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Introduktion till Digitalt EPD format för bygg-produkter i Sverige

SMART BUILT ENVIRONMENT

Introduction to a digital EPD format for Swedish building products

Med stöd från:

VINNOVA

Energimyndigheten

formas

STRATEGISKA INNOVATIONS-PROGRAM

Förord

Smart Built Environment är ett strategiskt innovationsprogram för hur samhälls-byggnadssektorn kan bidra till Sveriges resa mot att bli ett globalt föregångsland som realiserar de nya möjligheter som digitaliseringen för med sig. Smart Built Environment är ett av 16 strategiska innovationsprogram som har fått stöd inom ramen för Strategiska innovationsområden, en gemensam satsning mellan Vinnova, Energimyndigheten och Formas. Syftet med satsningen är att skapa förutsättningar för Sveriges internationella konkurrenskraft och bidra till hållbara lösningar på globala samhällsutmaningar.

Samhällsbyggnadssektorn är Sveriges enskilt största sektor som påverkar hela vår be-byggda miljö, men den är fragmenterad med många aktörer och processer. Att förändra samhällsbyggandet med digitaliseringen som drivkraft kräver därför samverkan mellan många olika aktörer. Smart Built Environment tar ett samlat grepp över de möjligheter som digitaliseringen innebär och blir en katalysator för spridningen av nya möjligheter och affärsmodeller.

Programmets mål är att till 2030 uppnå: 40 % minskad miljöpåverkan i ett livscykelperspektiv för nybyggnad och renovering: 33 % minskning av total tid från planering till färdigställande för nybyggnad och renovering: 33 % minskning av de totala byggkostnaderna: flera nya värdekedjor och affärsmodeller baserade på livscykelperspektiv och plattformar samt nya konstellationer av aktörer

SBE Livscykelperspektiv är ett av fokusområdena i programmet. Det har letts av Kajsa Byfors (projektkoordinator) och Jeanette Sveder Lundin samt Martin Erlandsson (delprojektledare). Denna rapport ger en introduktion till vilka standarder som finns för digitala format av livscykelbaserad information för byggnadsmaterial som utgör grundstenen i ett byggnadsverk. Det har letts av Anna Jarnehammar och Anna Bernstad Saraiva båda IVL Svenska Miljöinstitutet. Delprojektet har samfinansierats av IVL.

Stockholm, december 2017

Sammanfattning

Det finns ett behov av att standardisera det digitala formatet för livscykelbaserad information för byggnadsmaterial. För byggnadsmaterial är det främst den Europeiska standarden EN 15804 som används för att ta fram ett beräknat resultat för produktens miljöpåverkan under dess livscykel. Informationen som verifieras av en tredje part paketeras i en så kallad EPD, Environmental Product Declaration. Rapporten ger en introduktion till digitala format som är under utveckling för EPD:er och utgör en grund för att kunna föreslår vilka format som bör tillämpas i Sverige.

Den internationella utblicken visar att det främst är de olika programoperatörerna för EPD:er som driver utvecklingen av hur det digitala format ska se ut. En programoperatör är den aktör som säkerställer att det finns regler för hur miljöpåverkan under en livscykel av en viss produktgrupp ska beräknas samt att de EPD:er som publiceras har verifierats av en tredje part. Till stora delar har Europeiska programoperatörerna liknande syn på hur det digitala formatet av en EPD ska utformas, men man har kommit olika långt i utvecklingen av det digitala formatet. Centralt för samordningen av utvecklingen är International Open Data Network for Sustainable Building (In Data). Skillnader i hur långt man har kommit vad gäller digitalisering beror dels på omfattningen av produktområden man som operatör ansvarar för (dvs bara byggprodukter eller mer generellt för alla typer av produkter), dels på hur nationella eller internationella de olika systemen är. En rekommendation framöver är att samhällsbyggnadssektorn i Sverige engagerar sig i eller bevakar det arbete som sker i InData.

Det digitala format som vi föreslår för EPD i Sverige bör utgå ifrån Ökobau.dat 2013 samt det ytterligare harmoniserade ILCD+EPD formatet framtaget av InDatas arbetsgrupp. Dock krävs vissa tillägg för formatet för att hantera metadata. De viktigaste tilläggen är framförallt spårbarheten rörande produkten, dvs artikelidentiteter, hänvisning till varugrupp enligt exempelvis CoClass, samt eventuella skalbara parametrar som tex miljöpåverkan per kvadratmeter eller materialdata såsom densitet. Många av de tilläggs som behövs för en EPD finns idag i eBVD-systemet och med fördel kan formaten kombineras förutsatt att man kan identifiera vilken produktdata som hör till vilken EPD. Tillägg av så kallad metadata som rör kvalitetsbedömning av EPD-informationen, t.ex. om t data baseras på en specifik tillverkningsprocess alternativt en mer generell beräkning av miljöprestandan, behöver adderas separat. Schematiskt föreslås därmed ett format bestående av ILCD + EDP + metadata.

Summary

There is a need to standardize the digital format for life-cycle information for building materials. It is primarily the European Standard EN 15804 that is used to calculate the product's environmental impact throughout its life cycle and the information is then verified by a third party and communicated trough an EPD, Environmental Product Declaration. This report describes the state of the art for digital formats under development in EU for EPDs, and a suggestion of wich format should be applied in the SBE-*Livscykelperspektiv* project.

The international outlook shows that it is mainly the different national program operators for EPDs that are developing the digital formats in Europe. These operators ensure that there are rules for how a particular product group is to be calculated and that the EPDs published have been verified by a third party. To a large extent, program operators have similar views on how to design the digital format. Central to the development and coordination of this work seems to be the International Open Data Network for Sustainable Building (In Data). However, differences can be seen, mainly depending on the scope of product areas of the programme operator and how national or international the different systems are. A recommendation for the future is that the Swedish building sector engages or monitors the work done in InData.

The digital format proposed in Sweden for EPD should be based on Ökobau.dat 2013 and the further harmonized ILCD + EPD format developed by InData's working group. However, some additional formats are required to handle specifically metadata and property data. The most important additions are identification and traceability of the product and quality of the calculated environmental data. Many of these extra needed data sets are available today in the eBVD system and could be combined to get a more extensive description of the environmental performance of the product. So schematically, a format consisting of ILCD + EDP + metadata + property data, is proposed.

Innehållsförteckning

1 Background

The European Standard EN 15804:2012 provides a structure to ensure that all Environmental Product Declarations (EPD) of construction products, construction services and construction processes are derived, verified and presented in a harmonized way. It also provides core product category rules (PCR) and means for developing a Type III environmental declaration of construction products.

The number of Environmental Product Declarations (EPDs) for building products has significantly increased in recent years. While EPDs present environmental impact on a product level, there is an increased demand for presentation of Life Cycle Assessment (LCA) also on the level of buildings. Voluntary certification systems such as BREAM, LEED and the Swedish Miljöbyggnad program are all pushing the market in this direction.

In parallel, the increased use of Building Information Modelling (BIM) offers new opportunities in the building and management processes of the built environment. Thus, there are vast potentials in integration of product specific EPDs and generic LCA data of construction materials in BIM, and use the digital specifications of the buildings as a basis for the development of building level LCAs (Figure **1**). However, a major obstacle for this development is that EPDs currently are available only as PDFs, and therefore cannot be used to transmit information electronically without further manual processing.

In this context, establishing an open digital format for EPDs digital transmission and integration of EPD-LCA-BIM information based on the European standard (EN 15804) which everyone in the industry can relate to is necessary. Several initiatives aiming at this already exist in other parts of Europe and any Swedish definition of a digital format for EPDs must relate to these parallel processes.

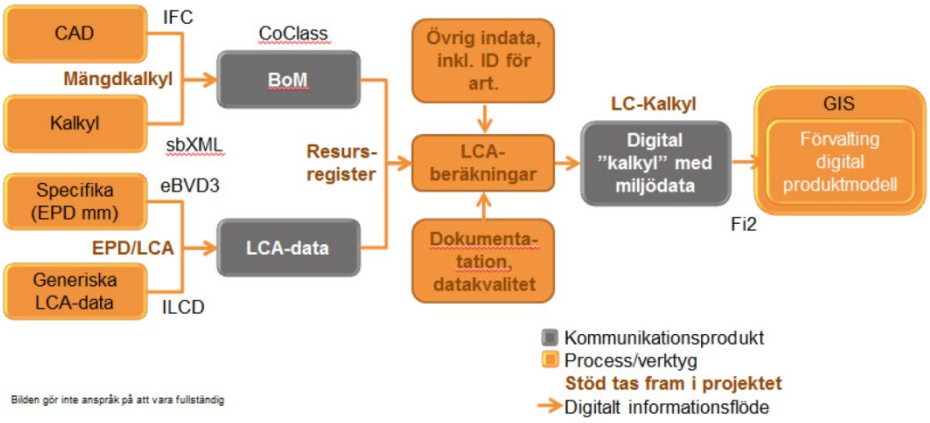

Figure 1. Schematisk illustration av olika delar som ingår I processen för att digitalisera LCA-arbetet för byggnader.

1.1 Aim

This project´s tasks are to:

1. Investigate and describe current European initiatives for the development of digital EPDs and identifying key agents and processes.
2. Describe the digital format currently used by European agents and analyze this in the context of using EPDs as input in building-level LCAs.
3. Present a suggestion of a format for digital EPDs that will be tested and used in the project.
4. Suggest metadata[1] include in a "national construction annex". Specifically the connection to the digital building product declaration, eBVD, has also been considered.
5. Investigate possible obstacles and solutions for management and further development of the open format developed in the project.

The report is intended to be relevant for a broad public within the construction sector. Thus, the aim is to be sufficiently explanatory in order to be useful also for professionals with little previous knowledge about EPDs and digital formats thereof.

1.2 Method

The overview of ongoing processes and initiatives related to digital EPDs in Europe was based on interviews with key agents. The selection of key institutions and persons was made based on input from EPD International and LCA-experts at IVL. It should be highlighted that all organizations included in the report are involved in the InData working group, although in some cases more as observers than participants. The suggestion of the Swedish format to be used for the digital EPD, as well as relevant metadata, was based on input from European EPD program operators, dataset providers and dataset format developers. The content of a national and construction-industry specific annex was based on contact with relevant national stakeholders that hold product information standards or systems, such as Svensk Byggtjänst (CoClass), Byggmaterialindustrierna (eBVD), BASTA etc. Possible solutions for management and further development of the open format developed in the project will be based mainly on contact with EPD International and ECO Platform.

[1] The term metadata (data about the data) is in this report referring to information needed in order to make correct use of the information provided in the EPD and inform the user of the quality of the information provided in the dataset.

2 International outlook

The aim of this section is to describe the current development of digital EPDs in Europe from the viewpoint of a number of key agents. Each agent is briefly described, followed by a presentation of their view on the following issues:

- Their view on the data format most relevant for development of digital EPDs
- Their view on the scope[2] and metadata content most relevant in digital EPDs
- Main challenges and opportunities
- Actions taken in the short and long term
- Issues related to economy and management of digital EPDs

2.1 IBU– Institut Bauen und Umwelt

IBU is the official program operator of the German EPD program. Being a business association, IBU was created 25 years ago by German manufacturers of construction products and components. Members include approx. 180 manufacturing companies and associations from the building materials industry inside and outside of Germany.

The IBU has developed a tool to create EPDs online – the EPD online tool. The tool is created to facilitate the development and verification process for companies through multi-user functionality with varying levels of authorization and a template oriented interface. In order to enter the created document (draft EPD, as the EPD is created only after verification) into the verification process, a membership at IBU is required. After verification, the EPD is published in German and/or in English as a PDF in the IBU EPD database. All EPDs created in the EPD online tool can be transferred via XML to ILCD format and imported to the Ökobau.dat database. This is free of charge, but due to the requirements of the Ökobau.dat, all EPDs must be translated into German prior to publication and present additional data related to the German BNB[3]-certification scheme. Around 30% of the IBU-members are from abroad, and many times not interested in translating their EPDs to German, but would like to offer them in digital format. Thus, in Februay 2017, IBU took the decision to start the process of developing a new database for digital EPDs, using the open source structure soda4LCA and ILCD formatted XML. Launched in end of May 2017, this will provide a database for digital EPDs in German or English, meeting the requirements of the “core-EPD” (including only phases A1-3) or the IBU-EPD (including more phases and information if considered interesting from the perspective of the declaration owner). Declaration owners can still transfer their data to the Ökobau.dat database if this is of interest to them, but this will not be done automatically. All EPDs created through the EPD-online tool will from May 2017 also be available as XML-files in the IBU.data database (Lehmann, 2017).

[2] This refers to the phases possibly reported in an EPD (A1, A2, A3 etc.) to be included in the digital EPD.

[3] Bewertungssystem Nachhaltiges Bauen, German governmental programs for sustainable construction.

The business structure of the digital database is yet to be settled. At the moment, IBU is planning a scheme where individual digital EPDs can be downloaded, but where downloading of the whole database for commercial uses will be possible only through a license-fee. A collaboration has been initiated with the Finnish company Bionova, who have an interest in providing data from the IBU.data in their building-level LCA-tools (Lehmann, 2017).

On a request from IBU-members, the IBU-board has also decided to include additional information in the IBU.data database, relevant in relation to different green-building schemes. Based on this, IBU has contracted a researcher with the task to present a matrix where different property data relevant for certification in relation to LEED, BNB and GTNB. BREEAM will be included in a second step. Based on the matrix, a template will be presented where companies can provide additional information related to the products described in the EPD. This document will pass a separate verification process, and a separate fee will be required. Verifiers willing to participate in this verification will be offered a specific training (Lehmann, 2017).

The content in this additional information is currently discussed by the IBU board in the search of the right balance between the interests of the declaration providers and the risk of entering a vast amount of data in the database, which needs to be updated each time any of the green building certification schemes makes an update. The matrix will be presented in end of May 2017 for IBU-members and the possibility of providing additional data in the IBU.data will probably be available from the beginning of 2018 (Lehmann, 2017).

As for the 1600 EPDs created through the IBU EPD-online tool, IBU is currently investigating the possibility of transferring this information from the standardized PDF-format to ILCD-formatted XML automatically, to avoid the need for manual transfer of this data (Lehmann, 2017).

2.2 Ökobau.dat

The German environmental database for construction products Ökobau.dat was created by the German Ministry of Environment (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit) in cooperation with the German construction materials industry in 2008. Since then, the Ökobau.dat EPD-database serves as mandatory data source within the governmental programs for sustainable construction (Bewertungssystem Nachhaltiges Bauen, BNB). At the time of creation, there were no overall methodological guidelines for EPDs, and specific guidelines were therefore created for the database. EN 15804:2012-04 was published in spring 2012. Already in 2011, the Ministry of Environment initiated a project with the aim of presenting an EN 15804 conformal version of the Ökobau.dat database. In 2013, the adjusted database was launched. The database was created by ThinkStep, IBO (Österreichisches Institut für Bauen und Ökologie GmbH), KIT (Institute for Applied Computer Science, Karlsruhe University), okworx and Online Now! GmbH, with support by the German construction materials industry. The Ökobau.dat Users Advisory Group acts as an advisory body for the development of Ökobau.dat. The group consist of (amongst others) members from the German governmental program

for sustainable buildings (BBSR), IBU, the Austrian equivalent to IBU, Bau-EPD (Austrian EPD Program Operator), Thinkstep and okworx (Oliver Kuscher).

EPDs created in the IBU EPD online tool and published in the IBU EPD database can be published without cost in the Ökobau.dat database for building materials after an initial evaluation at the German Ministry of Environment. A prerequisite for this publication is that the EPD is published in German. The database currently (March 2017) contains more than 1000 different building products. Most Ökobau.dat datasets have been generated based on GaBi background data, but use of ecoinvent background data is now also possible. Apart from product specific data, the database contains generic data created by ThinkStep on behalf of the German government. In order to become independent from commercial LCA-tools, a building level LCA-tool has also been developed (eLCA). This tool is used for the German BNB-certification of public buildings. All datasets as well as the eLCA- tool are available open source and free of charge.

The database is currently available as an online searchable database, but can also be downloaded as a ZIP archive or as eLCA export CSV file. Ökobau.dat has a standardized interface for data exchange via which other applications and software tools can read datasets from the database. Using certain permissions, data can also be imported directly into Ökobau.dat. At the present (March 2017), apart from the eLCA-tool, also OpenLCA supports data exchange via this interface (Ökobau.dat, 2017).

In constructing the digital format for EPDs in the Ökobau.dat database, the ILCD (Integrated Life Cycle Design) format was used. As this format originally was developed for inventory data, extensions were created to provide the additional information relevant for EPDs. However, the format is still compatible with ILCD data and the soda4LCA (service oriented database application for LCA) storage structure. The format developed for Ökobau.dat in 2013 and currently further adjusted and harmonized within the InData working group is in the following referend to the ILCD+EPD format.

2.3 International Open Data Network for Sustainable Building (InData)

InData is a working with the aim of harmonizing digital EPD information. The group was initiated by Tanja Brockmann from the German Ministry of Environment and the constellation was initially based on an ad-hoc group of participants at a congress on sustainable construction in 2014 (Brockmann, 2017). The group currently (March 2017) has participants from 14 institutions and 8 nations (Germany, Spain, Denmark, the Netherlands, Austria, Norway, Belgium, UK). Sweden (EPD International) has participated in the last meetings of the network. The main aim of the working group is to establish an International LCA data network structure for construction products based on EPD information, open for other products in the future. Some of the needs for harmonization of EPDs lifted by the working group are general and do not relate to the digitalization of the information (i.e. harmonized calculation of GWP, background databases, data input requirements, safety factors, quality assessment of sources of uncertainty of data, quantitative assessment of level of uncertainty etc.).

More detailed aims of the working group were presented in a decalouge released in September, 2016 (InData, 2016). According to them, the ILCD-format should be used as common data exchange format (i.e. the technical means of transferring information). The harmonization is according to the decalogue in need of a set of core information, while national additional information is possible (InData, 2016).

Aiming at creating an interlinked system for exchange of EPDs, a harmonization also of these issues becomes relevant, and these are therefore being discussed within the working group (Brockmann, 2017). One of the key areas of relevance is related to definitions, and the development of the bSDD (building smart data dictionary) has been identified as a major issue for further harmonization. The discussions within the working group are currently focused on issues such as how to create a common platform how to access digital EPDs from each EPD operator.

There are no plans from the German organization to use fees for the database. The federal institution would like to provide the database for free. However, from the perspective of the program operators, it might be less interesting to provide the data free of charge, including for commercial use. This is currently discussed within the working group, together with other organizational issues such as hosting, administration and responsibility for maintenance and upgrading of the network structure (Brockmann, 2017).

2.4 EPD International

EPD International AB is the programme operator of the International EPD(R) System, which is a further development and rebranding made in 2008 of the previous Swedish EPD Programme ("EPD-systemet" 1997-2008). Even with its expanded geographical scope, the programme remains the de facto first choice EPD programme for Swedish companies today and is managed by an organisation based in Sweden. The online database of the Swedish EPD program operator EPD International currently (March, 2017) contains more than 950 EPDs for a wide range of product categories by companies in 43 countries. The variety of product types (such as textiles, food and agricultural products, electricity, wood and paper products) as well as the number of countries represented in the database distinguishes EPD International slightly from several of the other European program operators. In addition, EPD International provides no mandatory template for the EPDs, although there are clear guidelines for the content of the EPD. A voluntary template provided by the organization is for all kind of product groups.

EPD International sees great advantages in digitalization of EPDs as there is a growing interest from the construction sector for a digital platform for EPDs. Apart from the possibility of using the information as input in building-level LCAs, this could also make it possible to develop sector specific averages for key data and thus easily using EPDs for bench-marking and other potential uses. Issues such as ownership, validity and how digital EPDs should be handled after expiring date must however, according to EPD International, still be dealt with (Jelse, 2017).

The digitalization of EPDs is strongly advocated by the construction industry. However, EPDs are developed also for products from other areas, such as wood and paper products, food and agricultural products, textiles as well as fuels and chemical

products. Thus, the digital EPD format developed with the principal aim as serving as input in building-level LCAs should preferably be relevant and usable also for all other product categories. As many program operators, including EPD International, register EPDs from many different countries, there is also a need for development of a format/system that works internationally (Jelse, 2017).

2.5 EPD Norge

The Norwegian official EPD program operator EPD-Norge is owned by The Confederation of Norwegian Enterprise (NHO) and the Federation of Norwegian Construction Industries (BNL). The Norwegian EPD database currently contains 450 articles for different product groups (furniture, chemicals, construction materials, energy carriers). Although the program is open for all industries, the construction sector has until now been dominant, with more than 75% of all EPDs in the EPD-Norge database relating to construction material.

EPD-Norge sees digitalization of EPDs in a context of other digitalization of material and construction data. Thus, the aim for the Norwegian program operator is to integrate digital data on environmental properties of a product in a context where other property data can be found. Based on this, apart from being compatible with relevant LCA-tools, it is important that the digital EPD-data is compatible with existing/coming systems for other types of property data related to the same product. Thus, the organization is currently considering if a separate database for EPDs is preferable in the future, or if EPDs should be available through other databases, such as the Norsk Byggtjenste (NOBB). This is where other property sets are becoming available in digital formats, and the NOBB could thereby be developed to a national BIM-hub. In a project initiated within short, the integration of EPD-data in existing property datasets in NOBB will be investigated (Pettersen, 2017).

As the digitalization of EPDs opens the door to increased use of external EPDs, based on non-Norwegian PCRs, EPD-Norge sees a need for development of conversion-factors when combining EPDs from different markets. A project will be initiated within short, comparing three different types of products registered in EPD International, EPD-Norge and IBU, with the aim of investigating the need for conversion-factors (Pettersen, 2017).

According to EPD-Norge, one of the main obstacles related to an internationally harmonized digital EPD-format is the lack of common definitions for relevant terms and products. Norway has, together with the Netherlands, been very active in the development of the Building Smart Data Dictionary (bSDD), a web service providing an open platform for identification of common standard building industry terms, definitions, translations, associated properties and relationships and unique digital identification (BuildingSMART, 2017). bSDD can be defined as a library of objects and their attributes, and the aim is to provide a possibility to identify objects in the built environment and their specific properties regardless of language. This dictionary can, according to EPD-Norge, be of high relevance in the connection between digital EPDs

and specific products, and the use of IFC (Industry Foundation Classes[4]) initially considered interesting also for digital EPDs (Pettersen, 2017). However, Norway has now taken a decision to make use of the ILCD+EPD format developed within the InData working group.

2.6 Bau EPD (Austria)

Bau EPD GmbH is the program operator for the Austrian EPD Platform. The Austrian platform has a well-developed collaboration with the German Ökobau.dat. All EPD data of Bau EPD is transferred into the Baubook Construction Calculator, enabling calculation of environmental performance from different material components (Baubook, 2017). This tool is available online free of charge after registration. Simplified LCA calculations on building level can be performed in the tool eco2soft, based on the existing component calculator (Baubook eco2soft, 2017). A test-version is available online free of charge, while a license is needed to use the full version of the tool. In the tools, energy use (as primary energy in MJ), climate change (as GWP in kg CO2-eq.) and acidification (as acidification potential in kg SO_2 eq.) are calculated (**Figure 2**).

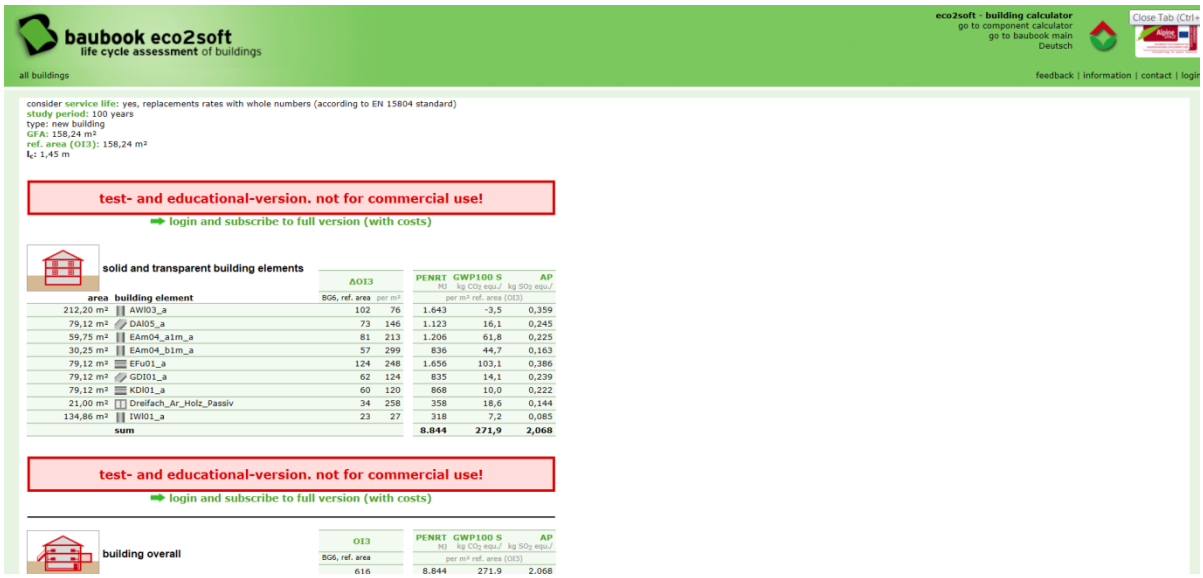

Figure 2. Test version of the eco2soft calculation tool.

At the current (March, 2017) the Bau EPD does not yet have any digital EPD-format. Instead, they provide the Information Transfer Matrix (ITM) of each dataset in Microsoft .xls/.xlsx format. These excel-files can be downloaded from the Bau-EPD website, calculated with the background database Ecoinvent or GaBi (Bau EPD, 2017). The list of ITM-matrices is updated with each issue of a new EPD and therefore always complete. The files contain results in relation to all phases and environmental impact

[4] The IFC specification is a neutral data format *specified in ISO 16739 (ISO 2013)* to describe and exchange information used in the building and facility management industry sector. IFC is the international standard for openBIM and *the format used in bSDD and CAD.*

categories included in the study as well as general data used in the LCA (contact information to manufacturer, functional/declared unit, content (including some chemical content information) and some key assumptions, such as assumed waste management), but no information about for example representativeness, variation between production sites, allocation procedures, used background data or validation is provided here. Based on these excel-files, Bau EPD data is fed into Ökobau.dat with the OpenLCA-EPD Editor, i.e. demanding manual resources (Richter, 2017).

2.7 BRE (UK)

Building Research Establishment Limited (**BRE)** is a building science center owned by the BRE Trust. BRE is the program operator for EPDs in the UK. The organization is participating in the InData work on European standardization. According to BRE, the standard must describe what information needs to be defined in terms of environmental properties and metadata, and link the EPD-dataset to any additional information that could be relevant.

The problem at the moment for transforming EPDs in PDF-format to digital ones is that each EPD has a different format. If the PDFs were standardized, they could be machine readable. If this is achieved, it could be one step on the way to digitalization, were the standardized PDF-format EPD automatically could be transferred to ILDC-EPD-format as XML-files. This is, according to BRE, the most interesting way forward. Thus, everybody adapting the same format in the PDF would be one step on the way (Abbe, 2017). However, this solution is still under development. In the meanwhile, a database containing all EPDs in the BRE database, has been created after manual translation to ILCD format XML-files. This database will be released within 2017.

According to BRE, there are no other construction product level databases in the UK that must be considered in the creation of digital EPDs. Thus, it would be relevant to include vast amount of property data in the digital EPD. Including more phases than A1-A3 in the digital EPD is, according to BRE, irrelevant, as remaining phases are context dependent, while digital EPDs must be used in different context in BIM. One major obstacle in the development of an international standardized database is the lack of common nomenclature. The development of the bSDD (building SMART Data Dictionary) will be most helpful for this (Abbe, 2017). Using UUID[5] as ID linked to the digital EPD would, according to BRE, be more relevant than using the GTIN ID used for the actual product for which the EPD is developed. According to Abbe (2017), UUID makes it easier to identify and use "similar" datasets from the database, if product-specific dataset not are available.

BRE has, in collaboration with PRé Sustainability, developed the online tool BRE LINA with a standardized format to facilitate construction of EPDs. The tool provides a default database, with processes modelled to EN 15804, from which processes can be selected by the user within different phases of the products lifecycle. Results are automatically presented in accordance with the EN15804-standard and verification is done online. The output from the tool is made available as PDF or XML-file. A future aim is to adopt this tool to the ILCD-EPD format currently developed within the InData-working group and to generate data which can be imported directly in building level

[5] Also known as GUID.

LCA-tools. The first EPD being developed using the BRE LINA tool and verification process was published in the beginning of 2017.

2.8 ECO Platform

ECO Platform is a European initiative established by European EPD program operators, European trade associations in the construction sector and LCA practitioners, focused on development of verified environmental information of construction products, especially through EPDs based on the standard EN 15804. ECO Platform is not a program or program operator in itself, but it has the objective to ensure that information about a product's environmental and sustainability performance complies with the new EU standard and is harmonized across borders (ECO Platform, 2017). Several attempts have been made previously, aiming at developing a common format for EPDs amongst member organizations, but none have been successful (Ryding, 2017).

The group is currently involved in the negotiations with the European Commission (EC) related to the PEF (Product Environmental Footprint) standard. In February, 2017, an amendment was made to the mandate M/350 from the EC to the European Committee for Standardization (CEN) in their development of horizontal standardized methods for the assessment of the integrated environmental performance of building (EC, 2017). In the amendment, the CEN is requested to align the work developed by CEN under mandate M/350 to the methodological requirements included in the PEF (as foreseen in 2013 and pilot projects for certain construction products in 2014-2016). The request is related to several aspects of EN15804; definition of functional unit, system boundary definitions, carbon offset and accounting, impact assessment models, LCI-nomenclature and definition of quality requirements. The aspects of largest relevance to the development of a harmonized format for digital EPDs are the ones relating to the use of ILCD LCI-nomenclature as standard, data quality requirements (defining more precise data quality requirements with respect to technological and geographic representativeness, similar to the time related data quality requirements), as this establishes the ILCD format in the EN15804 context and can have an impact on the core metadata relevant in the digital EPD. In addition, the amendment to the mandate M/350 contains a request related to CEN/TR 15941 (cited in EN15804) to define more precise data quality requirements (in line with requests related to EN15804 in this aspect), as well as a clear hierarchy for secondary data sources applicable for EN15804. In summary, although the request from the EC will result in several alterations of EN15804, most of them will have limited impact to the process of developing digital EPDs (Ryding, 2017).

2.9 Summary of international outlook

The organizations interviewed have rather similar opinions regarding many of the key issues related to the development of a digital format for EPDs. This can be a result of the fact that the organizations contacted within this project all are involved in one way or another, in the InData working group. However, several differences can also be seen (Table 1). Context derived issues can to a large extent explain some of the differences in prioritization and the view on challenges ahead. As an example, some EPD-program

operators (BRE and IBU) are owned by or strongly related to the construction sector. This means that the digital format developed by these does not have to be flexible enough to consider the need for development of EPDs for other product categories. Another example is that some countries have other existing databases with digitalized property information for construction items. This creates the possibility of integrating these databases, in order to minimize workload for companies with the same product registered in different databases.

Table 1. Summary of key information from the international outlook.

	Ökobau.dat	IBU	Bau-EPD	BRE	EPD-Norge	EPD International
View on relevant scope		A1-A3	Also waste management (D)	A1-A3	Maybe more than A1-A3	All lifecycle stages as included in the EPD
View on metadata		Must contain property data relevant for the whole lifecycle			Must be integrated in existing property database (NOBB).	Important not to exclude non-construction products or any EPD that is compliant with the standards
Covering only construction material	Yes	Yes	Yes	Yes	No	No
Presence of other relevant databases	No	No	No	No	Yes	Yes
Main challenges		Identification of relevant property data for the digital EPD.	Transfer of data to digital format.	Transfer of data to digital format.	Lack of international definitions for construction items. PCRs from different countries = differences in EPD-results for the same product.	Ddevelopment of a format relevant for non-construction materials as well as international consistency
Coming actions	Focus on international harmonization of format and content.	Developing interface for users in order to provide digital and PDF EPDs simultaneously and of new database, using adapted ILCD+EPD format.	Under discussion.	Harmonizing BRE-Lina with the ILCD+EPD format. Development of templates for machine readable PDFs.		Test of machine reading software in order to transfer current EPDs from pdf-format in to the ILCD+EPD format.
Issues related to economy and management of digital EPDs	Owned by the German government. No plans exist to take a fee for use of data.	Download of a large number of EPDs from IBU.data will demand license fee. Special fee for verification of metadata/property data included in the digital EPD.	Already have a fee for full versions of online tools for LCAs of construction materials and building.	Already have fees for use of BRE-Lina and IMPACT.	Investigating integration of EPD-data in exiting property datasets in NOBB	

3 Suggested format for digital EPDs

At the current, making use of the format developed for Ökobau.dat in 2013 and currently further adjusted and harmonized within the InData working group (the ILCD+EPD format) seems like the most interesting way forward for development of a system for digital EPDs in Sweden. Building on the ILCD-format seems reasonable based on the fact that this format already is widely used in Europe, has been adjusted to the EN15804 standard through the work made by Ökobau.dat (hereafter referred to as the Ökobau.dat-format) and is open source. Finally, the Ökobau.dat database already contains more than 1000 products in this format. Using the same format as basis could potentially make available a vast amount of datasets that could be useful in the building level LCAs developed within the present project.

Although some adaptions are necessary to fulfill the specific needs of the Swedish construction market. Such adjustments are suggested here. The aim is that the format developed through these adjustments will be presented and agreed upon by the different stakeholders involved in the present project.

The aim of this section is therefor to describe the format for digital EPDs currently used in the Ökobau.dat and suggest adjustments of relevance for the Swedish construction sector. General issues related to development of quality assurance and harmonization of EPDs are not included in the below, but are currently discussed within the InData working group (in which EPD International takes part) as well as in the process of harmonizing EN15804 with coming PEF standards.

3.1 ILCD-format – the base

The International Reference Life Cycle Data System (ILCD) format was developed within the European Platform on LCA in 2009. The main aim of the ILCD was to create a reference format for the European Reference Life Cycle Database (ELCD), but also to support the exchange (import and export) of the ELCD reference data sets with third party LCA databases and software tools as well as a common overall LCA exchange format to be used to exchange LCA data sets among all relevant LCA tools and databases Data Networks. As an object oriented data format, it has been designed to explicitly allow publishing and linking data over the Internet. The format allows modelling of several different data set types which identify different semantic concepts in LCA modelling that are linked together via typed links called “Global references”. These types of data set (concepts) are:

- “Common data types” mainly contain general information about the reference object and common enumeration values, containing characteristics of the LCA-modelling (allocation, representativeness etc.).
- “Contact” describes a person or organization. It can itself again reference another contact, allowing to document hierarchical relationships (e.g. person - working group - organization).
- “Flow”describes an elementary, product or waste flow. It references one or more Flow Property data sets.

- "Flow Property (quantity)" describes physical or other properties of a flow that can be used to quantify it, for example mass or gross calorific value. Each instance references one Unit Group data set.
- "LCIA Method" describes an LCIA method and its characterization factors e.g. an impact category like global warming potential or ecotoxicity. The data set can also document an entire LCIA methodology. The data set references one Flow Property data set that identifies the quantity of the characterization factors and - via the further reference to the Unit group - their dimension.
- Process for modelling both unit and aggregated processes and result sets. Input and output flows are modelled by Global references to other data sets of type Flow. Process data sets may optionally contain results of an impact assessment; in this case data sets of type LCIA Method will be referenced in a result list.
- "Source "represents an external source of information, such as literature or a database or data format. It can contain a reference to an external file or resource as well. It can reference a contact it is related to.
- "Unit Group (dimension)" describes a group of convertible units and the conversion factors to its reference unit.

Each unique data set carries an automatically generated Universally Unique Identifier (UUID) as well as a version number that is incremented upon changes to the data set. This combination enables unique identification of each data set (Wolf, 2011).

3.2 Integration of extensions for EPDs

Extension mechanisms were foreseen already in original implementation of the ILCD-format, with the aim of facilitating adaptation to other applications. In the format developed for Ökobau.dat (launched in 2013), these extension mechanisms were used to adapt the ILCD format's process dataset with additional information in order to model EPD datasets (Kusche et al., 2013).

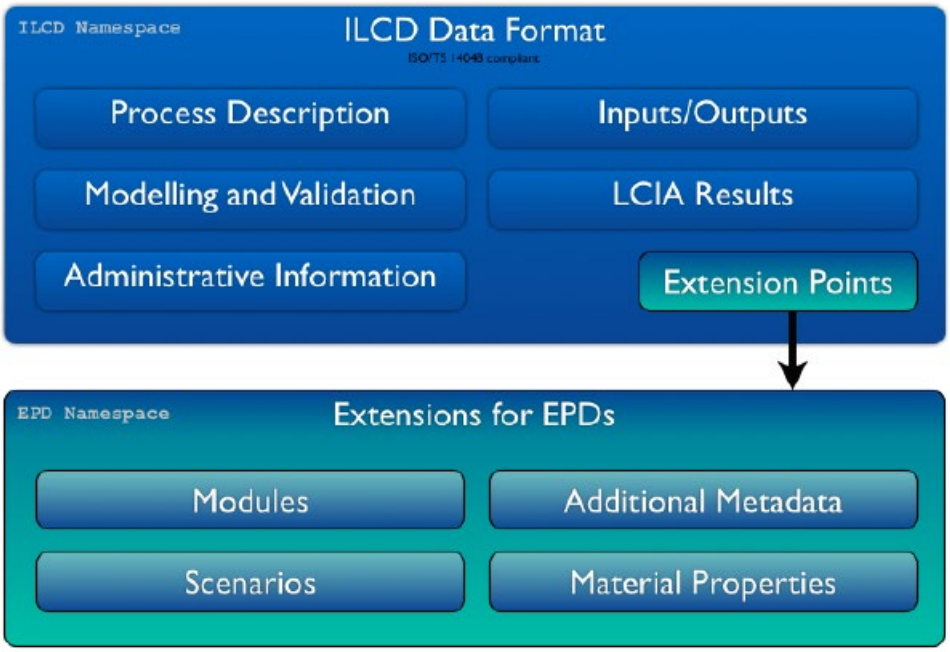

Figure 3. Conceptual presentation of the ILCD+EPD data format (Ökobau.dat, 2017).

The ILCD format's "Process"dataset is used for the purpose of describing an EPD. This holds the relevant metadata as well as the inventory results (in the "Exchanges" section) and the impact assessment results (in the "LCIAResults" section) for all lifecycle stages of the product. The actual product, for which the EPD is developed, is attached to the process as its reference flow. In this "Flow" dataset, properties of the product, like material properties such as density etc., can be included.

In some cases, the declared unit of the EPD dataset is presented in one unit, for example kilograms (a unit of mass), but the use of the product is measured in another unit, such as m^2 (area unit). Automatic conversion between units is necessary to guarantee an adequate level of user friendliness in any subsequent building-level LCA calculations where the digital EPD is used. Thus, this information needs to be available in machine readable format (Figure 4). Thus, for physical and chemical product properties, the MatML language is used. MatML is developed especially for the interchange of materials information over internet. While HTML tags specify how the data are to be formatted for display, the format conveys no description of the data themselves. This represents a serious drawback to those who wish to automate the processing of the data contained in those documents. MatML addresses the problems of interpretation and interoperability for materials property data exchanged via internet. Thus, MatML markup can be embedded in the product flow dataset using the ILCD format's native extension mechanism (Kusche et al., 2013).

```
<p>
1350<br>
metal<br>
aluminum alloy<br>
H18<br>
From “Properties of Aluminum
Alloys - Tensile,
Creep, and Fatigue Data at High
and Low
Temperatures.”<br>
Axial-Stress Fatigue Strength
(ksi)<br>
<table>
<tr><td>23</td></tr>
<tr><td>17</td></tr>
<tr><td>15</td></tr>
</table>
```

```
<MatML_Doc>
  <Material>
    <BulkDetails>
      <Name>1350</Name>
      <Class>metal</Class>
      <Subclass>aluminum alloy</Subclass>
      <Specification>ASTM B230</Specification>
      <ProcessingDetails>
        <Name>H18</Name>
      </ProcessingDetails>
      <PropertyData property=”p1” source=”s1”>
        <Data format=”integer”>23,17,15</Data>
      </PropertyData>
    </BulkDetails>
    <Metadata>
      <DataSourceDetails id=”s1”>
        <Name>
        “Properties of Aluminum Alloys - Tensile,
        Creep, and Fatigue Data at High and Low
        Temperatures.”
        </Name>
      </DataSourceDetails>
      <PropertyDetails id=”p1”>
        <Name> Axial-Stress Fatigue Strength</Name>
        <Units name=”ksi” Description=”kip per square inch”>
          <Unit>kip</Unit>
          <Unit power=”-2”>inch</Unit>
        </Units>
      </PropertyDetails>
    </Metadata>
  </Material>
</MatML_Doc>
```

Figure 4. Presentation of Aluminum Alloy data in HTML (left) and in MatML (right).

In terms of property data, a distinction must be made between scaling and non-scaling properties. In the case of scaling properties (mass, volume etc.), these are in the ILCD+EPD format described as “flow properties” and would increase by an increase of the designated unit used for the EPD, while non-scaling properties (such as density) would not, and should be described as “material properties”. The following property name identifiers are currently supported for declaring non-scaling material properties:

- bulk density
- grammage
- gross density
- layer thickness
- productivity
- linear density
- conversion factor to 1 kg

Bulk-density and grammage are mandatory in the Ökobau.dat version of the ILCD-format.

Adjusting the ILCD-format to the EPD-structure, it was also necessary to add information about the modules included in the assessment, as well as a manner to organize LCI-data as well as LCIA-results in accordance with the modular system of the EPD. Information about the type of data (generic/representative/average/template or vendor specific), safety margins and description of scenarios is to be included in the adapted format.

The major part of the ILCD-format was however maintained without changes by the group behind the Ökobau.dat adjustment of the ILCD-format to EPD purposes presented in 2013. As the ILCD-format originally not was developed for digital EPDs, it contains a vast amount of information not being used or not being altered when used for EPD purposes. In order to facilitate the use of the format, an excel file has been developed, describing the actual fields to be filled in, while hiding all extra information.

3.3 Mandatory metadata and category specific annex for construction material

The InData working group is currently identifying the relevant content in a "core" annex, containing metadata needed for correct interpretation of the results of the EPD. This process could however take some time, as different working group members tend to have slightly different views on the needs (see above). Thus, in order to advance within the present project, a set of core metadata to be included in the format (mandatory) is suggested in Table **2**. Large parts of this data are already included in the Ökobau.dat ILCD+EPD format, but not necessarily as mandatory information.

In addition to attaching the core metadata, where an international agreement would be much welcomed, and which could be seen as relevant independent of the category of products the EPD is developed for, the ILCD+EPD format has the possibility of linking with additional information (Kusche, 2017). This is here called a "construction material annex" (Figure **5**). There are three main areas of relevance in this annex:

1. Data that will facilitate categorization of the product on which the EPD is based (product group codes, GTIN etc.).
2. Additional environmental data, not covered by the impact categories included in the EPD.
3. Additional metadata, of relevance for the overall lifecycle environmental impacts from buildings constructed with products represented by the EPDs.

In relation to the first aspect, product group level codes used in BK04, BSAB and CoClass would be relevant to include in the format, as this can facilitate aggregation of products into groups relevant for a Swedish audience, and thus increase user-friendliness.

In relation to point two and three above, it is of key relevance to reflect upon the amount of additional data needed in the EPD-format to be useful in a Swedish BIM context. From the perspective of the producer, it could be positive to link the EPD to the information already provided in an eBVD, rather than having to introduce the same information again in the digital EPD. The GTIN ID could be used to provide such a link between the databases, based on the GTIN ID-being used also in the eBVD (this is currently recommended, but not mandatory). The eBVD-format already contains references to EPDs. According to these, if an EPD exists, results from this can be presented in the eBVD together with registration number of the EPD and the PCR used for the development of the same. Differently to this, the suggestion here is that the digital EPD merely should state if there is an eBVD, and if so, the information of where this can be found, but not present any data already provided in the eBVD.

While the recommendation here is that the format for digital EPDs should cover only the phases A1-3, it could be relevant to discuss the need for integration of information that has a direct impact on the environmental performance of the building/infrastructure where the material is being used. Integration of U-values and energy use for products where these aspects are relevant could facilitate calculations over the lifetime of the building. The same could be said about recommended maintenance frequency as well as the type and amount of products used during maintenance. While need for input of energy and material is addressed in the eBVD, U-values are not.

The suggestion of referring to eBVDs only applies for situations where the same product is registered in the eBVD-database. It was therefore seen as relevant to identify a smaller set of relevant types of additional information which should be included in the category specific annex for construction products. The instructions used for production of eBVDs where used as basis for this selection (Jarnehammar et al., 2016). These were combined with other properties of relevance for the calculation of building level lifecycle impacts.

Table 2. Suggested metadata included in the a digital EPD format. Parameters marked (a) are not included in the format currently used in Ökobau.dat, or an alteration of the approach taken in the current format is suggested. If an eBVD exists for the product, parameters marked with (b) are not to be included in the EPD.

Parameter	Comment
Manufacturer	Name of the producing company. Organization number.
Description	Short description of the construction product including main product components and or materials.
Declared unit	Declared unit of the product to which the data relates.
Publication date	This date is set as the date when the company submits the EPD registration. In case the documentation is incomplete or contains errors, the publication date on the EPD should be updated to correspond to the date of the final resubmission for registration. This date remains the same even with later updates of the EPD.
Revision date	In case of a new version of an already-published EPD, this date should be set corresponding to the date when the updated EPD is submitted for publication. It should not be included in case of a first EPD edition.
Validity	The year of expire of the EPD.
Version	As revisions can be made, the version number should always be presented.
Registration number	Registration number of the EPD
Program operator	Name of program operator where the EPD is registered
PCR used	Including name and version.
ID on an article or product[a]	We suggest that the ID refers to the article identity ant that the global standard GS1 is used with GTIN numbers, as this is preferred also in eBVD.
Location of production[a]	Coordinates of production place as decimal degrees (If the EPD reflects a national average, weighted average coordinates, considering the amount of product from each production site could be presented.
Classification of the product	If the digital EPD is to be identified through search engines of other program operators, classifications used in Ökobau.dat, IBU and GaBi could be included here. With time, this should be substituted by definitions developed in the bSDD.
Classification of the product[a]	Product group level codes used in BK04, BSAB and CoClass. In the case of CoClass, only the "component" code is to be registered in the digital EPD.
Property name identifiers for declaring non-scaling material properties[a]	Declaration of bulk-density and grammage are mandatory in the Ökobau.dat version of the ILCD+EPD format. It is however suggested here that no identifiers should be mandatory, as the relevance of each type of identifier varies for different products.
Reference Service Life (RSL)	Number of years of lifetime of the product. This is not relevant for the LCA calculation as only stages A1-3 are included in the digital EPD. This information will however be needed for the use of the EPD as input in building level LCA.
Reference year for generic data[a]	Interval of years since last update of data used in the LCI.
Reference year for specific data[a]	Interval of years since last update of data used in the LCI.
Technological coverage	Geographical area for which data used in the LCI is relevant.
Type of review performed	Information about the type of verification performed (independent verification of the declaration and data according to

	EN ISO 14025:2010 (Internal or External) as well as third party verification).
Energy content[a]	Lower heating value as MJ/kg dry weight.
Humidity[a]	Amount of water as % of total mass.
Energy use[a]	Amount and type (i.e. diesel etc.) of energy needed for the functioning of the product.
Overall heat transfer coefficient of the product[a]	For some products, such as windows, doors, insulation materials etc., it would be relevant to present the U-value (W/m^2, K).[6]
Safety-sheet[b]	If a safety-sheet exists for the product, there should be information about this, and a reference to the sheet. This can be attached to the data using the field "referenceToExternalDocumentation".
CLP classification[b]	Classification of product in accordance to the CLP-legislation (EU 1272/2008).
Candidate list[b]	Information about any content of substances from the candidate list should be presented, including the date of the ECHA-list used in the assessment.
EU-number/CAS-number[b]	Identification number of chemical substances. In first place, the EU-number should be presented. In case of alloys, the standard (EN/UNS/AISI) should be presented.
Metadata quality indicators[a]	Quality indicators such as representativeness of the data(general or specific data sets), geographic coverage etc. should be described here in order to evaluate the quality of the LCA-calculations for the whole building.,

In relation to location, this is currently expressed through country codes or regional codes. The use of coordinates would increase the possibility to integrate information from the EPD in a GIS software. As for classification, it could be highlighted that the category hierarchy used by Ökobau.dat differs from the one used by IBU, and the GaBi software uses yet another one. Thus, if there is a whish of including EPDs in interchangeable networks with other EPD databases, the EPD datasets need to be categorized in different coexistent and independent category hierarchies in order to enable users to easily find a dataset by browsing their preferred category system. The ILCD format supports the declaration of an arbitrary number of category systems in any type of dataset, providing a standard solution for this requirement (Kusche et al., 2013). The aim of the bSDD is however to present internationally agreed definitions of different objects in the built environment (bSDD, 2017). Once this database is more developed, it would be welcomed to include the definitions used in bSDD in the core metadata of the digital EPD. In the case of energy content, humidity, energy use and heat transfer, data must be machine readable in order to be considered in other parts of BIM. The integration of these data is currently investigated also by IBU. According to the current discussion within the IBU-board, key property data needed in machine-readable format in creation of building-level LCAs should be included directly in the EPD, and not in the additional information, presented as a separate dataset in IBU.data (Lehmann, 2017). The suggestion provided here should also be seen as a living document, which should be evaluated through the pilot studies included in the present project.

[6] The exact types of products where this information is mandatory could be specified.

Finally, is should be highlighted that the information suggested to be included in the above is product category specific to a large extent. While they are relevant for construction products, they might not be relevant for food and textiles, although EPDs can be made for all these product types (and more). Similar annexes could later be developed for other product categories.

3.4 Management and further development

EPDs in the International EPD System are to a large extent (almost 50%) related to non-construction material products. This distinguishes Sweden from Germany, Austria and the UK, where the agents involved in the discussion on digital EPDs derive from the construction industry. Similar to the situation in Norway, the development of digital EPDs in Sweden must also consider other systems where construction materials are registered. A digital format and user-friendly interface recently was created for environmental information of construction materials (eBVD 2015), and close collaboration with this system is necessary for efficient development, implementation and management of a digital format for EPDs in a Swedish context.

In the Swedish context, EPD International will have an important role in the development and implementation of digital EPDs. One of the main challenges in further developments is therefor to merge the interest from the construction sector of using digital EPDs as a building-block in digital building-level LCAs, with the general interests of maintaining the quality and reliability of the system, which is one of the main focuses of EPD International.

Some of the key issues for a successful development and implementation of the format are described below. It is suggested that these are investigated in a separate pilot project, where the format can be tested and evaluated from the specific needs of the Swedish construction sector as well as within the existing structure used by EPD International.

3.4.1 Integration with existing systems

In the suggestion presented here, additional environmental information required in the EPD-format will not be mandatory for products with a registered eBVD[7]. A connection between the digital EPD and eBVD must therefore be created. As results from an EPD are to be registered in the eBVD, it would be relevant to investigate the possibility of transfer of data also from the EPD to the eBVD. During the test-phase of the format for digital EPDs it must be investigated how the link between these systems can be created in practice and how updates in one system automatically can be registered in the other in order to minimize the workload for the manufacturers.

Another system of relevance in relation to the digital EPD is the development of CoClass, the new Swedish classification system for construction materials. In CoClass, objects are classified in relation to a functional system, constructive system and components, resulting in a code with three constituents, although classification in relation to all three levels is not mandatory (Svensk Byggtjänst, 2016). It is suggested here that merely the component level is to be included in the EPD. CoClass is linked to IFC and an integration of this information in a machine-readable way needs to be investigated.

[7] It should be highlighted here that eBVDs not are validated externally, different from the published additional information in IBU.data.

One of the main reasons behind the development of digital EPDs is the interest of using them as input in building-level LCAs. Thus, the need for further adjustments of the format prior to successful use of the information in this context must be investigated. This includes an evaluation of the relevance of the metadata and material property data suggested as mandatory in this report, as well as the need for inclusion of further information.

3.4.2 Transfer of information to digital format

Making EPD-data available in a digital format could increase the need for maintenance of the EPD-database. Costs will arise if the data has to be transferred to the digital format manually. Thus, it is highly relevant to develop a system where this is done automatically, in a resource-efficient manner. The UK suggestion of developing a standardized PDF-format which is machine readable could be one solution. The verification process of the EPD could in this case also include that the correct data is included on the right place, to ensure correct digitalization of the information. Another solution is currently developed by IBU. The tool basically serves both as a user friendly front-end for manufacturers to enter their data and for the data management by the IBU staff. When all information is complete and reviewed, the PDF and XML are generated from the same interface, meaning that data only has to be entered once. Oliver Kusche is the technical consultant for the development and implementation of this tool. This tool could potentially be used also by the Swedish program operator for a license fee (IBU has already demonstrated interest for such a solution (Kusche, 2017)). Alternatively, a similar tool could be developed for the Swedish program operator.

3.4.3 Validity

The issue of validity of digital EPDs is complex. An EPD will always have a validity period, and thus an expiring date. However, an EPD can become invalid during the validity period if the data which the EPD is based on is changed, while the manufacturer not updates the information in the EPD (Jelse, 2017).

Including the end-year of the validity period of the EPD in the ILCD-code would make it possible to filter only on valid datasets (EPDs). However information regarding potential invalidity due to changes in the manufacturing process would also be needed to assure the user that the dataset used in a building level LCA is valid. A possibility of deleting expired data automatically one year after expiring has also been discussed within the InData working group. If no other data is available for the product, the EPD could however potentially be maintained. It could also be interesting to develop automatic information to data providers, informing them that data will be deleted within short, as the expire date is getting close. If this option is chosen, additional data would have to be included in the digital dataset.

3.4.4 Quality

EPDs will in practice commonly be used in a comparative context, in selection of products with similar functions in the built environment. It is therefore of key relevance that compared EPDs really are comparable. Inclusion of metadata describing the general quality of the digital EPD is thereby pertinent. This can also facilitate identification and improvement of data used in building-level LCAs whenever data of higher quality is made available. Quality indicators could in this context include aspects such as representativeness and the amount of specific and generic data included in the LCI phase. This is investigated further in Task 1.4 of this project. The suggestion made in the present report is that this information should be included in

the digital format, and that it should maintain disaggregated information in order to compare and contextualize EPDs in relation to different aspects, rather than being aggregated into a single general quality indicator.

3.4.5 Ownership and business model

The data provided in the EPD, in its current PDF-format as well as its digital, is developed by the producing company, and thus, belongs to the same. Several private companies have however lately started using digital EPDs in commercial applications, which might be seen as a problem both from the perspective of the data developer and the program operators. This issue is currently discussed within the InData working group and must be evaluated also from a Swedish perspective.

3.4.6 Lifecycle costing (LCC)

The present report does not consider data needed for calculation of LCC neither on article nor building level. Inclusion of necessary data for such calculations could be interesting in future developments of the format, but it should be remembered that it is suggested here that the digital format for EPDs should cover only modules A1 to A3. It is however suggested that the format should contain data relevant for inclusion of environmental impacts also during the use phase, and additions could be made so that the format presents the same possibilities also for assessment of LCC in the future.

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