

# Characterisation of supply chain for reused building components in Europe

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## Abstract

This study aims at better understanding the key agents within the supply chain for reused construction and demolition (C&D) components, identifying the critical reuse barriers and opportunities and to formulate improved strategies which could increase reuse. The study was conducted using interviews and workshops with stakeholders in the construction and waste management process. Important barriers hampering reuse are related to e.g. *costs*; reuse activities may complicate the design, construction, demolition and waste management process which induces additional costs, *quality*; quality assurance of reused material is complicated and rarely offered in the current reuse supply chain but an absolute requirement in many applications, and *weak market structure*; the supply of reused C&D material is limited and varying or non-existing. An important challenge is to create an efficient system for quality assurance of reused materials. This is emphasized in all studied countries which indicate the need to work on these issues at EU level. Incentive structures to stimulate the reuse market are also needed. Possible triggers are e.g. to include a reuse perspective in public green procurement and in green building certification systems. However, in order to create a market based on environmental benefits, these must be documented, based on objective and transparent data, and evaluated against the costs associated to different reuse activities.

*Keywords: Reuse; Construction & Demolition Waste, Waste hierarchy; Supply chain*

## 1 Introduction

Construction and demolition waste (C&DW) is one of the largest waste streams in the EU. A large proportion of C&DW has the potential to be reused or recycled within the construction sector thus contributing to saving natural resources and energy. The Directive 2008/98/EC on Waste, states that by 2020 the material recovery of non-hazardous C&DW shall be increased to a minimum of 70% by weight. To reach this aim, innovative reuse and recycling strategies are needed.

In this context, a study was conducted with the aim to better understand the key agents within the supply chain for reused C&D materials, identify the critical reuse barriers and opportunities and to formulate improved strategies which could increase reuse. The study is part of a 3 year project (2011-2013) within the European 7<sup>th</sup> framework program, *Innovative Strategies for High-Grade Material Recovery from Construction and Demolition Waste* (IRCOW) with the main goal of developing and validating upgraded technological solutions to achieve an efficient material recovery from C&D waste by considering a life cycle perspective.

## 2 Materials and Methods

The study was conducted using interviews and workshop sessions with stakeholders involved in the construction and waste management process including designers, construction companies, demolition

enterprises, waste management companies, reuse agents and authorities. The reuse of C&D materials has been studied in six European countries; Sweden, Germany, Belgium, Poland, Italy and Spain. Based on the interviews the current reuse practices in the participating countries were described. Finally, optimal scenarios to promote reuse in the EU are proposed, in which the reuse barriers considered most significant are addressed.

Reuse is defined in directive 2008/98/EC article 3 §13 as any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.

### 3 Results and Discussion

Singular elements and architectural antiques, i.e. materials with a specific cultural or esthetical feature, are perceived as and considered valuable in all studied countries and a relatively well-developed market exists for such elements. Examples of building antiques that are sold in the reuse markets are old face bricks, floor tiles, wooden floors, antique doors and window frames, wood beams, masonry, marble or slate slabs, wrought iron pieces, etc.

The reuse market for more modern or common products, not involving any esthetical or other cultural characteristic, is much more limited, especially in southern Europe. However, in Belgium and Sweden, some examples of relatively well-organised collection and redistribution systems for reused C&D materials exist and trade is performed both on strictly commercial terms and with an element of social economy support. The businesses are mainly aimed at providing materials to the home renovation market, and the main costumers are private persons and small construction companies. Large scale reuse activities for commercial construction projects are extremely rare and have mainly been limited to a few pilot projects.

#### 3.1 Reuse barriers and opportunities

Important barriers hampering the reuse of C&D materials are related to e.g.;

- **Costs** – reuse activities may complicate the design, construction, demolition and waste management process which induces additional costs. These costs are not always compensated by lower product prices.
- **Quality** – quality assurance of reused material is complicated and rarely offered in the current reuse supply chain but an absolute requirement in many applications. Furthermore, the material properties, chemical content and compilation with legislation are often unknown.
- **Responsibilities** – reused products are usually sold without warranties putting a large responsibility on the building owner (or contractor) if included in commercial construction projects.
- **Assembly methods and material content and properties** - Glued joints and other assembly methods as well as composite materials not allowing for disassembly significantly hamper the reuse potential of C&D materials. Furthermore, hazardous substances, e.g. in many buildings from the 60s and 70s, or inferior technical properties compared to current requirements, e.g. energy performance, limit the reuse of such materials in new constructions.
- **Weak market structure** – the supply of reused C&D material is limited and varying or non-existing, and initiatives are needed to stimulate both the supply and demand of reused C&D materials.
- **Awareness** – the knowledge of reuse possibilities amongst professionals and public is in general perceived as low. There is also a lack of confidence towards reused materials which are seen by many as having lower quality than new ones.

In spite of the barriers, a positive attitude towards reuse of C&D materials could be perceived among several of the interviewed stakeholders. Some believed that resource efficiency will become an increasingly important issue in the construction sector in the future which in turn may favour reuse activities. In addition, the legislative framework (promoting the waste hierarchy and material

efficiency etc.) comprise opportunities for national agencies and municipalities to promote reuse activities in constructions works e.g. in construction and waste management regulations, in land transfer agreements and in environmental goals or green building recommendations etc.

In Figure 1 the important barriers and opportunities in different parts of the construction and waste management process for increasing the *supply* of reusable products is summarized. In Figure 2 the barriers and opportunities for increasing the *demand* of reusable products is summarized.

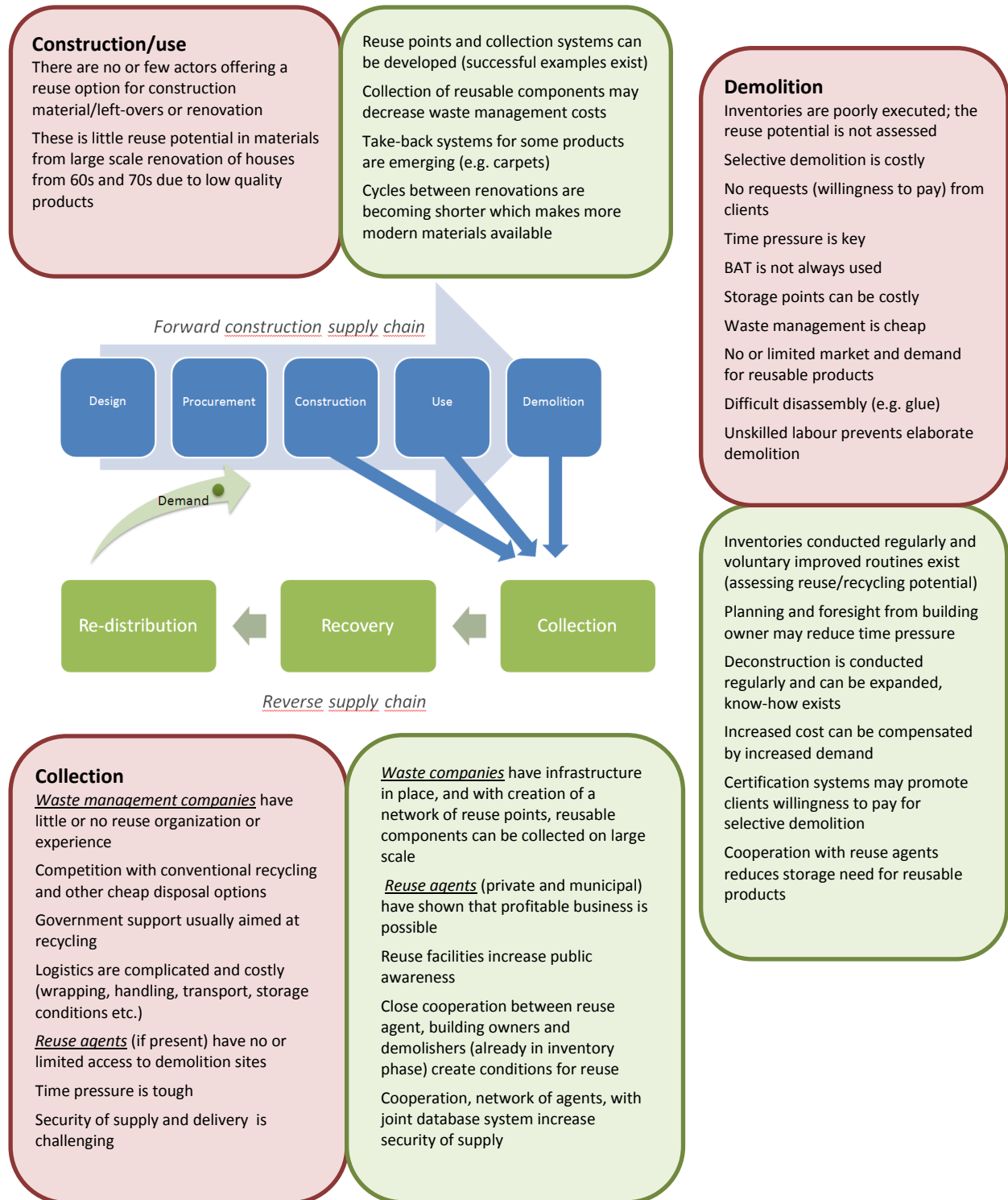


Figure 1. Key barriers and opportunities in different parts of the construction and waste management process considered to be important for increasing the supply of reusable products.

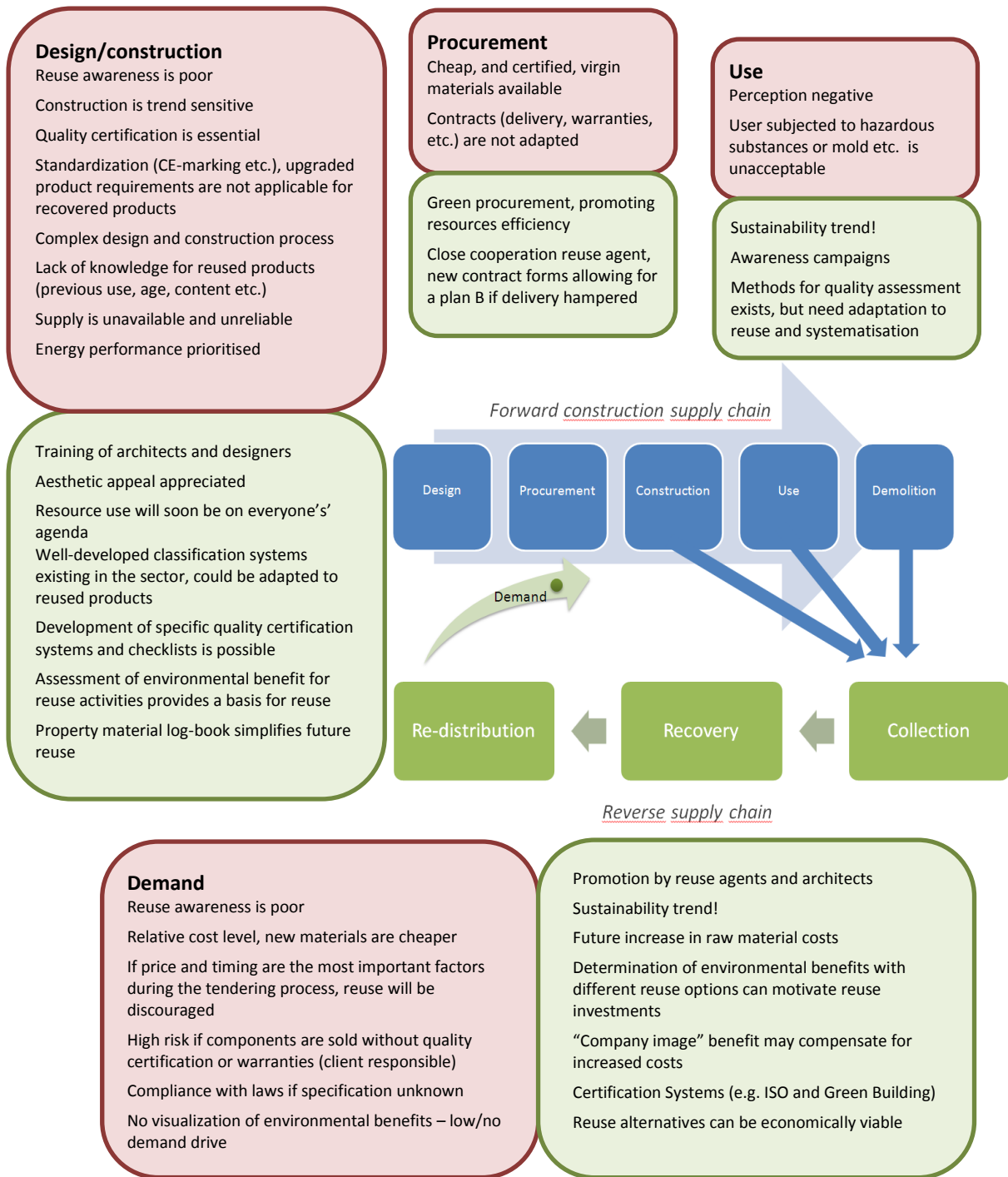


Figure 2. Key barriers and opportunities in different parts of the construction and waste management process considered to be the most important for increasing the demand of reusable products.

### 3.2 Development needed to facilitate reuse activities

Below the identified key development needs that could facilitate reuse activities, and allow for optimal supply chains, are presented.

**Research** on the practical reusability of C&D elements, inventories of available quantities and assessment of environmental benefits of different reuse activities is requested by several stakeholders. Such research could serve as important decision support tool when prioritizing which materials to focus on and in what applications. Data on environmental benefits from reuse activities can increase the demand for reused products based on sustainability and green-image motives, which in turn can be

a very strong driver. Assessments on environmental benefits, e.g. by Life Cycle Assessment, should be based on objective transparent data, preferably produced by independent research institutes and with standardized methods. In addition, more general reuse oriented guidelines and checklists have been requested which could be used as basis for presenting and promotion possible reuse alternatives to clients.

Establishment of a network *reuse points*. In order to increase reuse of C&D materials and components, easily accessible reuse points in which reusable C&D components can be delivered and purchased, thus increasing the supply of such products, is a prerequisite in an optimal reuse scenario. The collection systems for reusable materials can be organized and operated in a number of ways, e.g. by municipal institutions, private companies and charity organisations etc. and with or without labour subsidises. Best practices from Sweden and Belgium, including e.g. reuse facility at municipal recycling centres, private companies collaborating with demolition companies and second hand stores including selective demolition services, can serve as good starting points. The features of the reuse points in an optimal scenario may differ depending on who is supplying the products. Commercial actors (building owners, construction and demolition companies) may set higher demands than private persons on e.g. statistical monitoring of material flows (i.e. statistical services), documentation on the final recovery/disposal of the materials, documentation of the environmental benefit for different reuse activities and may require certified business partners. For private persons, availability may be the most important factor.

Establishment of a *key facilitating actor*, e.g. a reuse oriented industry association that has the power to deal with questions that are difficult to handle by small reuse actors. This association could facilitate reuse activities by working for common quality assessment methods, standardisations, warranty issues and implementation of reused products in the CE-marking structure as well as to develop and provide guides and recommendations on reuse opportunities and associated environmental benefit. In addition, this organisation could manage a database for reused products, creating a network of suppliers and thus increasing the availability and confidence in such products.

Centralization of information through a *database system*. A coordinated database system, connecting several reuse agents, is seen by many actors as an important tool to increase the availability of reusable materials and components. The system could hold information about classification, quantities, dimensions, quality information, location and availability in time (in store or products inventoried, but not yet dismantled) as well as know-how on reuse possibilities and applications and registers of suppliers and contractors. Such a system should preferably be operated at sector level, e.g. by the proposed reuse oriented industry association.

Development of *quality assessment systems* for reused products. In the home renovation market, the quality assessment of reused products is often limited to visual inspection by the buyer. To reach the commercial construction market higher demands are set on:

- Determination/specification of material properties in accordance to the applicable requirements
- Classification of the components
- Matching against laws and regulations (e.g. CE-marking, performance criteria)
- Development and implementation of quality assessment system

It is difficult and costly to organize quality assessment systems for reused products because of the nature of second hand material and the small scale of the involved actors. Common assessment criteria, checklists and warranty systems that can facilitate the quality work have been requested by both reuse agents, architects, designers and constructors, and should be addressed at a sectorial or European level, possibly by the proposed reuse oriented industry association.

Inclusion of reuse in *certification systems*. The concept of reuse and design for disassembly and reusability could be included in Certification Systems, which in turn can be a means to create value in reused materials and thus stimulate demand. Companies are concerned about their green-image, which

is a strong driver. This driver must be met by systematic, transparent certification systems (e.g. Green Building Certification Systems, or other standardized systems), where the benefits are possible to account for in a uniform way. If included in Green Building Certification Systems, these should be designed so that risks of sub-optimization (promoting activities contributing little to, or even reducing, overall environmental performance) are minimized, and there is thus a strong link to the need for research on reusable materials as discussed above.

Development of *contact agreements* in which reuse can be facilitated. Several different common contract agreements are applied in construction projects. Some agreements imply strict boundaries between different stakeholders and clearly state what ones responsibility is and what is not. This might make it difficult to implement new concepts such as including reused products in the construction process. An emerging concept for cooperation in construction projects is the Partnering concept. This concept comprises an improved cooperation between the involved actors where benefits for the entire project favours all involved actors. In cooperation arrangements favouring long-term relationships the opportunities to overcome practical, logistical and legal obstacles can probably increase.

Promotion of reuse in *public green procurement*. Public green procurement has been mentioned by many interviewees as a means to trigger reuse activities. Public construction projects and construction projects on public land may be designed with specific reuse oriented demands thus generating good examples and possibly create favourable conditions for further reuse activities. However, public procurement requires political decisions and that the concept of reuse is incorporated in public environmental goals, green building recommendations and policies etc., which in turn requires a solid knowledge base as decision support. Research on benefits of reuse concepts/applications, as mentioned above, may serve as basis for such decision.

*Reuse related design, product development and construction concepts*. Towards the future, new materials and construction concepts must be developed to allow reuse and adaptation of buildings, e.g. by;

- Applying design for disassembly in building design and using materials assembled by dry connections during construction
- Using more standardized component dimensions and assembly methods which would significantly increase future reuse potential
- Engaging component producers and suppliers in the aftermarket of products offering e.g. take-back systems for construction left-overs and possibly end-of use products, upgrades and repairs services etc.
- Promotion of systems like *BASTA* or similar – material database aiming at phasing out hazardous substances from buildings – which reduce future reuse obstacles associated to hazardous substances
- Further development of the use, and management, of material logbooks for buildings which may be useful when it comes to promoting/considering reuse opportunities in future renovations and demolitions

#### 4 Conclusions

If the needs above are met, together with actions increasing the reuse awareness amongst professionals and the public, then some of the most important barriers to reuse in the demolition, material collection, redistribution and construction process are believed to be overcome. In order to achieve this, cooperation from a number of stakeholders as well as support and initiatives from authorities is required. However, such initiatives may prove to be important, or essential, in order to reach a sustainable use of natural resources within the construction sector in Europe.

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