



**NTNU – Trondheim**  
Norwegian University of  
Science and Technology

# Establishment of EPD Programme in Latvia:

case of construction industry

**Ilze Garda**

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Supervisor: Annik Magerholm Fet, IØT

Norwegian University of Science and Technology  
Department of Industrial Economics and Technology Management



## Preface

This study is a master thesis conducted during the last semester in the Master of Science Industrial Ecology Programme at the Norwegian University of Science and Technology (NTNU) in Trondheim, Norway. The thesis is written in 2012, at the Department of Industrial Economics and Technology Management under the supervision of the professor Annik Magerholm Fet.

The objective of this thesis was to investigate the feasibility of the establishment of an EPD programme in Latvia by applying the knowledge and skills gained during my studies at the NTNU, and suggest a solution for an national EPD programme that complies with the current requirements and practices elsewhere in the European Union/European Economic Area.

I would like to thank my supervisor Annik Magerholm Fet for her feedback and guidance, as well as encouragement in the work process.

A special thanks goes to Jānis Kļaviņš for the very first introduction to the sustainability landscape of Latvia, and to my dear friend Ieva for her genuine support throughout these two years and for her infectious passion for research.

Ilze Garda

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## Abstract

Environmental assessment, reporting and documentation, including Type III environmental product declarations (EPDs), are becoming increasingly important internationally and throughout Europe. While some countries have been using EPDs for several years already, other have not yet applied this tool and methodology of life cycle assessment (LCA).

In March 2011, a new EU Regulation was passed that introduces a new essential (basic) requirement for construction works, namely, *sustainable use of natural resources*, and refers to the use of EPDs, when available. Based on these developments, the purpose of this thesis is to investigate the feasibility of the establishment of an EPD programme in Latvia.

The study has identified several barriers that slow down the process of acquiring new environmental assessment tools like EPDs at the national level in Latvia. Taking these into account, as well as the recent developments towards a common European ECO-EPD platform, the development of a contact-consultancy point that provides qualitative information and consultation about options for registering EPDs under already existing schemes, is proposed.

As the some of the readers of this study might be less familiar with the concepts related to EPD programmes and EPDs, these are explained in a greater detail than it would otherwise be necessary.



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## Abbreviations

CEN	European Committee for Standardization
CSR	corporate social responsibility
CPD	Construction Product Directive
CPR	Construction Product Regulation
EC	European Commission
EEA	European Economic Area
EPD	environmental product declaration
EMS	environmental management system
EU	European Union
GBC	Green Building Council
GDP	gross domestic product
GHG	greenhouse gases
GPP	green public procurement
IOA	input-output analysis
IPP	Integrated product policy
ISO	International Organization for Standardization
LCA	life cycle assessment
LCC	life cycle costing
MFA	material flow analysis
SCM	supply chain management
TC	technical committee
UNEP	United Nations Environment Programme



## 1. Introduction

### 1.1. Background

Development based on the principles of neoclassical economics has been dominating for many decades. The main goals of such development are economic growth (measured by the country's GDP and increase in GDP), accumulation of capital and ever-increasing production and consumption. This race for more has, however, negative social and environmental impacts and unlimited, exponential growth cannot be sustained on a finite planet with finite resources. Sustainability – sustainable, long-term development – has become a hot topic on the international political and scientific agenda. Historically, politics, business, environment and human well-being have been treated as different, often competing areas of interest. If we are to deal successfully with the environmental and social problems the society faces today, a holistic and systematic approach is needed.

This study is based on the premises of industrial ecology – a multidisciplinary field of research that aims to combine various disciplines of natural and social sciences in order to address the current problems and the idea of sustainable development from a holistic and systematic perspective. Further, a central concept is of the industrial ecology is environmental accounting and assessment that can be used as an effectively at the product level, organisation level, national and even global level.

Environmental assessment and documentation at the product level is of particular interest to this study. Reliable information about the environmental performance of a product is essential for responsible and informed consumer choices, as well as improved production methods and effective recycling strategies. Apart from that, the political initiatives and frameworks are crucial in order to develop the necessary market conditions for sustainable products.

Both the political frameworks and environmental accounting and documentation practices vary among regions and countries. Regarding the assessment, documentation and communication of the environmental performance at the various levels it is important to point out the importance of the efforts of the International Organization for Standardization in the development of ISO14000-family of the internationally recognized standards for environmental accounting and management. The European Union – which is the focus region of this study – has also been working on these issues and by now has developed its own standards and guidelines for environmental accounting and documentation. In addition, each of the

EU member states has its own rules, local requirements and “traditions” for approaching the issues related to environmental performance. In real life, this leads to uncertainties in and different approaches to environmental assessment and documentation across the EU that in general aims for harmonized requirements and open markets among its member states.

Further, this study is focused in particular on the sustainability of the construction sector and production of building materials. According to the report from the UNEP International Panel for Sustainable Resource Management, residential and commercial buildings are one of the major contributors to global greenhouse gas (GHG) emissions accounting for 8% of the total amount of these emissions (Hertwich, 2010).

Several other key reasons why the building and construction sector is highly important for sustainable development are listed in the international standard ISO 15392 (2008):

- it is a key sector in national economies;
- it is a large industrial sector that absorbs considerable resources over the life cycle of buildings and contribute to transformation of areas;
- it has considerable opportunities for improvement related to the environmental, economic and social aspects.

Construction industry and production of building materials are important because the use of particular materials and building methods affect not only the environmental impacts of the building process, but the choices made still in the design phase will have a significant impact on durability, energy efficiency and various emissions throughout the entire life cycle of industrial plants, office buildings, our homes and infrastructure.

In the European Union (EU), sustainable growth is pointed out as one of the three guiding principles of *Europe 2020* – the EU's growth strategy for the coming decade. Various initiatives to include environmental considerations into the specific sectors are also present in the EU, including initiatives in the construction sector – green public procurement, CEN standards, eurocodes, CE marking of products and other.

In March 2011, the Construction Products Directive 89/106/EEC was repealed and Regulation No 305/2011 laying down harmonised conditions for the marketing of construction products was published and came into force. This has led to a certain change of landscape in the sector, since the new regulation clearly requires sustainable use of natural resources by stating that “construction works must be designed, built and demolished in such a way that the use of natural resources is sustainable” (Regulation No 305/2011).

These developments are particularly important for those EU countries where systematic assessment and verification of environmental performance of products and processes are not yet well-established. Latvia, an EU-member state since 2004, is an example of such country where concepts like life cycle management and documentation of sustainability and environmental performance are not yet widely applied, both due to the lack of reliable, region-specific data and the lack of necessary competences.

## **1.2.Objective and scope of the thesis**

Objective of this thesis is to investigate the feasibility of the establishment of an EPD programme in Latvia by mapping and analyzing the current conditions (gaps, barriers and opportunities) and suggesting a solution for a national EPD programme that complies with the current requirements and practices elsewhere in the EU/EEA.

Thus, the main tasks of this study are to:

1. Map the relevant background theory and methods used in industrial ecology.
2. Give an overview of the existing framework for sustainable construction in the EU/EEA.
3. Give an overview of the methods for environmental assessment and reporting in the construction sector.
4. Investigate existing EPD programmes in the EU/EEA (4 representative programmes are chosen).
5. Investigate the national context for the environmental and sustainability issues in Latvia
6. Map and analyze the current conditions (gaps, barriers and opportunities) for establishment of EPD programme in Latvia.
7. Suggest a solution for a national EPD programme that complies with the current requirements and practices elsewhere in the EU/EEA.

## **1.3.Limiations**

First of all, sustainability is often seen as consisting of three main components – environmental, economic and social factors. This thesis deals primarily with the environmental impacts and environmental performance of a product, leaving a detailed assessment and documentation of social and economic impacts outside the

scope of this study. Further, this thesis focuses on the sustainability issues at the product level. Processes, global and regional material and energy flows are somewhat addressed where appropriate; however, a more detailed discussion about these levels are outside the scope of this work.

#### **1.4. Structure of the thesis**

The problem of this study is approached from the system perspective – the starting point of this study is the mapping of the current requirements for assessment and documentation of sustainability aspects in construction industry (chapter 4), further the investigation of the standards of the assessment and documentation of environmental performance in this industry in the EU (chapter 5). Then, the existing EPD programmes are covered (chapter 6), before exploring the national context of environmental and sustainability issues in Latvia (chapter 7). This is followed by the concluding discussion (chapter 8).

The relevant background theory is given in the chapter 3.

## 2. Methodology

The primary goal of research is to produce new knowledge or structure and deepen understanding of the existing theories, concepts and issues (Kothari, 2004). Various quantitative and qualitative methods exist that can be used in the research – surveys and questionnaires, observations and experiments, group interviews and individual interviews – all depending on the scope, objective and structure of the study. For the detailed explanation of the various research methods, the reader may refer to, for example, *Research Methodology* by Rajendra Kumar (New Dehli: APH publishing, 2011).

This particular study is conducted based on *literature review* (secondary data sources) and *qualitative interviews with experts* (primary data sources).

### 2.1.Literature review

A literature review (Oliver, 2004) consists of a textual analysis (Babbie, 2004) of secondary information sources (Saunders et al., 2003) The relevant information sources for this thesis include policy documents and legal acts at the European and national level, international and European standards, books and publications in peer-reviewed journals on the topics related to sustainability and environmental accounting, environmental reporting and documentation, environmental labelling, product labels and declarations, standardisation, and others. Various conference papers and presentations, as well as the data available on the internet, are also used in the literature review.

Apart from the above mentioned sources, the secondary data for this study were collected by reviewing the publications in the following international peer-reviewed journals:

- Building and Environment
- Business Strategy and the Environment
- Environmental Management and Corporate Social Responsibility
- International Journal of Life Cycle Assessment
- Journal of Cleaner Production
- Journal of Environmental Management
- Journal of Industrial Ecology
- Sustainability

A special attention is given to the publications and other sources of secondary information that refer to small and medium-sized enterprises (SMEs) – this is due to

the fact that the Latvian economy, as well as the whole EU economy, is largely based on SMEs.

## 2.2. Qualitative interviews

Qualitative interviews provide means for collecting more in-depth and qualitative information about the topic of the study (Holme, 1991). The respondent in the interview is called an informant, and he/she normally has a significant knowledge about the topic.

Qualitative interviews can also be conducted with experts. An expert, according to Winkler and McCuen-Metherell (2008), is “someone who is acknowledged as an authority in a particular subject or who has had a unique experience with it”. Experts can be an important and valuable source of qualitative information almost on topic (ibid).

There are four types of qualitative interviews (McNamara, 1999):

- Informal, conversational interview usually with no predetermined questions, thus ensuring a high adaptability;
- General interview guide approach is meant to ensure that the same general areas, or topics, of information are collected from each respondent, but there is still significant freedom and flexibility in the interview;
- Standardized, open-ended interview is characterized by the same open-ended questions asked to all interviewees; such information is easier to analyse;
- Closed, fixed-response interview – respondents are asked the same questions and they choose their answers from the same set of alternatives.

Primary data for this study were collected through qualitative interviews of the experts from the representative stakeholder groups – the Latvian industry, authorities and academia. The interviews were mostly informal, conversational type, although some questions were prepared beforehand.

### 3. Background theory

#### 3.1. General principles of industrial ecology

Industrial ecology is a multidisciplinary field of research that aims to combine various disciplines of natural and social sciences in order to address the current problems and the idea of sustainable development from a holistic and systematic perspective. One of the most commonly used definitions of the industrial ecology states that it is “the study of the flows of materials and energy in industrial and consumer activities, of the effects of these flows on the environment, and of the influences of economic, political, regulatory, and social factors on the flow, use and transformation of resources” (White, 1994). This definition illustrates clearly the holistic perspective of this field and its interest in metabolic processes of industrial society, their environmental impacts and their interaction with the various institutions. This is a very much needed approach if we are to pursue the path of sustainable, long-term development.

One of the central concepts of the industrial ecology is environmental accounting – it constitutes the very basis of important decisions regarding design and technology options, sustainable production methods and recycling strategies, as well as sustainable and responsible consumption. Environmental accounting can be carried out at the various levels – starting from the assessment of environmental performance of a single product till accounting at the company level and further, material and energy flows at the national, regional and global level. Depending on the scale and scope of environmental accounting it may be based on various methodologies like life cycle assessment (LCA), life-cycle costing (LCC), input-output analysis (IOA) at the company, regional or national level, material/substance flow analysis (MFA/SFA) and other.

Systems thinking (Bertalanffy, 1968) and a holistic approach is the very cornerstone of the industrial ecology. In the context of the industrial ecology, the systems thinking is manifested by use of a life cycle (cradle-to-grave) perspective, material and energy flow analysis, systems modelling and sympathy for interdisciplinary research and analysis – all this in order to avoid narrow and partial analysis leading to erroneous decisions and unintended consequences (Lifset and Graedel, 2001).

Industrial metabolism is another important foundation of industrial ecology and a part of systems thinking approach within the field. It is defined as “physical processes that convert raw materials and energy, plus labour, into finished products and wastes” (Ayres, 1994). Thus, this concept addresses the tracing of material and energy flows from extraction of resources through production and consumption to

the final disposal and/or recycling of the materials and energy locked in the given product.

Finally, a stakeholder analysis is a qualitative business research method that has been widely applied in the industrial ecology, especially within the areas of environmental management and corporate social responsibility (CSR). Freeman (1984) defines stakeholders as “any group or individual who can affect or is affected by the achievement of the organization's objectives”, thus, a stakeholder analysis investigates the various groups that are directly or indirectly affected by organisation’s activities or those can directly or indirectly affect these activities. Ackoff (1988) goes even further by considering also the interests of the very young and those who have not yet been born and pointing out that in order for the future generations to be able to decide for themselves, their options should be kept open. Interests of the various stakeholder groups are often conflicting, so a thorough stakeholder analysis helps to identify and organize these various interests, assess the associated opportunities and risks.

### **3.2.Sustainability accounting and environmental accounting**

The term “accounting” refers most often to the collection, analysis and management of financial information like profit and loss statements, income and expenses related to business activities. Research linking the more traditional financial accounting to the broader sustainability accounting emerged in the early 1990s and has since then received growing interest and attention of academia and practitioners (Lamberton, 2005).

Sustainability accounting aims to capture environmental, economic and social aspects of organisation’s activities; though it is sometimes used synonymously with environmental accounting (ibid). Sustainability accounting is often based on the triple-bottom line (Elkington, 1998) that covers economic, environmental and social aspects. A commonly known example of the framework for sustainability accounting is Global Reporting Initiative that based on these principles.

Environmental accounting is based on the accounting and analysis of the inputs and outputs in form of material and energy flows and economic aspects of sustainability are captured by applying life cycle costing. Accounting for the social dimension of sustainability is more challenging due to “its intangible, qualitative nature and lack of consensus on relevant criteria” (von Geibler et al., 2006).

Though not a focus of this particular study, it is also important to mention life cycle costing (LCC) and total cost accounting (TCA) that are methods for assessing the so-called total cost of ownership and for accounting of environmental and social impacts in addition to financial expenditures while taking into accounting the whole life cycle of a product. These methods, especially LCC, considers all the costs of acquiring, owning and disposing of a given product or system (Fuller, 2010). Such cost accounting methods have relatively recently gained attention because shareholders, as well as stakeholders, have begun to realise that environmental information is relevant to decision making also from the economic perspective (Schaltegger and Burritt, 2000). For more detailed discussion of these methods, the reader may refer to Schaltegger and Burritt's *Contemporary environmental accounting: issues, concepts, and practice*.

Motivation for sustainability and environmental accounting were summarized as early as in 1993 by John Elkington – a well-known authority in the field of sustainable development and corporate responsibility. He wrote that businesses engage in such practices in response to new regulations, in response to emerging business requirements or in response to changing public expectations. This is as true in 2012 and various studies have confirmed these being the main drivers for the evolution of sustainability accounting and reporting

### **3.3. Methods for environmental accounting and documentation**

#### **3.3.1. Environmental management systems**

Environmental accounting is often considered along with the practice of cleaner production and it is quantification of all material and energy flows (input and output) that are further used to assess the impacts of these flows on the environment (Fet, 2010). Establishing and maintaining of environmental accounts give the opportunity to further develop goals, policies and programs for improvement of organization's environmental performance. It also provides the basis for environmental indicators and their development over the time, as well as the basis for development of environmental management system (ibid).

An environmental management system (EMS) is a structured framework for accounting and managing significant environmental impacts of the organization. It may develop and certified according to international standards (like ISO14001 or EMAS) or national schemes (like Miljøfyrtårn), or it can be developed based on internal, more informal guidelines and considerations (Brady, 2005).

Reasons for implementing EMS are often customer requirements for the documented and certified EMS, requirements of national legislations, as well as potential for cost savings as a result of properly monitored and managed environmental inputs and outputs (Brady, 2005). Improved track of environmental records is also a significant part of organization's CSR strategy that is an important part of reputation building in the market, in the community, as well as the existing and potential employees.

### 3.3.2. Life cycle assessment

LCA is a very central tool in the industrial ecology. It is a quantitative method that is based on the concept of systems thinking and holistic approach to problems and that is meant for the accounting of the industrial metabolism of a product. A full-scale LCA considers all the phases of resource use and environmental releases associated with a system, i.e., a product, process or activity, and it is first of all intended as a relative tool for comparison of alternative products, processes or activities (Curran, 2008). Other quantitative methods used in the industrial ecology include material flow analysis and input-output analysis.

The process of conducting an LCA is time and data intensive and requires attention to detail and access to reliable data. The LCA process is thoroughly described in ISO 14040:2006 Environmental management -- Life cycle assessment -- Principles and framework. The main steps of the process are illustrated in the Figure 1. The figure also shows the most common applications of LCAs.

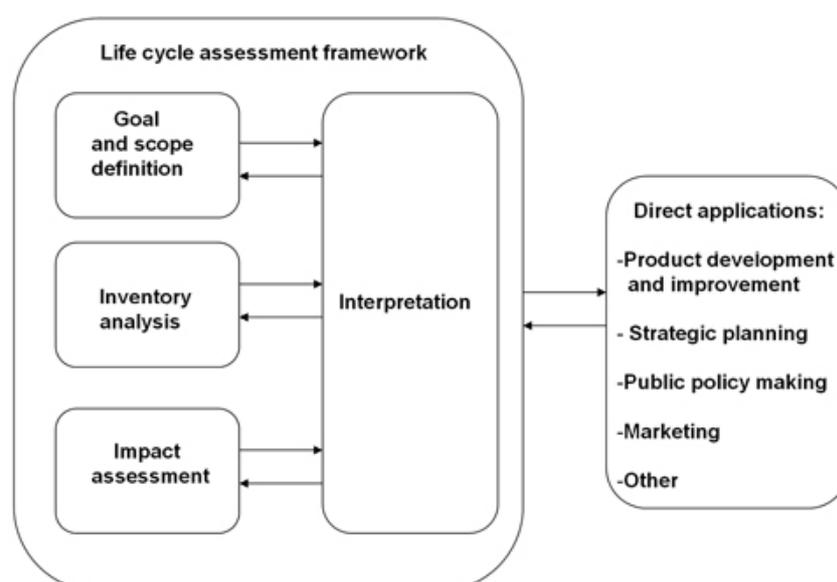


Figure 1. Steps of conducting an LCA (ISO, 2006)

LCA enables life cycle management (LCM) of products and services since it is a tool that provides valuable information about full impacts of decisions and choices and makes it possible to cover also those impacts that occur outside of the production or final consumption but that are directly influenced by selection of a particular product, process or service (Curran, 2008). In order to make an optimal and well-balanced decision LCA should be used together with other decision criteria, such as cost and performance analysis – for example the life cycle costing method.

Though not a part of this thesis life cycle costing method is mentioned because it is a powerful tool combining the economic, environmental and social costs of an asset. Life Cycle Cost (LCC) of an asset is defined as "the total cost throughout its life including planning, design, acquisition and support costs and any other costs directly attributable to owning or using the asset" (New South Wales Treasury, 2004). Huppel et al (2004) are even more specific by stating that LCC is a cost "borne directly and indirectly by public and private actors involved, and possibly including cost of external effects", thus taking into account also environmental dimension and costs that are not always reflected in the market price.

This method is somewhat similar to LCA since both methods are based on the systems thinking approach and considers the life cycle perspective – only while the LCA is concerned with environmental impacts and performance, the LCC is concerned with the monetary costs occurring throughout the entire life cycle.

### **3.3.3. Supply chain management**

Christopher (2005) defines supply chain management (SCM) as the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole. Again, traditionally cost has been considered only in monetary terms, while increased focus on environmental issues has resulted into the cost being defined more broadly. Green SCM involves introducing and integrating environmental issues and concerns into supply chain management processes by selecting suppliers and auditing and assessing their environmental performance (Handfield et al., 2005).

SCM per se is a well-established issue on the strategic agenda; however, green SCM is an emerging field and fewer publications and research studies are available on environmental supply chain management and its impacts or environmental management activities extended beyond the first tier of external suppliers (Fortes, 2009).

A multinational study by Testa and Iraldo (2010) found that reasons for introducing green SCM can be both ethical and commercial; it also came the conclusion that green SCM is strongly complementary with other advanced management practices and that it contributes to improved environmental performance, however, the effects on financial performance are more ambiguous.

Apart from direct customer or legislative requirements that affect some of the actors in the supply chain, the green supply chain initiatives are in often cases initiated by large organizations and corporations because of the increased media attention and coverage, the bargaining power over suppliers and the amount of resources the company possesses play an essential role in initiation and development of successful collaboration projects.

### 3.3.4. Product labelling and EPDs

Product labelling is a means of communicating the environmental performance of a product or service to the customer and these means are deployed by companies as a result of legislative or customer requirements, and/or in order to increase the market share and improve brand image (Brady, 2005). While in some cases product labelling is strict and mandatory (for example in pharmaceutical industry or for hazardous chemicals), all kinds of environmental product labelling exist around the world. The legislative requirements for applying a certain label vary significantly from country to country, and due to this variety in labels and requirements for these, there is a high level of misleading use of environmental labels.

A number of standards are established by the ISO in an attempt to define specific requirements for the most common types of labelling - these are listed in Table 1.

Table 1. ISO standards in the field of environmental labelling (from Brady, 2005)

ISO 14020	Environmental labels and declarations – general principles
ISO 14024	Environmental labels and declarations – Type I environmental labelling – principles and procedures
ISO 14021	Environmental labels and declarations – Type II environmental labelling – self declared environmental claims
ISO/TR 14025	Environmental labels and declarations – Type III environmental declarations

Type I eco-labels are voluntary schemes and companies that want to use the logo of such a label have to demonstrate compliance with a set of established criteria and this compliance is checked and verified by a third party, thus ensuring the credibility

of information (Brady, 2005). Examples of the most widely known Type I eco-labels include EU Eco-label, Blue Angel, Nordic Swan and Green Seal.

Type II covers self-declared environmental claims and is considered to be the most widespread form of providing environmental information. However, an important critique and weakness of this type is that such claims can easily be misleading, vague or even untrue. The ISO 14021 standard has tried to deal with this problem by establishing rules and guidelines for making self-declared environmental claims (Brady, 2005).

Type III environmental declaration programme or EPD is defined by the ISO 14025:2010 a “voluntary programme for the use and development of Type III environmental declarations”. EPD is developed based on the conducted LCA of a product or service and it should be further verified by the third party. To put it simply, it is a label that discloses the information about the life cycle environmental performance of products and services. Such label is not a claim of environmental superiority – the purpose of it is to enable comparison of products that fulfil the same functions based on objective and quantified environmental information (Costello and Schenck, 2009).

Several national and international EPD programs exist. The same is the case for other types of environmental product labelling. Different countries have often different standards, there are numerous ways of marking and labelling same type of products and this means higher costs for exporters and rather significant obstacles for entering markets – a concern over the large amount of various environmentally-related rules is expressed by the United Nations working group. An international harmonization of standards and labels is suggested as a step towards lowering entry barriers, while simultaneously promoting the transition to green economy (UNCSD Secretariat and UNCTAD, 2011).

## 4. Sustainable construction in the EU

### 4.1. EU policies

The key objective of the EU in the field of sustainable development is “to integrate environmental sustainability with economic growth and welfare by decoupling environmental degradation from economic growth” (European Commission, 2012a). In this context, the relevance of improved sustainability of the construction industry is undeniable since buildings account for the largest share of the total EU final energy consumption (42%) and they also produce about 35% of all greenhouse emissions (European Commission, 2007a). Additionally, waste produced from building materials during the construction and demolition stages is the source of 25 % of all waste generated in Europe (CEN, 2005). From the economy perspective, the EU’s construction market accounts also for 10% of GDP and 7% of the workforce (European Commission, 2007a).

Accordingly, the construction industry was included as one of the six markets in the Lead Market Initiative in 2006. The European Commission developed the concept of 'lead markets' in order to promote favourable market conditions for new innovative products, services and technologies in the EU market thus providing solutions to the variety of economic, environmental and societal problems faced by the EU (CEN, n.d.-a). The main objectives within the Lead Market Area Sustainable Construction are shown in Table 2:

Table 2. The main objectives in the Lead Market Area ‘Sustainable Construction (European Commission, DG Enterprise and Industry, 2012)

Policy tool	Main task
<b>Standardisation, labelling, certification</b>	Development of 2 <sup>nd</sup> generation eurocodes by CEN (European Committee for Standardisation).
<b>Legislation</b>	Screening of national building regulations - in order to assess national regulations for sustainable construction, enforcement of these regulation, the existing public and private initiatives, etc.
<b>Public procurement</b>	Establishment of the Network for Contracting Authorities – in order to connect public authorities seeking to procure innovative and sustainable solutions within their construction projects.
<b>Complementary actions</b>	Upgrading of skills of construction workers.

The detailed action plan for this Lead Market Area can be found in Appendix 1.

In general, one of the earliest attempts of the EU in the field of sustainable development was creation of the Integrated Product Policy (IPP). The development of the IPP dates back to 1997 when a review of current practices in the Member States was carried out; further a Green Paper on IPP was published in 2001 (International Institute for Sustainable Development, n.d.).

The IPP recognizes that all products cause environmental degradation in some way during their life cycle – may it be from manufacturing phase, utilisation or disposal. The IPP seeks to minimise these impacts by considering all phases of a products' life-cycle and taking action where it is most effective. The tools used to achieve this objective include both voluntary and mandatory measures like economic instruments, substance bans, voluntary agreements, environmental labelling and product design guidelines (European Commission, DG Environment, 2012a).

In 2008, the European Commission presented its Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan (shortly - SCP/SIP). In this document, the need for consistent data on products and consistent product assessment methods is recognized as one of the key factors for successful implementation of this policy (SCP/SIP Action Plan, 2008). When possible, the European harmonised standards should be used and ideally these should be based on international standards, thus increasing the industry competitiveness and cooperation inside and outside the EU (ibid).

Green public procurement (GPP) is another important instrument towards a more sustainable consumption and production. According to the European Commission, DG Environment (2012b), public authorities spend around 2 trillion EUR annually in purchasing, this being equivalent to approximately 19% of the EU's gross domestic product. Such a proportion makes the public authorities in Europe a major consumer whose purchasing power and choices have accordingly a major effect on business and production practices. GPP is a voluntary instrument, so the Member States are free to determine the extent of the GPP implementation in their own procurement processes.

As a part of the EU efforts to promote green public procurement, the European Commission started to develop the EU Commission's GPP Training Toolkit in 2008. Construction is one of 10 product and service groups for which the common purchasing recommendations have been developed covering the procurement of construction works, as well as the supply of related services such as cooling, heating and ventilation services and the provision of electricity (European Commission, DG Environment, 2012b). Environmental criteria that may be included in procurement specifications for construction works aims to address the design, construction, use

and disposal phase of buildings and are thus related to energy performance, building materials and waste and water management (ibid).

Environmental criteria that can be readily used in tender documents were also developed for some more specific product groups, including the following construction products:

- windows, glazed doors and skylights;
- thermal insulation;
- hard floor-coverings;
- wall panels.

## 4.2.EU legislative framework

The recent developments in the EU legislative framework for the construction industry follow the above discussed aspiration for consistent data and consistent product assessment methods throughout the EU.

There are two primary types of legislative acts in the European Union – directives and regulations. A directive is a legislative act that establishes the EU policy and it is further left to the Member States to implement the directive into their national legislation in the way the state finds appropriate (Folsom, Lake and Nanda, 1996). A regulation, on the other hand, is a legislative act that enters into force as soon as it is passed and it is legally binding for every Member State; thus, a regulation overrides national laws on the same subject and sequentially the national legislation should be adjusted in order to be consistent with a regulation (European Commission, 2012b).

An important objective of the EU legal acts in the field of construction products is to create a single market, enhance free product movement in the internal market and remove technical barriers to trade caused by disparity in requirements that are stated in national product standards, national technical specifications and approvals and other national provisions related to construction products.

Until March 2011, the main legislative act for construction products in the EU was the EU Directive 89/106/EEC, commonly referred to as the Construction Products Directive. It aimed at the approximation of laws, regulations and administrative provisions of the Member States relating to construction products and provided for the establishment of harmonised standards, the CE marking and the granting of European technical approvals for the construction products placed on the EU market (Council Directive 89/106/EEC, 1989).

According to the Construction Products Directive any construction product placed on the EU market had to be suitable for construction works, meaning that such a product had to meet the following essential requirements for construction works stated in the Directive:

1. mechanical resistance and stability
2. safety in case of fire
3. hygiene, health and environment
4. safety in use
5. protection against the noise
6. energy economy and heat retention.

As shown in the above listing, environmental impacts to a certain degree were addressed in point 3 (for example, pollution or poisoning of the water or soil) and point 6 that requires effective use of energy for heating, cooling and ventilation systems. However, the essential requirements for construction works in the CPD did not address sustainability in particular and the requirements addressing environment were very vague and did not stimulate any additional efforts for a better environmental performance (World GBC, 2011).

As of March 2011, the Regulation No 305/2011 of the European Parliament and of the Council entered into force and laid down harmonised conditions for the marketing of construction products, simultaneously repealing the earlier Construction Products Directive. The latest is replaced by the new Regulation in order to simplify and clarify the existing framework, as well as to improve the transparency and effectiveness of the existing measures. The Regulation No 305/2011 is commonly referred to as the Construction Products Regulation (CPR).

The key to the removal of technical barriers in the field of construction is the establishment of harmonised technical specifications for the assessment of the performance of construction products (Regulation No 305/2011, 2011). These harmonised standards should be established by the European standardisation bodies and as such should provide the methods and the criteria for assessing the performance of the construction products in relation to their essential characteristics (Regulation No 305/2011, Article 17, 2011). The transition to the new Regulation is divided into two phases (European Commission, 2012c):

- preparation phase till June 30, 2013 - establishing of the organisational framework and preparation of the technical framework documents;
- operation phase from July 1, 2013 – CE marking under the CPR starts and manufacturers prepare Declarations of Performance.

Overall, the new CPR is not revolutionary, instead it clarifies and simplifies the CPD, and the overview of the procedural changes can be found in Appendix 2. The most

important fact for the scope of this thesis is, however, that the Regulation introduces a new essential (basic) requirement for construction works, namely, *sustainable use of natural resources*. This requirement is further described and explained in the Annex 1 of the Regulation:

*“The construction works must be designed, built and demolished in such a way that the use of natural resources is sustainable and in particular ensure the following:*

- (a) reuse or recyclability of the construction works, their materials and parts after demolition;*
- (b) durability of the construction works;*
- (c) use of environmentally compatible raw and secondary materials in the construction works.”*

The basic requirement on *hygiene, health and environment* (3) is also somewhat expanded compared to the respective requirement in the CPD and the definitions are made more detailed and precise. An important precision is the inclusion of the all life cycle stages when considering impacts of construction works on hygiene, health and environment. The respective requirement in the CPD clearly referred only to design and building phases; the CPR refers to the entire life cycle of “construction, use and demolition” (Regulation No 305/2011, Appendix 1, 2011).

The overview of the changes in the basic requirements is presented in Table 3 where the new amendments are marked in red. The detailed list of changes can be found in Appendix 3 (new amendments and changes are again marked in red).

Table 3. The overview of the changes in the basic requirements (Reg. No 305/2011, App. 1, 2011)

No	Requirement	Changes
1	Mechanical resistance and stability	No changes
2	Safety in case of fire	No changes
3	Hygiene, health and environment	Expanded
4	Safety and accessibility in use	Expanded
5	Protection against noise	No changes
6	Energy economy and Heat Retention	Expanded
7	Sustainable use of natural resources	New

As to the assessment and documentation of *sustainable use of resources*, it is stated in the recital clause (56) of the Regulation that:

*“For the assessment of the sustainable use of resources and of the impacts of construction works on the environment Environmental Product Declarations should be used when available.”*

The CPR does not require mandatory use of EPDs, it is still voluntary; however, such a reference is a strong link towards a common usage and acceptance of EPDs as a tool for documentation of environmental impacts of a product.

Where applicable, the declaration of performance should also include the information about the content of hazardous substances in the construction product in order to improve the possibilities for sustainable construction and to facilitate the development of more environmentally friendly products (Regulation No 305/2011, recital clause (25), 2011).

It should be also noted that the new Regulation takes a special notice of small and medium-sized enterprises (SMEs) that represent the majority of the EU enterprises. This is done particularly in two ways:

- 1) by simplification of the existing procedures, so as to increase transparency of these and to reduce the costs incurred by enterprises, in particular, small and medium-size enterprises (European Commission, 2012);
- 2) by requiring the designation of Product Contact Points for Construction in each Member State – such a Contact Point should provide free of charge information about the national provisions and specific national requirements for the construction products and construction works in the respective Member State (Regulation No 305/2011, 2011).

Until July 2012, only Denmark had established such Contact Point for Construction (European Union, 2012 and Danish Energy Agency, n.d.).

Overall, the new Regulation has led to a certain change of landscape in the sector, since it clearly requires sustainable use of natural resources by stating that “construction works must be designed, built and demolished in such a way that the use of natural resources is sustainable” (Regulation No 305/2011, 2011).

## 5. Environmental assessment and reporting in construction sector

### 5.1. Relevant ISO standards

#### 5.1.1. Introduction

The International Organisation for Standardisation (ISO) is an international non-governmental organisation founded in 1947 and located in Geneva, Switzerland. With its 164 members, it is today the world's largest developer of voluntary international standards that provide specifications for products, services and practices, thus helping to make industry more efficient and effective, promoting good industry practices and lowering barriers to international trade (ISO, n.d.).

The members of the ISO are the National Standards Bodies that also represent ISO in their respective countries. ISO standards are developed by a group of experts, after a proposal is submitted to and accepted by the relevant technical committee (TC). When a consensus is reached on the draft of the standard within the TC, it is further shared with all ISO members who then comment on the draft and vote its final version. The whole process of standard development is consensus-oriented. If a consensus is reached and a standard is approved by member vote, it becomes an ISO standard; if not, it goes back to TC for further editing (ISO, n.d.).

When an ISO standard is approved and published, it may further be translated and adopted as a national standard by the ISO members (ISO, 2011a). By December 2011, the ISO had published 19 023 standards and standard-type documents; 143 of these were for the construction industry, including construction materials and buildings (ISO, 2011a).

#### 5.1.2. ISO Technical Committees

The work of ISO is organized in technical committees (TCs) that are further structured into sub-committees (SCs) or working groups (WGs). For the scope of this thesis the following two technical committees are relevant:

- TC 207 on Environmental management;
- TC 59/SC 17 on Sustainability in buildings and civil engineering works.

The TC 207 was established in 1993, as a response to the UN Conference on Environment and Development in Rio de Janeiro and its call for sustainable development. It is responsible for the development and maintenance of the ISO-14000 family of international standards which are standards devoted to various disciplines of environmental management. These are generic standards that can be implemented in any type of public or private organization and applied to any type of products and services (ISO, 2009a). The main objectives of the ISO-14000 family are to help organisations to:

- Minimize harmful effects on the environment caused by their activities
- Meet regulatory requirements
- Achieve continual improvement of their environmental performance
- Improve business performance through more efficient use of resources (ISO, 2012a).

The structure of the TC 207 is presented in Figure 2 that shows its six sub-committees with the respective areas of competence, as well as the standards that have been developed by these SCs. Standards under development are shown in lighter colour in parentheses.

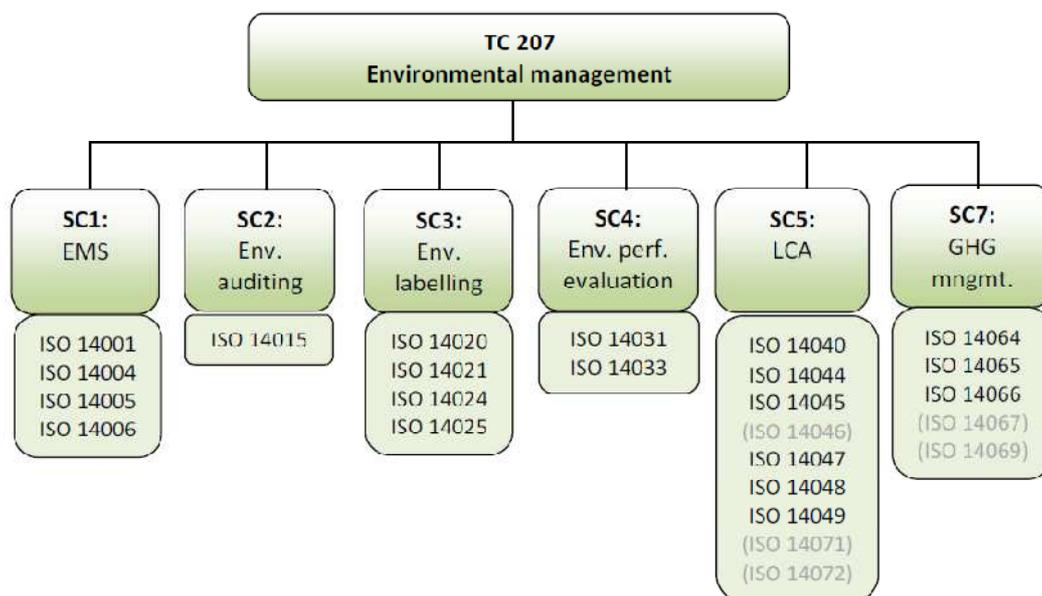


Figure 2. The structure and the standards of TC 207 (from Mageroy, 2011; updated in 2012)

All construction works must of course fulfil functional and technical performance requirements, but they also should consider and take into the account the environmental, economic and social performance (Krigsvoll, Fumo and Morbiducci, 2010). These aspects within the standardisation work are under the responsibility of the TC 59/SC 17 that is a part of TC 59 on Buildings and civil engineering works.

The TC 59/SC 17 is specifically concerned with Sustainability in buildings and civil engineering. It was established in 2002 and has by now published 4 standards and another 3 standards are under development. The structure and working groups of the TC 59/SC 17 and the overview of the standards developed by this TC are presented in Figure 3. Standards under development are shown in lighter colour in parentheses.

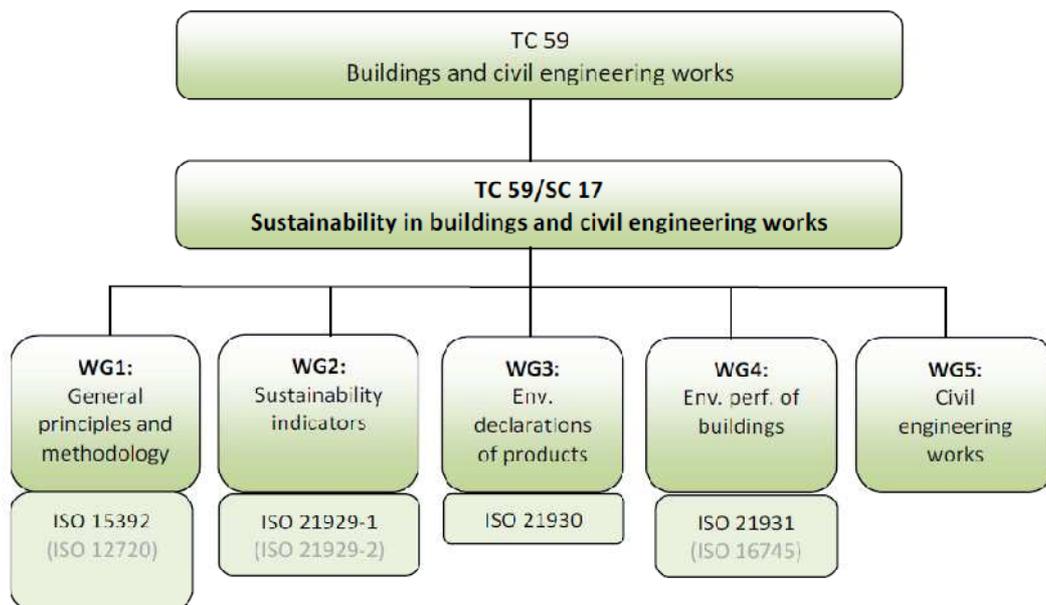


Figure 3. The structure and the standards of TC 59/SC 17 (ISO, 2012b)

The relationship and connection among the standards of the TC 59/SC 17 are nicely illustrated in Figure 4. As seen from the Figure, the full spectrum of sustainability aspects are covered by ISO 15392 and ISO 21929 Part 1 that are both standards providing the methodological basics (ISO 15392 – ISO, 2008). The project of ISO/TR 21932 that also covered all sustainability aspects was deleted in 2012 (ISO, 2012c). The sector-specific EPD standard ISO 21930 covers only the environmental aspects only.

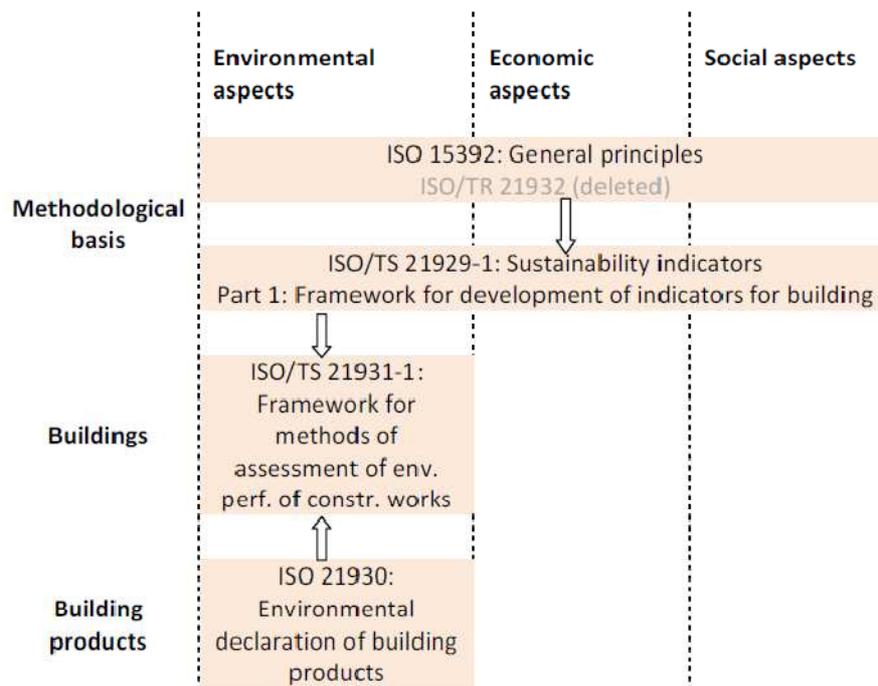


Figure 4. Related ISO standards for *Sustainability in building construction* (ISO 15932 – ISO, 2008)

With regards to Figure 4 that is based on the structure described in the ISO 15392, it is important to point out that the CEN standards related to sustainability of buildings and building products are structured the same way, though the terminology may somewhat vary. The CEN standards are further discussed in the next section.

The most essential details about the standards related to environmental management systems, life cycle assessment and product labelling were already presented in the sections of chapter 3. The following ISO standards are of particular interest for the further discussion in this thesis:

- *ISO 14025* – Environmental labels and declarations - Type III environmental declarations - Principles and procedures;
- *ISO 14046* – Water footprint of products, processes and organisations (under development);
- *ISO 14067* – Carbon footprint of products (under development);
- *ISO 15392* – Sustainability in building construction – General principles;
- *ISO 21930* – Sustainability in building construction - Environmental declaration of building products.

These will be further discussed in greater detail in the next sections. The standards for environmental auditing (TC207/SC2), environmental performance evaluation for organisations (TC207/SC4), and the rest of the standards on greenhouse gas management (TC207/SC7), as well as detailed investigations of TC59/SC17 standards for the assessment of whole buildings are outside the scope of this thesis.

### 5.1.3. ISO 14025

ISO 14025:2006 *Environmental labels and declarations - Type III environmental declarations - Principles and procedures* is a generic international standard that “establishes the principles and specifies the procedures for developing Type III environmental declaration programmes and Type III environmental declarations” (ISO 14025 – ISO, 2006). The standard is applied on a voluntary basis and it is important to note that any goods or services are referred to as a product in ISO 14025.

ISO 14025 is developed in accordance with the general principles laid out in ISO 14020 *Environmental labels and declarations – General principles*. Further, it requires that LCA which will be used for setting up an EPD is conducted in line with the principles, requirements and guidelines provided in ISO 14040 and ISO 14044.

The overall objectives of this standard are (ISO 14025, clause 4 – ISO, 2006):

- to provide the reliable quantified information on the environmental aspects of products;
- to allow for informed comparisons between products;
- to encourage improvement of environmental performance;
- to provide information for further environmental assessments.

EPDs developed according to this standard are primarily intended for the use in business-to-business communication, but it is not precluded to use them in business-to-customer communication. It is noted in the standard that an EPD developer should within limits take into account the information needs and awareness of its target audience.

The standard provides the requirements for (ISO 14025 – ISO, 2006):

- development and operation of an EPD programme (including procedures for definition of product categories and the development of product category rules (PCR), as well as for the application of LCA methodology);
- development of EPDs;
- verification of EPDs;
- additional requirements for developing EPDs for business-to-consumer communication.

Ensuring comparability and transparency of information and procedures is critical since the objective of EPDs is to allow for comparisons of the environmental performance of products throughout the whole life cycle. Verification is another

important component that should also be done in a transparent manner. This is relevant for PCR review and independent verification of LCA/LCI on which the EPD is based, as well as the final EPD itself.

ISO 14025 is a generic standard and as such does not include any sector-specific requirements and provisions – these are left up to other standards that are built upon this, for example, ISO 21930 that is a sector-specific standard addressing construction industry and, in particular, construction products.

Requirements for development and operation of an EPD programme, including PCR and EPD development, and contents of the EPD, are discussed in more detail in the section 6.1. *Development and operation of an EPD programme.*

#### 5.1.4. ISO 14046 and ISO 14067

ISO 14046 and ISO 14067 are two international standards that are currently still under development, so information about these is somewhat limited. However, it is important to mention them because of the ongoing debate on the role of these two standards for the product assessment and labelling.

While the ISO 14025 is a standard for the development of EPDs based on multiple indicators, ISO 14046 *Life cycle assessment - Water footprint - Requirements and guidelines* and ISO 14067 *Carbon footprint of products - Requirements and guidelines for quantification and communication* represent single-indicator standards, i.e., standards that addresses, in particular, a single impact category.

##### - *Carbon footprint*

The issues like global warming and reduction of carbon emissions are at the top of the environmental policy agenda today, and as unscientific as it may sound, terms like ‘climate change’, ‘carbon footprint’ etc. have become somewhat of a fashionable buzzwords (Finkbeiner, 2009; Weidema et al., 2008). The likely reason is that to the general public a carbon footprint is a more appealing concept than LCA – it is simpler to quantify, easier to grasp and it has been significantly promoted outside the research community (Weidema et al., 2008). SETAC Europe LCA Steering Committee (2008) also points out that searching for simplification of LCA methodology that would allow assessing a large number of products in short time is a significant driving force for carbon footprint popularity.

There are already various standards for GHG quantification and management, including ISO 1404x series for life cycle assessment that already includes the impact category for global warming potential. In this context, it is not surprising that the questions like “Why do we need another standard specifically on greenhouse gases?” arise. According to Abi-Akl (2012) the purpose of this standard is not only to set rules for the quantification and communication of carbon footprint, but also to harmonize the different national initiatives related to “carbon labeling” of products and services. Unifying standards lower barriers to trade and leads to increased consistency and credibility of environmental claims. Besides, as pointed out Weidema et al. (2008), the “the existing ISO standards are vague on several crucial points”, and the ambition for the new standard should be that it is both rigorous and easily applicable in practice.

The objective of ISO 14067 is to develop internationally acknowledged system to account for the carbon footprint of products (goods and services). The standard will provide requirements for the quantification and communication of greenhouse gases (GHG) associated with products over their entire life cycle. The earlier draft version consisted of two parts, respectively, while in the later discussions the working group proposed to combine both parts in a single standard (Panthi, 2011).

Importantly, ISO 14067 offers a wide range of communication options for both business-to-business and business-to-consumer communication (PCF World Forum, 2012):

- carbon footprint declarations;
- environmental claims and labels;
- reporting;
- performance tracking.

ISO 14067 is based on the life cycle assessment principles laid out in ISO 14040 and ISO 14044, but it will give a more specific guidance than the underlying ISO 14044:2006 (PCF World Forum, 2012). The standard has also references to the ISO series of standards for environmental labelling, as well as ISO 14065 and ISO 14066 on validation and verification related to GHG. In June 2012, the standard is still under development at the Enquiry stage (ISO, 2012d), but a draft standard has been published by the ISO.

#### - *Water footprint*

Despite the strong capabilities of LCA and the continuous maturity of this methodology, freshwater use as an issue has traditionally received very limited attention in LCA (Koehler, 2008). Though a somewhat speculative assumption, but

the LCA methodology was essentially developed by practitioners and academia in industrialized countries where water scarcity is yet irrelevant (ibid).

On a global scale, however, water availability and water quality are increasingly becoming areas of great concern indicating that there is a considerable need for methodological solutions to properly account for freshwater use related to a product's life cycle and globalized value chains. This has led to the initiation of the work on an international standard for water footprint (Koehler, 2008, and Wessman, 2010).

The project was initiated in 2009 and is planned to be completed in 2012/2013 (Humbert, n.d.) In May 2012, the standard was still under development in the Committee stage (ISO, 2012e). ISO 14046 will provide the principles, requirements and guidelines for the assessment and communication of the water footprint of products, processes and organisations based on the life cycle assessments as given in ISO 14044 (Eriksson and Neven, 2009).

The proposed scope of the standard includes all types of water, and the region-specific factors like scarcity, level of development etc. will be taken into account (Eriksson and Neven, 2009). The standard will be consistent with other standards the ISO 14000 series, in particular, with ISO 14040 and ISO 14044 for LCA, ISO 14020 for environmental communication, and ISO 14064 and ISO 14067 for GHG quantification and communication (Humbert, 2009).

The main criticism of these two standards is that they assess a single impact category of climate change and water usage, respectively. Both standards do not address other environmental, social and economic impacts associated with products (Abi-Akl, 2012; EC Institute for Environment and Sustainability, 2011). A product that has a small carbon or water footprint does not necessarily score well on the other impact categories. Thus, such single-criterion standards and claims based on these standards may result in oversimplification (Weidema et al., 2008), misleading assumptions about the superiority and environmental quality of products (Abi-Akl, 2012) and problem shifting between the impact categories (Finkbeiner, 2009).

Since the information about ISO 14046 and ISO 14067 is rather limited due to them being in the "under development" stage and the main focus of this study is on the development of EPDs that cover several indicators according to the existing legislative requirements in the EU, these two standards will not be further mentioned in this thesis (though they represent a very interesting and current topic for another study).

### 5.1.5. ISO 15392

ISO 15392:2008 *Sustainability in building construction - General principles* is a sector-specific international standard that identifies the objectives and establishes the general principles for sustainability in buildings and other construction works. The standard is based on the concept of sustainable development (as defined in the Brundtland report) and the concept of the life cycle of buildings and other construction works – from the resource extraction till the final disposal (ISO 15392 – ISO, 2008).

The general principles laid out in this standard are (ISO 15392, clause 5.3 – ISO, 2008):

- continual improvement
- equity (intergenerational, interregional and intra-societal considerations);
- global thinking and local action
- holistic approach;
- involvement of interested parties;
- long-term consideration (incl. life-cycle thinking);
- application of the precautionary principle and risk management;
- responsibility (incl. moral responsibility);
- transparency and availability of information.

The general principles further form the basis for a suite of standards addressing specific issues related to sustainability of construction works. It also gives the guidance on the application of these general principles for environmental, economic and social aspects that are inextricably linked and interdependent (ISO 15392 – ISO, 2008). The areas of concern for these three types of aspects are listed in Table 4, and the suite of standards developed according to the principles laid out in this standard and their interconnection is shown in Figure 4.

Table 4. The areas of concern for the different aspects (ISO 15392, clause 6.2-6.4 – ISO, 2008)

No	Aspects	Areas of concern
1	Economic	Asset value, economic resources.
2	Environmental	The environment, resources.
3	Social	Social infrastructure, cultural heritage, human health and comfort.

ISO 15392 recognizes the importance role of organisations and other stakeholders in sustainability of construction industry; however, it does not intend to give provisions for the assessment of organisations or stakeholders. The standard also does not provide any levels and benchmarks to be used as the basis for sustainability claims.

#### 5.1.6. ISO 21930

ISO 21930:2007 *Sustainability in building construction – Environmental declaration of building products* is a sector-specific international standard of voluntary nature that provides the principles and requirements for Type III environmental declarations, specifically for building products. This standard builds upon ISO 14025 and is meant to complement the generic ISO 14025. Though a part of standard series on sustainability in building construction, it covers only the environmental aspects and does not account for the economic and social aspects of construction products.

ISO 21930 is an attempt to respond to the increasing demand from various actors in the construction sector for information that would enable them to address the environmental impacts of buildings and other construction works and to harmonise various national approaches used for addressing this demand (ISO 21930 – ISO, 2007). The key element for that is having a consistent way of developing EPDs that are based on LCAs performed in a consistent manner; here the standard refers to ISO 14040 series.

The overall goal of EPDs is “to encourage demand for, and supply of, building products that cause less stress on the environment” by communication of accurate and verifiable information on environmental aspects of these products (ISO 21930, clause 5.1 – ISO, 2007). Environmental declarations represent a standardized format for the communication of the quantified (as well as qualitative) information about products. Such declarations for building products are important because they:

- first of all, provide input data and information for the assessment of the whole buildings and construction works, and
- allow for informed choices of purchasers and consumers.

The goal of this standard is thus to provide a transparent and scientifically robust methodology for developing of EPDs for building products (ISO 21930, clause 5.1 – ISO, 2007). The same as ISO 14025, also this standard stresses the importance of involvement of interested parties (clause 5.2) and comparability of EPDs (clause 5.6 of this standard with the reference to ISO 14025:2006, clause 4 and 5.6).

Only the manufacturer, or group of manufacturers, of the product are authorized to declare the environmental performance of the product (ISO 21920, clause 5.3 – ISO, 2007). An EPD developed in accordance with this standard is primarily intended for business-to-business communication, though it may also be used for business-to-consumer communication (ISO 21920, clause 5.4 – ISO, 2007).

An important concept within ISO 21930 is the information module that can be explained simply as part of the life cycle. When an EPD covers all life cycle stages, these should be divided into at least 4 main life cycle stages (information modules) as indicated in Figure 5 under “Stages”. These stages may be further sub-divided into “Modules” (see Figure 5).

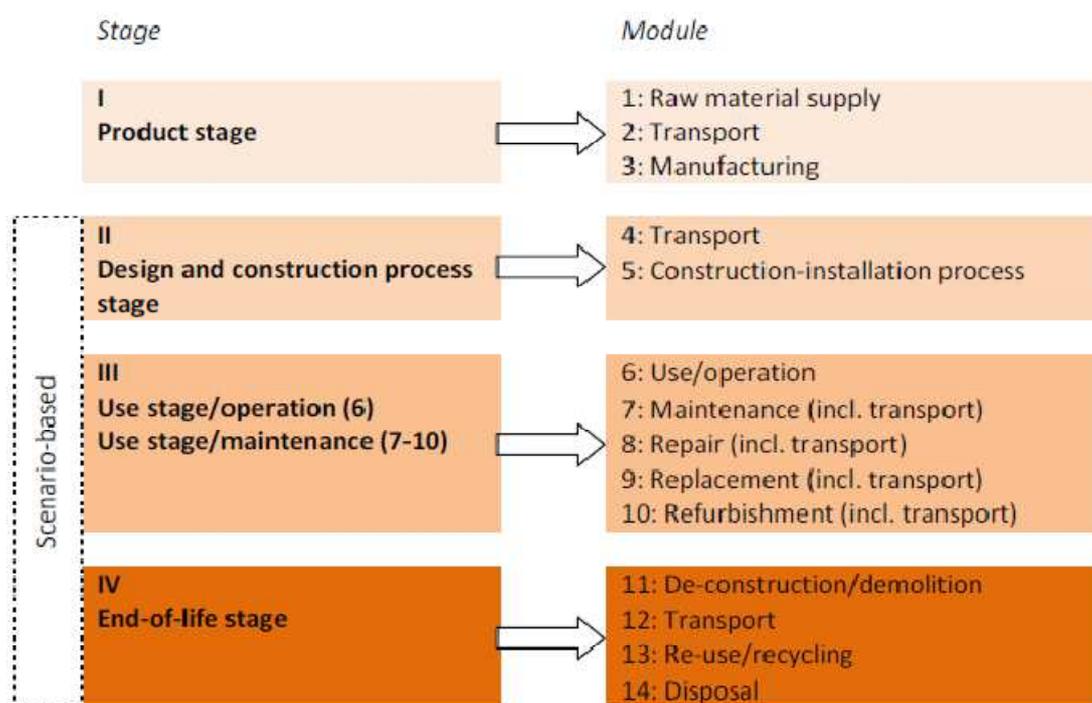


Figure 5. Information modules of the EPD according to ISO 21930 (ISO 21930 – ISO, 2007)

Further, the standard operates with 3 types of assessment options (ISO 21930, clause 5.5 – ISO, 2007):

- cradle-to-gate – modules 1-3 are mandatory;
- cradle-to-gate with option – modules 1-3 are mandatory, modules 4-14 are optional;
- cradle-to-grave – all modules are mandatory.

As it will be shown in the later analysis of the new EN 15804:2012 (a “twin” standard by the European Committee for Standardisation), the European standard uses a very similar division of life cycle stages.

As to the content of the declaration, ISO 21930 requirements are largely similar to those provided in the generic ISO 14025 (see Table X in the section *Development and operation of an EPD programme*). The requirements that are specific in the ISO 21930 include (Magerøy, 2011):

- “simple visual representation of the building product”;
- information about the sites and manufacturer that the LCA results are representative for;
- a statement that the declaration represents an average performance.

ISO 21930 specifies also the categories for the declaration of environmental impacts, use of resources and generated waste. These include (ISO 21930, clause 8.2.2 – ISO, 2007):

- environmental impacts;
- use of resources and renewable primary energy;
- waste to disposal;
- and emissions to water, soil and indoor air that shall be declared in accordance with national standards and practice.

For the sake of convenience, these categories will be investigated in more detail in the section 5.2.4. and at the same time compared with the respective reporting category requirements in the new European standard EN 15804 on the development of EPDs for construction products in Europe. The reporting categories and their components of both standards are listed in Table 7.

### 5.1.7. Summary

Overall, ISO 21930 is largely similar to ISO 14025. Both standards are based on the life cycle perspective and on the development and usage of PCRs, but ISO 21930 provides additional requirements for the development of EPDs and for the contents of the declaration. ISO 21930 is also more specific with regards to information modules in order to enable usage of the EPDs developed according to this standard for further assessments of the environmental performance of the whole buildings.

The requirements for developing PCRs and verification of EPDs are the same between the two standards, so the same PCR can be used whether the EPD is prepared according to ISO 14025 or ISO 21930 (Magerøy, 2011). ISO 21930 does not provide requirements for the development and operation of EPD programmes; these are laid out in ISO 14025.

Both standards provide requirements for EPDs that are primarily intended for business-to-business communication, but the usage of these for business-to-consumer communication is not precluded.

## 5.2.Relevant CEN standards

### 5.2.1. Introduction

The European Committee for Standardization (CEN, from French - Comité Européen de Normalisation) is an international non-profit organisation that was officially established in 1975 and is currently based in Brussels. CEN and its 33 national members work together to develop voluntary European standards (ENs) and technical specifications. It is the only recognized European organization according to Directive 98/34/EC for the planning, drafting and adoption of European Standards in all areas of economic activity with the exception of electrotechnology and telecommunication for whom specialised standardisation organisations exist (CEN, n.d.-b).

The main objective of CEN is to remove trade barriers among the EU Member States that are caused by different national practices and technical specifications. When there is one common European standard or technical specification in all the EU countries and all conflicting national standards are withdrawn, a product can reach a far wider market, simultaneously with lower development, testing and certification costs (CEN, 2010).

European standards aim to reach and reflect a consensus among the economic and social interests of the member countries. Most of the standards are initiated by industry through the National Standards Bodies, but they can as well be initiated by consumers, associations and other actors. Besides, many standards are developed to support the European legislation and these are then initiated by the European Commission (EC) and the European Free Trade Association (EFTA) (ibid).

When the standard is developed and ratified, ratification by CEN, the National Standards Bodies adopt this European Standard as an identical national standard, at the same time withdrawing any conflicting national standards. Thus, the European Standard becomes the national standard in all member countries of CEN (ibid). The total number of the active documents per December 2011, was 14 498 (CEN, n.d.-b).

### 5.2.2. Cooperation between ISO and CEN (the Vienna Agreement)

The CEN has signed the so called Vienna Agreement with the International Organization for Standardization (ISO) – according to it, European and international standards can be developed in parallel, avoiding the double work and increasing global applicability and harmonisation between the standards developed by these two organisations. More than 30% of the European Standards adopted by CEN are identical to international standards. Besides the identical EN/ISO Standards, a number of European standards developed by CEN are closely linked to ISO standards (CEN, 2010).

Some of the most common identical standards for environmental management include (CEN, 2012):

- EN ISO 14001:2004 (identical to ISO 14001:2004)
- EN ISO 14020:2001 (identical to ISO 14020:2000)
- EN ISO 14021:2001 (identical to ISO 14021:1999)
- EN ISO 14024:2000 (identical to ISO 14024:1999)
- EN ISO 14025:2010 (identical to ISO 14025:2006)
- EN ISO 14040:2006 (identical to ISO 14040:2006)
- EN ISO 14044:2006 (identical to ISO 14044:2006)

The connections, similarities and differences between the standards for environmental product declarations developed by these two organizations are discussed in the section 5.3.

### 5.2.3. CEN/TC350 standards

In March 2004, the European Commission issued the Mandate 350 directing the CEN to develop standards for environmental performance of construction products and whole buildings. In response, CEN created a Technical Committee 350 (TC350) to be responsible for the development of standardized methods for the assessment of the sustainability aspects of new and existing construction works and for standards for the environmental product declaration of construction products (World GBC, 2011). In June 2008, the working area of CEN/TC350 was expanded to include the development of standards for the assessment of social and economic performance (life cycle costing) of buildings.

The TC consists of several working groups (WG) with respective responsibilities and the structure of the CEN/TC350 and its areas of responsibility are given in Table 5.

Table 5. The structure of CEN/TC350 (CEN, n.d.-c)

Working group	Title and responsibility
CEN/TC 350/WG 1	Environmental performance of buildings
CEN/TC 350/WG 3	Product level
CEN/TC 350/WG 4	Economic performance assessment of buildings
CEN/TC 350/WG 5	Social performance assessment of buildings
CEN/TC 350/WG 6	Civil Engineering works

By July 30, 2012, the CEN/TC350 has published 8 standards – both for the assessment of the whole buildings and for the development of environmental product declarations for construction products. Two standards for the assessment of buildings remain still to be published. The overview of the work outcome of CEN/TC350 on *sustainability of construction works* is presented in Table 6.

Table 6. The standards developed by CEN/TC350 on Sustainability in construction works (CEN, 2012b)

Standard	Name of the standard	Status
<b>Standards for construction products</b>		
CEN/TR 15941	EPDs - Methodology for selection and use of generic data	Published
EN 15804	EPDs - Core rules for the product category of constr. prod.	Published
EN 15942	EPDs - Communication format B-2-B	Published
<b>Standards for buildings</b>		
EN 15643-1	Sustainability assessment of buildings - Part 1: General framework	Published
EN 15643-2	Part 2: Framework for the assess. of environmental performance	Published
EN 15643-3	Part 3: Framework for the assessment of social performance	Published
EN 15643-4	Part 4: Framework for the assessment of economic performance	Published
EN 15978	Assessment of env. perf. of buildings - Calculation method	Published
prEN 16309	Assessment of social performance of buildings - Methods	Under approval
-	Assessment of economic performance of buildings - Methods	Under drafting

The work programme of CEN/TC350 and the relationship among the standards developed by it, are presented in Figure 6 (only the published standards are included). As seen from the Figure 6, the terms used are slightly different, but the structure of the standard family is strongly similar to that of ISO TC59/SC17 responsible for standards on *Sustainability in building construction* (see Figure 4). Also the CEN/TC350 covers sustainability by looking at the three aspects of it – environmental, social and economic.

The work of CEN/TC350 is closely linked to the implementation of the Regulation No 305/2011 which covers also the technical and functional performance. The technical and functional parameters are also where the information necessary for environmental, economic and social considerations come from, therefore it also included in the Figure 6 for illustrative purposes, though the main focus of thesis of course remains on the performance aspects related to sustainability and environment, in particular.

	Integrated building performance			
Concept level	Environmental performance	Social performance	Economic performance	Technical and functional performance
Framework level	EN 15643-2: Assessm. of buildings - Part 2: Framework for the ass. of env. perf.	EN 15643-3: Assessm. of buildings - Part 3: Framework for the ass. of soc.l perf.	EN 15643-4: Assessm. of buildings - Part 4: Framework for the ass. of ec. perf.	
Building level	EN 15978: Assessm. of env. perf. of buildings - Calculation method			
Product level	EN 15804: EPDs-Core rules for the product category of construction products			
	EN 15942: EPDs-Communication format B-2-B			
	CEN/TR 15941: EPDs-Methodology for selection and use of generic data			

Figure 6. Related CEN standards for *Sustainability of construction works* (EN 15978:2011 – CEN, 2011)

For the scope of this thesis, the CEN standards for the development of environmental product declarations for construction products are the most important, especially EN 15804 that was published in April 2012 and that provides product category rules for construction products and services and is now the guiding document for development of EPDs in Europe. This standard and its implications are studied in greater detail in the next section.

#### 5.2.4. EN 15804:2012

EN 15804:2012 is a sector-specific standard that lays out the core product category rules (PCR) for construction products and services and sets the requirements for the development and verification of EPDs for these products. The standard was published as recently as in April 2012, and it is a part of European harmonisation efforts (Smith, 2012). If the methods used in the EU are consistent, the generated information can be transferred from scheme to scheme across Europe, enabling the use of such consistent EPD for the further assessment of entire buildings, and lowering barriers to trade.

The overall goal of the EN 15804 is to ensure that “all environmental products declarations (EPD) of construction products, construction services and construction processes are derived, verified and presented in a harmonised way” (EN 15804 – CEN, 2012). It also serves a tool for the implementation of the new Construction Products Regulation analysed in the section 4.2., in particular as a tool for the assessment and documentation of sustainable use of natural resources – a new requirement introduced by this Regulation.

In practice, the EN 15804 can be perceived as the core PCR for construction products in Europe that (EN 15804, clause 1 – CEN, 2012):

- defines the parameters to be declared;
- defines the life cycle stages and processes to be included;
- defines the rules for the development of scenarios;
- includes the rules for calculating the LCI and LCIA, including requirements for data quality;
- includes the rules for reporting environmental and health information that is not covered by LCA;
- defines the conditions that enables the comparability of EPDs.

The EN 15804 does not deal with the communication issues, contents and the layout of EPDs. The common requirements for the contents and layout of the declaration are presented in EN 15942:2011, and a detailed guidance and templates can be found in the Annex A of the standard. It is, however, not prohibited to use another layout (EN 15942 – CEN, 2011).

The normative references to other standards include EN 15978 on *Assessment of environmental performance of buildings*, ISO 14044 on *Life cycle assessment*, ISO 14025 and ISO 21930 standards for environmental product declarations, as well as several ISO standards for buildings and constructed assets covering *Service life planning* (EN 15804, clause 2 – CEN, 2012).

In the same way as the ISO 21930, the EN 15804 operates with life cycle stages and information modules. The structure and contents of these stages and modules are presented in Figure 7, and they are very similar to those laid out in the ISO 21930. EPD information that is “packed” in such information modules allow for easy organisation and expression of complicated data covering the life cycle of the product. This of course requires that the underlying data are consistent, reproducible and comparable (EN 15804 – CEN, 2012).

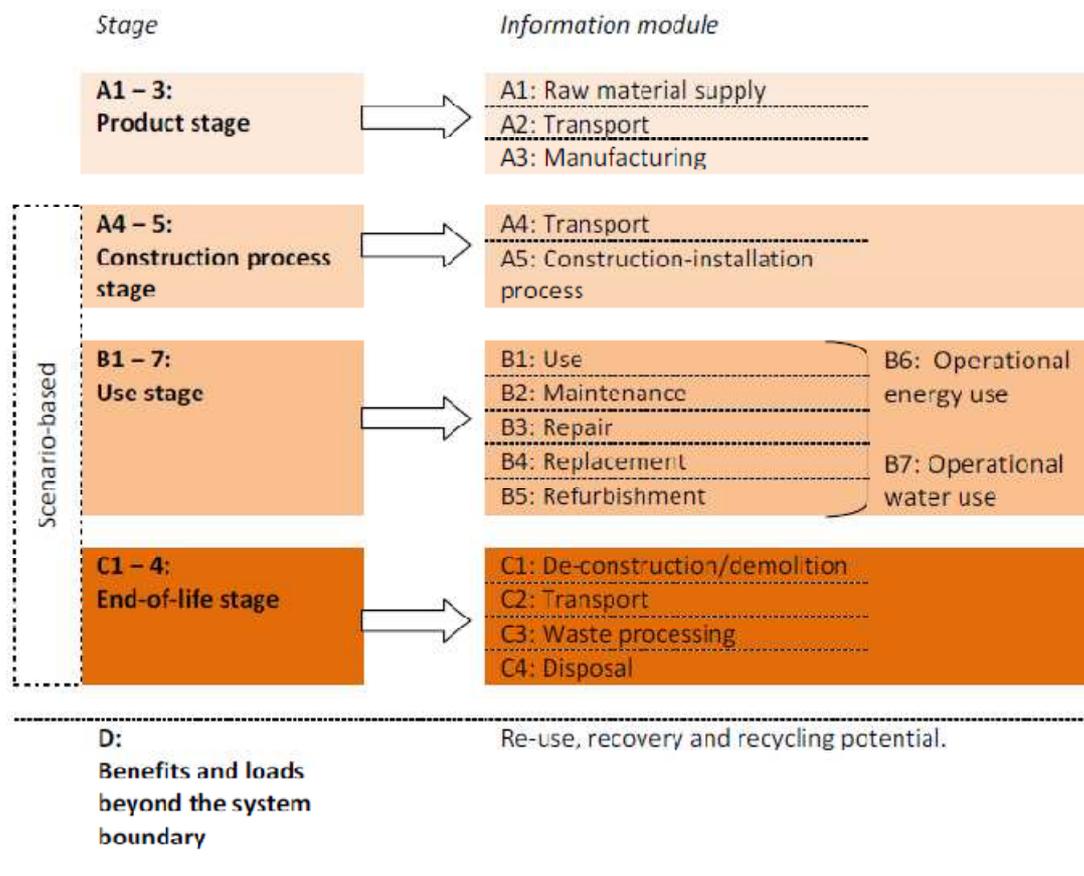


Figure 7. Information modules of the EPD according to EN 15804 (EN 15804 – ISO, 2012)

The most significant difference between the ISO and EN systems is that the EN 15804 introduces an optional supplementary stage beyond the building life cycle (see clause 6.4.3.6) that is meant to account separately for the re-use, recovery and recycling potential, thus indicating a stronger focus on the importance of secondary energy and materials. The information module *No 13: Recycling* of the ISO 21930, is here replaced with the *C3: Waste processing (for re-use, recovery, recycling)*. In ISO 21930, the optional information about recycled content or potential for energy recovery may be reported under *Additional environmental information* (ISO 21930, clause 8.2.4 – ISO, 2007).

Another difference is that, instead of numbering the information modules from 1-14 as it is done in the ISO 21930, the European standard operates with a slightly different numeration system based on letters that represent life cycle stage and numbers that represent an information module within a respective stage.

Further, the EN 15804 operates with 3 types of assessment options that conform fully with the assessment options named in the ISO 21930. These are listed below (EN 15804, clause 5.2 – CEN, 2012):

- cradle-to-gate – modules A1 to A3 are mandatory;
- cradle-to-gate with options – modules A1 to A3 are mandatory, other modules are optional, and D-module may also be included;
- cradle-to-grave – all modules from A1 to C4 are mandatory, D-module may also be included.

The comparison of construction products based on their EPDs is defined by the contribution they make to the environmental performance of the building, and comparisons are also possible the assembled systems and components, i.e., at the sub-building level. More detailed conditions for comparability of EPDs are presented in the clause 5.3 of the standard.

As to the contents of declaration, the guidance on the layout and communication of EPD information are to be found in the EN 15942 *Environmental product declarations - Communication format business-to-business*. Declaration of general information is, however, also described in the clause 7.1 of the EN 15804. The lists of the required general contents are rather similar, but the European standard introduces a few more requirements:

- a description of the main product components and materials;
- a statement of the 5-year period of validity (the ISO 21930 does not establish a specific period of validity, this is left up to PCRs).

Besides, the reporting of the LCA-based data from the information modules is covered separately in the clause 7.2 of the EN 15804. In general, the requirements for the EPD contents are more detailed and more specific compared to ISO 21930 and these are described in the EN 15942 on *Communication format: business-to-business*. The EN 15942 suggests using the generic template called *Information Transfer Matrix* (clause 5 of the standard), and there are also several other templates for the reporting of the LCA results in the Annex A of the ISO 15942, though the use of exactly these templates is not mandatory (ISO 15942 – CEN, 2011).

As to the environmental impact categories to be reported, there are some significant differences between the requirements of the ISO 21930 and EN 15804. The required parameters according to the two standards are listed in Table 7. The additional or

more detailed requirements of the EN 15804 are marked in red colour. The blue-marked indicators represent similar indicators that have been grouped differently.

Table 7. Indicators to be reported according to ISO 21930 and EN 15804

<b>ISO 21930:2007</b> (clauses 8.2.2 – 8.2.3)	<b>EN 15804:2012</b> (clauses 6.5, 7.2.3 – 7.2.5 and 7.4)
<b>Environmental impacts:</b> <ol style="list-style-type: none"> <li>1. Climate change (GHG)</li> <li>2. Depletion of stratospheric ozone layer</li> <li>3. Acidification of land and water sources</li> <li>4. Eutrophication</li> <li>5. Formation of tropospheric ozone (photochemical oxidants)</li> </ol>	<b>Environmental impact indicators:</b> <ol style="list-style-type: none"> <li>1. Global Warming Potential (GWP)</li> <li>2. Ozone Depletion Potential (ODP)</li> <li>3. Acidification potential (AP)</li> <li>4. Eutrophication potential (EP)</li> <li>5. Formation potential of tropospheric ozone (POCP)</li> <li>6. Abiotic depletion potential for non fossil resources (ADP-elements)</li> <li>7. Abiotic depletion potential for fossil resources (ADP-fossil fuels).</li> </ol>
<b>Use of resources and renewable primary energy:</b> <ol style="list-style-type: none"> <li>1. Depletion of non-renewable energy resources;</li> <li>2. Depletion of non-renewable material resources;</li> <li>3. Use of renewable material resources;</li> <li>4. Use of renewable primary energy;</li> <li>5. Consumption of freshwater</li> </ol>	<b>Resource use indicators:</b> <ol style="list-style-type: none"> <li>6. Use of renewable primary energy excluding renewable primary energy resources used as raw materials</li> <li>7. Use of renewable primary energy resources used as raw materials</li> <li>8. Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)</li> <li>9. Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials</li> <li>10. Use of non renewable primary energy resources used as raw materials</li> <li>11. Total use of non renewable primary energy resources (primary energy and primary energy resources used as raw materials)</li> <li>12. Use of secondary material</li> <li>13. Use of renewable secondary fuels</li> <li>14. Use of non renewable secondary fuels</li> <li>15. Use of net fresh water.</li> </ol>
<b>Waste disposal:</b> <ol style="list-style-type: none"> <li>1. Hazardous waste</li> <li>2. Non-hazardous waste</li> </ol>	<b>Waste category indicators:</b> <ol style="list-style-type: none"> <li>1. Hazardous waste disposed</li> <li>2. Non hazardous waste disposed</li> <li>3. Radioactive waste disposed.</li> </ol>
<b>Emissions to water, soil and indoor air:</b> To be declared in accordance with national standards and practice.	<b>Emissions to water, soil and indoor air:</b> To be provided in accordance the horizontal standards on measurement of release of regulated dangerous substances using harmonised testing methods according to the provisions of the respective Technical Committees for European product standards (when available)

(Recycling content and energy recovery potential can be optionally reported under <b>Additional environmental information.</b> )	<b>Output flow indicators:</b> <ol style="list-style-type: none"> <li>1. Components for re-use</li> <li>2. Materials for recycling</li> <li>3. Materials for energy recovery</li> <li>4. Exported energy.</li> </ol>
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As can be seen from Table 7, EN 15804 is more specific and requires more detailed reporting of the LCA results. This comparison also indicates a stronger focus on the accounting of secondary energy and materials and a strong interest to account for and document the re-use, recovery and recycling potential of products.

Finally, the process of verification and establishing the validity of an EPD shall be done in accordance with the ISO 14025 and ISO 21930; no additional requirements or simplifications are introduced in the European standard (EN 15804, clause 9 – CEN, 2012). A rule of thumb for the reassessment and updating of a published EPD is that changes in environmental performance should be reported to the verifier if they are outside the limits of +/- 10% on any one of the declared parameters of the EPD (ibid).

To conclude, most importantly the new standard ensures that the same environmental indicators are to be used in all EPDs and that data will be consistently reported using the same life cycle stages and modules (PE International, 2012). This, in turn, should increase the availability of compatible environmental information and data for construction products that can further used for the assessments of entire buildings (Smith, 2012).

### 5.3. Comparison of ISO and CEN standards for EPDs

For a manufacturer of construction products who wants to develop an EPD for some of its products, there are currently 3 standards available “on the market”:

- ISO 14025 – a generic international standard;
- ISO 21930 – a sector-specific international standard;
- EN 15804 – a sector-specific European standard.

First of all, the ISO standards normally related to other standards and they have no political background. The CEN standards, on the other hand, often relate to the EU directives or policies (Krigsvoll, Fumo and Morbiducci, 2010).

All of the standards that were investigated in detail share a common objective of enabling the exchange of sustainability related information about internationally

traded products and services. Both of the sector-specific standards aim to establish rules and procedures for the development of consistent and comparable EPDs for construction products and services that could be further used for the assessments of entire buildings (or assembled systems and components at the sub-building level).

ISO 14025 is a general standard that provides principles and procedures for the development of EPDs for any product or service; it is also adopted as an identical standard in the EU – EN ISO 14025:2010. ISO 21930 and EN 15804 are sector-specific standards developed specifically for construction products and services. Both of them are based on the same general provisions of the ISO 14025.

Terminology used in ISO and CEN standards differs slightly - ISO standards in the field of sustainable construction talk about environmental, economic and social indicators, while CEN is referring to integrated performance of buildings that is comprised of environmental performance, life cycle cost performance and health and comfort performance of the building (Krigsvoll, Fumo and Morbiducci, 2010).

In general, the European EN 15804 is more specific and precise in its requirements, and it provides a more detailed list of environmental and other indicators for the reporting of results of the conducted LCA.

The EN 15804 also establishes accounting for secondary material and energy flows. It has broadened the scope to include “beyond the building life cycle” stage (module D) that covers re-use, recovery and recycling potential. The additionally introduced module D aims to increase transparency of the environmental benefits and loads associated with reusable products, recyclable materials, and/or useful energy carriers that can be used as secondary materials or fuels (EN 15804, clause 6.3.4.6 – CEN, 2012).

Increased attention to recycling potential and use of secondary materials and energy can also be observed from the list of the selected environmental indicators and reporting categories in EN 15804 that are more detailed and more attentive to secondary flows of energy and materials (see Table X). In the ISO 21930, recycling is included as an information module no 13 in the end-of-life cycle stage (EN 15804 terms it as “waste processing”) and one may optionally report recycling content and energy recovery potential under *Additional environmental information*. However, re-use, recovery and recycling potential is treated rather vaguely and without specific considerations in the ISO standard.

Finally, the ISO standards pay also comparatively more attention the involvement of interested parties and the open consultation process during the PCR development, while the EN 15804 is a core PCR itself and thus has a more descriptive character.

Overall, the ongoing international work for standardisation of the assessment and documentation of sustainability aspects will make these assessments more transparent and the results of the assessments more credible, comparable and – what is also important – consistent. This will, in turn, increasingly allow using the information presented in the EPDs for further assessments of entire buildings, as well as allow for informed choices of purchasers and consumers.

## 6. Existing EPD programmes in the EU

### 6.1. Development and operation of an EPD programme

As the main focus of this thesis is to investigate feasibility of establishing a new national EPD programme, requirements, recommendations and other relevant information related to the development and operation of such programme are studied in greater detail in this section.

A study by Schenck (2010) identifies the following “key ingredients” for a strong EPD programme:

- conformance with the international standards on EPDs and LCAs that would ensure the comparability and recognition of the EPDs developed under the programme;
- government programmes enabling appropriate legislation, a strong life cycle inventory programme, and national standardisation;
- active participation of the industry in the development of sector-specific PCRs;
- higher education programmes develop the necessary LCA/EPD competencies (incl. relevant research) and NGO programmes for education of the general public;
- cooperation with other EPD programmes.

The international and European standards and their respective requirements are discussed in the following sections that partly cover also the importance and the requirements for the mutual cooperation and harmonisation between the programmes. The recent initiatives for harmonisation and mutual recognition are investigated in the section 6.6. The aspects related to government policies and programmes, industry initiatives and the status of education programmes and competences are particularly investigated in the Latvian context in the chapter 7.

The guidelines and requirements for Type III EPD programme development and operation are given in ISO 14025 and an illustrative process scheme on programme development and operation is provided in Annex A of the standard. According to this standard, an EPD programme can be operated by “a company or a group of companies, industrial or trade association, public authorities or agencies, an independent scientific body or other organization” (ISO, 2006). One of the first tasks is to define the scope of the programme, e.g., a certain geographical area or certain industrial sectors or product groups (ISO 14025, clause 6.2 – ISO, 2006).

Some of the main responsibilities of the programme operator include, but are not limited to (ISO 14025, clause 6.3 – ISO, 2006):

- preparation, maintenance and communication of general programme instructions (contents of the general programme instructions as required by ISO 14025 are presented in Table 8);
- ensuring involvement of interested parties in the programme, procedure and PCR development;
- publishing of PCRs and EPDs within the programme, and maintenance of the publicly available lists and records on these;
- selection of competent independent verifiers;
- monitoring changes in procedures and documents and revising own procedures and documents when necessary.

Table 8. The contents of the general programme instructions (ISO 14025, clause 6.4 – ISO, 2006)

No	Contents	Comments
1	<i>Scope of the programme</i>	E.g., geographic area or sector-specific.
2	<i>Objectives of the programme</i>	-
3	<i>Identification of the programme operator</i>	A company or a group of companies, industrial or trade association, public authorities or agencies, an independent scientific body or other organization.
4	<i>Intended audience of the programme</i>	B-2-B, B-2-C or both.
5	<i>Involvement of the interested parties</i>	E.g., suppliers, manufacturers, trade associations, purchasers, users, consumers, NGOs, public agencies, independent parties, certification bodies.
6	<i>Procedure for definition of product categories</i>	-
7	<i>Procedure for development and maintenance of PCR</i>	Including content of PCR, rules for period of validity, and selection procedure for predetermined parameters.
8	<i>Procedure for independent verification</i>	Including competence of verifiers, and competence of PCR review panel.
9	<i>Funding sources and other resources</i>	-
10	<i>Periodic review of the programme instructions</i>	-
11	<i>Fees</i>	If relevant.

One of the key components is the involvement of interested parties and the open consultation process that should cover the development of the programme itself and PCRs, and the rules of how to produce and verify an EPD (ISO, 2006). Definition of product categories is another task to be performed under the open consultation process. The key rule stated by ISO 14025 is that products can be placed in the same product category if they fulfil the same functions and applications and the same functional unit can be applied (ISO 14025, clause 6.6 – ISO, 2006).

PCR documents are intended to ensure accurate quantification of environmental aspects of products, communication of these aspects and impacts consistently and

transparently that would further ensure the comparability of these aspects and impacts among products in the same product category (Ingwersen and Stevenson, 2012). Harmonisation of PCRs across the EPD programmes is therefore very important.

The required contents of a PCR document according to the ISO 14025 are presented in Table 9. To achieve the necessary level for the harmonisation and consistency of the results, the programme operators are strongly encouraged to use readily available PCRs, when available. The development of a new PCR for the same product category may be justified in certain situations, but should not be based on the origin of the existing PCR (ISO 14025, clause 6.7.1 – ISO, 2006).

Table 9. The contents of a PCR document (ISO 14025, clause 6.7.1 – ISO, 2006)

No	Contents
1	Product category definition and description
2	Goal and scope definition for the LCA of the product (acc. to the ISO 14040-series)
3	Inventory analysis (incl. data collection, calculation procedures and allocation of material and energy flows)
4	Impact category selection and calculation rules (if applied)
5	Parameters for reporting LCA data
6	Requirements for provision of additional environmental information
7	Materials and substances to be declared
8	Instructions for producing the data required to develop the EPD
9	Instructions on the content and format of the EPD
10	Information on which stages of the life cycle are not considered (if applicable)
11	Period of validity

The ISO 14025 allows for the development of multiple program operators in different countries and each of them has its own set of PCR documents. A study by Ingwersen and Stevenson (2012) unfortunately indicate that PCRs for the same product categories have begun to proliferate, and this could potentially undermine comparison and credibility of life-cycle-based claims for comparable products.

In order to ensure that EPDs are comparable and that they are understood and interpreted correctly, ISO 14025 requires that the programme operator ensures the availability of general programme instructions, PCR documents and explanatory material (ISO, 2006). The conditions for deeming different EPDs as comparable are given in the clause 6.7.2 *Requirements for comparability*.

ISO 14025 further requires the application of LCA methodology according to ISO 14040 series of standards for producing the quantified environmental information for an EPD. The PCR document should build upon at least one life cycle assessment.

Results from other environmental analysis tools or information modules (for example, other EPDs) should be used where relevant (ISO 14025, clause 6.8 – ISO, 2006).

As to the contents and format of the EPD, these should comply with the requirements stated in the respective PCR. Some of the basic elements are, however, stated in ISO 14025 – these are summarized in Table 10. The rules for categorisation of LCA/LCI data and LCA results are given the clause 7.2.2 of the standard, and the requirements related to additional environmental information are described in more detail in the clauses 7.2.3 and 7.2.4 respectively.

Table 10. The contents of an EPD (ISO 14025, clause 7.2.1 – ISO, 2006)

No	Requirement for the content
1	Identification and description of the organisation
2	Description of the product
3	Product identification
4	Information about the EPD programme
5	PCR identification
6	Publication date and period of validity
7	LCA, LCI or information module data
8	Additional environmental information
9	Declaration of content (materials and substances)
10	Excluded life cycle stages (if applicable)
11	Statement that EPDs from different programmes may not be comparable
12	Information about obtaining explanatory materials
13	Information about verification

Once the initial EPD is published, it should be updated as necessary to reflect, for example, changes in technology or manufacturing process, or other conditions that would alter the contents and accuracy of the initial declaration (ISO 14025, clause 7.3 – ISO, 2006).

Verification is another important component of the EPD development process that aims to ensure the compliance of the developed EPD with the general programme instructions. The declaration data can be verified independently internally or externally, and the use of third party verification is a decision left up to for the programme operator to take (ISO, clause 8.1.1 – ISO, 2006). The minimum requirements for PCR review, verification of LCI/LCA data and verification of the final declaration are provided in the clauses 8.1.2 – 8.1.4 of the standard. The requirements for independence and competences of verifiers are given in the clause 8.2.

Even if most of the EPD programmes are set up according to the ISO 14025 and develop their EPDs according to the ISO 14025 and ISO 21930, they still produce different EPDs (Petters, 2011). The reason for that is that the mentioned ISO standards are too vague and allow the programmes and their procedures to develop inconsistently (ibid).

Harmonisation of general programme instructions and PCRs, as well as mutual recognition of administrative procedures, procedures for PCRs and declaration format, is encouraged between the various programmes in order to ensure comparability of EPDs (ISO 14025 – ISO, 2006). The recent efforts for the development of European ECO platform is a great example of cooperation among the programme operators. The European ECO platform is a proposal for the European umbrella organisation for national EPD programme operators (Peters, 2011).

Another recent example of harmonisation efforts between the EPD programmes is a mutual recognition agreement between the German IBU programme and the Swedish International EPD System that was reached in 2012 (Schminke, 2012). These two initiatives are discussed in more detail in section 6.6.

## 6.2. Germany: IBU

The German EPD programme, commonly referred to as IBU and administered by the Institute of Construction and Environment (IBU), is one of the oldest EPD schemes. It was established in 1998 by manufacturers of construction products who were determined to support the demand for more sustainability in the construction sector (IBU, n.d.). The key facts about the programme are presented in Table 11.

Table 11. Key facts about the German EPD programme (from Mageroy, 2011).

Germany	
<b>Programme name:</b>	IBU
<b>Programme owner:</b>	Institute of Construction and Environment (Institut Bauen und Umwelt e.V.)
<b>Year of establishment:</b>	1998
<b>Focused on:</b>	Building products
<b>Based on:</b>	ISO 14025 and ISO 21930

Today IBU is one of the most widely recognized EPD programmes with 206 published EPDs and ~20 EODs under development (Peters, 2011). There is also a great variety in the origin of declaration holders – IBU has published EPDs of manufacturers in Germany, Finland, Italy, Netherlands, Belgium, Austria, Spain, Denmark, Switzerland, Turkey and Malaysia (ibid).

IBU works in close cooperation with construction and environmental authorities in Germany and actively participates in the international standardisation processes (IBU, n.d.). The members of IBU are construction product manufacturers and service providers, as well as associations. According to the data from 2011, IBU had 75 ordinary members and 11 associated members (Peters, 2011). There are also other actors involved in IBU's work – health and environmental experts and consultants, independent experts from the research community and the authorities, as well as testing facilities (IBU, n.d.).

The programme is financed through the membership and licensing fees. The size of the annual membership fee depends on the member's total turnover per year and whether a member is an ordinary company or an association and similar grouping and may vary from 800 EUR to 9000 EUR (IBU, 2012). The initial verification and awarding of declaration are 1250 EUR with the additional licensing fee per year from 100-800 EUR depending on the total amount of the published declarations (ibid).

In order to develop and verify an EPD under the German EPD programme, the owner of the EPD has to be a member of the programme (IBU, 2011); an application for membership can be made to the IBU informally on letter-headed paper.

The procedure for creating an EPD under the IBU programme is illustrated in Figure 8. In short, it is initiated by a request from producer and further consists of three steps (IBU, n.d.):

1. Creating PCR document (if it is not already developed for the product category);
2. Creating declarations (based on the data from LCA that is performed according to the respective PCR);
3. Checking and verification by an independent third party.

If the PCR is not readily available for the respective product category, it should be developed in accordance with the requirements in the ISO 14025. The draft document is first developed by producers and experts in the field and moderated by IBU, and it is then further questioned and verified by the Advisory Board that acts as an independent third body. The open consultation that is a required part of the process takes place on the Internet-based Forum and allows for comments by all interested parties.

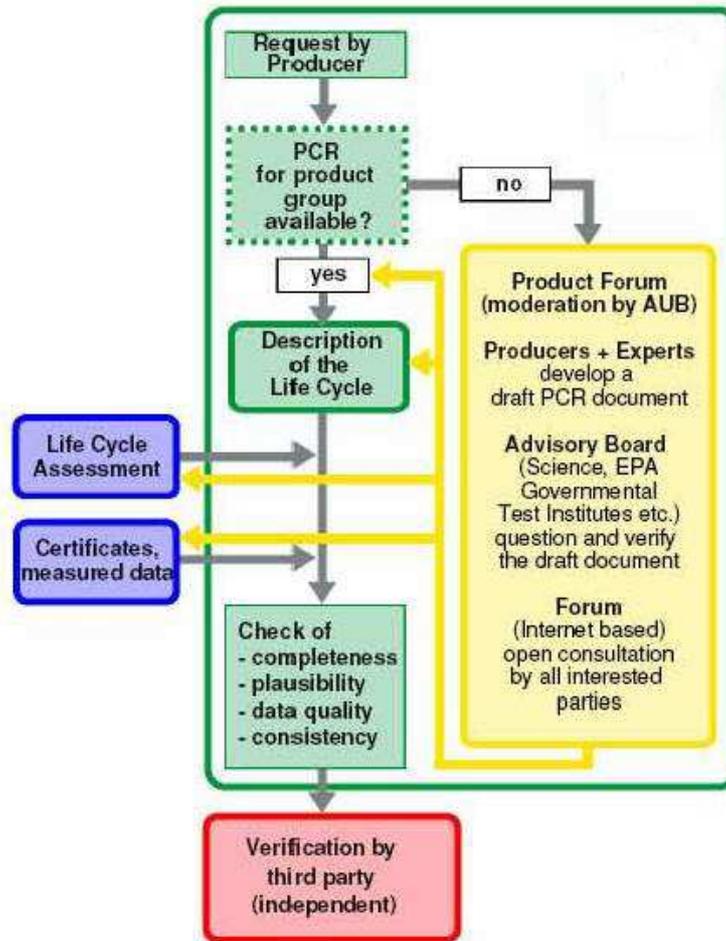


Figure 8. EPD development and verification procedure under the IBU programme (IBU, n.d.)

The verification of the created EPD and its underlying data is carried out by an independent third party (the committee of experts). The programme operator IBU has no influence over the verification process whatsoever; its final task is to publish the declarations that have been verified by the committee of experts (IBU, n.d.)

Regarding the contents and layout of the published declarations, these are developed in compliance with the ISO 14205 and ISO 21930 (Magerøy, 2011). After the adoption of the EN 15804, the declarations are being prepared and published according to the more specific guidelines in this standard and its supplementary standard EN 15942 on *Communication format: business-to-business*.

The German EPD programme is the first to fully adopt the new European standard EN 15804 into its general programme instructions and general product category rules for building-related products and services in order to facilitate the use of so called European EPDs in building assessment schemes and for showing compliance with the requirements of the Construction Products Regulation No 305/2011 (Peters, 2011). The general programme instruction of IBU were updated in 2011 and now

forms the basis for the conformance of the EPDs developed under the IBU programme to the EN 15804 and ensures the recognition of its EPDs throughout Europe (IBU, 2011).

IBU has also a strong position outside Germany. One of its goals is support and active participation in the efforts of the European construction products industry towards more sustainability in construction sector (Peters, 2011). IBU is a leading force in development of the ECO-EPD platform – a common effort by the existing EPD programme owners to harmonise EPDs issued under various European schemes (PE International, 2012). This initiative will be discussed in more detail in the section 6.6.

The organisations in Australia and New Zealand are also currently working on the development of an Australasian EPD scheme based on the well-established German IBU EPD system (PE International, 2012).

### 6.3.Sweden: International EPD System

The Swedish EPD programme or International EPD System (also referred to as EnvironDec or IES) is administered by the Swedish Environment Management Council in cooperation with the member organisations in a number of countries, such as Italy, Spain and the USA (IES, 2012a). It was founded in 1997 by the initiative from the business sector (Bogeskar et al., 2002). The key facts about the programme are presented in Table 12.

Table 12. Key facts about the Swedish EPD programme (from Mageroy, 2011).

Sweden	
<b>Programme name:</b>	International EPD System (also EnvironDec)
<b>Programme owner:</b>	Swedish Environment Management Council
<b>Year of establishment:</b>	1997
<b>Focused on:</b>	Various products
<b>Based on:</b>	ISO 14025 and ISO 21930

The main objective of the international EPD System is “to help and support organisations to communicate the environmental performance of their products (goods and services) in a credible and understandable way” by offering any interested organisation in any country to develop EPDs according to ISO 14025 and by supporting other EPD programmes seeking cooperation and harmonisation (IES, 2008). In the draft document of the updated programme instructions, there is also a reference to the new EN 15804 and forthcoming ISO 14067 (IES, 2012b).

The Swedish system does not focus on any particular product category; instead it offers creation of PCRs and EPDs, and independent third party verification for with all types of goods and services (IES, 2012a). Apart from the full scale EPDs, the International EPD System also offers to compile environmental information on specific issues, for example, climate impact through a climate declaration which describes the emissions of greenhouse gases based on LCA (ibid).

Initially the Swedish EPD programme with developed in close cooperation with the respective scheme in Italy; however, the Italian programme uses different characterisation factors and often refers to a public LCA database that does not exist in Sweden (Bogeskar et al., 2002). By 2012, the International EPD System has issued ~400 EPDs of 180 companies; it has 28 member organisations and verifiers in 11 countries around the globe (Thorneus and Marino, 2012).

Overall, the Swedish EPD programme is very internationally oriented scheme – apart from Sweden, it hosts the membership organisations and declaration holders from 15 countries around the globe (IES, 2012c). These are shown in Figure 9. Additionally, the first Finnish EPD was published in the International EPD System in May, 2012 (IES, 2012c).



Figure 9. Origin countries of the declaration holders in the International EPD System (IES, 2012c)

The programme documentation for the International EPD System consists of four parts (IES, 2012d):

- Introduction, intended uses and key programme elements
- General Programme Instructions
- Supporting annexes
- Process certification clarification.

The general programme instructions are currently under revision and the draft version of the updated document is now available for open consultation until August 31, 2012. The new version of the general programme instructions is expected to apply from January, 2013. Until then, the current version of the programme instructions is valid (IES, 2012d). The draft version also aims at aligning the current instructions with the EN 15804, though the alignment is not as clear as, for example, in the guiding documents of the German EPD programme.

The organisational structure of the Swedish EPD programme is presented in Figure 10. The International EPD Consortium acts as the programme operator according to ISO 14025. The programme is further managed and administered by the steering committee, technical committee and the secretariat (IES, 2012b). The development of new PCR documents is undertaken by a PCR Moderator that coordinates the work of experts and the Stakeholder Consultation Group. Once the EPDs are developed by the organisations, they are verified by either certification bodies or individual verifiers and published by the secretariat (ibid).

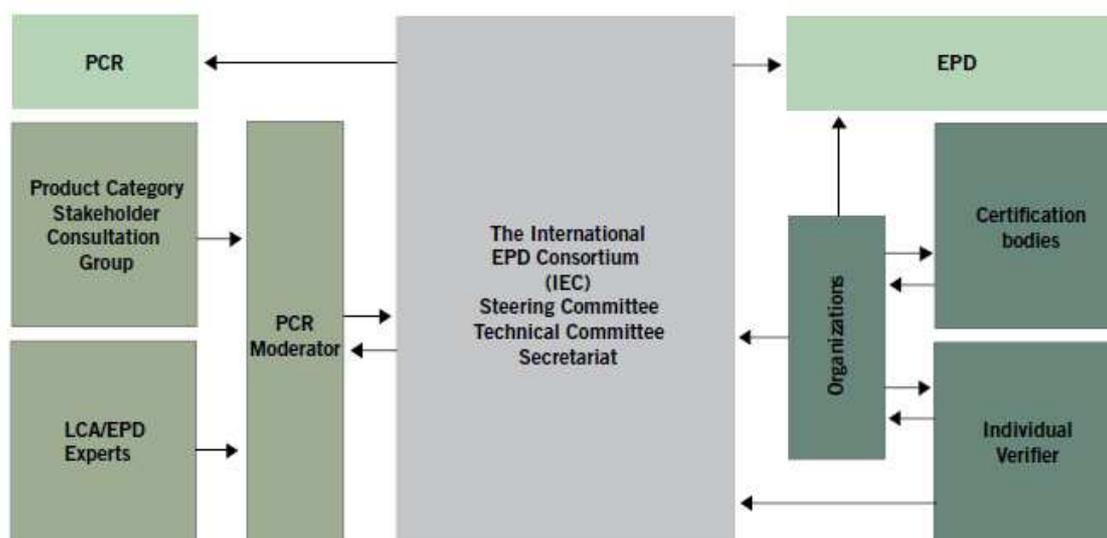


Figure 10. The organisational structure of the Swedish EPD programme (IES, 2008)

The creation of a new PCR document may also be initiated by any stakeholder by contacting the Secretariat; all stakeholders can as well as participate in the open consultation process on the programme's website (IES, 2012a).

When it comes to the content, layout and structure of the published declarations, the EPDs from the International EPD System are the ones with the greatest variance (Magerøy, 2011); some of the EPDs even seem entirely different. This could be due to the fact that neither the general programme instructions nor the respective PCRs provide specific and clear requirements for the content and structure.

As to the financing, the Swedish EPD programme operates with annual fees that cover all EPDs registered by the respective organisation, and registration fees (IES, 2012e). According to the information on their website, the annual fee is 1000 EUR for small and medium-sized organisations with less than 250 employees, and 2500 EUR for large organisations with more than 250 employees. The registration fee for the first EPD is 1000 EUR, and there are discounts for the second, third etc. EPD.

As a result of the introduction of the new “unifying” EN 15804, the International EPD System and the German IBU programme, has recently agreed on the mutual recognition of verified EPDs developed and published by these two programme operators (Schminke, 2012). This means that the EPDs of both programmes are mutually recognized without additional verification and the declaration holder of such an EPD may use one or both programme logos. The mutual recognition, however, is restricted to EPDs of construction products including furniture and textiles built into a building (ibid).

The achievement of mutual recognition is an ongoing process, but most of the program characteristics have already the right level of accordance due to the common reference to the ISO 14025, ISO 14040/44 and EN 15804 (in the draft version). In addition, a number of issues have been identified that still need to be aligned (Schminke, 2012).

#### 6.4. Norway: Norwegian EPD Foundation

The Norwegian EPD Foundation, or EPD-Norge, was officially established in 2002 by the Confederation of Norwegian Enterprise and the Building Industry Association (EPD-Norge, n.d.). The actors currently involved in the work of the programme include the authorities, experts from the research communities, as well as public and private organisations (EPD-Norge, 2011). The key facts about the programme are presented in Table 13.

Table 13. Key facts about the Norwegian EPD programme (from Mageroy, 2011).

Norway	
<b>Programme name:</b>	Norwegian EPD Foundation (EPD-Norge)
<b>Programme owner:</b>	Confederation of Norwegian Enterprise (Næringslivets Hovedorganisasjon, NHO)
<b>Year of establishment:</b>	2002
<b>Focused on:</b>	Building products and furniture
<b>Based on:</b>	ISO 14025 and ISO 21930

The Norwegian EPD Foundation is a non-profit organisation, and it is financed by the Confederation of Norwegian Enterprise, industry associations (EPD-Norge, 2011), and through the annual fee from the enterprises that have EPDs verified by the Norwegian EPD Foundation, as well as a registration fee for each published EPD (EPD-Norge, n.d.). The prices on the programme's website are from 2010 – the annual administration fee is set to 8000 NOK and registration fee to 10000 NOK for each EPD that covers the 5-year period of validity (ibid). If the same organisation develops more than 10 EPDs, then starting from the 11<sup>th</sup>, the registration fee is 1000 NOK per EPD.

Procedure for the development of EPDs under the Norwegian EPD programme is presented in Figure 11, and it follows the requirements in the ISO 14025. The process is initiated by the producer who wants to create an EPD for his product. If a PCR document for the respective product category is not readily available, it should be developed according with the PCR-template that is downloadable from the programme's website (EPD-Norge, 2011). The draft version is usually prepared by an LCA-expert in close cooperation with the working group that consists of several manufacturers, related organisations and other stakeholders. Before the Verification Committee of EPD-Norge accepts the PCR document, the draft version is being sent to the relevant stakeholders for evaluation and commenting (ibid).

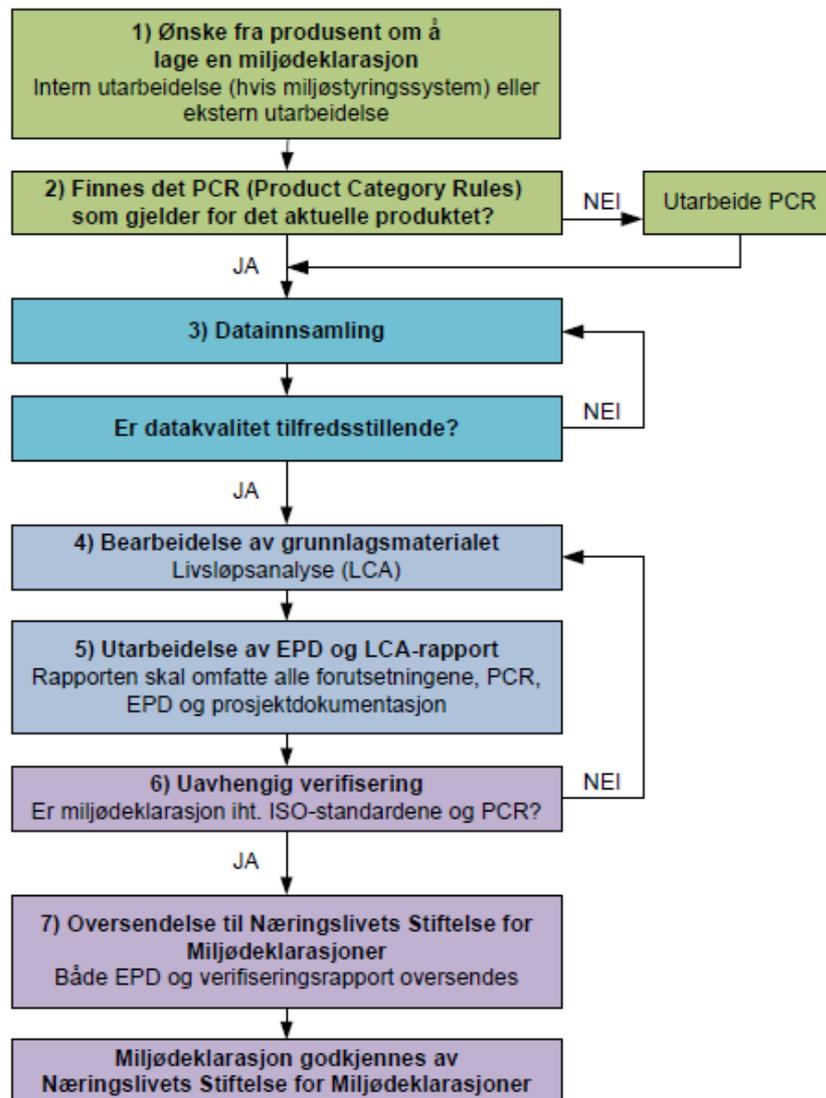


Figure 11. Procedure for the development of EPDs under the Norwegian EPD programme (EPD-Norge, 2011)

Verification of the conducted LCA and the EPD is carried out according to the guidelines laid out in the ISO 14025. Once the EPD has been verified, it is published on the website of the Norwegian EPD Foundation (EPD-Norge, 2011). According to the data from 2011, there were 92 EPDs published under the Norwegian EPD programme – more than a half of these for construction products and building materials (Magerøy, 2011).

As to the new EN 15804, the information on the programme's website is quite out-of-date. Under the section that lists the international standards related to the development of EPDs and other environmental labels, in August, 2012, the EN 15804 is still listed as a working item from 2009, even if the standard was officially published in April, 2012 (EPD-Norge, n.d.).

There is, however, a PCR template available for preparing PCRs according to the EN 15804. The EN 15804 and the associated implications and challenges were also on the agenda at the annual meeting that took place in June, 2012 (EPD-Norge, 2012).

In general, the information in English on the programme's website is rather limited and well out-of-date (this holds true also for the website in Norwegian) – a condition that might represent a significant obstacle for the non-Norwegian organisations interested in the development of EPDs under the Norwegian EPD programme.

### 6.5. Finland: RT Environmental Declaration

The Finnish EPD programme, RT Environmental Declaration, was founded by the Building Information Foundation RTS and the Confederation of Finnish Construction Industries RT as early as in 1988 when the European Union adopted the Construction Products Directive. The Finnish programme is thus the oldest of the EPD schemes. The key facts about the programme are presented in Table 14.

Table 14. Key facts about the Finnish EPD programme (from Mageroy, 2011).

Finland	
<b>Programme name:</b>	RT Environmental Declaration
<b>Programme owner:</b>	the Building Information Foundation RTS, and the Confederation of Finnish Construction Industries RT
<b>Year of establishment:</b>	1988
<b>Focused on:</b>	Building products
<b>Based on:</b>	ISO 21930

Even if the Finnish EPD programme uses the methodology based on the international standards, including the ISO 21930, the procedures and terminology used are significantly different from those observed in the other EPD programmes. The main programme document is *Methodology for Compiling Environmental Declarations for Building Products and Assessing Environmental Impacts of Buildings* that provides guidelines for the content and compiling EPDs, or eco-profiles of the building products (RTS, n.d.). As explained in the methodology document, an eco-profile accounts for the environmental impacts of a building product, and it is based on the results from the LCI; the results cover the stages “from cradle to gate” (VTT, 2004).

According to the rather scarce information available on the programme's website, the national methodology is following the basic principles stated in the ISO 14040 and ISO 14020, and it considers also the preliminary results achieved within ISO CD 21930 (RTS, n.d.). Referring to the ISO 21930 as a CD (commission draft) indicates that this information is well out-of-date, since the standard has been published in 2007.

The RT Environmental Declaration is strongly focused on the Finnish market and there is no information available on the adoption and integration of the EN 15804 in the methodology for the declaration development under the Finnish EPD programme.

## 6.6. Harmonisation and cooperation initiatives

### 6.6.1. European EPD Platform "ECO"

In September 2011, the EPD programmes from Finland, France, Germany, Great Britain, Italy, the Netherlands, Norway, Poland, Portugal, Sweden and Spain signed a "Memorandum of Understanding" in order to establish a common European EPD Platform, called "ECO" (IBU, 2011). The finalised work on environmental standards produced by the CEN/TC 350 has given a considerable push towards harmonisation of practices, and by now in total 25 organisations, including several national Green Building Councils, have involved in establishing a common European EPD platform (ibid).

The European ECO platform is a proposal for the European umbrella organisation for national EPD programme operators (Peters, 2011). The goal of the European ECO-EPD Platform is a common implementation of the EN 15804 that aims for a mutual recognition among the member programmes (Schminke, 2012).

Several reasons have been identified that supports the idea and need for a European EPD platform (Peters, 2011):

1. Market asks for common and consistent EPDs throughout Europe that could be used for further building assessments;
2. The new Construction Products Regulation requires environmental data and data on sustainable use of resources, and refers to environmental product declarations;
3. The need for lean procedures and less bureaucracy.

According to Peters (2011), the national programmes participating in such an umbrella scheme would develop their European ECO-EPDs with the core content

developed according to the EN 15804; it would also be possible to place additional information on the EPD according to regional demands. The strength of such system would mutually accepted procedures and core content, a common quality control and consensus-based development. As the European ECO-EPD would be a programme operator for the European Associations, these would have an option to verify and register their EPDs directly under the European platform (ibid).

### **6.6.2. Mutual recognition between IBU and the International EPD System**

Another recent example of harmonisation efforts between the EPD programmes is a mutual recognition agreement between the German IBU programme and the Swedish International EPD System that was reached in 2012 (Schminke, 2012). This means that the EPDs of both programmes are mutually recognized without additional verification and the declaration holder of such an EPD may use one or both programme logos. The mutual recognition, however, is restricted to EPDs of construction products including furniture and textiles built into a building (ibid).

The recognition process is still ongoing, but most of the program characteristics have already the right level of accordance due to the common reference to the ISO 14025, ISO 14040/44 and EN 15804 (in the draft version). In addition, a number of issues have been identified that still need to be aligned (Schminke, 2012).

The general programme instructions of the International EPD System are currently under revision and the draft version indicates efforts to align the current instructions with the EN 15804. The new version of the general programme instructions is expected to apply from January, 2013 (IES, 2012).

## **6.7. Summary**

The German EPD programme and the Swedish International EPD System are both internationally-oriented programmes, though the German programme is also strongly positioned as a national programme. The Norwegian EPD Foundation and the Finnish EPD programme are, on the other hand, two examples of the programmes strongly oriented towards their respective national audiences.

The work of the German, Swedish and Norwegian programmes is based on the international standards ISO 14025 and ISO 21930 (for building products), and all these programmes show interest in adoption of the European EN 15804 (also for building products). They all apply LCA methodology for the PCR and EPD

development and a study by Magerøy (2011) also indicates that the Norwegian, Swedish and German PCRs generally comply with the requirements of ISO 14025. The Finnish programme claims to follow the ISO 14040, ISO 14020 and ISO 21930, though the main document for methodology was published in 2004 and does not seem to be revised since.

Regarding the adoption of the new EN 15804, the German and Swedish programmes are the ones demonstrating significant progress in the adoption process, with the German IBU programme clearly leading the race – it has already fully updated the general programme instructions and the product category rules for building-related products and services according to the EN 15804. The recently developed IBU's EPDs already comply with the requirements set out in the EN 15804 and EN 15942.

The observable trend towards cooperation, harmonisation and mutual recognition between the existing EPD programmes is indeed positive and promising. All of the investigated programmes are listed as the signatories of the "Memorandum of Understanding" that aims to establish a common European EPD Platform and facilitate the development of EPDs with core content according to the EN 15804. The further development of the common European ECO-EPD platform is particularly interesting.

## 7. Sustainable construction in Latvia

### 7.1. Introduction

Issues related to sustainability and environmental impacts of products, services and organisations have been out on the European political agenda since the term “sustainable development” was coined in the Brundtland report in 1987, and environmental product declarations (EPDs) have been developed in Europe for more than two decades already with the very first EPD programme being established in Finland in 1988.

EPDs are becoming increasingly more popular and recognized as the means for providing essential information about the environmental and sustainability aspects of products and services, especially (but not exclusively) in the case of construction products and services. Recently, the requirement to account for sustainability aspects has also been manifested in the EU legislative framework through the new Construction Products Regulation and its requirement for sustainable use of natural resources (Regulation No 305/2011, 2011). As to the assessment and documentation of sustainable use of natural resources, the Regulation refers to the use of EPDs when available (ibid).

There is also an increasing demand by the market for common and consistent EPDs throughout Europe that could be further used for building assessments (Peters, 2011). The first ISO standard on the Type III environmental declarations was published in 2006, followed by the sector-specific ISO 21930 for building products; however, the requirements of these standards have been somewhat vague allowing for the differences among the EPD programmes, their PCRs and EPDs to proliferate.

In April 2012, the European Committee for Standardisation (CEN) finalized their work on a sector-specific standard EN 15804 that is strongly based on the earlier ISO work and respective standards, and has a similar structure and contents to the ISO 21930, but the European standard is considerably more specific and precise in its requirements, and it presents a firm basis for the harmonisation of the European EPD programmes and their EPDs (see in particular the section [...] *Harmonisation and cooperation initiatives*).

These developments are particularly important for those European countries where a systematic assessment and verification of environmental performance of products and processes are not yet well-established. Latvia, an EU-member state since 2004, is an example of such country where concepts like life cycle management and documentation of sustainability and environmental performance are not yet widely

applied. It is, however, important to keep an eye on the developments in the export markets and to be able to meet new requirements, if Latvia is about to keep and expand its position in the export markets.

A study by Schenck (2010) identifies the following “key ingredients” for a strong EPD programme:

- conformance with the international standards on EPDs and LCAs that would ensure the comparability and recognition of the EPDs developed under the programme;
- government programmes enabling appropriate legislation, a strong life cycle inventory programme, and national standardisation;
- active participation of the industry in the development of sector-specific PCRs;
- higher education programmes develop the necessary LCA/EPD competencies (incl. relevant research) and NGO programmes for education of the general public;
- cooperation with other EPD programmes.

The international and European standards and their respective requirements were investigated in detail in the chapter 5. The same sections also partly cover the importance and the requirements for the mutual cooperation and harmonisation between the programmes, and the recent initiatives for harmonisation and mutual recognition were discussed in the section 6.6. The aspects related to government policies and programmes in Latvia, industry initiatives and the status of education programmes and competences are discussed in the next sections of this chapter.

Prior to exploring these aspects, a short and general introduction the national economy and the state of environmental matters in the country, is given in the section 7.2.

## **7.2.Key facts about Latvia**

The national economy of Latvia is a strongly service-based economy, the main sectors being trade, financial services, real estate operations and construction. The unbalanced structure of the economy led to a large economic decline caused by the global financial crisis in the period 2008–2010 (Central Statistical Bureau, n.d.). In 2011, the GDP increased with 5,5%, and this was mainly due to the growth in construction industry (+12,4%), manufacturing industry (+11,7%), trade (+8,7%), and transportation and logistics (+8,0%) (ibid). Apart from the financial downturn in the period 2008-2010, the Latvian economy is characterised by strong economic growth (increase in GDP), but low purchasing power parity (Eurostat, 2011).

The construction industry in particular was continuously growing since 1995; however, it was heavily affected by the financial crisis in 2009 when its share of GDP dropped by around 27% (Central Statistical Bureau, n.d.). In the later years the industry has started to recover and, in 2011, the construction industry accounted for close to 8% of the GDP which is again approaching the pre-crisis level (Central Statistical Bureau, 2011).

The national economy is largely based on small and medium-sized enterprises. In 2009, 99,5% of all enterprises fell into this category – 82,6% being micro-enterprises, 14% - small enterprises and 2,9% - medium-sized enterprises (Ministry of Economics, 2012a). This is an important factor with regards to the EPD development, because the high costs, the amount of work and required specific competences needed to conduct an LCA and create an EPD has been identified as a major obstacle for SMEs to use EPDs (Zackrisson et al., 2008).

In 2011, Latvia was ranked as the 2<sup>nd</sup> greenest country in the world according to the Environmental Performance Index (EPI) by Yale University; the trend results for 2012 show that Latvia will keep its position (EPI, 2012). As flattering as it may sound, the closer inspection of the methodology behind the index (EPI, 2011) indicates that the high ranking is not due to thought-out long-term policies and proactive environmental initiatives, but rather because of the chosen indicators and rating criteria that allows Latvia to score that high based on the country's geographical location (f. ex. access to drinking water, water quantity), lack of industrial activities (f. ex. indicators related to CO<sub>2</sub> emissions and air quality), the hydropower-based electricity and the large proportion (~56%) of land covered by forests. Thus, there is no external (or internal) pressure towards more sustainable development, largely because „we just happen to be green”.

### **7.3.Environmental management practices**

As to the environmental management tools used in Latvia, the management system certification is relatively well-known and applied, though it is rarely required or used in, for example, green public procurement or procurement processes in the private sector.

According to the data from Latvian Association for Quality, 122 organisations are certified to be in compliance with ISO 14001:2004 (28 of them are construction companies) and 7 organisations are verified to conform to EMAS (LKA, 2009). These numbers do not include organisations and sites that have been certified by foreign certification bodies. Newer data on the existing certifications are not available, because the Association stopped operating in 2009 due to the lack of financial support and, unfortunately, no other organisation has overtaken its function of updating the database of certified organisations.

There is no aggregated information on the use of Type II environmental claims, but environmental product labelling of Type I is somewhat known. The most commonly used environmental labels in Latvia include (Zaļā brīvība, 2008):

- EU Organic Farming label;
- FSC - Forest Stewardship Council label;
- Latvijas ekoprodukts (Latvian eco-label);
- Bra miljoval (Sweden);
- Nordic Swan;
- EU-flower (EU eco-label);
- Blue Angel (Germany).

Type III environmental declarations (EPDs) based on life cycle assessments (LCA) are largely unknown in Latvia. Some large international companies refer to EPDs in their environmental policy statements – for example, ABB (2011) promises to develop EPDs for its main products, and Ruukki has published 4 EPDs on the company website with the company logo only and with no apparent independent verification (2010).

In general, however, Latvia has no practical experience with the LCA methodology and assessment/verification/certification of the assessed environmental impacts construction products and services, and construction works (Kļaviņš, 2011). The new Construction Product Regulation thus represents a challenge. While the basic procedure for CE-marking of products and assessment of their technical and functional properties remains largely the same, the Regulation introduces a new requirement for sustainable use of natural resources and refers to the usage of EPDs when available (Regulation No 305/2011, 2011).

Currently, construction products in Latvia are mostly assessed for their conformity with technical, safety and performance requirements. The national laws and regulations are harmonized with the EU Construction Products Directive 89/106/EEC and the assessment procedures are in accordance with this Directive (Ministry of Economics, 2011).

## 7.4. Framework for construction industry and sustainable construction

### 7.4.1. Policy documents and legislative framework

The relevant policy documents include (Sauka, 2011):

- Latvian National Development Plan 2007-2013 that defines sustainable development as “an integrated and balanced development of society’s welfare, as well as of the environment and economy, which satisfies inhabitants’ current social and economic needs and also ensures observance of environmental requirements (without depriving future generations of the ability to satisfy their needs) and preservation of biological diversity” (LNDP, 2006);
- Construction Industry Guidelines 2011-2015 (draft document by the Ministry of Economics);
- General Principles for Construction Policy (includes a principle on environmentally-friendly, competitive and sustainable construction).

The legislative framework for construction industry in Latvia includes the following legal acts:

- the Construction law;
- the General Construction Regulations;
- Cabinet Regulation No 181 on Procedures for the Conformity Assessment of Construction Products in the Regulated Sphere;
- regulations issued by the local municipalities (locally binding).

The very base of the construction regulation system in Latvia is *the Construction Law* that was adopted by Saeima (the Latvian Parliament) in 1995; it applies to all types of structures. The Law determines and regulates the mutual relations, rights and responsibilities among the actors involved in the construction process, as well as the liability for the end-result and areas of responsibility between the state and local authorities (The Construction Law, 1995). According to the Construction Law the general supervision and coordination of construction is performed by the Ministry of Economics, which also develops an integrated national policy on construction and ensures its implementation (ibid).

A new Construction law has been under development for many years. The current draft of the new Construction law states 4 main principles of construction works, including the principle of sustainable construction. However, there are no further interpretations on how this principle is going to be implemented and followed-up (Ministry of Economics, 2012b).

Further, the overall construction procedural rules are prescribed in *the General Construction Regulations*, adopted in 1997. These Regulations prescribe the requirements for the preparation and development of the building design and the requirements for the performance of construction work, as well as the demolition of structures (General Construction Regulations, 1997). Further, the Cabinet of Ministers issues more specific Regulations and Latvian Building Codes (national construction standards) - these are the 2<sup>nd</sup> level legal acts.

The 3<sup>rd</sup> level legal acts are regulations issued by the local municipalities. These are binding for all actors in construction process within the particular municipality. In order to control and supervise construction process at the municipal level, the local municipalities shall set up the *Construction Board* (The Construction Law, 1995).

As already mentioned in part XXX, sustainable construction is one of the six markets in the Lead Market Initiative by the European Commission. One of the activities within this focus area was screening of national building regulations in order to assess whether and how the EU member states regulated sustainable construction, whether and how these regulations were enforced, what public and private initiatives were present, etc. (European Commission, DG Enterprise and Industry, 2012). The screening of Latvian building regulations (European Commission, 2011) indicated the following aspects regarding the current situation of sustainable construction in the country:

- Lack of political will and commitment – sustainable construction is low on political agenda at all levels of government (lack of resources, other priorities);
- No coordination of actors in the construction supply chain;
- Lack of information on sustainability for all the actors involved in the construction industry;
- Inadequate incentives and regulations, lack of targets and adapted standards for implementation of sustainable construction.

Though environmentally friendly construction, rational use of natural resources, sustainability of construction etc. are mentioned in the policy documents and legal acts, including the Construction law, these remains as general phrases and no actual initiatives or enforcement mechanisms are set up and implemented (Bažbauers, 16.07.2012).

The general trend to be followed by Latvia is that the national building standards and Regulations issued by the Cabinet of Ministers should be harmonised with the EU legislation and based on the CEN standards (European Commission, 2011). By now, Latvia has adopted the suite of the CEN/TC350 standards on *Sustainability of construction works* as national standards (Zakutajevs, 27.07.2012.); however, there are no further plans or vision as how to implement these and how to enable local

manufacturers of construction products to meet the requirements for the information on the environmental and sustainability aspects as laid out in the Construction Products Regulation.

#### 7.4.2. Authorities and notified institutions

According to the Construction Law the general supervision and coordination of construction industry is performed by the Ministry of Economics, which also develops an integrated national policy on construction and ensures its implementation (The Construction Law, 1995). The Ministry of Economics also coordinates and supervises the systems of national standardization and accreditation. Regarding the testing and certification of construction products, there are four notified testing laboratories and three notified certification bodies (Egle, 2012)

Meanwhile, the sustainability and environmental issues, including climate change policy and green public procurement, are under the authority of the Ministry of Environmental Protection and Regional Development (Ministry of Environmental Protection and Regional Development, n.d.), and although the new Construction Products Regulations poses an interdisciplinary challenge to be solved by the experts from both organisations, no such efforts of cooperation are yet present.

#### 7.4.3. LCA/EPD competences in Latvia

The key competences necessary for the EPD development are expertise in LCA and more general knowledge and understanding about environmental management and accounting (main principles, available standards etc.). The Latvian universities that offer academic study programmes in environmental science are listed in Table 15.

Table 15. Study programmes in environmental science at the Latvian universities (Higher Education Quality Evaluation Centre, 2012)

University	Programme name	Received degree
<b>Bachelor-level programmes</b>		
<i>Daugavpils University</i>	Environmental science	Bachelor's degree in natural sciences
<i>Latvia University of Agriculture</i>	Environmental science	Bachelor's degree in environmental sciences
<i>Riga Technical University</i>	Environmental science	Bachelor's degree in environmental sciences
<i>University of Latvia</i>	Environmental science	Bachelor's degree in natural sciences
<b>Master-level programmes</b>		
<i>Latvia University of Agriculture</i>	Environmental engineering	Master's degree in environmental engineering
<i>Riga Technical University</i>	Environmental science	Master's degree in environmental

		sciences
<i>University of Latvia</i>	Environmental science	Master's degree in natural sciences
<i>University of Latvia</i>	Environmental management	Master's degree in environmental sciences
<b>PhD programmes</b>		
<i>Latvia University of Agriculture</i>	Environmental engineering	Doctor's degree in engineering
<i>Rezekne University College</i>	Environmental engineering	Doctor's degree in environmental engineering
<i>Riga Technical University</i>	Environmental science	Doctor's degree in environmental engineering
<i>University of Latvia</i>	Environmental science	Doctor's degree in environmental sciences

Most of these programmes are either strongly focused on biology/environmental science or engineering courses, thus they generally lack a trans-disciplinary perspective. While the basic principles of environmental management are taught at several universities, the only university offering an introductory course in LCA is Riga Technical University (RTU) where the master-level introductory course is taught to 1<sup>st</sup> year master students.

The course is worth 3 ECTS<sup>1</sup> credits and has 2x45 minute lectures per week. It aims to explain the main principles and contents of the ISO 14040 and to give students a general understanding about LCA, the methodology behind, the most widely applied environmental impact categories (RTU, 2012). The basic calculations are carried out using MS Excel; SimaPro and CMLCA (LCA software tool from Leiden University) are mainly used for demonstrations only, so the course remains somewhat theoretical. Students interested in LCA can do an LCA for their master thesis; so far 2 students have used this opportunity (Bažbauers, 16.07.2012.)

A study on the current situation and future perspectives of teaching LCA at RTU indicated that in order to improve students' competences in this field and their ability to perform LCAs independently, it is necessary to expand the course giving more time for practical exercises and the actual work with LCA software (Simanovska, 2009).

#### 7.4.4. Potential for sustainable construction in Latvia

The initiative for the development of the methods for sustainability evaluation in the construction industry currently comes from the business actors and non-governmental organisations (as has often been the case for the establishment of EPD programmes in Europe). The main drivers for such interest are long-term vision and export strategies, especially for larger companies (Sauka, 25.07.2012.) The export-

<sup>1</sup> ECTS – credit points in the European Credit Transfer System

oriented companies are starting to show interest in the tools like carbon footprint and environmental product declarations (Bažbauers, 16.07.2012.)

There are two non-governmental organisations (associations of construction companies and building material producers) in Latvia whose main objective is to address the environmental and sustainability issues faced by the industry. The first one, *The Green Home (Zaļās mājas)*, was established in 2006, while the other one, *The Latvian Sustainable Construction Council (LSCC)*, is an initiative of *The Green Home*.

The LSCC was founded in late 2010 together with the most active supporters of the sustainable construction practices from within the industry itself. The organisation is currently strongly focused on the adoption and applying of the BREEAM evaluation and certification scheme for sustainability assessment of buildings in Latvia (LSCC, 2010). Although the main focus area of the LSCC is the assessment of entire buildings and construction works, the organisation is very supportive of the new requirements in the Construction Products Regulation, as the consistent and reliable information about the environmental impacts of construction products would further facilitate and ease the assessments of buildings and construction works (Sauka, 24.07.2012.)

In addition, the Latvian Association of Civil Engineers (LACE) has regularly organised seminars about the potential of sustainable construction, use of sustainable construction materials, construction regulation trends in Europe and other related topics (LECA, 2012).

In general, however, the demand for sustainable construction within Latvia is still very low due to the lack of information and knowledge about the subject, as well as the lack of appropriate skills (Construction Industry Guidelines, draft document, 2011). The term “sustainable construction” is often related to the application of the newest energy technologies and activities related to energy efficiency (ibid). The two major problems identified in the draft document of the Guidelines are:

- the high initial cost of new technologies (life cycle cost of building and construction is rarely taken into account);
- insufficient skills and knowledge about sustainable construction among the industry professionals, as well as insufficient awareness about the principles and benefits of sustainable construction among the general public.

Finally, the green public procurement that would very well serve as a way to introduce more sustainable production and consumption patterns, has not really worked out in Latvia. Although the documents and guidelines on GPP exist, these are very rarely applied and the contract is granted based on the bid with the lowest price, i.e., the lowest initial cost (Bažbauers, 16.07.2012.). This is in most cases due to the following reasons (Zakutajevs, 27.07.2012.):

- authorities do not plan in the long-term; the financial resources are allocated to a specific short-term period;
- there is a lack of simple environmental criteria that would be easy to apply and that would allow for easy comparisons (in particular criteria based on LCA methodology require significant amount of time and resources making it difficult to apply by small and medium-sized companies);
- lack of necessary skills for preparing green procurement documents.

## 8. Discussion and conclusion

Development of a national EPD programme is a long-term commitment associated with significant time and financial resources. The objective of this study has therefore been to investigate the feasibility of the establishment of such programme in Latvia.

This was done by conducting a literature review, consisting of analysis of the relevant background theory; the investigation of relevant policies, frameworks and legal acts; analysis and comparisons of international and European standards and practices for development and operation of EPD programmes and creation and verification of EPDs. The qualitative interviews with the representative experts from the Latvian industry, authorities and academia were conducted in order to explore and understand the national context for addressing the environmental and sustainability issues.

The study has identified three main barriers for the sustainable construction in Latvia:

- the lack of political will to engage proactively in sustainable construction;
- the lack of meaningful cooperation among the various stakeholders (manufacturers, suppliers, authorities, academia and other)
- long-term strategies, systems approach and life cycle perspective are, unfortunately, rather unpopular concepts in Latvia.

Apart from impeding the development of sustainable construction practices, these issues also significantly slow the process of acquiring new environmental assessment tools like EPDs. Other challenges, though seemingly easier to overcome, include:

- shortage of competences necessary for LCAs and the development of EPDs
- insufficient knowledge about the principles and benefits of sustainable construction, as well as lack of the skills among the industry professionals.;

Taking this, as well as the recent developments towards a common European ECO-EPD platform, the suggestion is to hold the horses regarding the establishment of another national programme. Instead an appropriate solution for the time being could be the development of a contact-consultancy point that provides information and consultation for the interested parties and can act as a mediator between the interested organisation (manufacturer) and another well-established EPD programme, if necessary. The aim is not to develop a national programme for the

sake of having one, but first of all to provide the “window of opportunity” for those organisations interested in developing EPDs for their products.

From the EPD programmes investigated in detail, it is the German IBU programme and the Swedish International EPD System that are the most internationally-oriented programmes that welcome declaration holders from various countries. While the general programme instructions of the Swedish programme are still under review and the new version will not be available until January 2013, the IBU programme has already aligned its programme instructions and PCR for building related products and services with the new EN 15804 – a factor that is important for Latvia as an EU country.

Both programmes are well-established with a long and continuous experience in EPDs for construction products, especially the German IBU programme. It is also the main driving force behind the European EPD programme initiative, a very promising initiative that would not only facilitate the harmonisation and recognition between the existing programmes, but hopefully also make it easier for the countries without national EPD programmes to obtain EPDs for their products.

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## Appendices

### Appendix 1

#### The action plan for Lead Market Area ‘Sustainable Construction’

(Source: European Commission, n.d.)

Policy Instruments	Objectives	Actions	Timetable	Actors
Legislation	Encourage the adoption of a performance based approach in national building regulations.	Screening of national building regulations to identify domains in which to integrate a performance based approach, based on individual reports from each Member State.	2008-2009	EC Member States
	Expand the scope of the Energy Building Performance Directive in accordance with the Energy Efficiency Action Plan.	Take advantage of the 2008 review of the Energy Building Performance Directive to extend its applicability and inclusion of Union-wide performance targets and evolving standards for new construction.	2008-2009	EC Member States Industry
	Analyse and assess the innovation potential and cumulative effects of EU and national legislations on innovative approaches in construction.	Industrial leader panel to carry out case studies on construction companies and related industries/services.	2008-2010	EC Industry
Public procurement	Develop guidance for the choice between EMAT and the Lowest Price and for the use of Life Cycle Costs in construction works - Promote Life Cycle Assessment for construction products (“Environmental Product Declaration”) and for buildings (standardisation work in progress).	Promote networking between public procurers and construction practitioners to develop such guidance and relevant pilot schemes. Test and validate these pilot schemes notably in cluster initiatives.	2008–2009	EC Member States Industry
Standardisation, Labelling, Certification	Develop voluntary performance targets to enable the implementation of incentives and other policy measures to promote	Define a framework, assessment method and benchmarks for assessing the sustainability performance of buildings and of the construction	2008-2011	EC, Member States
	sustainable buildings and construction practices	value chain		States Industry, Research
	Develop European standards that allow taking into account sustainability aspects in construction design.	Expand the scope of Eurocodes in order to integrate other sustainability aspects in construction design, such as energy and environmental aspects.	2008-2011	EC Member States Industry
	Define the framework for technical assessment adapted to a rapid certification of innovative products to sustainability criteria.	Adopt the Construction Products Regulation, providing for better procedures to obtain European Technical Approvals and for better recognition in Member States for sustainability issues.	2008	EC, EP, Council
Complementary Actions	Show the business case for an effective supply chain and identify relevant contractual, management, financial and insurance arrangements.	Publish a guide on how to establish collaborative working schemes in construction projects, general provision of contractual, management and insurance rules as well as good practice for SMEs - Disseminate this guide to public and private investors, contractors and other market operators.	2008	EC Industry
		Analysis of the national liability and insurance regimes and assessment of the feasibility for the insurance sector to promote alternative	2008-2009	EC Industry
		warranty/label schemes.		Insurance sector
	Anticipate the future qualifications and skills needs to uptake innovation in construction.	Propose scenarios for future qualification needs and develop an EU-wide strategy to facilitate the up-grading of skills and competencies in the construction sector.	2008	EC Industry Education systems

## Appendix 2

### From the Construction Products Directive to the Construction Products Regulation: The overview of the changes

(Source: European Commission, 2012)

	Construction Products Directive	Construction Products Regulation
<a href="#"><u>Simplified procedures</u></a> (CPR chapter VI)	Non-existent under the CPD	<ul style="list-style-type: none"> <li>using existing data/test results to reduce the amount of necessary testing; (e.g. "Without Testing/Without Further Testing", "Cascading testing", "Shared Initial Type Testing")</li> <li>specific approach for micro-enterprises</li> </ul>
<a href="#"><u>Declaration of Performance (DoP)</u></a>	Non-existent under the CPD	Compulsory when harmonised European standard exists
<a href="#"><u>Harmonised European standards</u></a>	Intended use assumed in harmonised standards but not explicitly declared	Declaring intended use in DoP is obligatory
<a href="#"><u>European Technical Assessment Documents</u></a> (Voluntary route for DoP)	ETA "approved" construction product for intended uses	ETA assessed product - test results provided without "judgement" of fitness of use of product in ETA
<a href="#"><u>Obligations of economic actors</u></a> (CPR Chapter III)	Indirect obligations	Specific obligations for manufacturers, distributors and importers
<a href="#"><u>Product Contact Points</u></a> (CPR Art. 10)	None existent under the CPD	Member States shall give information on rules and regulations for construction products. These contact points have to be established by 1 July 2013.
<a href="#"><u>Notified bodies</u></a>	Notified by Member State authorities	Assessed by Member State authorities against specific criteria in the CPR

## Appendix 3

### Changes in the basic requirements for construction works\*

(Source: Council Directive 89/106/EEC, 1989 and Regulation No 305/2011, Appendix 1, 2011)

\* new amendments and changes are marked in red

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#### 1. Mechanical Resistance and Stability

The construction works must be designed and built in such a way that the loadings that are liable to act on them during their construction and use will not lead to any of the following:

- (a) collapse of the whole or part of the works ;
- (b) major deformations to an inadmissible degree ;
- (c) damage to other parts of the construction works or to fittings or installed equipment as a result of major deformation of the load-bearing construction ;
- (d) damage by an event to an extent disproportionate to the original cause.

#### 2. Safety in Case of Fire

The construction works must be designed and built in such a way that in the event of an outbreak of fire:

- (a) the load-bearing capacity of the construction works can be assumed for a specific period of time ;
- (b) the generation and spread of fire and smoke within the construction works are limited ;
- (c) the spread of fire to neighbouring construction works is limited ;
- (d) occupants can leave the construction works or be rescued by other means ;
- (e) the safety of rescue teams is taken into consideration.

#### 3. Hygiene, Health and the Environment

The construction works must be designed and built in such a way that they will, throughout their life cycle, not be a threat to the hygiene or health and **safety of workers**, occupants or neighbours, **nor have an exceedingly high impact, over their entire life cycle, on the environmental quality or on the climate during their construction, use and demolition**, in particular as a result of any of the following:

- (a) the giving-off of toxic gas ;
- (b) **the emission of dangerous substances, volatile organic compounds (VOC's), greenhouse gases or dangerous particles into indoor or outdoor air ;**
- (c) the emission of dangerous radiation ;
- (d) **the release of dangerous substances into ground water, marine waters, surface waters or soil ;**
- (e) **the release of dangerous substances into drinking water, or substances which have an otherwise negative impact on drinking water ;**
- (f) faulty discharge of waste water, emission of flue gases or faulty disposal of solid or liquid waste ;
- (g) dampness in parts of the construction works or on surfaces within the construction works.

#### 4. Safety and Accessibility in Use

The construction works must be designed and built in such a way that they do not present unacceptable risks of accidents or damage in service or in operation such as slipping, falling, collision, burns, electrocution, injury from explosion **and burglaries**. **In particular, construction works must be designed and built taking into consideration accessibility and use for disabled persons.**

### **5. Protection against Noise**

The construction works must be designed and built in such a way that noise perceived by the occupants or people nearby is kept to a level that will not threaten their health and will allow them to sleep, rest and work in satisfactory conditions.

### **6. Energy Economy and Heat Retention**

The construction works and their heating, cooling, lighting and ventilation installations must be designed and built in such a way that the amount of energy they require in use shall be low, when account is taken of the occupants and of the climatic conditions of the location. Construction works must also be energy-efficient, using as little energy as possible during their construction and dismantling.

### **7. Sustainable Use of Natural Resources**

The construction works must be designed, built and demolished in such a way that the use of natural resources is sustainable and in particular ensure the following:

- (a) re-use or recyclability of the construction works, their materials and parts after demolition ;
- (b) durability of the construction works ;
- (c) use of environmentally compatible raw and secondary materials in the construction works.