suppliers, or improving energy efficiency for ordering, deliveries and invoices.

4.2 How can the analyses be used?

Spend analyses can be used as a basis for fact-based strategies and purchasing planning. They can be consulted to better organise purchasing activities. Recurring spend analyses reveal how purchasing behaviour changes over time and how well strategic efforts have succeeded. Forecasts for future volumes can be made for strategic purchasing, and budgeting can be facilitated. The analyses enable purchases from different categories of products and services to be controlled.

The analyses can also be used as part of the basis to understand how we should control suppliers, such as by showing which categories and suppliers are most important to spend time and resources on. The analyses can show us where we should reduce the number of suppliers where we have too many and increase the number where we have too few.

The analyses can show whether our own resources (number of procurement agents, purchasers, procurement officers, delivery points) match the largest volumes of purchase and our most important suppliers. They can show where we can streamline the ordering process and which categories and suppliers should be included in a computer-based ordering system. They can also show how invoicing can be simplified.

If we can additionally include indicators for how purchases affect environmental aspects in the spend analyses, then we are able to develop our sustainability work. Then we can develop fact-based purchasing strategies and plans, in order to more effectively and strategically contribute to achieving our organisation's sustainability objectives.

4.3 Spend analysis tools

A spend analysis can be done in Excel, Access or another calculation tool. There are also several other programs and online services on the market that can be used. The advantage of using such services is that we also gain access to experiences from suppliers. A great deal of the categorisation can also be obtained since it is possible to make use of the work and experience of other customers. Additionally, the most common calculations and analyses are included in the service. What these tools are lacking, however, is a stringent integrated analysis for reviewing the environmental impact of purchases.

5. Regarding assessment of environmental effects

5.1 Trade and its environmental impact are global

The increased trade in goods and services is leading to emissions resulting from the extraction of raw materials, manufacture, transportation, use etcetera occurring in many diverse geographical regions. This distribution means that the total environmental impact becomes ever more difficult to accurately quantify. ⁴ Emissions from industry have in themselves changed, and the points of emission move between countries when manufacturing etcetera are relocated, but they have not disappeared. ⁵ The consumption of goods in one location causes environmental problems in countries where the natural resources are exploited and where the manufacturing takes place. By affecting consumption, the problems can be reduced, not only in the country of consumption but also in the countries of origin. ⁶

Between 1995 and 2008, Sweden's import of goods increased from approximately seven tonnes per person to nine. The largest proportion of Swedish imports was represented by oil-based products, at 40-50 percent. Wood products, such as timber, accounted for 10-18 percent of imports over the same period. ⁷

⁴ The Swedish Environmental Protection Agency (2010)

⁵ Davis and Caldeira (2010)

⁶ Zhang and Chen (2010), the Swedish Environmental Protection Agency (2010); Davis and Caldeira (2010)

⁷ The Swedish Environmental Protection Agency (2010)

At the same time as trade and consumption have become global, so have many environmental problems. The demand for and trade in raw forest materials and animal feed for consumption in one location affects the use of land and biological diversity in other locations. And changing land use, in turn, contributes to the emission of greenhouse gases. Greenhouse gas emissions in one area affect the climate globally. Approximately three quarters of climate emissions caused through public consumption and investments occur in countries other than Sweden.⁸

By causing a change in demand, the environmental impact of products and services can be reduced. By working strategically with purchases, by working on supplier relations, and by setting and following up on requirements, purchasers can influence the environmental impact of the purchases. But which products and services in my organisation's entire purchase volume have the largest environmental impact? This is the question that an environmental spend analysis can answer.

Calculating consumption-based carbon dioxide emissions

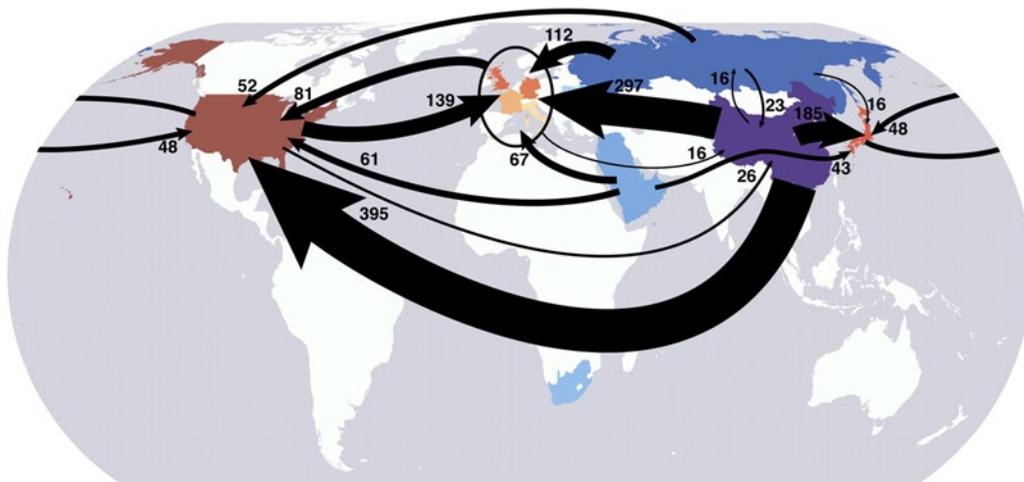


Figure 1. This illustration shows a consumption-based calculation of CO₂ emissions that were embedded in trade flows in 2004 (in million tonnes of CO₂ per year). From Proceedings of National Academy of Science.⁹

5.2 The consumption perspective

To apply a consumption perspective means that the calculated environmental effects from the production of products and services should be ascribed to the place where consumption takes place, such as a country or region. In this context, it is the purchasing organisation that should be accountable for the calculated environmental effects. From a purely consumption perspective, a country's (or a studied area's)

⁸ The Swedish Environmental Protection Agency (2012), Konsumtionsbaserade miljöindikatorer: Underlag för uppföljning av generationsmålet ["Consumption-based environmental indicators: Supporting information for following up the generational goal"]. Report 6483, the Swedish Environmental Protection Agency, Stockholm.

⁹ Davis and Caldeira (2010)

exports are excluded, because these products are consumed elsewhere. In this case, however, we have applied a purchasing perspective.

5.3 The purchasing perspective

By the purchasing perspective, we mean that the environmental impact for the studied organisation's sales or exports is not deducted from the environmental impact from purchases. The environmental impact from purchases are studied as a whole, regardless of whether part of what is purchased is subsequently exported to another organisation or a care user.¹⁰

Part of the purpose of a spend analysis is to chart and highlight areas in which improvement could be made through various efforts that affect the purchases made. Spend analyses become an instrument for the purchaser's influence possibilities. The fact that products and materials that are purchased may be used to create things that will be sold, donated or exported is therefore not as relevant.

5.4 Basis for assessing environmental impact

Various methods can be used in order to assess the environmental impact and environmental effects that different purchases have. To fulfil the purpose of ESA, however, these methods must fit into the consumption and purchasing perspective. Life-cycle analyses (LCAs) are examples of such methods. Therefore, we have collected environmental impact data from LCA databases and standardised environmental product declarations of the ISO Type III standardisation.

5.4.1 LCA

The environmental impact of individual products and services, from extraction of raw material to refuse, can be studied using various science-based and standardised methods – so-called life-cycle analyses (ISO standards 14040 and 14044). Using an LCA, it is possible to identify which environmental impact is largest for a product, and where in its life cycle each type of environmental impact occurs.

¹⁰ Otherwise, the question must also be raised regarding which party the environmental impact of, for example, home help services should be placed on: is it the municipality or the care user who benefits from the service? With the purchasing perspective, we examine only the municipality's purchase of home help services, and the entire environmental impact for this is added to purchases made by the municipality.

Schematic illustration of a life-cycle analysis



Figure 2. Schematic illustration of different parts of a product's life cycle that can be studied using a life-cycle analysis (LCA). Illustration: The National Agency for Public Procurement

When calculating environmental impact, it is not only the choice of materials and type of energy that is important. The use and life of the product or building and what happens after use is also significant. The way an LCA study is delimited is therefore important for what it will show.

Simplified example: An LCA of a tea bag might show that, over its entire life cycle, it is the use of the correct quantity of tea (number of tea leaves) and heating the water that have the largest environmental impact.

Information about the significance of the use phase can be used by manufacturers in a variety of ways. A manufacturer may choose to convey to its customers that it is important to use an appropriate portion and that the source of the energy used for boiling the water is important.

The knowledge can also be used as an excuse for not addressing the environmental impact from production or cultivation, which are things that the manufacturer can influence. A study of the route taken by a raw material or a resource from the cradle until the finished product arrives to the customer or store, on the other hand, focuses on things that the manufacturer can influence. But then things are missed that constitute a considerable part of the environmental impact.

LCAs can be done by specifically studying a product or service. LCAs can also be carried out by compiling LCA information from databases that contain details about the environmental impact of various materials. It is most common for the methods to be combined so that an LCA for a product or service contains both information specifically prepared for the studied product or service as well as generic information from an LCA database.

The results of a completed LCA could be presented in the form of a standardised environmental product declaration (for example an EPD, see below) in order to make comparisons between different products and suppliers possible.

5.4.2 Type III Environmental product declaration

In order to allow comparisons between the same type of product and supplier, the information and values that are to be compared need to be produced using equivalent methods and boundaries. For this reason, standards need to be followed. The international standardisation ISO include standards for LCA. There are also standards applying to voluntary environmental product declarations. In the ISO system, environmental declarations that are to be examined by independent parties and produced within the scope of an environmental declaration programme are so-called Type III declarations. The standard describing such environmental declarations is numbered 14025.¹¹

The Environmental Product Declaration (EPD), is one example of a Type III declaration. Information contained in an EPD is largely based on an LCA of the product, service or contract. An EPD can also provide information on how to reduce the environmental impact from using the product, how the product can be recycled, and other information that is not addressed in an LCA.

There are different programmes for EPDs that are run by different programme operators. The programmes set up regulations and provide guidance on how life-cycle analyses shall be conducted and how an EPD shall be compiled. The rules describe which methods and boundaries should be followed and state that an EPD must be reviewed by an independent party. The purpose of these rules is to make EPDs for the same types of products and services comparable with each other. According to ISO 14025, programme operators shall develop the programmes transparently and allow various interested parties to participate.



Figure 3. The EPD logo

One such programme is the International EPD® System, which is administered by EPD International AB in Sweden. Declarations from this programme are compatible with many other environment declaration programmes thanks to shared agreements regarding methods etcetera. The programme has a database where all approved EPDs and climate declarations are freely available.¹²

¹¹ www.sis.se

¹² www.environdec.com/sv/

The European Commission is currently developing its own system for LCA-based communication of the environmental impact of products and services. It will allow for information to be provided about the environmental impact of different products.

For products, the work is termed Product Environmental Footprint (PEF), and for organisations Organisation Environmental Footprint (OEF).¹³ However, after many years of work, PEFs have still not been put on the market.

6. Common Procurement Vocabulary

As previously mentioned, development of the regular spend analysis includes CPV codes being entered into the category structure of ESA. Common Procurement Vocabulary (CPV) is the EU's nomenclature for products and services that are purchased through public procurement. CPV standardises the descriptions of a large number of goods, services and contracts. A procurement notice must contain one or more CPV codes that describe what is being procured.

One of the purposes of CPV codes is to help potential suppliers to find items of interest more easily amongst the procurement notices. Another reason is to obtain data for procurement statistics.

The CPV code structure consists of a combination of eight numbers, a check digit (code) and a written description. The structure is hierarchical; the top level – the main classification – aims to describe an industry, and the subsequent levels become increasingly specific.

The main classification is represented by the two first numbers of the CPV code, after which numbers represent groups, subgroups, categories and subcategories. If the lower groups or categories are not further divided, the subsequent groups or categories are given as zeros.

At the lowest, most specific level, the CPV code system consists of 9,454 descriptions of various products, services and contracts.¹⁴

¹³ <http://ec.europa.eu/environment/eussd/smgp/>

¹⁴ simap.ted.europa.eu/web/simap/cpv/; document: "CPV 2008 Guide"

Part 2 Description of Environmental Spend Analysis

This part of the report describes what ESA – which makes use of process LCAs – consists of. There is also a description of what an environmental spend analysis reveals and what analyses can be made. Part 4 of the report describes the compromises that were made during the work and what the method is based on.

7. What does ESA consists of?

ESA is a method that integrates quantified (numbered) LCA-based values for environmental effects with a general spend analysis.

The ESA method consists of three components; a category structure, LCA-based values for environmental effects, and an allocation key.

A category structure (category tree or spend structure) arranges different types of purchase/purchasing categories into a hierarchy with primary categories and various levels of subcategories. ESA has four main levels.

Level	Level consists of	Exampel	Code
Level 1	Primary category	Land and buildings	None
Level 2	Subcategory	Contracts and technical consultants	None
Level 3	Subcategory	Lighting systems	None
Level 4	Subcategory with CPV designation	Street lighting	Lowest level CPV code

Figure 4. Illustration of the levels in the ESA category structure. At level 4, the description is the same as the description of the current CPV code.

ESA also contains LCA-based values for environmental effects. These values are set for several categories at level 4.

Since some CPV designations describe products and services that vary greatly in environmental impact – such as automotive fuels, for example – we have set up an allocation key. We will go into a more detailed description of allocation keys later.

When environmental values are incorporated into a spend analysis and it follows the method for ESA, the only input data needed is what would be required to conduct a common spend analysis. This mainly involves the data relating to all payments made to suppliers.

Using the category structure, payments to suppliers can be entered into different categories. Each subcategory at level 3 has been given a default value for its environmental impact. In this way, categorisation does not always need to be done at the lowest level (level 4). It is sufficient to categorise payments to suppliers down to level 3, although the result becomes more accurate the lower the level of categorisation used and the more accurately allocation keys are adjusted.

The category structure is discussed in more detail under heading 9 below.

8. What environmental effects are shown

In the version of ESA described here, we have chosen to limit ourselves to integrating the climate impact. The reason for this is purely a matter of resources; calculating more values was unfortunately beyond our resources when the method was developed. In principle, however, there is no limit to the method. Quantitative values included in an LCA can also be shown in the environmental spend analysis after processing as described below.

The version of ESA based on the input/output method also provides indicators for land use, particles harmful for health, and can indicate acidification, eutrophication, ground-level ozone etcetera. In that version, we integrated more environmental effects because it did not involve a great deal of extra work to obtain that information due to the way the databases are set up.

8.1 Climate impact

Climate impact is shown as tonnes (or kg) of carbon dioxide equivalents (CO₂ equivalents), which means that all emissions of different greenhouse gases are converted to the effect that an equivalent emission of carbon dioxide would have. Details about the climate impact of different products, services and contracts was retrieved from databases containing LCA and EPD information.

The greenhouse gases are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O, laughing gas) and chlorofluorocarbons (CFCs, HCFCs and HFCs) such as freon. Different gases affect the climate to a different degree.

Anthropogenic sources of greenhouse gases include combustion, various types of change in land use, various methods used in forestry and farming, and the industrial production of gases, such as nitrous oxide and freons etcetera.

9. Description of category structure

The primary level in the ESA category tree (spend structure) is based on the organisation and how extensive its purchases are. From very extensive to less extensive in a descending scale.

Primary purchasing categories/types of purchase	Purchase volumes (SEK)	Climate impact (tonnes CO2-e)
Purchase of larger/entire businesses, and operating contracts		
Materials and services that largely go indirectly to care users		
Land and buildings		
Equipment and materials		
Services and materials for the own organisation		
Support services, mainly skills		
Not categorised		
Total amount		

Figure 5. Category structure of the Environmental Spend Analysis. Here, the top level (level 1) of purchasing categories is shown.

Purchase of large/entire businesses and operating contracts are services corresponding to entire operations, or very extensive services. This is a primary category.

Materials and services that largely go indirectly to care users is a primary category. It includes extensive support for the organisation's own activities, or the purchasing of products and services that are included in products or services that the own organisation produces or provides to users (or "customers").

Land and buildings, which includes complex building or construction contracts along with related services, is a primary category.

Equipment and materials is a primary category. These are consumable items as well as equipment that is more associated with production.

Services and materials for the own organisation is a primary category. These are services and materials – mainly inventory– that can especially be associated with administration, operation or building your own organisation.

Support services, mainly skills is a primary category. These are mostly consulting services.

Not categorised is a collective heading for purchases that, for various reasons, we have not been able to categorise.

Below follows a description of the contents of each primary category. The descriptions extend as far as the third level of the category structure. Lower levels are not presented here.

This is followed by a brief discussion of alternative ways of arranging the category structure.

9.1 Operating entire businesses and operating contracts

Running entire businesses and operating contracts are services of such scope that they would correspond with running entire operations if the purchaser chose to perform it in-house instead of purchasing the services. Examples include services such as operating public transport routes, healthcare facilities such as district health care centres and hospitals, various homes for social care, healthcare services and elderly care services, or services in the form of operating contracts for housing etc.

Purchase of large/entire businesses and operating contracts	Purchase volumes (SEK)	Climate impact (tonnes CO₂-e)
Purchase of core activities		
Operation of road networks and infrastructure		
Operation of electricity, gas and heating networks		
Administrative activities,		
Public transport		
Cultural and sports facilities		
Management of nature reserves and parks		

Purchase of large/entire businesses and operating contracts	Purchase volumes (SEK)	Climate impact (tonnes CO₂-e)
Rescue services		
Community services		
Healthcare services		
School services		
Social and care services		
Elderly care services		
Support, grants and remuneration		
Contributions to associations		
Support, grants and remuneration		
Total		

Figure 6. On level 2, the Purchase of large/entire businesses and operating contracts purchasing category consists of the subcategories shown above.

9.1.1 Environmental aspects

Since the life-cycle perspective is used to measure environmental impact – climate impact in this version –, it can be assumed that the significant environmental aspects also are present in the LCA value for each respective service. Of course, the way that system boundaries and the allocation¹⁵ of environmental impact are set affects the outcome. These factors can vary somewhat.

It can mainly be assumed that the climate impact from housing and healthcare facilities includes heating for buildings, electricity, and materials and fuel that constitute a significant part of the service. One adaptation to the category structure that has been made for the purposes of ESA is, amongst other things, that Management of nature reserves and parks is highlighted specifically. This is done to

¹⁵ Allocation refers to the process of determining which party or part of a process should be ascribed all or part of a certain environmental impact.

facilitate the use of sustainability requirements specific to nature conservation, such as requirements for specific skills within the field and care instructions.

9.1.2 Something to keep in mind about the categories

Figure 6 above shows that even payments that public purchasing cannot control, such as for compulsory and upper secondary schools, can be included in the analysis. Compulsory and upper secondary schools are run privately or by other public organisations. These services are normally not procured. The cost in the analysis may consist of per-pupil funding or reimbursement to another municipality for pupils attending school there.

Suppliers of school services may also perform other services that can be procured, such as employment training, adult education or staff training. We have therefore kept School services as a subcategory but have given it a clear title. It is then up to the person making the analysis to choose whether to include payments for certain educations or to certain suppliers or not.

Payments to associations may be grants, or in some cases the purchase of services. For similar reasons, these items have clear titles. The Support, grants and remuneration subcategory is included as an aid in categorising suppliers and payments.

Note that allowances given to private individuals through social services or social-security-style contributions are, of course, not intended here, since these are not purchasing.

It is then up to the person making the analysis to choose whether to include these categories or certain suppliers or not.

9.2 Materials and services for car users

The Materials and services for users category contains products and services that are more or less directly used by citizens and users. They are purchased by the public sector and supplied directly to citizens and users.

These are various services and initiatives in the healthcare area, such as medical services, prosthetics and accessibility aids.

Products and services can also be purchased by the public sector, supplied to the public sector, and thereafter - processed or not - forwarded to citizens and users. These may include foodstuffs for the organisation's own kitchens, running kitchens, supplying meals and catering services, as well as accessibility equipment and prosthetics.

Support in the form of allowances or other kinds of subsidy paid to private individuals through social services or social-security-style contributions are, of course, not intended here, since these are not purchasing.

Materials and services for care users	Purchase volumes (SEK)	Climate impact (tonnes CO2-e)
User support		
User support – social services		
User support – elderly care		
Fees		
Accommodation and rent for premises		
User support – medical/healthcare		
Odontological treatment		
Primary healthcare and hospital interventions		
Prosthetics and accessibility equipment		
Foodstuffs, meals, catering		
Foodstuffs		
Meals and catering, representation		
Other services – food handling		
Total		

Figure 7. On level 2, the Materials and services for care users purchasing category consists of the subcategories shown above.

9.2.1 Climate impact

Since the life-cycle perspective is used to measure environmental impact – climate impact in this version of the method –, it can be assumed that the major environmental aspects are included in the LCA value for each respective service. Of course, the way that system boundaries and the allocation of environmental impact are set in the LCA data affects the results, and these factors can vary somewhat.

Essentially, it can be assumed that heating of buildings and materials are included in the climate impact of services within social care and nursing, services at healthcare facilities, and accommodation. Transportation is included for home help services. For Meals and catering, it can be assumed that foodstuffs, electricity for cooking and fuels for transport are all included.

9.2.2 Something to keep in mind about the categories

User support – social services include rehabilitation services, support and care services that do not involve accommodation, and day centre services, as well as staffing services for individuals such as personal assistants.

User support – elderly care includes the purchase of home help services and various kinds of treatment or support that are not classified as healthcare.

Fees are charges that are paid for care users or their accompanying personal assistants, such as if they need to pay admission fees. In the various tests of ESA we have conducted, this category has been the least used and can possibly be disregarded.

Accommodation and rent for premises refer to individual premises where the public sector is responsible for the contract. Contributions made to individuals, such as housing allowance, is not intended to be included here.

The User support – medical/healthcare category (see level 2) and its subcategories contain individual services within primary and other healthcare that do not involve accommodation.

9.3 Land and buildings

Land and buildings cover a great deal of the sector referred to as the built environment. This includes among other things building and construction contracts, road and property maintenance, as well as building energy, water supply, and sewerage.

This category also includes consulting services relating to building and construction, such as architects and technical consultants.

The acquisition of properties, and the management of land and water are also included here.

Land and buildings	Purchase volumes (SEK)	Climate impact (tonnes CO2-e)
Property (land and water)		
Acquisition of property – land and water		
Management and use of land and water		
Contracts & technical consultants		
Installations – civil engineering		

Environmental Spend Analysis – description of method

Land and buildings	Purchase volumes (SEK)	Climate impact (tonnes CO2-e)
Acquisition of buildings, facilities, modules		
Architects and technical consultants		
Lighting installations		
Building contracts		
Trade services, carpentry, installations		
Cultural heritage buildings and monuments		
Earthworks & geotechnics		
Property management		
Fire prevention		
Building maintenance		
Alarms, surveillance and related equipment		
Renting property, renting out		
Cleaning, chimney-sweeping, pest control		
Energy, water and sewerage		
Non-fossil fuel		
Electricity		
District heating		
Fossil fuels such as fuel oil and natural gas		
Water and sewerage		

Land and buildings	Purchase volumes (SEK)	Climate impact (tonnes CO2-e)
Roads, traffic, street cleaning/snow removal, waste disposal		
Roads and traffic		
Selective waste collection, waste disposal and treatment		
Street cleaning/snow removal		
Total		

Figure 8. On level 2, the Land and buildings purchasing category consists of the subcategories shown above.

9.3.1 Climate impact

The life-cycle perspective is used to measure climate impact. Building and construction contracts include the production phase, building materials and a certain number of shipments. Energy for a property's daily operation is not included in contracts, but can be found under Energy, water and sewerage since it is part of property management that is purchased.

Regarding energy in the form of fuel, it is assumed that all fuels that are purchased are also used. Combustion is therefore also included in the LCA values for fuel.

Electricity for operating lighting installations etcetera is not included here. Electricity for operation is instead found under the Energy, water and sewerage subcategory since electricity is purchased separately and not usually together with the machinery or lighting. Of course, the way system boundaries and allocation of environmental impact is set makes a difference. These factors can vary somewhat.

One adaptation of the category structure for the purposes of ESA is that we have highlighted lighting installations. This is to facilitate sustainability requirements that are specific to the promotion of energy efficiency.

9.4 Equipment and materials

Equipment and materials include the purchase of everything from vehicles, decorations and furniture to office supplies. Fuel for vehicles is also included here.

Many IT and telecommunications products have a strong link to technical systems, operating contracts, and occasionally consultants. Multifunction devices with printing, scanning and transmission capabilities are also often connected to IT networks and can be considered part of such services.

Environmental Spend Analysis – description of method

These types of purchases have therefore been entered into the same purchasing category and placed under the primary category Services and materials for the own organisation. These are therefore not included in the table below.

Equipment and materials	Purchase volumes (SEK)	Climate impact (tones CO2-e)
Vehicles		
Boats and ships		
Fuel		
Flying devices		
Vehicle taxes and fees		
Agricultural and garden machinery		
Light vehicles and passenger vehicles		
Vehicle repair, maintenance and support services		
Spare parts		
Railway vehicles		
Trailers, lifts, specialised vehicles and specialised machinery		
Heavy vehicles and construction equipment		
Consumable materials		
Electrical materials, light fittings, light sources		
Real estate/building/construction materials (not timber)		
Paint, glue and wallpaper		
Packaging materials and packing		

Environmental Spend Analysis – description of method

Equipment and materials	Purchase volumes (SEK)	Climate impact (tones CO2-e)
Fertilisers, plant material, animal feed, agrochemicals		
Chemicals, lab chemicals, cleaning chemicals		
Office supplies (not IT related)		
Cleaning materials		
Wood products and wood for handicraft		
Furnishings and furniture		
Sport and play, playgrounds, furnishings and equipment etcetera		
Kitchen equipment and utensils (not appliances)		
Music and culture, equipment and furnishings		
Furniture, furnishings and upholsterers		
Clothes and textiles		
Work clothes, protective clothing, printed clothing		
Laundry and textile services and such textiles		
Textiles, other		
Office machines, lab, measuring equipment		
Office machines (not IT related)		
Laboratory equipment, measuring instruments etcetera		
Medical devices and equipment		

Environmental Spend Analysis – description of method

Equipment and materials	Purchase volumes (SEK)	Climate impact (tones CO2-e)
Healthcare equipment		
Instruments & dressing materials		
Medicines and pharmacy goods		
Machines, pumps, tools		
Generators, turbines, electric motors		
Machinery and appliances for kitchens, washing, cleaning		
Pumps, machine tools, craft machines, devices etcetera		
Tools and mechanics		
Repair and maintenance		
Repair, maintenance and service (not vehicles)		
Explosives, ammunition, weapons		
Explosives, ammunition, weapons		
Other materials		
Glass		
Ceramics		
Metals and minerals		
Plastics, synthetic materials and rubbers		
Other		
Total		

Figure 9. On the two highest levels, the Equipment and materials purchasing category consists of the subcategories shown above.

9.4.1 Climate impact

The life-cycle perspective is used to measure climate impact. Electricity for operating appliances, machines, pumps etcetera is not included. Electricity for operating such devices is instead found under the Land and buildings main category, in the Energy, water and sewerage subcategory. This is done because electricity is purchased separately and usually not together with machinery or lighting.

Automotive fuel, however, can be found under Vehicles. Regarding energy in the form of automotive fuel, it is assumed that all fuels purchased are also used. Combustion is therefore included in the LCA values for automotive fuel. Of course, the way system boundaries and allocation of environmental impact is set makes a difference. These factors can vary somewhat.

Categorising electric vehicles is a little more difficult, since electricity purchased for running vehicles is likely to be charged in connection to a building. These purchases are therefore entered under the Land and buildings main category, in the Energy, water and sewerage subcategory.

One adaptation of the category structure for the purposes of ESA is, amongst other things, that we have differentiated between heavy and lighter vehicles and work machinery. This is to facilitate emissions requirements specific to the different types of vehicle and machinery.

Attempting to differentiate wood products from other materials in the categories and that wood for handicraft has been entered under the same category is also something of a sustainability adaptation. This is done to facilitate sustainability requirements specific to wood raw material, such as requirements regarding forestry methods and consideration to nature. We have tried to put machines, pumps, appliances and so on that run on electricity in the same subcategories or close by. This is to facilitate sustainability requirements specific to the promotion of energy efficiency. Electric light fittings and light sources are highlighted for the same reason.

9.4.2 Something to keep in mind about the categories

It is often difficult to set boundaries and definitions during categorisation. Experiences from testing ESA shows that it can be difficult to differentiate payments and suppliers in the different categories, such as for curtains and furnishing fabrics. They can be found under *Clothing and textiles*, but may be better placed under *Furnishing and furniture*.

Real estate/building/construction materials is another example where delimitation between *Wood products* and *Electrical materials, light fittings, light sources* and *Paint, glue and wallpaper* can be difficult.

A further example is the categorisation between the three subcategories of *Generators, turbines, electric motors*; *Pumps, machines*; and *Tools and mechanical*.

Similarly, under *Healthcare equipment*, the categorisation can get scalpel-sharp between various *instruments and medical equipment*, and the same is true between *Consumables* and *Pharmacy items*.

9.5 Materials and services for the own organisation

Purchases made to keep the own organisation running have been sorted under Materials and services for the own organisation. These are items such as IT and telecommunications equipment, travel for staff, shipping and postage, bank services, PR and communications.

Materials and services for the organisation	Purchase volumes (SEK)	Climate impact (tonnes CO2-e)
Finance and administration		
Administrative services		
Banking and financial services and costs		
Late payment fees		
Insurance and settlement of claims		
Pension administration		
IT and telecommunications		
IT operations and systems, printing services		
IT hardware, monitors, multifunction devices, AV equipment		
IT consultants		
IT software		
Telecommunication		
Telecommunication equipment		
Social alarm services and materials		
Culture and information		

Environmental Spend Analysis – description of method

Materials and services for the organisation	Purchase volumes (SEK)	Climate impact (tonnes CO2-e)
Artists and events		
Fees – interest organisations		
Books, newspapers and media		
Art and decoration		
Copy and print		
Paper and printed matter		
PR, advertising and information		
Customised products and gifts		
Staff		
Hotels, accommodation and conferences		
Staff training		
Employee welfare		
Passenger transport, school transport, travel agency services		
Shipping and postage		
Distribution and shipping costs		
Freight transport and moving services		
Warehousing and inventory management		
Mail and postage		
Total		

Figure 10. On level 2, the *Materials and services for the own organisation* purchasing category consists of the subcategories shown above.

9.5.1 Climate impact

The life-cycle perspective is used to measure climate impact. Electricity for operating IT and telecommunications equipment, appliances and machines is not included. Electricity for operating such devices is instead found under the *Land and buildings* main category, in the *Energy, water and sewerage subcategory*. This is because electricity used for operating the equipment is purchased separately and, as far as we are aware, never together with the items.

Regarding hotel and conference services, it can be assumed that building heating, electricity and meals are included.

For transportation services within the *Shipping and postage category*, it can be assumed that emissions from these transports are included.

For the *Warehousing and inventory management* subcategory, it can be assumed that building heating and electricity are included.

One adaptation of the category structure for the purposes of ESA is, amongst other things, that paper products and printed matter has mainly been entered under the same primary *Culture and information* category, even though some paper products are classified as consumables in other settings.

Regarding *PR, advertising and information, Copy and print, Books, newspapers, media* and *Paper and printed matter*, paper and the printing process is often the common denominator. In order to facilitate sustainability requirements specific to the printing process and for paper from wood raw material, such as requirements regarding forestry methods and consideration to nature, these are entered under the same primary category.

In order to facilitate the use of sustainability criteria regarding transport services, School transport is found under *Staff and passenger transport* rather than under the *Materials and services for care users* main category, even though the purchase of school transport could be viewed as an indirect service.

9.5.2 Something to keep in mind about the categories

Many *IT and telecommunications* products have a strong link to entire technical systems, operating contracts, and consultants. *Multifunction devices with printing, scanning and transmission capabilities* are often also connected to IT networks.

These types of purchase have therefore been entered into the same purchasing category and placed under the primary *Services and materials for the own organisation* category.

9.6 Support services, mainly skills

Within the *Support services, mainly skills* category can be found other consultants and hired staff.

Support services, mainly skills	Purchase volumes (SEK)	Climate impact (tonnes CO₂-e)
Staffing		
Administrative staffing		
Operational staffing		
Skills support		
Research and development		
Supervision, coaching, process support		
International relations etcetera		
Legal/organisational/financial consultants		
Laboratory services		
Recruitment consultants		
Translation and Interpreters		
Other Services		
Animal care		
Total		

Figure 11. On level 2, the Support services, mainly skills purchasing category consists of the subcategories shown above.

9.6.1 Climate impact

The life-cycle perspective is used to measure climate impact. For services that also involve a large amount of transportation, emissions from such transportation should be included in the LCA value. However, the services under this main category can be assumed to consist mainly of intellectual services involving a small amount of transportation.

9.6.2 Something to keep in mind about categories

The services under this main category mainly involve support in the form of skills for the own organisation. Supervision, coaching, process support and the like do not refer to services directed towards care users and patients but to the organisation's own staff. Animal care could include, for example, veterinary services.

Part 3 Method and materials

This part of the report describes how the ESA method is designed, as well as the methods used and compromises that were made during the work.

10. The work

A very small portion of the work involved literature studies. This was done at the beginning of the project. Most of the development work has consisted of practical tasks – finding general solutions and practical solutions to specific problems. Employees of the National Agency for Public Procurement provided expertise in municipal purchasing and public procurement as well as the energy and environmental aspects. They have also provided concrete hypotheses and solutions. The consultants' task was to solve specific problems and develop specific features, as well as to give advice in their areas of expertise. Problems, hypotheses, solutions and hypothetical tests were processed in workshops with hired consultants.

The method was tested by analysing the actual purchases of two municipalities. Practical tests were carried out together with the Environment Department of Gothenburg and the Purchasing Department in Helsingborg. Colleagues at the municipalities contributed with their skills and experiences, as well as coming to conclusions and presenting lessons from the tests. In this way, they have contributed valuable knowledge about practical circumstances and an understanding of various subjects relating to the environment and purchasing.

11. Design of categories and structures

11.1 Purchasing categories and category tree

The purpose of a spend analysis is to provide an overview of an organisation's all purchases, and make it possible to conduct the analyses needed. In order to accomplish this, we describe purchasing categories and construct a hierarchical structure for them.

A general division of categories can be based on whether our organisation purchases entire operations – so-called outsourcing, for example –, whether we purchase extensive support for our own activities, or purchase products and services or materials that are included in other products or services that we make or provide or that are needed for the running of the organisation. Another aspect to consider is what our purchases will be used for in our own organisation. In the business world, divisions are often set between direct materials and services, indirect materials and services, and materials and services supporting organisation and competence. Such divisions can sometimes correspond with how the organisation is set up.

The purchasing categories and category tree (the spend structure) in a spend analysis traditionally describe the types of products, services or contracts that are usually bought within the same industry and the way that supplier markets can be delimited within the industries. These delimitations must, of course, be made in a way that suits the purchaser. However, the focus is on what the markets are like, not the purchaser's organisational structure. In a spend analysis for an entire organisation, therefore, the purchasing categories and category structure should not be divided to show the organisation's own administrations or units. Of course, this does not prevent spend analyses from being conducted for parts of an organisation.

The category tree should contain categories in different levels to allow analyses to be made on different levels and to provide transparency. But since the purpose is, among other things, to provide an overview of all purchases of an organisation, a few levels will usually suffice.

11.2 Adaptions for ESA

ESA is intended to show the environmental impact of purchases. The purchasing categories and category tree in ESA have to a certain extent been adapted for this purpose. This has been done by taking into consideration the materials and manufacturing or refining processes for certain products. The idea is to make it easier to be able to set environmental requirements in procurement. So, for example, paper products and printed matter have mostly been placed under the same primary category, even though some paper products are classed as consumables in other contexts.

11.3 Adaptions for public activities

The primary target group for ESA consists of public organisation such as municipalities, regions and government authorities. In this version of ESA, a spend tree has been developed for use in all public activities. It leans towards municipalities but has also been designed to be as general as possible.

The spend structure, meanwhile, is so flexible that, in the future, it will be possible to adjust and develop different versions so that more specific structures can be made. For example, specific structures could be made for municipalities, regions, universities and public companies, such as housing companies etcetera.

Another kind of adaptation is that foodstuffs and catering are kept together under one primary category. Staff travel, conferences and school transport are kept together under one primary category. The same applies to IT operation, IT consultation, hardware, and software, which are also all gathered under a single primary category.

11.4 Adaptions to public procurement

Public authorities are governed by public procurement legislation. When publishing a contract notice, CPV codes must be used to describe what is being produced. As an adaptation to public procurement, the 9,454 CPV codes have been integrated into the

spend structure. The idea from the start was that this connection could be beneficial for finding statistics of an organisation's own purchase volumes and their environmental impact when procurements are to be made, and to suggest which CPV codes might be used when publishing a contract notice. For the latter aspect, however, the procurement agent must also take the legal aspects of the CPV codes into consideration.

11.4.1 CPV and spend analysis

In the beginning, the CPV code structure was based on the type of material being procured. Since the latest revision in 2008, the structure is instead based on the type of product being procured. The CPV structure also help to define the way that products and services shall be considered in the procurement regulations. For example, the procurement of standardised IT software (division 48) is considered a product, whilst procuring tailored IT software (division 72) is considered a service. The rules for procuring products differ somewhat from those relating to services. There are more products similar to one another that are divided in a similar way in the CPV structure.¹⁶

The CPV structure is categorised in a way that does not always follow the classifications used by the industries or supplier markets. The following can serve as an example for sustainability work. CPV code 92533000-6 is named Nature reserve services, and 92534000-3 is Wildlife preservation services, and both fall under the main vocabulary of Recreational, cultural and sporting services. This and other relationships in the CPV structure make it difficult for a purchaser to get an overview of purchases if a spend analysis is made based on the CPV structure only. On the other hand, a spend analysis is not the purpose of the CPV structure.

Purchasing categories and category trees are designed somewhat differently, as described above. The purpose is to provide us with an overview of our purchases so that we can do our purchasing more strategically. According to this logic, IT software can fall under the same main category regardless of whether it is a product or a service. Nature conservation efforts and such expertise can be placed under Nature and environmental consultants. It should be remembered that a service can be placed under more than one category. It is often difficult to avoid problems when defining boundaries.

However, the fact that CPV codes are now based on products means that we can add them to the structure we have chosen for our various purchasing categories in the spend analysis.

¹⁶ simap.ted.europa.eu/web/simap/cpv; documents: "CPV 2008 Guide" and "CPV 2008 Explanatory Notes"

12. Environmental effects and values

12.1 What types of environmental effect are processed?

ESA can show the kind of environmental impact that can be quantified or numbered and calculated. The constraints lie in which methods and which qualities of information that are considered acceptable for retrieving the information to be shown, and what purpose ESA is used for.

12.1.1 Environmental effects in LCA

This first version of ESA used information produced through scientific work within LCA and/or standardised methods for LCA values and EPDs. An LCA can contain values for climate impact, land change or pressure for land conversion, acidification, eutrophication, amount of health hazardous respirable particles, ground-level ozone, depletion of ozone in the atmosphere, water use, energy use, and other environmental aspects that are relatively simple to quantify. If information and values for these environmental aspects is available, ESA can process it.

12.1.2 Other environmental impacts

There are other important environmental impacts in addition to the aspects stated above. For example, several environmental objectives and international conventions deal with the impact on biological diversity and species depletion.

One major shortcoming of LCAs is that they rarely contain information on the impact on biological diversity. One of the reasons for this is the difficulty in finding units and key ratios that are simple to manage during measurement and other quantitative treatment.

Another deficiency in LCAs is that they often do not include measurements on human health effects due to exposure to toxic substances.

Environmental impacts that are unquantified are not handled in ESA.

12.1.3 Other aspects of sustainability

There are other important aspects of sustainability, such as the effect on biological diversity and various social standards. It should be possible to manage these within the method, provided that all information is quantified or numbered and possible to aggregate or summarise. This is necessary for the information to be able to be handled in the analysis together with the purchase volumes. Of course, the information in its summarised or aggregated state must also be possible to understand and should also convey some information of importance.

12.2 System boundaries

12.2.1 Process LCA

A life-cycle analysis that studies the environmental impact of an individual product, service or material by following the process from natural resource, raw material, manufacture and so on until end-of-life management is called a process LCA or accounting LCA. Here, the LCA values are based on the process LCA.

As far as possible, we avoid mixing results from methods based on process LCA with results and methods based on input/output. The system boundaries for the different types are so different that the results are difficult to compare with one another without coming to misleading conclusions.

A comparison between different LCA values should have the same reference points in the system boundaries in order to avoid misleading conclusions.

12.2.2 From cradle to gate

Since the analyse is a purchasing analysis, we have set the system boundaries so that they include products, services and contracts from cradle to the purchaser's gate. The environmental impact that arises through use following purchase lies outside the boundaries, with a few exceptions.

For fuels, the system boundaries are extended to also include use, i.e., combustion. The assumption is that fuels purchased are combusted.

The electricity used for operating machines, installations and lighting is covered by the electricity purchasing category, as is the case for other kinds of energy.

The boundaries help to avoid the environmental impact from energy use being counted twice. Type III environmental product declarations are also often limited to cradle to gate, which simplifies matters when environmental values are entered into the category structure.

The environmental impact from the use phase (with the exceptions mentioned above), from end-of-life management, recycling, heat recovery from waste etcetera lie outside the system boundaries.

12.2.3 Environmental value per SEK

The environmental impact and effects calculated using LCA methods are based on the product's mass (kilogrammes), volume (litres) or energy use (joules or power, watts). For example, in order to calculate the climate impact of a certain amount of meatballs, the number of kilogrammes of meatballs must be used at some stage, and the weights of the ingredients must be calculated. But it is not possible under normal circumstances for a municipality, for example, to conduct such analyses for many purchases.

Thus far, in order to be able to efficiently conduct environmental analyses for many purchases, simplified measurements and tools are needed. For example, some LCA values may represent certain other products, services and contracts. If the LCA values are set per SEK, we do not need to know the mass, volume or amount of energy used in the calculation for all of the purchased products.

Overall calculation steps from LCA to environmental impact of a purchase

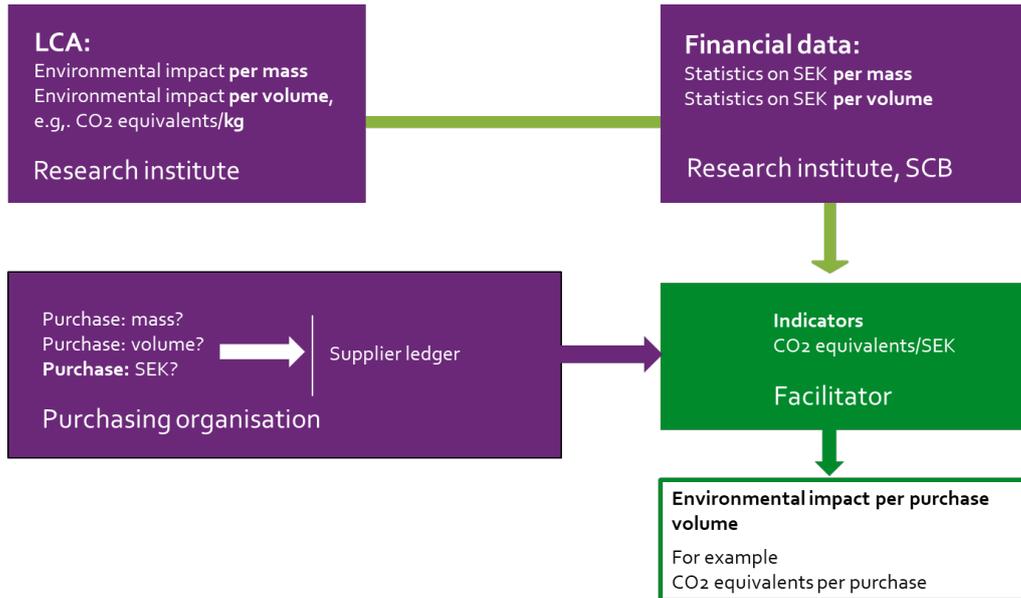


Figure 12. Overall calculation steps from LCA and purchase volume to environmental impact per purchase volume. Illustration: The National Agency for Public Procurement.

In working to develop ESA, IVL has carried out the process of converting many LCA values so that they are expressed per SEK (for example, kg CO₂-e per SEK) instead of per kilogramme, litre, or other measurement.

13. Selection of products, services and contracts

There are 9,454 CPV codes. This is too many codes for supplying values to each one for the time being. A selection has therefore been made.

CPV codes and descriptions make up level 4 of the category structure described in chapter 9.

Level	Level consists of	Examples	Environmental impact per SEK
Level 1	Primary category	Land and buildings	None
Level 2	Subcategory	Contracts and technical consultants	None
Level 3	Subcategory	Acquisition of buildings, facilities, modules	None
Level 4	Subcategory with CPV designation	"Prefabricated buildings"	Value is set here

Figure 13. Illustration of the levels in the ESA category structure. At level 4, an environmental indicator is deployed in the form of environmental impact per SEK. The Environmental spend analysis for process LCAs has climate indicators – that is, climate impact in the form of CO₂ equivalents per SEK – for several different types of purchase.

We have covered the products, services and contracts that have a large climate impact according to other LCA analyses. These products are fuels, electricity, transport, building and construction contracts, foodstuffs, IT products, paper and technical chemical products, and certain construction materials. Several products from each product area were selected. The values were set at level 4 of the category structure.

We intended to also have values for enough products, services and contracts to cover the entire level 3 of the category structure. We have therefore selected several products on the lower level 4 to be able to cover the entire category structure on level 3. Each category on level 3 has been given a default climate impact value. This default value is collected from level 4, where a presumed representative CPV code may represent the entire purchasing category. The default value may also consist of a pre-set value from an allocation key, in cases where such an allocation key has been established.

The default value is used to calculate environmental impact when there is no environmental value for the specific CPV code in question. All categories at level 3 therefore have at least one environmental value.

14. Structure of LCA values per SEK

We have selected several products, services and contracts that have been assigned environmental values as starting values for climate impact ("climate indicators" below). IVL Swedish Environmental Research Institute was tasked with developing climate indicators. IVL are also responsible for the description in this "Arrangement of LCA values per SEK" section.¹⁷

Shortcomings in method and implementation are discussed under Part 4, Discussion.

14.1.1 Climate indicators

In order to generate climate indicators, economic purchase data for the chosen product groups is needed, as is climate data for the same product groups.

The calculation for the climate indicators is illustrated in equation (1) below.

$$\text{Climate indicator} \left[\frac{CO_2-e}{SEK} \right] = \frac{\text{Climate impact} [CO_2-e]}{\text{Product value or cost of service} [SEK]} \quad (1)$$

The climate impact of the product or service and its economic value are generated independently of each other. The methods for producing these are described below. The climate indicator depends on both the economic value and climate impact of a product or service, as illustrated in the figure below.

Climate indicators as a function of economic value and climate impact

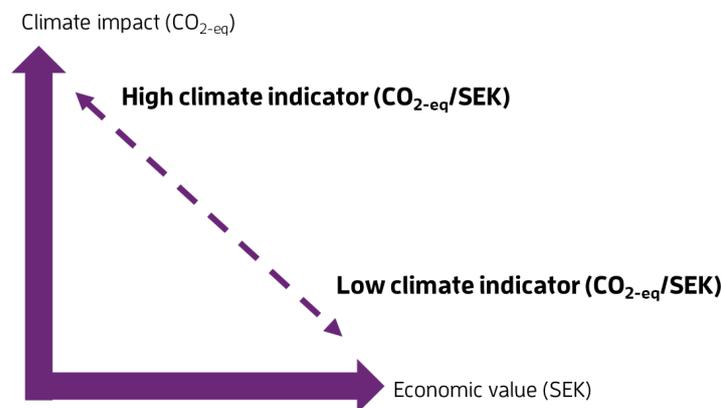


Figure 14. The climate indicator depends on both climate impact and economic value. Illustration: IVL Swedish Environmental Research Institute.

The data used in the project is partly from IVL's own databases and publications and partly from external sources. The latter are predominantly in the form of life-cycle

¹⁷ Rydberg, Tomas and Lindberg, Jacob; IVL Swedish Environmental Research Institute, Gothenburg.

analyses of products and services. In some cases, several kinds of product or service have been grouped together and assigned the same value, since they were considered to have comparable climate footprints. The assessments were made by IVL and are based on several factors, including what products and services consist of and how they are made or structured.

14.2 Economic data

Economic data for the various products and services was retrieved using import and export statistics from Statistics Sweden (SCB)¹⁸. The product groups included in the statistics are divided according to the Combined Nomenclature (CN). The statistics are comprised of products imported and exported to and from Sweden and include their value in SEK, and in many cases also their weight in kg. Each product group can thereby be assigned a relative product value; see equation (2) below.

$$\text{Relative product value} \left[\frac{\text{SEK}}{\text{kg}} \right] = \frac{\text{Product value [SEK]}}{\text{Product weight [kg]}} \quad (2)$$

Since CN and CPV are different classification systems, these have been matched against each other for the selected product groups as far as possible. For selected services, where this method could not be used, the economic data was calculated according to standard values for an hour of work; for example, 1,000 SEK/h to perform a particular service.

Examples

Two examples follow below – one product and one service – showing how a CPV code is assigned a relative product value.

Pasta products:

CPV code 15850000–1, *Pasta products*, can be matched to CN code 1902, which is for pasta products such as spaghetti, macaroni, noodles, lasagne, gnocchi, ravioli and cannelloni, including when cooked, stuffed with meat or other foodstuffs, or otherwise prepared; couscous, also prepared. The relative product value (SEK/kg) is 12.1 and 18.3 for import and export data, respectively.

Secondary and upper secondary school education:

CPV code 80200000–6, *Secondary education services*, cannot be matched with CN because it is not a product. Instead, a value can be set per hour worked; in this case, 1,000 SEK/h has been used.

¹⁸ <http://www.statistikdatabasen.scb.se/pxweb/sv/ssd/STARHAHA0201HA0201B/ImpExpKNTotAr/?rxid=d69473a1-aad6-48bd-a47e-5dc6fad2d9d8.com>

14.3 Climate impact

Climate impact for products can be calculated in units of CO₂ equivalents per kg. For services, the unit in most cases is CO₂ equivalents per hour. These can then be linked to economic data in order to calculate the climate indicators according to equation (1) above.

There are different methods for extracting climate impact data, which affects the precision of the data. In its work, IVL has considered the material composition of the products as well as the climate footprint of the constituent parts in order to determine the total climate impact of the products. IVL has also used existing LCAs for products, services and contracts. The different calculation methods have their advantages and disadvantages with regards transparency, precision and resources.

For services, data was mainly collected by searching for LCAs. Life-cycle analyses for services are not nearly as common as they are for products. In some cases, an LCA for a particular service was assessed to also be suitable for other services that would be given climate indicators. There follow two examples where life-cycle data was used.

Examples

Pasta products:

For Pasta products (CPV code 15850000–1), an environmental product declaration from the international EPD system is used. The EPD applies to pasta from Kungsörnen,¹⁹ which can be assumed to be applicable to all pasta products; 0.9 kg CO₂e/kg.

Secondary and upper secondary school education:

For Secondary education services (CPV code 80200000–6), to make a rough approximation, an environmental product declaration for research services²⁰ is used, where the climate footprint is calculated per hour of work; 2.1 kg CO₂-e/h.

14.4 Calculating climate indicators

By combining economic data with climate data, climate indicators can be calculated as shown in equations (3) and (4) below.

¹⁹http://gryphon.environdec.com/data/files/6/9109/cd433se_Lantmannen_kungsornten_pasta.pdf (based on previously-registered EPD, deregistered in 2016, <https://www.environdec.com/>)

²⁰ <https://gryphon4.environdec.com/system/data/files/6/8775/S-P-00206%20Climate%20declaration.pdf>

Products:

$$\text{Climate indicator } \left[\frac{CO_2}{SEK} \right] = \frac{\frac{\text{Climate impact } [CO_{2-e}]}{\text{Product weight } [kg]}}{\frac{\text{Product value } [SEK]}{\text{Product weight } [kg]}} \quad (3)$$

Services (applies to most services):

$$\text{Climate indicator } \left[\frac{CO_2}{SEK} \right] = \frac{\frac{\text{Climate impact } [CO_{2-e}]}{\text{Hour } [h]}}{\frac{\text{Product value } [SEK]}{\text{Hour } [h]}} \quad (4)$$

15. Allocation keys

ESA also uses allocation keys for certain purchases. Allocation keys are needed when the categories at level 4 do not sufficiently represent the environmental aspects of purchases. In some categories, the climate impact of the included products and services spans a wide range. An example of this is automotive fuel. Automotive fuel may consist of biogas, with a very small climate impact (net), to E85, diesel or petrol, the latter has the highest climate impact. ²¹

Information on the break-down of deliveries for different products and services may be available in more detail than in category level 4.

Examples of areas where more information may be available are automotive fuel and foodstuffs. Many organisations often investigate the proportion of different fuels and foodstuffs that are purchased. As part of the municipalities environmental work, the use of different types of automotive fuel is often charted.

In the environmental spend analysis, the allocation key takes the sum of purchases on level 3 or 4 (depending on the resolution of the input data) and distributes it over several items on lower levels. The distributed amount is multiplied by a percentage of the underlying items included in the key. Climate indicators are specified for the underlying items. After calculation, the climate impact is aggregated and lifted to level 4 as a weighted value.

²¹ Applies under certain conditions: Biogas, and E85 containing ethanol made from cultivated maize or grain that is not a waste product, and fossil-fuel and artificial-fertiliser-based farming methods, or palm oil used for biodiesel where oil palm plantations have displaced tropical forest, can have a larger impact on the climate than fossil fuels. However, the situation regarding E85 and biogas in Sweden is such that, at the time of writing, they have a lower climate impact than fossil fuels.

16. Calculating the environmental impact of a purchase

In order to conduct an environmental spend analysis, input data in the form of information on payments (amount in SEK) made to suppliers is needed.

Input data must follow or be matched with the categorisation in ESA.

The categorisation must be at level 3 or 4 in the category structure. The purchase volume per category on level 4 is multiplied by the environmental value set for the same category (on level 4). The result is an environmental value that indicates the environmental impact from the purchase volume in that category.

Examples of categories and subcategories	Environmental impact per SEK	Purchase value	Environmental impact of purchases
Land and buildings	None	Aggregated from subcategories	Aggregated from subcategories
Contracts and technical consultants	None	Aggregated from subcategories	Aggregated from subcategories
Acquisition of buildings, facilities, modules	None	Aggregated from subcategories	Aggregated from subcategories or default value
"Prefabricated buildings"	Value for a certain environmental impact, per SEK	Amount (SEK) for "Prefabricated buildings"	Resulting environmental impact of purchases in this category

Figure 15. Illustration showing the calculation of the environmental impact of purchases in ESA. Thus far, the Environmental Spend Analysis for process LCAs has a climate indicator, that is, climate impact in the form of CO2 equivalents per SEK, for several different types of purchase.

When no environmental value exists for a particular CPV code, the default value for environmental impact per SEK for the category (on level 3) is used to calculate the environmental impact for the purchase volume.

When there is no purchase volume on level 4, the default value is used for calculating the environmental impact for the purchase volume.

The purchase values per category and the calculated environmental impact for the purchases per category are added together from lower levels and upwards in the category structure.

For a purchasing category on level 3, therefore, the purchase value consists of the sum of the purchase values from the subcategories (level 4).

For a purchasing category on level 2, therefore, the purchase value consists of the sum of the purchase values from the subcategories (level 3).

For a primary category (level 1), therefore, the purchase value consists of the sum of the purchase values from the subcategories (level 2).

For a purchasing category on level 3, therefore, the calculated environmental impact consists of the sum of the environmental impact values from the subcategories (level 4) or the sum of the subcategories plus the default value, or only the default value.

For a purchasing category on level 2, therefore, the calculated environmental impact consists of the sum of the environmental impact values from the subcategories (level 3).

And so on.

Part 4 Discussion

17. Purpose

One of the purposes for ESA is that the method shall be practically applicable and able to advance the work of reducing the environmental impact of purchases. Although the work and methods used to obtain environmental values should have a scientific and preferably standardised foundation, and, in the case of the spend analysis, be based on proven experience, a desire to achieve the best should not obstruct something that may be good enough.

The best might correspond to a scientific level of quality for all constituent parts. ESA is not a product of science, but an attempt to apply research results within life-cycle analyses and other areas.

A common method used in categorisation within purchasing is for the spend analysis to function as both a map and a compass. In the beginning, the map scale is on a high level and undetailed, but the results provide indications regarding which purchasing categories should be prioritised. As we continue our work, the categories are investigated further, and we gain more knowledge and information about them. The knowledge gained is used to refine the analysis tool, such as for improving the category structure, the categorisation of suppliers, and input data. Going forward, it should also include environmental impact values.

Of course, errors and misconceptions are also corrected as work continues. In the next analysis, the scale of the map will get more detailed than before, and the spend analysis will provide results that are more precise than the previous analysis; and so, the work continues.

The work of categorisation and the proven method of the spend analysis are based on approximations and the gradual introduction of additional improvements. Improvements in the work of purchasing that are based on knowledge that is good enough should not be hindered by the fact that, for the moment, we have not found the best knowledge. We have chosen to build an infrastructure for this type of analysis.

18. Shortcomings

ESA is a guide providing directions, indications showing approximate environmental effects that purchases can have within different categories. The results from these analyses shall be regarded part of the ongoing efforts to improve understanding of the organisation's own purchases and the environmental impact of purchasing itself.

Precision in both methodology and supporting data can and should, of course, be improved in future versions.

18.1 Categorisation and matching

18.1.1 ESAs category structure

It is often difficult to set boundaries and definitions during categorisation. Experience from testing ESA shows that it can be difficult to differentiate what should be placed under the primary *Materials and services for care users* and *Purchase of large/entire businesses and operating contracts* categories.

One possible solution for future versions of the category structure would be to remove the *Materials and services for care users* main category.

The subcategories under *Materials and services for care users* could be distributed across other main categories. The same applies to the *User support* and *User support – medical/healthcare* subcategories, which could instead be placed under *Purchase of large/entire businesses and operating contracts*.

The Foodstuffs, meals, catering subcategory could be placed under *Equipment and materials* or *Materials and services for the own organisation*.

18.1.2 The need for a more precise structure

As mentioned in 9.4, *Equipment and materials*, as well as in the paragraph above, it can be difficult to categorise products that are similar. For example, it is not easy to differentiate between various instruments and medical equipment, or between consumable materials and pharmacy items. For those purchasing small volumes of these products (and when the products are not strategically significant), the problem can be addressed by merging subcategories. Having an abundance of categories can counteract the overview we are striving for.

This first version of the category structure for the environmental spend analysis is designed to cover most public organisations, but there is a certain amount of bias towards municipalities. Organisations with more specialised "production" may have greater reason to set up category structures that are more custom designed for their purchases. Customisation involves, for example, setting up extra subcategories that are more specific and removing other categories.

Examples of such activities include regional healthcare activities, public companies and authorities, or specialised operations such as hospitals or heads of public transportation, public housing and real estate companies, and the Swedish Transport Administration.

A small number of public organisations have adopted some form of category structure. ESA should be able to be adapted to these, too.

18.1.3 CPV and categories

Matching the category structure with the CPV is to some extent a matter of interpretation. The CPV code descriptions are placed under purchasing categories. Of

course, in many cases, interpretations differing from ours could be made. Several CPV codes could also fit under more than one purchasing category.

18.1.4 CPV and CN

The Combined Nomenclature (CN) has been used to develop climate indicators, since the economic statistics were available in that format. Matching CN with CPV is in some cases a matter of interpretation. The understanding of the matching between the CN and CPV could be deepened for the purpose of development and improvements.

18.1.5 Categories and other nomenclatures

Nomenclatures other than the CPV are used in electronic purchasing systems. Why not match the category structure with those instead? The UNSPSC (United Nations Standard Products and Services Code) is one example that is sometimes used in electronic purchasing systems. It could be used for future development. In testing together with Helsingborg, we have started matching with these codes. This matching may also be revised later. What is important for the time being is to do matching that shows the connections to different purchasing categories and their climate impact.

18.2 Economics and prices

The prices that have been used are from customs import and export statistics across different years. These values are not specific to the exact product or service that your organisation has purchased. But in order to be able to develop an environmental key ratio per SEK per type of product or service – to make it possible for the tool to be used by any organisation – this kind of general pricing information and statistics have been used. The only way to avoid this would be for the ESA tool to be regularly updated with environmental key ratios per SEK.

To increase robustness and refine the data used for the climate indicators, more electronic information and pricing statistics are needed.

Future development efforts for ESA should aim to link the analysis with electronic payment systems and integrate selected environmental effect values from LCA-based product declarations, such as EPDs, at the article level. This could pave the way for the spend analysis to base more environmental assessments directly on mass and volume instead of going via the environmental key ratio per SEK.

18.3 LCA and climate indicators

18.3.1 Shortage of LCAs and EPDs

There is often no mean number for the LCA values of various products or services. There are quite simply not enough LCAs for establishing mean values.

The specifically chosen products or services and their corresponding climate impact values constitute examples or approximations of products or services included in each category. The values also come from a few different sources, and the underlying

calculation methods may therefore differ. It is therefore impossible to know whether the stated values are typical or mean values for each category.

The environmental values – climate indicators in this version – should therefore be viewed as indicators rather than mean values. Without that awareness, there is a risk that these will be considered mean values.

However, efforts are under way at many research institutions and companies to produce LCAs for different products and services. As time passes, the data will become increasingly comprehensive, allowing mean values to be determined.

18.3.2 Shortcomings in LCAs

There are other important environmental impacts in addition to the aspects described in an LCA. LCAs rarely contain information about effects on biological diversity. The amount of land that is used for extracting raw material and manufacture can be an indirect measurement, since a change in land use affects the biotopes and species that live there.

More direct methods that are rooted in ecological science and conservation biology should be developed in order to assess the impact on biological diversity. Another deficiency in LCAs is that they often do not include measurements on human health effects caused by exposure to toxic substances. Measurements have been made where the effects of substances are recalculated to the number of potential cancer cases and compared with other substances. However, it can be assumed that the level of uncertainty with these measurements is considerable.

In LCAs and EPDs, these shortcomings are managed by attaching information in a different format to numbers, such as descriptions. However, unquantified environmental impacts cannot be handled in ESA.

18.3.3 Number of climate indicators

ESA includes climate indicators for approximately 500 categories on level 4. Some of these are adopted from products or services that are presumed to be equivalent as to what they consist of and how they are assumed to be constructed. At the same time, there are 9,454 CPV descriptions, so the number of climate factors should be increased to achieve greater precision.

The default values for climate factors cover purchases that cannot be categorised under the CPV descriptions that have been given a climate indicator.

18.4 Interpreting the results

18.4.1 Comparisons between climate indicators

The fact that the environmental impact is a price rather than a mass or volume means that it is difficult to compare the environmental impact per SEK of a product or service with the environmental impact per kilogramme or litre or other measure for the same

product or service. Climate indicators per SEK have proven difficult to compare with each other directly due to this mathematics.

When the price conditions are uncertain, recalculation is needed to make this possible. The point of ESA, however, is to make comparisons, not between climate indicators themselves, but between the total climate impact of different purchasing categories.

18.4.2 Results from specific price conditions

The fact that the environmental impact is per price also means that a product or service that is cheaper than the model assumes can make the environmental impact appear to be less in the analysis than in reality.

The opposite is also true; a product or service that is more expensive than assumed by the model can produce a result that makes the environmental impact appear to be larger in the analysis than what it truly is.

When interpreting the analyses for their own purchase volume, those conducting the analysis and interpreting the results needs to understand this inherent mathematics. It is also important to understand that the method is designed to be used repeatedly and based on steadily increasing knowledge about the situations within each of the various purchasing categories.

18.4.3 Results from price changes

The fact that the environmental impact is per price means that significant price changes will affect the results. A product that is cheaper than usual may cause the results from the analysis to appear as though the environmental impact has lessened.

It is of course not reduced purchase prices that reduce the environmental impact, but other factors entirely.

To avoid this, updated environmental key ratios need to be submitted regularly to the ESA tool, or it needs to be developed to link directly to LCAs as close to the article level as possible.

When interpreting repeated analyses, those conducting the analysis and interpreting the results needs to understanding of this inherent mathematics.

19. Advantages

ESA can provide qualified numerical climate impact indicators across the entire purchase volume, as well as indicative comparisons between different types of purchase. A stringent tool or method for this has thus far been lacking. ESA is also a method with potential for development since it interacts with several important parts of strategic purchasing and important pieces of the sustainable purchasing puzzle.

19.1.1 Numerical environmental effects

The environmental effects are put in numbers (quantified), as this allows them to be measured. Things that can be measured are often ascribed greater importance than things that cannot be measured. Measurability is also connected with the very nature of purchasing, where purchase volumes and other economic aspects are calculated.

19.1.2 Basis in scientific and standardised methods

The quantified environmental effects are based on methods with a scientific foundation and international standards in order to maintain a sufficiently high quality.

There are various life-cycle analyses and input/output methods to make use of. However, the problem of addressing this in purchasing is demanding. ESA is a solution to this problem in purchasing.

The various methods for ESA are kept separate from one another as far as possible; process LCAs are not mixed with input/output analyses or other methods, since they do not produce comparable values. It is like mixing apples and oranges.

19.1.3 Manageable for the user

LCAs provide measurements of the environmental impact per kilogramme or litre etcetera, whilst the basis of purchasing is economic. Environmental impact per mass or volume is converted to environmental impact per SEK externally to the method. We also provide key ratios for the environmental impact per SEK of different types of products and services. The environmental spend analysis can thus be conducted by using the regular values (payments in SEK) used in a spend analysis for the environmental analysis.

By integrating the environmental aspects into the spend analysis, the purchasing department is not burdened with more work than for a regular spend analysis.

19.1.4 Potential to increase the number of indicators

Other aspects of sustainability, such as the impact on biological diversity and various social conditions, should be able to be managed using the method, provided that the information is quantified or numbered and possible to aggregate or summarise. This is so that the information can be processed in the analysis together with the purchase volumes. Of course, the information in its summarised or aggregated state must also be possible to understand and should also convey something of importance.

19.1.5 Environmental objectives, procurement and purchase volumes

Several environmental objectives and international conventions deal with things such as the impact on biological diversity and species depletion. Different organisations often have their own objectives regarding the environment and sustainable purchasing.

ESA makes it possible to connect purchase volumes, quantified environmental impacts from purchases, and setting requirements in procurement together with environmental objectives.

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