



FRAMEWORK FOR POLICIES, REGULATIONS AND STANDARDS

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*Vision without action is merely a dream.
Action without vision just passes the
time. Vision with action can change the
world.*

Joel A. Barker

1 INTRODUCTION

BAMB's mission is to enable the shift to a circular building sector, thereby reducing waste, retaining value for materials in the system and slowing down the use of resources to a rate that meets the capacity of the planet. The EU, as well as many national, regional and local governments, see the advantages and need for a circular economy and understand that the environmental and financial gains associated with a circular economy are in the best interest of society.

Policies, standards and regulations will have a crucial impact on the applicability of dynamic and circular building design. For example, in terms of circular business model development, such instruments all have a bearing on value creation. Governments and regulators have the potential to be influencing forces in all phases of a building's lifecycle. In addition, public authorities can take a key role as early adopters and leaders in embedding and normalising circularity.

The transition to a dynamic and circular built environment¹ requires both action and vision. This transition will need systemic changes, boosting opportunities and eliminating barriers, going beyond technical innovation. The Framework for

Circular built environment: a built environment designed according to Reversible Building principles, is with a design and construction strategy that has the ambition to realise buildings whose parts follow material loops and facilitate building alterations and support changing user needs.

Emphasising the ability of buildings and their components to return to an earlier state, this strategy strives for high resource productivity.

It includes a spatial dimension, in which a building can be efficiently refurbished, as well as a technical dimension, wherein a building's components can be disassembled and used again or deconstructed and recycled or biodegraded.

¹<https://www.bamb2020.eu/topics/common-language/reversible-building-building-design/>



Policies, Regulations and Standards provides a roadmap for changes which will allow the transformation of the industry to circular principles, through a set of recommendations to guide policy-makers.

Throughout the BAMB project, the impact of current policies, standards and legislation on the implementation of circular and dynamic buildings has been considered and analysed. The Framework for Policies, Regulations and Standards is the culmination of a series of tasks under the heading *Standards and Regulations for reverse logistics and circular value chains in buildings*, as well as work carried out in the development of the State of the Art report on Policies and Regulations, which provided an analysis of current policies and regulations related to the circular built environment. Research has been undertaken at different policy levels (from EU, through national and subnational, to local) and for different links in the circular value network², and the results have been collated and analysed. This work, along with interactions with different stakeholders and policy platforms, has led to the development of this Framework for Policies, Standards and Regulations, which contains recommendations for the future development of policies, standards and legislation that will better favour the applicability of dynamic and circular building design.

Following the introduction, the methodology for developing the Framework is presented, explaining the tasks which have contributed to the understanding of current policy instruments. This is followed by four sections which summarise and develop conclusions based on work carried out during the course of the project in the following areas:

- State of the Art – a review of current policies and regulations at the EU level, at the national level in Sweden, Belgium, Portugal and the UK, and at sub-national level in Ronneby Municipality (Sweden), the Brussels Capital Region and the Flemish Region (Belgium).
- Interactions with other platforms and policy bodies – the project has collaborated and participated in events with many platforms and policy bodies throughout the duration of the project. Intelligence on policy and regulation gained during these interactions has been captured to form part of the framework and its recommendations.
- Impact Assessments – in-depth analyses of five current or past policies/ regulations to identify success factors and barriers to the uptake of circular building principles. Policies examined were at the national or sub-national level:
 - the Swedish Environmental Objectives (1999, 2009),
 - the Site Waste Management Plan Regulations (2008) in the UK, which have now been repealed,

Circular value network: The circular value network of a building is the set of interrelated activities performed by companies of a specific industry to maintain or increase the social, financial or environmental value of that building and its parts.

² <https://www.bamb2020.eu/topics/common-language/circular-value-network/>



- the circular economy programme adopted in the Brussels region of Belgium - Programme Régional en Economie Circulaire (PREC) (2016-2020),
- Tracimat (2018), a demolition inventory system for certifying the quality of construction and demolition waste in the Flanders Region of Belgium,
- Incorporação de 5% de materiais reciclados (2011), a procurement tool requiring a percentage of recycled materials to be used in the construction of public buildings in Portugal.
- Best Practices – a review of a range of (often emerging) mechanisms considered to have direct relevance to the desired BAMB Systemic Changes, to be innovative and to promote a change towards Circular Economy thinking. Best practices were drawn from around the world and included the Act for the Promotion of Long Life Quality Housing (2009) in Japan, Be.Circular (PREC) in the Brussels region of Belgium and the Public Procurement Rules of the Rijkwaterstaat (the Ministry of Infrastructure and Water Management) in the Netherlands.

The final section brings together the conclusions drawn from the four areas above and provides a set of recommendations for the future development of policies, standards and regulations which will better favour the applicability of dynamic and circular building design.

2 METHODOLOGY

The research in policies, standards and regulations was divided into four sections (see Section 1):

- State of the Art,
- Interactions with EU and other platforms,
- Impact assessments
- Best practices.

These four areas were selected to provide a breadth and depth of research to identify a range of success factors, as well as barriers and opportunities, from current policies, standards and regulations (see Figure 1 below). Additionally, the best practices would allow new or developing trends to be uncovered.

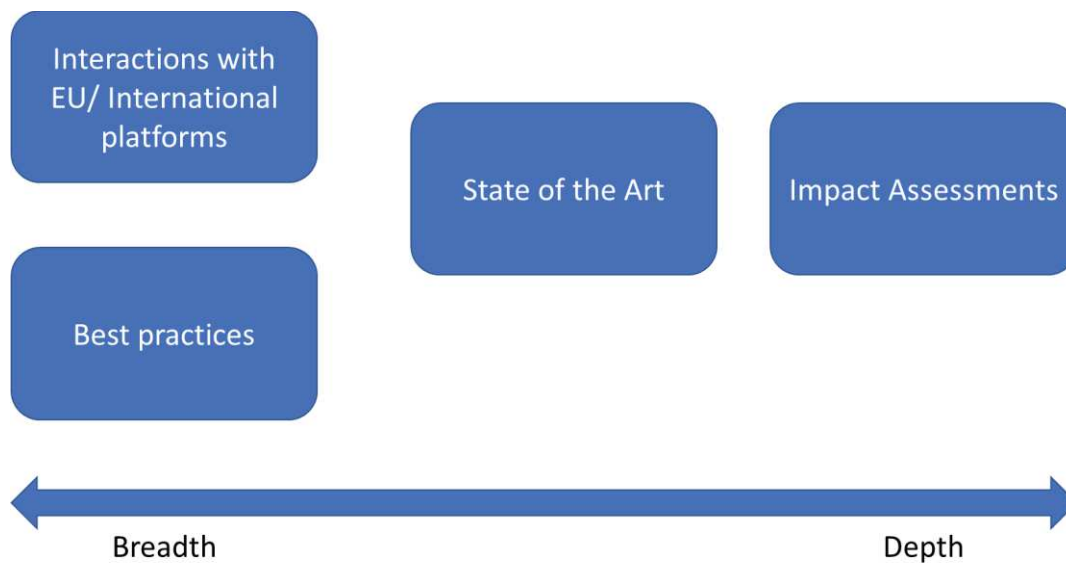


Figure 1: The approach to ensuring breadth and depth of research for the framework

To allow effective analysis of the various policy instruments, it was first necessary to narrow the geographical scope to be investigated through the State of the Art and Impact Assessments. This was necessary to take account of language barriers and knowledge of the policy structures in place in the countries to be selected. In addition to broadly applicable EU level regulations, four countries were identified based on pilot locations and the geographical activity of the involved BAMB partners in order to sufficiently narrow the scope for an in-depth analysis at the local and national levels, and to take account of language barriers for analysis.

The geographical limitation is shown in Figure 2 below:

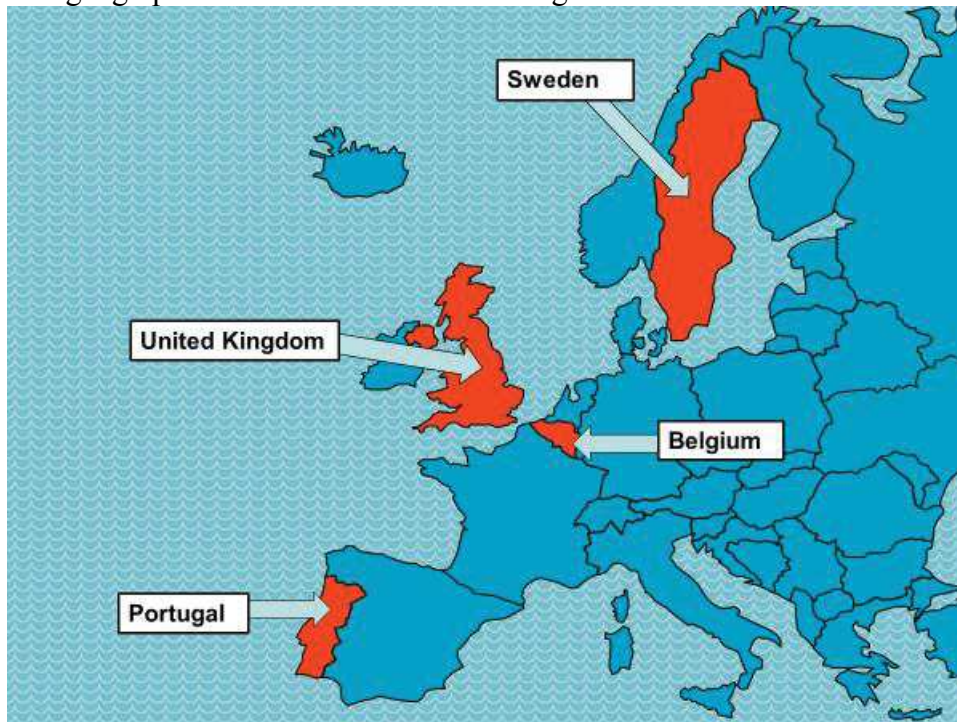


Figure 2: The geographical limitation for the State of the Art and Impact Assessments

For interactions with EU and international platforms, and for the gathering and analysis of best practices, no geographical limitations were set.

State of the Art

The State of the Art chapter presented in Section 3 summarises and updates the policy content of the full State of the Art report (D1), published by the BAMB consortium in 2017.

The State of the Art report collated information on all relevant current policies, standards and regulations in the European Union, Belgium, Portugal, Sweden and the United Kingdom. In addition, policies and regulations at sub-national level in Ronneby Municipality (Sweden) and the Brussels Capital Region and Flemish Region (Belgium) were considered. The policies were then analysed for the potential opportunities and barriers to dynamic and circular building design.

For this Framework, the full State of the Art report was reviewed to identify any significant changes or new policies arising since the report was submitted. It was then further analysed to provide a synthesis of the current status, to identify opportunities and to provide recommendations for existing and future policies.



Review of collaborations with EU and international platforms

Throughout the BAMB project, the consortium has established and maintained links with a number of platforms, both European and international, related to the built environment sector and/ or aligned to circular economy principles.

For the development of Section 4, all collaborations were collated and summarised. They were then analysed to identify the lessons learned and to draw conclusions on policy instruments and opportunities and current direction of travel related to circular and dynamic building design.

Impact Assessments

Five policies were selected for a detailed impact assessment (IA) to provide insight into the design of policies and standards and to allow the identification of success factors (and barriers) to successful policy design and implementation which could be harnessed to support the implementation of the BAMB vision. Policies were chosen from the long list developed from the State of the Art report, having been prioritised according to a set of selection criteria. The full methodology for selection is given in Section 5.

The five policies represent a range of policy and regulation mechanisms: national framework, procurement legislation, industry regulation, sub-national programme and sub-national industry certification system. All were chosen for their applicability to the BAMB vision and to the built environment.

The detailed IA for each policy was summarised in Section 5, barriers and opportunities for the move to a dynamic and circular built environment were identified. The full impact assessments are provided in Appendix A.

Best practices

Throughout the project, BAMB partners have gathered examples of best practice from around the world which illustrate behaviours and mechanisms which would support the move to a dynamic and circular built environment. These were collated and scored against a set of criteria to identify those which would be further researched and included in this paper. (A detailed methodology is provided in Section 6).

The 16 selected best practices were analysed in detail to provide a detailed assessment of their alignment to BAMB systemic changes, their circular economy impact and their level of innovation. A summary of each of the best practices is provided in Section 6, along with recommendations for adoption or adaptation.



The role of the Special Interest Group

A stakeholder network has been developed alongside the project to disseminate information from the project and to enable collaborative work with interested parties. Members are drawn from across the built environment industry area, as well as policy and research. Within the stakeholder network, the Special Interest Group (SIG) on Policies and Standards has over 240 members from 28 countries. The most represented countries are the UK, Belgium and the Netherlands.

Members of the SIG have participated in discussions on policy, standards and regulation throughout the project and have proved a valuable source of expertise and information, providing feedback on research into policy and regulation and examples of best practice.

The Framework report

The broad range of research and analysis carried out in the field of policy and regulation has been brought together in this Framework report. The Framework identifies success factors for policy and regulation which have the potential to overcome existing barriers, and exploiting emerging opportunities, as well as highlighting current regulations and policies which could support the transformation to dynamic and circular building design. In addition, gaps in policy have been identified and recommendations developed for future policies and regulations to facilitate the transition towards a circular built environment.



3 REVIEW OF STATE-OF-THE-ART ON POLICIES AND STANDARDS

3.1 Methodology

This state-of-the-art analysis has the objective to provide an overview of the current policy instruments that are considered to have relevance in relation to promoting, or possibly hindering, the adoption of circular economy opportunities in the built environment. The analysis has been done on the European level, as well as on the national level for 4 Member States (Belgium, Portugal, Sweden and UK) and 3 sub-national entities (Ronneby Municipality; Brussels Capital Region and Flemish Region). The geographic scope has been defined based on geographic dispersal, as well as the access to information (including linguistic barriers) – and thus limited to the partner countries of the BAMB project.

A policy matrix has been developed to identify the different types of existing policy mechanisms and legislation (legal instruments, financial instruments, public investment, raising awareness) for different policy levels (EU, national, sub-national) across the value chain. This matrix has enabled mapping the existing policies linked to circular and dynamic building and further refining the scope.

Based on the mapping of existing policies, a State-of-the-art Report on Policies and Standards was drafted at the end of 2016, paying attention to summarize identified policies and instruments' content, as well as the opportunities and barriers that they present for the adoption of the BAMB tools and the shift to a circular building sector.

To get broader feedback on the initial conclusions and trends illustrated within the 2016 report, a workshop was conducted in January 2017 with the BAMB Stakeholder Network Special Interest Group on Policies and Standards. Information was also exchanged with the European Regional Development Fund (ERDF) project “Le Bâti Bruxellois, Source de nouveaux Matériaux”³ (BBSM) research team with regards to the investigated policies and standards, in order to guarantee complementarity of the research and avoid duplication.

Since January 2017, some policies related to the built environment and/or circular economy have been evolving and new policy instruments and standards have been introduced. Below is a list of the most relevant policy developments and updates identified:

- The revised *Waste Framework Directive* (2018/2008/98/EC) clarifies the definition and use of construction and demolition waste for back filling, as well as increasing the focus on waste prevention.

³<https://www.bbsm.brussels/en/home/>



- The *EU Construction and Demolition Waste Protocol and Guidelines* has been launched with the overall aim to increase confidence in the construction and demolition waste management process and the trust in the quality of construction and demolition recycled materials.
- The communication from the European Commission on *Resource efficient opportunities in the building sector* has led to the development of *Level(s)*, a voluntary reporting framework to improve the sustainability of buildings and a transition towards a circular economy within the building sector.
- An ISO Standard “*ISO / CD 20887 Design for Disassembly and Adaptability of Buildings*” is under development.
- The European Commission’s communication on *The implementation of the circular economy package: options to address the interface between chemical, product and waste legislation* explores the four most critical issues identified in the way the legislation on chemicals, products and waste work together and how these are hampering the development of a circular economy.
- The Brussels-Capital Region drafted a strategy for reducing the environmental impact of existing buildings by supporting the energy efficient and sustainable refurbishment of the Region’s building stock.
- Within the Flemish regulation VLAREMA, a new acceptance and processing policy for producers of recycled aggregates came into force in August 2018. From this point, all producers of recycled aggregates shall differentiate between materials with high and low environmental risk.

The conclusions and recommendations presented in this chapter build on the State-of-the-Art analysis, while considering these new developments. In addition, though extending beyond the defined geographical scope, findings from the BAMB pilot projects have been a source of input.

3.2 Conclusions

Energy performance

From the different policy instruments relevant to promoting, or possibly hindering, the adoption of circular economy opportunities in the built environment, the binding legislations mainly focus on energy performance and construction and demolition waste management.

This results from the transposition by Member States of the requirements of the revised *Energy Performance of Buildings Directive* (2010/31/EU) into their legislation. The effective level of requirements depends on the Member State and the (sub-) national context.

Even within sustainable building and circular economy policy instruments, energy remains a key focus point. For example, the *Flagship Initiative 4: “Resource Efficient Europe,”* of the EC’s *Europe 2020 10-year Strategy*, supports the shift towards a low carbon economy,



increasing the use of renewable energy sources, modernizing the EU's transport sector and promoting energy efficiency.

Waste and materials

As with energy, waste regulation results from the transposition of the requirements of the *Waste Framework Directive* (2018/2008/98/EC) by Member States at the national and sub-national level. While the Scottish government, for example, has developed a Zero Waste Plan, and the Flemish government has set up a Regulation on recycled aggregates, Portuguese waste management is not yet defined and implemented as in other EU countries.

Although in the last revision of the *Waste Framework Directive* more emphasis is put on waste prevention, the major focus of current initiatives remains on waste management, recycling and improving the uptake of secondary raw materials. This is amongst other things supported by the *EU Construction and Demolition Waste Protocol and Guidelines*, *EU guidelines for the waste audits before the demolition and renovation works of buildings*, and the objectives of the *European Innovation Partnership on Raw Materials*.

Hazardous materials

The use of substances in construction products which have a negative impact on human health and/or the environment might not only have a negative impact through their 1st life-cycle but will also hamper their future reuse and high quality recycling. The regulation concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) aims to ensure a high level of protection for human health and the environment.

Furthermore, the European Commission's communication on *The implementation of the circular economy package: options to address the interface between chemical, product and waste legislation* aims to prevent hazardous chemicals from entering the material cycle as well as staying in the material cycle through recycling.

In addition, a transparent communication on the content declaration as well as the use of Materials Passport would support the identification of potential hazardous substances in the future for which no clear information is available today. This will facilitate the identification and decision making for safe reuse and recovery in the future.

Voluntary instruments

Policy instruments aiming to promote waste prevention and reuse – meeting the circular economy objectives such as 'designing out waste and pollution' and 'keeping products and materials in use at their highest utility and value at all times' – are mostly voluntary.

Similarly, most policy instruments supporting sustainable building design and construction, comprising building materials' (environmental) assessment, are voluntary instruments. For a long time, these instruments have been developed at national or sub-national level. Private certification schemes have also demonstrated having a positive impact on sustainable building design. Based on this positive impact and as a result of the *Communication from the Commission to the European Parliament, the Council, the European Economic and Social*



Committee and the Committee of the Regions on Resource efficiency opportunities in the building sector, a voluntary reporting framework to improve the sustainability of buildings has been developed at the European level: Level(s). Using existing standards, this voluntary framework provides a common EU approach to the assessment of the environmental performance in the built environment based on life-cycle thinking and a circular economy approach.

Complex supply chain

The building sector is characterized by a complex and multi-disciplinary supply chain, which is reflected by the wide range of policies impacting it. It is important to assess the impact of (future) policies on the different links of the value network. The *Construction Products Regulations* e.g. offers a common language and harmonized rules that could allow for reprocessed, recycled and reused materials to be widely exchanged by providing confidence in their performance and quality. However, obliging the CE marking for all reclaimed construction products could, depending on the type of construction product, have a contradictory effect and even distort existing second-hand markets, as a result of the complexity of the process and the resulting cost. It is therefore crucial to systematically investigate the potential barriers and opportunities for the different links of the value network.

3.2.1 Barriers

The current complexity of legislative frameworks, and the fragmentation of policies over the different policy levels, may lead to a lack of integration of the different policies and in some cases could result in contradicting policy mechanisms.

It could be argued that a key barrier comes from energy efficiency policies across Europe. The prioritization of energy efficiency and the high energy performance of buildings may unintentionally result in building designs and materials which do not lend themselves to deconstruction and reuse. It is not the high performance itself that could hamper the adoption of dynamic and circular building design, but the choice of construction techniques and materials to achieve the required performance. For example, in seeking to create an airtight connection between building elements to improve energy efficiency, connecting materials may be used which make it difficult to deconstruct and reuse the parts. The BAMB Reversible Building Design work package has developed a Reversible Building Design Protocol including connections to enable resource efficient repair, re-use and recovery of building materials, products and components such as floors, windows, ventilation systems and internal walls.

Furthermore, the definitions provided by the *EU Waste Framework* seem to lack clarity. As a result, high recovery rates recorded in many countries may correspond to down cycling of stony fraction used for road foundation, which is far from the objective and strategy of buildings as material banks as understood within BAMB.

An additional barrier can be seen in the fact that until recently many of the existing policies and instruments have been developed from a linear viewpoint, which does not take into consideration the potential reality of a circular built environment. For example, current urban regulations and building permits are based on a linear and static vision of buildings which



may impede changes and transformations supported by reversible design and materials recovery. This was illustrated in the BAMB pilot in Brussels, the Circular Retrofit Lab, which experienced difficulties when applying for a building permit. All changes to the building are required to pass through a separate permit procedure, each taking up to nine months, as current permit rules do not allow for reversibility and adaptation.

Similarly, some financial incentives require complete ownership of buildings, which may be contradictory to new business plans and ownership models within a circular built environment. Moreover, the implementation of new circular business models such as 'products as a service' are hampered by the lack of clarity regarding legal and judicial aspects and the responsibilities and liabilities that are related to these new ways of working.

Although a life-cycle approach is recognised more and more as being essential to support the transition towards a circular economy, currently used life-cycle assessment methods within the European built environment, such as prescribed by the CEN TC 350 and PEF, are still based on a linear vision. Both methods consider potential (net) environmental benefits or impacts resulting from recycling, energy recover and reuse of building products. However, there is a lack of methodological support regarding the assessment of buildings that are designed to be transformed easily and building components that have the potential to be used again multiple times in the same building or other applications. Further in this section, we give some insights how the BAMB project explored the refinement of the LCA methodology, to tackle these methodological issues.

At the moment of writing this report, the standard EN15804 (building product level) is still under amendment process and plans are undertaken to revise the standard EN15978 (building level). For both standards the alignment with the PEF methodology has been demanded by DG Environment. However, there is still no consensus on how to tackle the end-of-life allocation issue, as CEN TC 350 and PEF methodologies differ greatly on that point. The current CEN TC 350 standards incorporate a cut-off approach moving potential benefits related to (multiple) reuse outside of the system boundaries. Within the PEF approach the system is expanded to incorporate future benefits related to reuse (of a product) but, this is more labour intensive regarding data inventory, and lack clear guidelines on building level.

The lack of companies and stakeholders' knowledge and awareness has also been identified as an important issue with regards to the implementation of effective resource and waste management, as well as the adoption and use of Materials Passports and Reversible Building Design tools.

3.2.2 Opportunities

Although the lack of clear definitions is seen as a potential barrier, the EU Waste Directive also offers an opportunity to support the transition towards a circular building economy. The Directive introduces the "polluter pays principle" leading to Landfill Taxes in several countries. The increasing cost of landfill provides an economic driver for alternative solutions, such as reversible building design, which avoid end-of-life waste. Furthermore, the *Waste Framework Directive* (2015/2012/2008/98/EC) has been revised in 2018, increasing



the focus on waste prevention and minimum requirements for Extended Product Responsibility (EPR). The revised document promotes repair and reuse and a transition towards sustainable production and consumption models. Further clarification of the current definitions, as well as the definition of clear reuse targets, could help to increase the quality level of the recovered, reused and recycled materials.

Such an integrated approach is also essential if we want to avoid today's energy efficiency actions hampering tomorrow's recovery of valuable materials. The *Energy Efficiency Directive's* (2012/27/EU) requirement to refurbish 3% of public building stock per year offers the incredible opportunity to do things better and to respond to a variety of challenges in a sustainable and effective manner.

Emerging initiatives such as *Level(s)* and the ISO standard *ISO / CD 20887 Design for Disassembly and Adaptability of Buildings* (see also Chapter 6) are emphasising the importance of design and more specifically design for disassembly and adaptability. Amongst other things, these initiatives are promoting the extension of the service life of the building as a whole, either by facilitating the continuation of the intended use or through possible future changes in use; as well as facilitating the future circular use of building elements, components and parts that make up a building's material bank. They provide design principles and emphasise the importance of assessing the performance across additional areas, such as future reuse potential, reclaimed content contribution to reduced embodied carbon, and adaptability to change use and/or capacity. In addition, there is a need of environmental and circularity benchmarks; target performance values with which (future) buildings should comply.

Resource efficiency is hindered by inadequate business-to-business information on what substances and materials products contain. Such information is needed to know how products can be repaired, remanufactured or recycled, and if the presence of certain chemicals can constitute technical or health barriers that prevent recycling. To tackle this issue the *EC Communication on the Options to address the interface between chemical, product and waste legislation* has been drafted. This increasing awareness of the need to provide clear information on material and product characteristics to support resource productivity is fully in line with the objectives and developments of the BAMB Materials Passports.

More recently a new wave of circular policy development is underway. *The Circular Economy Package* (EU), the *Circular Economy Strategy* (Scotland), the *Regional Program for Circular Economy* (Brussels Capital Region), etc. have been adopted. All of these instruments identify construction and demolition waste and the building sector as essential pillars to address. However, it is noted that the role of design of buildings and building products has not been addressed.

This provides a significant opportunity to reframe sustainable building policies and instruments to allow for a circular approach. While the wealth of data provided through the existing voluntary programmes, plans, strategies and tools will feed into BAMB's tools and support carrying out circular and dynamic buildings; the BAMB tools will also serve as interesting input to further strengthen existing mechanisms and enable their adaptation and better implementation within a circular built environment.

3.2.3 Recommendations

The recommendations that can be drawn from the State-of-the-art Analysis can be subdivided in 3 categories: general recommendations and a new policy vision, the extension of existing policies, and adaptations of existing policies.

General recommendations and a new policy vision

3.2.3.1 Overcoming fragmentation

One of the main barriers that has been identified is the fragmentation of the policies over the different policy levels as well as between the different policy domains. This leads to a lack of integration which in some cases leads to contradicting and conflicting policies. Therefore, an inclusive policy approach that tackles the fragmentation of policies between different policy ‘silos’ and between different policy levels is necessary.

A clear direction and an integrated and homogeneous approach should be provided on the higher policy levels (European and Member State). However, these policies should enable, if not support, innovation on a sub-national and local level. In Sweden for example, building regulations are defined on a national level which doesn’t allow municipalities to enforce a more ambitious and circular local regulation for construction and buildings. The ‘Permit to do’⁴ - a French law, enables providing certain deviation possibilities regarding urban development regulations to support innovation - providing a 'permit to do' instead of a 'permit to build.' In some European member states, such as Belgium and the Netherlands, Living Labs provide an interesting way of how innovation and experiments are possible within a regulated domain.

Furthermore, linking the requirements regarding energy performance of buildings to other requirements such as the environmental impact of buildings, resource effectiveness of buildings and reversible building design, could enable a more integrated vision on the importance of design of buildings (and products) on sustainable resource use – energy and non-energy related. For example, the recently developed BBKA low carbon building certification in France which has an emphasis on the total carbon impact, including material/embodied aspects⁵.

3.2.3.2 Health impacts

In addition, it is important to align strategies to (re)use resources in a responsible way with health strategies in which the selection of building materials and the design of the building improve the quality of indoor as well as exterior environment, instead of deteriorating it. Through reuse of buildings and building components, the manufacturing of new building products and the extraction of primary resources are avoided, and by doing so also potential harmful emissions to air, water and soil. However, an important attention point, is the potential risk on indoor air quality by reusing old building products that were made in a time

⁴ L'article 88 de la loi LCAP du 7 juillet 2016 « Permis de faire » Le décret n° 2017-1044 du 10 mai 2017

⁵ <https://www.certivea.fr/offres/label-bbca-batiment-bas-carbone#>



where toxicology and law enforcement (cf. REACH) was not as far as today. Hence, the importance of historic data on reclaimed building products, e.g. through Materials Passports.

3.2.3.3 Cost

Reversible building solutions are often perceived as too expensive compared to the conventional solutions, which have been optimised over decades. This reflects a short-term perspective, in which the financial investment cost is considered a principal decision criterion, not looking at potential financial gains and the individual or societal added value that circular and reversible building solutions could deliver over their entire service life. Having a great impact on the environment and society, a new policy approach is needed for the current building industry, one which integrates external environmental and societal costs as well as a long-term perspective.

The internalization of external costs should be an inherent part of (public) procurement processes. One of the best practices case studies which can be referred to in this context is for example the case of the procurement process developed by Rijkswaterstaat - the Dutch executive governmental organization responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands.

3.2.3.4 Extension of existing policies

Existing hard laws on energy performance, waste management and construction product regulations offer the opportunity to address certain aspects supporting the implementation of dynamic and reversible buildings. Extending these policy instruments by integrating Materials Passports and Reversible Building Design principles would enable the development of an integrated approach regarding climate change, energy, environmental and economic issues.

It is noted that in some countries, 50% to 65% of all national global warming emissions are directly related to material related processes⁶. According to Ecofys and Circle Economy, current climate change mitigation actions mainly focus on energy efficiency, renewable energy and reduced deforestation, which equates to a reduction of 13 billion tonnes of CO₂e in 2030. However, 26 billion tonnes of CO₂e is needed to meet the Paris agreement target of reducing global temperature increase to 1.5°C. Policy (but also market and civil) actions supporting circular economy measure could, according to Ecofys and Circle Economy, cover half of the gap to meet the Paris agreement.

3.2.3.5 Energy Efficiency Directive

The *Energy Efficiency Directive* (2012/27/EU) revised in December 2018, requires the establishment of a long-term strategy for mobilising investment in the renovation of the national stock of residential and commercial buildings, both public and private (article 4), the annual renovation of 3% of public buildings owned and occupied by National central governments (Article 5), public procurement focusing on high energy performance of

⁶<https://www.ovam.be/link-tussen-materielenbeleid-en-klimaatbeleid>



buildings (Article 6) and the reduction of embodied energy (Article 7). The articles 6 and 7 should be further developed as one article focusing on the high resource performance of buildings and integrating energy efficiency, resource productivity and the reduction of the environmental impact.

3.2.3.6 Emissions Trading System

Further concerning the prominence of energy and emissions targets in existing policies, it is interesting to note a missed opportunity to target the construction sector specifically in order to reach the EU's greenhouse gas emissions and energy efficiency targets. Construction is not an industry specifically targeted by the Emissions Trading System, but when looking at the figures for GHG attributed to construction (40%) in Europe, it seems necessary to set clear and specific targets for the sector. As power and heat generation are already targeted by the ETS system, emissions targets specific to construction products manufacturing and construction processes could facilitate greater accountability and coherency across environmental policies. Furthermore, we have to acknowledge the limits of the EU ETS system, as it is currently susceptible to 'carbon leakage', in which some businesses transfer production activities to other countries with laxer or no emission constraints and may lead to even bigger amount of global greenhouse gas emissions. However, most of the building product manufacturing industries are characterised by local businesses – this is especially the case for stony materials – which are easier to regulate and control.

Moreover, there is an opportunity to link circular buildings with decarbonisation. Metrics could be set to acknowledge the carbon credit linked to dynamic and circular building design, which could then contribute to decarbonisation goals and tools by recognising CO_{2e} savings. The BAMB Circular Building Assessment method supports the environment net benefit evaluation of circular building scenarios against linear, business as usual, design choices.

3.2.3.7 Construction Product Regulation (CPR) and Environmental Product Declarations (EPD)

More information is required on the composition of materials and their impact on health as well as on the characteristics of building materials and products in regard to their potential for resource recovery and reuse. Different initiatives such as the *Construction Product Regulation (CPR)* and *Environmental Product Declarations (EPD)* provide information on material and product characteristics. A construction product covered by a harmonized standard (or a European Technical Assessment) according to the CPR, must have a performance declaration and be CE marked to be sold. EPD is an independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impact of products. However, the information required by CPR and EPD is currently insufficient to support effective resource recovery and reuse. A standardized and harmonized data set (required data content and data format) providing this information is required to build on and complement these existing initiatives, enabling producers to extend the information they provide for these existing initiatives with valuable information to support the transition towards continuous loops and a circular built environment. The *Construction Product Regulation* requirement 7 'Sustainable use of natural resources' could e.g. be further



developed to embrace a Buildings As Materials Bank vision⁷ supporting the transition towards a circular economy in the building sector. Further on, one aim of the CPR is to improve the free movement of construction products within EU but a Member States may not unilaterally introduce complementary national regulation, even if they consider shortcomings or gaps in the harmonized standards. One such example is to make more far-reaching demands through national legislation than the CPR on accounting for the chemical content of construction products. Such regulation may affect the ability to sell building products and thus constitute trade barriers.⁸

Furthermore, in addition to providing clear information on the material/product composition and its potential for future recovery through circular end-of-life options, it is also crucial to have information on the product's use life. Enhancing the traceability and data collection of the life cycle(s) of materials/products in a structured database could enable defining the recovery value and effective end-of-life options.

Through the revised *Waste Framework Directive* (2018/2008/98/EC) the European Commission aims to increase the focus on waste prevention and minimum requirements for Extended Product Responsibility (EPR) by promoting repair and reuse and a transition towards sustainable production and consumption models. To do so, some of the recommendations drafted in the *EU Construction and Demolition Waste Protocol and Guidelines* could be extended.

- The implementation of pre-demolition waste audits could be extended to pre-development audits in a first stage. In a second stage, the use of Circular Building Assessment tools, such as the one developed within the BAMB project, could enable to define a clear view of the reuse potential on building / product and material level, eliminating the need for future audits. This, however, requires a shift from end-of-life waste management to early design waste prevention and resource management.
- The enforcement of traceability along the waste chain could be extended towards a traceability of all products and materials along their different life-cycles based on the use of digital sets of information stored in structured database as described above. For example, QR codes and RFID tagging could be used to access information on materials, toxicity, manufacturer and history of building elements to support their reuse.
- Town planning comprising the development of recycling plants in urban areas should also incorporate development of stockpiling and refurbishment facilities to support the reuse and continuous loops of materials and products.
- The quality management of secondary raw materials should be extended to the quality management of reclaimed and refurbished materials and products. The use of digital sets of information such as Materials Passports will facilitate the quality management of the re-claimed products of the future.

⁷ <https://www.bamb2020.eu/topics/blueprint/vision/>

⁸ Judgment of the Court (Tenth Chamber) of 16 October 2014 — European Commission v Federal Republic of Germany Case C-100/13.



- An open market for recycled content facilitated by public procurement should be extended to an open market for reused and refurbished materials and products and incentives for their use considered.
-

3.2.3.8 Towards a standardized framework

Different circular framework programmes are embracing the built environment as one of the main pillars to be addressed. Most of them lack clear objectives regarding the metrics to be reached as well as quantitative decision making and assessment / measuring tools that enable supporting the implementation and the monitoring of resource productivity. The adoption of Materials Passports, Reversible Building Design and Circular Building Assessment tools, such as developed in BAMB, enable meeting this gap.

However, it is important that a standardised framework, comparable to the Energy Performance of Buildings Regulation, is set up to guarantee a common language and assessment method that provides a clear direction to the sector in the different Member States. The integration of the BAMB tools (Reversible Building Design and Circular Building Assessment Tools) within the further development of existing sustainability schemes such as *Level(s)* could enable providing such a framework. This could permit the integration of different environmental aspects comprising energy efficiency, resource productivity and sustainable building in one integrated and coherent approach.

Furthermore, besides quantitative measuring tools, the circular framework programmes should integrate policy action that supports awareness and knowledge development of the different stakeholders of the value network with regards to the different aspects characterising the innovations of a dynamic and circular built environment through tools⁹, training and raising awareness regarding Reversible Building Design, Circular Building Assessments and indicators, business models, etc. In addition, policymakers can stimulate circular niche activities through, for example, supporting living labs and lighthouse projects.

3.2.3.9 Adaptation of existing policies

In 2005, the EU published its strategy on the *Sustainable Use of Natural Resources* (COM(2005)670). This emphasised the importance of sustainable production and consumption for the prosperity of Europe and included considerations of the application of Life Cycle thinking to policy. However, the existing life-cycle assessment tools are built on a linear vision of the building industry which at best incorporates recycling. The concept of multiple cycles of reuse as defined within the BAMB project is not adequately considered neither in the current frameworks nor in the end of life options. It is therefore essential to

⁹More initiatives such as *The Circulator* which is a project funded by [EIT Raw Materials](#) aimed at supporting aspiring entrepreneurs in making conscious **strategic choices regarding the sustainability of their business model** and value proposition and BMIX (<http://vlaanderen-circulair.be/bmix/index.php>).



review the current life-cycle assessment frameworks by integrating a vision of circularity and extending the end-of-life options.

The implementation of circular economy and reversible building solutions will necessitate the adaptation of local building legislations where they are acting as a barrier. For example, according to the Dutch building codes and law, the leasing of a façade system was judicially not possible because it is a structural part of the building. The Dutch Association of Metal Window and Façade Producers, VMRG, developed a contract based on emphyteusis (the right to a long-term lease) which enables the producer to remain the owner of the façade system and implement a “Product as a service” business model within the existing judicial structure. Building codes and regulations are developed based on the static character of the current built environment, which hampers the ease of transformation of buildings, as well as the implementation of circular building solutions linked to circular business models such as product as a service models. Adaptations to current legislation are needed to enable new models of ownership. Similar responsibilities and liabilities corresponding to these innovative and circular building solutions need to be defined to support the transition.

Furthermore, current building codes such as the Eurocodes are also developed with a static built environment in mind. The disassembly of buildings, systems and products might require an alternative approach to meet the required structural performance.

4 REVIEW OF COLLABORATIONS WITH EU AND INTERNATIONAL PLATFORMS

4.1 Methodology

Over the course of the project interactions and collaborations have been set up with different types of public bodies in different European countries as well as with European and International policy platforms. These interactions have enabled to, on the one hand, learn from current developments in the field of policy and standards related to circular economy in the built environment and, on the other hand, share and discuss the concepts and output developed within the Buildings as Material Banks project.

The set-up of the Special Interest Group on *Policies and Standards* has furthermore enabled to exchange with a broader group of interested stakeholders on the different aspects related to policies affecting the transition towards a circular economy. The outcomes produced by the BAMB project in the development towards the drafting of the Framework for policies and standards have also been shared and discussed within this Special Interest Group. For example, a workshop has been organized to discuss the State-of-the art document, in which current policies have been described as well as the barriers and opportunities they present regarding a circular and dynamic built environment.

This chapter will summarize the different interactions that have taken place as well as the lessons learned that could be drawn.

4.2 Description of the platforms and interactions

4.2.1 CEN TC350 working group 3

CEN/TC350 is responsible for the development of horizontal standardized methods for the assessment of the sustainability aspects of new and existing construction works (buildings and civil engineering works), including horizontal core rules for the development of environmental product declaration of construction products (EPD).

Working group 3 (building product level) is focusing on the alignment between EN 15804 and PEF Guide on several LCA aspects, divided in several task groups:

- Definition of functional unit
- System boundaries – carbon offsets
- Additional environmental impact categories + methods
- Common life cycle inventory nomenclature for ease of data transfer
- Fossil and biogenic carbon emissions and removals
- Carbon storage and delayed emissions
- data quality requirements



- System boundaries - Modelling of (net) environmental benefits/loads regarding reuse, recycling and energy recovery (cf. Module D vs. Circular Footprint Formula among others)

The BAMB consortium has been following the activities of the last task group to better understand the discrepancy between CEN and PEF approaches. This has enabled the BAMB project team to develop, within the framework of the development of the Circular Building Assessment tool a refined and circular approach to determine environmental impact of (reversible) buildings. Both CEN and PEF approaches were further refined, in order to:

- Determine environmental impact profiles of building products reused in different buildings and building solutions
- Determine environmental impact profiles of reversible buildings (or designs) that are potentially transformed (in an easy way)
- Parameterise of environmental impacts for all possible End-of-Life scenarios of buildings and their components, considering multiple reuse cycles within the same building or other (building) applications
- Facilitate automation of environmental impact calculation within to-be-developed circular buildings assessment tool(s)
- Stimulate future and current circularity (i.e. recycling of materials and reuse of building components in the beginning and at the end of its life cycle). Specifically, for the PEF approach, the market-based procedure for allocation of environmental impacts relating to circularity, has been further refined for a ‘reclaimed products’ market.

In order to meet the vision in which buildings really acts as material banks, further testing of the developed approaches is required and also data characterization related to the reuse of different types of materials and products.

Whilst calculation of environmental impact is an important tool in checking proposed solutions, the methodological discussions should not be a distraction to taking action to move from linear towards more circular solutions. For this reason, the BAMB Circular Building Assessment focuses on comparing environmental impact of circular & dynamic building scenarios to a ‘business as usual’ baseline scenario for a specific asset (at system or building level).

4.2.2 One Planet Network

The One Planet Network has been formed to implement the 10-Year Framework of Programmes on Sustainable Consumption and Production, which supports the global shift to SCP and the achievement of SDG 12 (responsible consumption and production). It is a multi-stakeholder partnership for sustainable development, generating collective impact through its six programmes amongst which “Sustainable building and construction”.



The Sustainable Buildings and Construction Programme (SBC) aims to, amongst other things, improve the knowledge of sustainable construction, support and mainstream sustainable building solutions and foster enabling frameworks to implement SBC policies.

As a member of the SCB programme, the BAMB project has been actively collaborating with the SBC programmes on different levels. The BAMB project has been exchanging and sharing knowledge and good practices and participating on the development of cooperation networks through: the participation to two webinars, the organization of the joint event on circular economy in the built environment and digitalisation with the One Planet Network, sharing of best practices based on the BAMB pilot Projects, linking circular building business models to tourism infrastructure within the Sustainable Tourism Programme.

The main lessons learned from the cooperation with the One Planet Network can be summarized as follow:

- 1) A wide, diverse range of stakeholders have to be involved in the transition towards a circular and dynamic built environment. This will require to raise awareness, educate and provide the right tools for these different stakeholders to engage them in the transition.
- 2) A circular and dynamic built environment offers some short and long term advantages. It is important to acknowledge the incentives and communicate these to the right stakeholders using their own language to enable them to disrupt the routine and habits that are directing their ways of working.
- 3) A transition towards a circular economy requires stakeholders, companies and governments to engage in a long term vision.
- 4) Transparency, communication and collaboration between the different stakeholders are key:
 - Clear and open communication between the stakeholders is required to meet the objectives together.
 - Sharing information between the different stakeholders within a project and even between different projects enables to develop circular and dynamic solutions and foster reuse
 - Open source and open access data is required to enable decision making towards circular and dynamic building development for new construction and refurbishment
- 5) Reliable and consistent data is essential to support the decision making
- 6) Digitalisation is an important enabler in the transition towards a circular economy. It is supporting the required data gathering and access. Furthermore, it enables to simplify and speed up assessments resulting in tangible tools and time efficiency in the decision making process.



- 7) Concrete implementation, projects and collaboration are needed to support the transition, enable to provide concrete input in order to support the points developed above.

4.2.3 Ellen McArthur Circular Economy 100 platform

The Circular Economy 100 brings together members from across the economy to provide unique opportunities for multi-stakeholder collaboration. Member groups include corporates, governments and cities, academic institutions, emerging innovators, small and medium sized enterprises (SMEs) and affiliates. A number of BAMB partners are members, including BRE, BAM, IBM, EPEA and Brussels Environment. The programme is designed to advance understanding of the circular economy, build organisational capacity, and exploit networking opportunities across business, government and cities, and academic institutions. The twice-yearly CE100 Acceleration Workshops and Annual Summit are held around Europe/USA and London respectively.

Although the focus is not built environment, there is a built environment cluster and there have been several built environment projects and publications.

Another important area is the link to cities where there is a growing membership of policy makers joining a dedicated work stream focused on 'circular cities'. There is likely to be a growing emphasis on how to make the buildings and city infrastructure transition to a circular economy, which is also where some of the learning and outputs from BAMB project could be applicable.

The main lessons learned:

Although the focus of CE100 is pan sector, rather than built environment focused, there are opportunities to develop projects and guidance with other members that contribute to knowledge in this space. BAMB has been publicised on multiple occasions via this programme, including a BRE (CE100 member) presentation at an acceleration workshop, inclusion in a case studies report, and a recent video produced with EMF and distributed via the thinkDIF virtual conference 2018¹⁰¹¹.

BAMB can offer support to built environment members of CE100, and also those members who have large real estate portfolios. This would need to be carefully targeted, simple to communicate and packaged in a visually attractive way (in keeping with CE100/EMF approach to dissemination). Some areas to target could include health & wellbeing benefits of Material Passports, Impacts measurable via the Circular Building Assessment, Social value insights derived from Mostar (and possibly Amsterdam project), and value/ business modelling conclusions.

¹⁰ <https://www.youtube.com/watch?v=o2hyMZ0oA3w&feature=youtu.be>

¹¹ <https://www.bamb2020.eu/news/dif-2018/>



4.2.4 Resource Efficient Use of Mixed Wastes project: Improving management of construction and demolition waste

The *Resource efficient use of mixed wastes project* consists of a study ordered by DG Environment. The study aimed to investigate the current CDW management situation in EU Member States, identifying obstacles to recycling and deficiencies that could lead to non-compliance with EU waste legislation. Good practices in terms of creating conditions for increasing CDW recycling and for improving the quality of recycling and recovery were identified and a set of recommendations to address potential barriers formulated. Success stories of efficient CDW management were showcased and the credibility of official CDW statistics was assessed

The BAMB project participated in the seminar presenting the preliminary findings of the study as well as to the latter reviewing. It also contributed to the EU stakeholder workshop to validate and expand upon initial conclusions and recommendations of the study.

The study identified some important barriers which have led to the formulation of key recommendations. The lack of reliable and consistent data on waste production and management in many countries is a major barrier to improve the waste management and identify different resource recovery end of life options for these streams. This is also one of the major findings of the impact assessments in chapter 5. Furthermore, the statistics on recycling do not consider reuse and thus the waste that has been prevented is not given value. Finally, backfilling was identified as a major barrier to high quality recycling.

Based on this study and the conclusions from the EU stakeholder workshop, some key recommendations were developed.

1. Measure to manage – better and more detailed data collection
2. Target waste prevention – targets, reuse buildings, procurement incentives, avoid hazardous materials
3. Refocus on reuse – promote reuse above recycling, industry takeback schemes, mandatory pre-demolition audits, use of BIM
4. Keep it clean – improved source segregation, selective demolition
5. Remove the backfilling barrier – promote higher value recycling through redefining backfilling and excluding from 70% recovery target
6. Products, not waste – develop more End of Waste Criteria
7. GPP: lead by example – set green public procurement criteria to promote reduce/reuse, better data capture
8. Enforce to reinforce – bigger penalties for infringement, minimum resourcing levels for enforcement activities, rollout of EDOC (electronic duty of care)
9. Continuous and holistic improvement – self assessment using a maturity matrix approach, pan policy approach needed
10. Promote eco-design & design for deconstruction to enable better reuse



The final report was published recently¹² and expands the rationale and possible implementation of these recommendations, along with other information, such as high level impact evaluation of certain intervention and further detail on best practices around the EU (with a focus on resource efficiency rather than circular economy).

4.2.5 EC Communication on Resource efficiency opportunities in the building sector – Level(s)

The general objective of this initiative is to reduce the environmental impact of buildings by improving the overall resource efficiency and, as a consequence, to improve the related competitiveness of construction businesses. This identified the need for a common EU approach to the assessment of the environmental performance of buildings: a 'common framework of core indicators', rigorous enough to drive improvement in performance and allow for comparison between buildings. Different studies have been conducted to meet the objectives of the communication and provide a concrete framework providing a flexible system of indicators that can be incorporated into new and existing assessment schemes or be used on their own by a diverse range of stakeholders, including public authorities, design teams and property investors: Level(s).

The BAMB consortium has been following the work developed within the context of the EC communication on *Resource efficiency opportunities in the building sector* as well as the developments of the voluntary sustainability assessment scheme Level(s). Furthermore, the BAMB consortium has been actively contributing to, amongst other things, the consultation to the Identification of macro-objectives for the resource efficiency of EU buildings and exchanging with DG Environment, DG Growth and JRC on the development of the BAMB outputs that have been identified as valuable to support the further development of levels.

The main lessons learned can be summarized as follow:

The common language and the integrated approach on sustainable building, which is defined on a European level and can be applied in different member states, provides a clear direction on which the building sector and industry can rely on. It is therefore also required by the sector to where possible further develop and built on this framework instead of developing additional and maybe contradictory initiatives.

The consultation and involvement of the stakeholders for the development of the macro-objectives as well as for the testing of the framework result in a time consuming process. However, this process is crucial to raise awareness, to enable the sector to take ownership of the framework and to foster a large scale uptake.

4.2.6 OVAM – Circular Flanders

Circular Flanders is an initiative from OVAM (the Flemish governmental service responsible for policies regarding waste, materials and soil decontamination) that aims to provide a hub and inspiration for the circular economy in Flanders. It is built on a partnership of governments, companies, civil society and knowledge institutes that take action together.

¹² http://ec.europa.eu/environment/waste/studies/pdf/CDW_Final_Report.pdf



In order to streamline policy-relevant research within the framework of the circular economy in Flanders, the Circular Economy Support Center was created within Circular Flanders.

The BAMB consortium is collaborating with Circular Flanders on the further development of the reburg.world website which provides an inspiring vision for how an imaginary circular city ‘Reburg’ could really work. The BAMB consortium provided input for the “buildings as material banks” layer of the website, illustrating the challenges and insights regarding circular economy within the built environment based on the blueprint developed within BAMB and presented from the point of view of different types of stakeholders.

Circular Flanders is developing some interesting initiatives to engage stakeholders in the transition towards a circular and dynamic built environment.

A first initiative to mention is the organization of open calls for innovative project proposals to support circular economy within the themes ‘Circular city and businesses’ and ‘Circular procurement’. Already, for two years in a row, building related projects are the most popular.

A second initiative is the launch of a Green Deal ‘Circular Construction’ at the beginning of 2019, to bring different profit and non-profit organisations together to learn from each other and to engage them in initiatives supporting a circular economy within the built environment. A Green Deal on ‘Circular Procurement’ was already launched in 2017.

A third initiative is the launch of a Living Labs on ‘Circular Construction’ in 2019 with a major objective to support a near-future policy framework for the transition in the construction sector to a circular economy, based on (real-time) experiment and applied research.

Finally, through the website of Circular Flanders different tools are provided to support stakeholders to develop circular economy activities, amongst which some tools supporting the creation of circular business models.

4.2.7 I.C.L.E.I

ICLEI – the International Council for Local Environmental Initiatives – is the global network of 1,500+ cities, towns and regions committed to building a sustainable future. Through joint action, peer learning, and strong partnerships between civil society, business leaders and all levels of government the ICLEI aims to accelerate local sustainable development and make real change on the ground. Local and regional governments across the ICLEI network work alongside a diverse team of global experts shaping policy and sparking action in support of sustainable urban development.

The BAMB project has been interacting with the I.C.L.E.I on the topic of Sustainable and Circular Public Procurement. As a result of this cooperation the Procura + manual and case studies developed by I.C.L.E.I have also been analysed within the best practice section.

The lessons learned from the interaction with the I.C.L.E.I can be summarized as follows.

- 1) Public procurement can be playing a crucial role in the transition towards a circular and sustainable built environment. It accounts for approximately 20% of Europe’s



GDP and enables to provide the sector with a clear direction to follow. Public authorities' purchasing decisions impact millions of people through the supply chain. Sustainable procurement is about using public spending to achieve social and environmental objectives, and to strategically use the public sector's economic power to catalyse innovation in the private sector.

- 2) Sustainable and circular public procurement embraces more than the integration of sustainable or circular indicators and specifications within the tender dossier. An innovative and participatory approach relying on sharing of information and mutual learning is essential in all stages of the procurement process to meet the objectives.

4.2.8 DG GROW's Thematic Group 3 'Sustainable use of natural resources'

To follow up the framework Construction 2020 of the Communication on "Strategy for the sustainable competitiveness of the construction sector and its enterprises" (COM (2012) 433 final), a High Level Tripartite Strategic Forum and 5 *Thematic Groups* gathering relevant stakeholders have been set up. These thematic groups are discussing and defining actions for the implementation of the Construction 2020 strategy.

Thematic Group 3 (TG3) "*Sustainable use of natural resources*" is focusing on the environmental performance of buildings and the valorisation of Construction and Demolition Waste.

The BAMB project has been following to the work of the TG3 and has been actively contributing to developments regarding the thinking process and preparation of the guidelines for Design for Deconstruction.

This collaboration has pointed out the complexity of developing policy instruments that are built on a consensus and thus accepted by a broad range of stakeholders. This participatory approach is a time consuming process. However, this participatory approach is an essential process. It enables to:

- 1) Raise awareness and provide the stakeholders with innovative information and knowledge on different aspects related to the topic through expert presentations, which supports the decision making process in a constructive way;
- 2) Learn from the barriers and opportunities that are encountered by different stakeholders and develop solutions to overcome and/or built on these;
- 3) Develop policy instruments that are understood, supported and taken up by the market.

4.2.9 GLOBE-EU

Globe EU is an international non-profit association that, within the European Parliament, serves as a platform for discussing European Commission policy proposals and for



coordinating political action among like-minded legislators in the European Parliament and at member state level that believe in sustainability, resource efficiency, Corporate Social Responsibility and environmental management.

It seeks to facilitate structured discussions between Members of the European Parliament, Commission officials, specialists, and a diversity of stakeholders through high-level round tables, workshops and conferences.

The BAMB project has been actively involved in the preparation of the pre-conference to the official opening of the [EU's Green Week 2018](#) "Green Cities for a Greener Future" hosted by GLOBE EU.

The lessons learned from the preparation work with GLOBE EU can be summarized as follows.

- 1) Presence of hazardous waste in construction is often underestimated
- 2) Many materials that can be reclaimed have no market: existing building codes and standards often act as an impediment to reusing waste materials
- 3) CDW is evenly divided between construction, demolition, and refurbishment. It is estimated that within the hotel sector important refurbishments are occurring every seven or ten years, which is leading to large quantities of waste
- 4) Public Procurement is an important mechanism to integrate environmental impact and reward reduced and positive impact
- 5) Countries in which waste management policies have high requirements and these requirements are enforced show higher levels of recycling.
- 6) Already existing initiatives that can be scaled-up (for new and refurbished buildings): material passports, reversible building design, circular building assessments, data sharing, online platforms, green public procurement

4.2.10 World Circular Economy Forum

The World Circular Economy Forum is a yearly event that presents the world's best circular economy solutions and brings together over 1,000 key thinkers and doers from around the world. Stakeholders from very different back grounds have been supporting the discussions by presenting their vision.

The main conclusions that could be drawn from the 2017 event can be summarized as follows:

- The internalization of external costs is seen as essential to support the transition towards a systemic shift. This would also enable to avoid that countries that are currently in the development process would follow the path that has been used by



developing countries in which the development was coupled with an increased footprint which would then be reduced.

- Different stakeholders have been supporting a transition from taxation on work to taxation on materials so that we would “paying for labour to save materials instead of paying for materials to save labour”
- Policies need to support the upscaling to foster the systemic change. It is essential to work on policies at all different parts of the value network
- Cities play a major role in the transition towards a circular economy. Therefore ‘circular’ policies need to be implemented on a city level supporting adapted financial mechanisms. Furthermore, mechanisms need to be developed to measure the systemic transition.
- Different cities have been presenting the strategy they have been implementing to support the transition towards a circular built environment. For all cities a multi-stakeholder approach has been identified as crucial as well as raising awareness through best practices. Furthermore, the city of Amsterdam follow the strategy to experiment and learn by doing to support the development of policy recommendations.
- The transition towards a circular economy will lead to new professions and new job requirements but will also affect existing jobs, it is important to support the transition for the jobs that are being lost or will have to evolve.
- Public procurement accounts for 20% of GDP and plays therefore an essential role in supporting the transition towards a circular economy.

BAMB was represented at WCEF in Japan in 2018, with a workshop organized by EASME, to highlight the work done to date and to talk with European and Asian participants about potential collaboration and exploitation in the future. The BAMB table was well attended for each of the three networking sessions and several interesting leads were developed for follow up. A further workshop where new (started in summer 2018) Horizon 2020 projects, relating to Circular Economy, were discussed was also useful in identifying activities where BAMB outputs/knowledge could be used to help advance the R&D. A project called HOUSEFUL¹³ has particular relevance in this context.

4.2.11 Global Initiative for Resource Efficient Cities (GI-REC) and ACR +

GI-REC is a cooperation platform offered by UN Environment to connect many different institutions that are using systems approaches (specifically urban metabolism and morphology approaches) towards building low-carbon, resilient, and resource efficient cities.

¹³ <http://houseful.eu/>



Brussels being one of the partner cities of this cooperation platform, a collaboration has been developed within the framework of the development of macro level indicators for circular economy. The contribution within this framework has led to a report that will be published by the end of 2018.

ACR+, the Association of Cities and Regions for sustainable Resource management, is an international network of cities and regions sharing the aim of promoting a sustainable resource management and accelerating the transition towards a circular economy on their territories and beyond.

Circular economy calling for cooperation between all actors, ACR+ is open to other key players in the field of material resource management such as NGOS, academic institutions, consultancy or private organisations.

Brussels Environment being a member of ACR+ has enabled the BAMB project to interact with ACR+ on different projects such as FISSAC, RE4 and the H2020 Support Mechanism and to actively participate to ACR+ activities.

These initiatives and interactions have enabled to identify the needs for multi-stakeholder approach and how the tools developed within BAMB can support the different stakeholders and cities in the systemic shift.

4.2.12 Ministry of the Environment of Finland, Ministry of Environment and Food of Denmark, Ministry of Infrastructure and the Environment of the Netherlands, Ministère de la Transition écologique et solidaire (France)

The BAMB project has been in contact with different public authorities and Ministries of Environment from different European countries exchanging on the challenges different member states are facing with regards to the transition towards a circular economy in the built environment. Information has been shared on the current developments, tools and strategies.

- A participatory approach that involves all the stakeholders in the definition of the objectives as well as the roadmap to achieve them is important to support a systemic shift
- By defining clear objectives governments are providing a clear direction to the sector
- The different instruments developed within the BAMB project are of interest to different public authorities since they enable to assess a positive impact in a quantifiable way

4.3 Conclusions

The interactions with the different policy platforms over the course of the BAMB project enabled the BAMB consortium to identify a shift from waste management and recycling to resource management including reuse. This transition is a slowly process as is the process of policy development for a complex sector such as the built environment. The large number of



stakeholders and the size of the value network leads to a time consuming process in the development of policy instrument that is acceptable for all.

However, experiments are identified as interesting enablers to learn by doing and to support policy developments based on concrete facts and lessons learned. In addition, they enable to support a multi-stakeholder approach and provide some best practices which can help to raise awareness. Policy makers can play an important role to facilitate experiments, as well as frontrunner and niche activities, to support upscaling.

Public procurement has also been identified as an essential policy instrument to support the development of sustainable innovation and a transition towards a circular economy. Furthermore, the enforcement of regulation is an essential leverage to reduce the use of virgin resources and the production of construction and demolition waste.

5 SUMMARY OF THE IMPACT ASSESSMENTS

5.1 Methodology

The policies to be selected for Impact Assessment were drawn from those considered in the State of the Art report (see Section 3) and were restricted to the four countries identified: Belgium, Portugal, Sweden and the UK. Given the number of policies and standards contained in the report, it was considered beyond the scope of the BAMB project to conduct an impact assessment on the majority of items included. It was therefore agreed to conduct a prioritisation exercise on all policies and standards in the report, to identify which would be likely to have the greatest influence on the BAMB project and methodology. A common methodology was used by all partners involved.

For the first selection, scoring was based on:

- Level of use/influence of the policy/ regulation
- Direct applicability to circular economy and built environment (either positive or negative)
- Relevance to BAMB

The highest scoring policies were then subjected to a further sift, where availability of supporting data and ease of impact evaluation were assessed and scored. A snapshot of the prioritisation matrix for the UK is shown in Figure 3 below:



Prioritisation matrix for policy/ legislation Work package 5, Action 3						materials passports reversible building design wastes reduction data management circular building business models	Availability of supporting data	Ease of impact evaluation	TOTAL SCORE
Policy ↓	Country/ Region ↓	Level of use/ influence 0-3	Direct applicability to circular economy and built environment (either positive or negative) 0-4	Relevance to BAMB/ built environment 0-4	Total for first prioritisation				
Environmental Protection Act (1990)	UK	3	1	0	4				
Climate Change Act (2008)	UK	3	0	0	3				
Environment Act (1995)	UK	3	1	0	4				
Planning and Energy Act (2008)	UK	3	0	1	4				
Building Act (1984)	UK	3	1	1	5				

Figure 3: A snapshot of the prioritisation matrix for selection of the UK regulation to be the subject of the Impact Assessment

Through this process, a total of 5 current policy actions were selected and were subject to an Impact Assessment:

- Site Waste Management Plan Regulations (2008) (UK)
- Swedish Environmental Objectives (1999, 2009) (Sweden)

- Programme Régional en Economie Circulaire (PREC) (2016-2020) (Brussels-Capital Region, Belgium)
- Tracimat (Flanders Region, Belgium)
- Incorporação de 5% de materiais reciclados (2011) (Portugal)

The geographic spread of the policies is shown on the map in Figure 4 below:

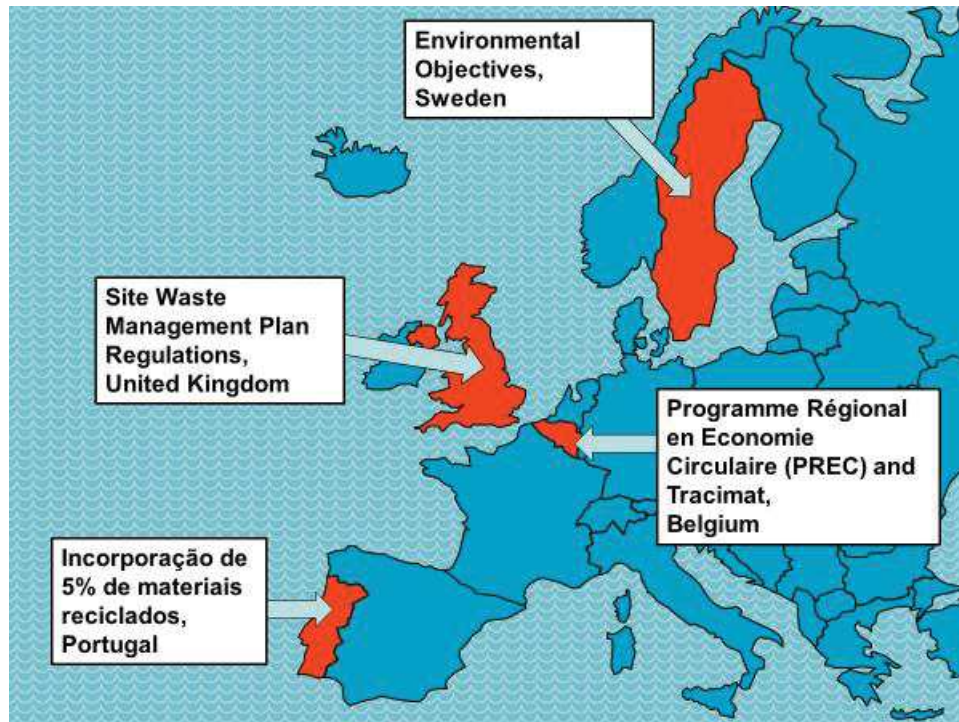


Figure 4: The geographic locations of the policies and regulations examined in the Impact Assessment

The policy actions provide a mixture of levels (both national and regional), and consist of a broad policy framework (Swedish Environmental Objectives), a circular economy policy framework (PREC), sector specific measures (Site Waste Management Plan Regulations and Tracimat), and procurement regulations (Incorporação de 5% de Materiais Reciclados).

The Impact Assessment methodology was developed by BRE and drew on a range of best practices, including the framework Magenta Book, the Impact Assessment manual provided by the UK Government for the evaluation of policies and regulations. Step by step guidance was provided for the project partners conducting the Impact Assessments (IAs) and an outline framework developed to ensure a level of consistency across the IAs.

Whilst the methodology used for the Swedish Impact Assessment was purely qualitative, a mix of quantitative and qualitative data was used in the other assessments. Given the lack of a suitable control group (counterfactual) for sufficient comparison of conditions ‘before’ vs. ‘after’ policy implementation, a holistic and objective approach was developed, including multiple perspectives to strengthen the validity of the evaluation. In this way, the causal relationship between policy and outcomes could be more clearly established.



The full Impact Assessments are provided in Appendix A.

It should be noted that both Tracimat and the PREC are also included in chapter 6 (Best Practices) where they are considered from the perspective of new approaches to implementing circular economy practices.

5.2 Site Waste Management Plan Regulations (2008)

The Site Waste Management Plan (SWMP) Regulations were a set of regulations introduced in the UK to address two issues:

- the illegal dumping of waste (fly-tipping) - in 2007/08, there were an estimated 1.28 million fly-tipping incidents, with 7% as identified as construction, demolition and excavation waste
- construction resource efficiency - in 2008, the amount of construction, demolition and excavation waste generated in England was 101 million tonnes, and of this, 12.55 million tonnes was landfilled.

The Regulations required SWMPs to be developed for construction projects over £300,000 (equivalent to approximately €339,000) in project value. According to the Regulations, SWMPs should be undertaken prior to the commencement of the project, with a forecast of waste generated and how it would be managed. The plan should be updated regularly throughout the project to provide information on how much waste was actually generated and how it was being managed, with a review undertaken after the close of the project. For construction projects over the value of £500,000 (equivalent to approximately €565,000), a more detailed SWMP was required. The Regulations put duties on the client and principal (main) contractor.

Prior to this there was a Voluntary Code of Practice for SWMPs, which was recommended for projects over £200,000 (equivalent to approximately €226,000) in value, which was adopted mainly by the larger contractors.

The Regulations were repealed in December 2013 as part of the English Government's 'Red Tape Challenge' as they were viewed as 'not fit for purpose'. However, many businesses continue to undertake SWMPs and they are also a requirement in sustainability building standards such as BREEAM, as well as through some local authority planning and client requirements.

5.2.1 Conclusions of the Impact Assessment

It was concluded that the Site Waste Management Plan Regulations (2008) were clear in their two-fold objectives of decreasing illegal waste and increasing construction resource efficiency. However, there were a range of issues which were identified as contributing to an overall lack of effectiveness of the Regulations and which eventually led to their repeal.

Barriers

One of the weaknesses in the SWMP Regulations identified by the impact assessment was the lack of engagement with the client and designer stakeholder groups. It was reported that client organisations were not generally interested or involved in the SWMPs and it was left to contractors to write and implement the plans. Indeed, many clients did not sign their part of the declaration. This lack of engagement at the design phase resulted in the SWMPs being considered too late in the construction process to have maximum impact. A further barrier was noted in the naming of the plans: Site Waste Management Plan was considered too open to misunderstanding as being site based, and therefore focused on the actions of the contractor.

There was little data gathered and published regarding specific costs and savings attributed to the different activities associated with the introduction of the SWMPs. This was also considered to be a barrier to the effective implementation of the regulations, as the financial burden (or gain) to businesses of the SWMPs was unclear. Indeed, research suggested that although realised savings on larger projects outweighed the negative cost impacts, the opposite was true for smaller projects.

A lack of consistency in approach by different local authorities was also identified in the impact assessment as influencing the implementation of the regulations. Survey results showed that there was a significant lack of awareness of the SWMP Regulations amongst local authority planning, building control and waste management officers, with different local authorities administering the SWMPs in different ways. This was found to lead to a high risk of inaction, confusion and inconsistency, and in the most extreme cases, property owners and contractors could find that neighbouring properties on which they were working were subject to different procedures as they were in different local authorities.¹⁴

Another barrier to the effectiveness of the regulations was identified as being lack of a clear ‘owner’ for the regulations. Regulations were not effectively enforced, and it was noted that there was no clear consensus as to which agency would be responsible for driving through and enforcing the regulations, nor a plan for how this would be achieved.

In addition, there were many types of projects, such as small scale construction and refurbishment, which fell under the threshold limit of £300K. These smaller projects were perceived to be the key contributors to illegal activity, and hence one of the objectives – to reduce fly tipping – would be less impacted as a result of their exclusion.

Implementation on affected projects was also variable in quality and rigour. For example, the objective to identify waste reduction measures could be as simple as a statement of intent. In addition, the robustness of waste forecasting and monitoring was not systematically checked, and the level of detail required, from a compliance basis, quite low.

Generally, there was an upward trend in the amount of construction and demolition waste diverted from landfill from 2008. However, the data is inconclusive on the cause and no discernible pattern was identified for when the Regulations were in place or not. This indicates there were contributing factors such as rising costs of landfill, improved waste

¹⁴ Shiers et al (2014)



infrastructure and recovery routes and better segregation of waste on site. Factors for the increase of excavation waste being landfilled include a change in Permitting Regulations, a number of major infrastructure projects and the need for this type of material to fill landfill voids.

Opportunities

The SWMP Regulations were preceded by a voluntary code of practice for SWMPs. Drivers for their use included client demand, rising costs of waste disposal and inclusion in the BREEAM scheme. A number of impact evaluations were undertaken with varying results on the costs and benefits derived. Users of, both voluntary and mandatory, SWMPs generally considered that cost savings were made, but exact quantification was difficult as there were multiple factors to consider, including improved corporate image, corporate social responsibility, increased tendering success, better management and quality systems and better site conditions. Conversely, concerns were voiced that they had become a tick box exercise, general awareness of waste gains had been made and advances in material manufacture, waste processing and design had overtaken the SWMP ambitions. Ultimately, there was an official consultation (Consultation documents and responses for the Regulations and their repeal) managed by the government which demonstrated 75% of respondents supporting mandatory SWMPs. Despite this support, the regulations were repealed.

Once the regulations were in place, assistance was provided to companies, which was considered to be effective. These included awareness raising events, guidance and a set of templates. The regulations were also considered by some to have helped as an administrative tool, keeping all waste requirements (including those found in Duty of Care legislation) in one central document.

The SWMP Regulations were thought to have improved waste performance, particularly for larger contractor companies, through providing a greater understanding of waste arising, how it is managed and the cost of it, combined with a framework to enable change. Surveys have shown that many companies benefitted from the introduction of SWMPs including through increased cost savings and profitability, better legal compliance, reduced environmental impact, integration with existing environmental policies, and better health and safety and working practices. Particularly highlighted are the environmental benefits and ensuring compliance with waste legislation.

Another element of the SWMPs which emerged from the impact assessment was the usefulness of the data forecasts and data collected, along with the consistency of waste reporting. It was also noted that SWMPs provided a means to discuss waste management with the client, becoming part of the pre-contract discussions and 'provided a formal structure and some 'weight' to activities that were already occurring'. Increased transparency in waste costs led to more informed decisions and enabled the commercial part of the business to take a greater interest. Additionally, placing a requirement to implement a SWMP encouraged innovation within the industry, such as developing new methods for recovering aggregates or developing take back schemes, and drove improvements in the subcontractor supply chain but did not significantly affect methods of construction.



The positive outcomes of the SWMPs is evidenced by their continuation in use, particularly by the larger contractors and via building assessment schemes such as BREEAM, although they are combined with other site issues such as energy and water, as ‘Resource Management Plans’¹⁵.

Prior to, during and post SWMP regulations, BRE provided a tool called SMARTWaste which was revised to provide automatic compliance with SWMP through following the steps in the online process. Use of this tool increased dramatically during the years of SWMP regulation. Other tools, by the Environment Agency and WRAP, were also developed to support those needing to comply with the legislation. As a result, a repository of waste data was collected and used to prioritise actions to reduce, reuse and recycle construction waste. For example, WRAP produced many guidance reports, case studies and commitments (such as ‘halving waste to landfill’) and transitioned from SWMPs to voluntary Resource Management Plans. BRE continues to provide support for SWMPs via Smartsite¹⁶ and collects data from around 1000 live sites every year. This data is used to develop benchmarks which are further used to set the threshold levels for achieving waste minimisation credits in BREEAM.

5.3 Swedish Environmental Objectives (1999, 2009)

In 1999, the Riksdag (the Swedish Parliament) adopted a number of environmental quality objectives to provide a broad policy structure for environmental action. The objectives were further refined in 2009, and a three-tier system put in place, which consists of:

- A generational goal:
to hand over a society in which the major environmental problems in Sweden have been solved for the next generation, without increasing environmental and health problems outside Sweden’s borders.
- 16 Environmental Quality Objectives, which describe the goal for a range of environmental aspects (e.g. *A good built environment: cities, towns and other built-up areas must provide a good, healthy living environment and contribute to a good regional and global environment. Natural and cultural assets must be protected and developed. Buildings and amenities must be located and designed in accordance with sound environmental principles and in such a way as to promote sustainable management of land, water and other resources.*
- Milestone targets set out the changes in society needed to achieve the environmental quality objectives and the generational goal (e.g. *no net emissions of Greenhouse Gases by 2045*).¹⁷

¹⁵

https://www.breeam.com/NC2018/#10_waste/wst01_nc_a.htm%3FTocPath%3D10.0%2520Waste%7C_____1

¹⁶ <https://www.bresmartsite.com/products/smartwaste/>

¹⁷ <http://www.swedishepa.se/Environmental-objectives-and-cooperation/Swedens-environmental-objectives/The-environmental-objectives-system/>



The three objectives most relevant to the BAMB project are:

- Reduced climate impact
- A good built environment
- A non-toxic environment

The environmental objectives are followed up on a regular basis, with annual reports to the Government as a basis for the Budget Bill. An in-depth evaluation of environmental action and the prospects of reaching the objectives is performed once every parliamentary term. The evaluation aims to address whether existing policy instruments are sufficient, or if adjustments and new measures are needed in order to achieve the objectives.

A number of government agencies are responsible for following up and evaluating specific environmental quality objectives.

5.3.1 Conclusions of the Impact Assessment

The Swedish Environmental Objectives system has been in place for almost 20 years. It has evolved during this time and is regularly evaluated. The impact assessment concluded that there are many elements of the system which are considered positive (including its visionary nature, the clarity with which the direction of travel is expressed, and the way that it brings environmental ambitions together in one place). However, there are also concerns that most of the objectives will not be met on time (Naturvårdsverket, 2017) and that they are not ambitious enough to reach the goals of the Environmental Objectives system. However, the Impact Assessment identified that the system clearly promotes circular economy aspects and that the circular economy is a central part of the generational goal and objectives.

Barriers

One of the barriers for success of the Objectives System was concluded to be that objectives themselves are visionary but the system does not contain any solutions for the problems that need to be tackled. Government departments are expected to develop their own solutions to the objectives and milestones. Whilst the system therefore creates pressure for the agencies concerned to identify and propose solutions, the solutions are not necessarily sufficiently ambitious to meet the objectives.

In terms of working towards a circular economy, the impact assessment found a barrier to be that material loops are considered in terms of a waste issue rather than design. Also, it was noted that a range of different perspectives on circular material loops are in place which reduces the potential impact.

The complexity of some of the objectives was also considered to be a negative. For example, in the case of Good Built Environment the topic is so broad that the objective remains visionary rather than a clear goal.

From the perspective of civil society, the objectives system is not a mandatory framework, so stakeholders including commercial businesses have no requirement to buy in to the objectives



and no concrete targets. It was considered that better communication of the objectives system and more mandatory targets would be needed to get business on board.

The impact assessment identified that the system needs to be closely monitored and evaluated, but that this is considered to be a risk as the resources required for evaluation could be diverted away from delivery. One way which could be used to reduce this risk is by structuring the evaluation, and that resources will be identified, so it can be used to plan and implement actions.

It was considered that a more prescriptive approach and clearer guidance towards circular practices in the building sector, as well as reinforcement from the government to agencies about the significance of sustainability issues in the building sector in reaching the objectives, would support the case for implementation. It was also noted that the milestone for reducing waste and increasing the recycling from building and demolition waste was seen as a non-typical milestone for the objectives system, as it is the concrete implementation of EU waste legislation at the national level. This milestone was considered to lack the emphasis on quality that is more usual, instead focusing on quantity. It was noted in the impact assessment that there has been some controversy around how this goal should be calculated. The interviewees describe an uncertainty around if this milestone has affected the recycling rates or prevented waste from the building sector in any significant way.

Opportunities

The objectives system was found to demonstrate a long-term commitment, providing leadership from the government, but also, as there is broad cross-party consensus, a clear direction of travel which will remain stable regardless of the political party in power. That stability was considered to allow businesses to understand where policy is heading (e.g. in the development of building regulations). The system is also considered to place the environment high up the agenda.

The adaptability of the objectives system was considered to be a strength, with the system reviewed every few years. Although it was also noted that the negative of this is that this can make the system more difficult to implement and time-consuming to keep up to date with changes.

The system was considered to force agencies to work together and cooperate around sustainability issues and the system encourages collaboration between government agencies and also with other stakeholders. Dialogue, for example with the construction industry, includes workshops on waste sorting and circularity, developing guidance for the industry.

By allowing the agencies involved to identify solutions to the objectives, milestones and descriptions in the Environmental Objectives system, the agencies have a large degree of autonomy. (However, as noted above, this can also create a barrier to achieving the objectives, as the solutions may not be sufficiently ambitious.)

These agencies then in turn are part of shaping the playing field for the building sector in Sweden. The degree to which the Environmental Objectives system is mandatory and prescribed to be at the forefront of the specific agencies work seems to have influence on how



much the Environmental Objectives system has influence over initiatives taken and the development of rules and regulations. Here it seems important that the agencies' governmental instructions correlate with the Environmental Objectives system.

With respect to circular economy ambitions, the objectives build on the loops and cycles that have been discussed in Sweden since the 70s. Overall, it was considered that the focus on circular aspects are a central part of the generational goal and the objectives, with the system clearly relating to circular economy aspects in general, and to some extent towards the building sector. Emphasis is on toxic free loops as well as waste reduction and recycling.

The impact assessment found that it is considered that the focus of the environmental objectives and the circular economy are very similar. Circular economy adds a financial aspect to the traditional Swedish way of striving for loops, and the interviewees emphasised the importance of not losing the qualitative aspects of what is used and reused, e.g. chemical content. It was identified that it is not only about the amount of material recycled, but also about content, keeping track of the dangerous substances, not spreading them and making sure they are phased out of the cycles in the long run. They also mention the gain of doing things "right" from the beginning, designing for a circular economy, thinking long term, not just one more cycle.

There have been initiatives in the last few years, stemming partly from the Environmental Objectives, which indicate a movement in the direction of more focus on building and material information (e.g. LCA, Building logs etc.), design for deconstruction and oversights of the building regulation with regard to more modern building regulations including health and sustainability issues. Thus, it seems that the current version of the Environmental Objectives system does further development in a more circular direction.

It was not considered that the environmental objectives system would be suitable for upscaling to the EU level, as would be too complex and complicated to get multiple governments to agree to the objectives and likely that they would be watered down. Nevertheless, the generational goal "to hand over a society in which the major environmental problems in Sweden have been solved for the next generation, without increasing environmental and health problems outside Sweden's borders" should be the basis of every environmental/sustainability policy program of EU and its member states.

5.4 Tracimat

Construction and demolition waste (CDW) originates from demolition of buildings and construction works, as well as during construction and breakdown of roads and pavements. When the stony fraction of this CDW is processed by the crusher, 'recycled aggregates' are produced. These aggregates originate from the mechanical processing of inorganic material from construction works (VLAREMA, art. 1.2.1).

When buildings are demolished, new materials are created that are eligible for reuse or recycling. Their field of application is, to a large extent, determined by their purity. Thanks to selective demolition, pure fractions are collected on site. To stimulate the practice of selective



demolition, Tracimat (TRACIng MATerials), a voluntary supply chain tracing system, was set up.

Tracimat is a non-profit neutral construction and demolition waste (CDW) management organisation that will certify the selective demolition process by issuing a "certificate of selective demolition" for demolition waste that has been selectively collected and subsequently gone through a tracing system, thereby assuring the processing company of the quality of the recycled demolition waste.

In Flanders, if the CDW is accompanied by a "certificate of selective demolition" the processor can accept the demolition waste as "low environmental risk material" (LERM) and can therefore process it separately from waste streams with a high environmental risk (HERM).

Tracimat initially focuses on the stony fraction, which in terms of weight by far represents the greatest portion of the CDW in Flanders and Belgium. The processor of the stony fraction of the waste, i.e. the crusher, produces 'recycled aggregates'. Tracimat traces selectively collected stony demolition waste from its point of origin down to the crusher, thereby requiring distinguishing between LERM and HERM at the time of acceptance and assuring the crusher of the environmental quality of the input demolition waste. Where possible, the organisation's field of activity will be expanded in the future to include other types of CDW materials, e.g. timber waste.

Tracimat is legally incorporated into the Flemish environmental regulation VLAREMA for Sustainable Management of Material Cycles and Waste, implemented in the Flemish Materials Decree. Tracimat operates in feedback with the Common Regulation for Recycled Aggregates, allowing it to trace construction and demolition materials down to the crusher.

A new acceptance and processing policy (LERM vs HERM) for producers of recycled aggregates came into force in August 2018. From this point, all producers of recycled aggregates should differentiate between materials with high and low environmental risk.

5.4.1 Conclusions of the Impact Assessment

Barriers

Very little data is available on the production and quality of recycled aggregates. Currently producers of recycled aggregates do not keep data. Due to this lack of data, it is difficult to quantify the impact Tracimat can achieve through the new acceptance policy (LERM versus HERM) for producers of recycled aggregates.

The lack of trust between stakeholders within the building value network was identified as one of the main obstacles of a circular economy within a built environment. A good example is given by the current lack of trust in the quality of recycled aggregates. The Impact assessment concluded that the introduction of the new acceptance policy (LERM versus HERM) for producers of recycled aggregates will ensure a certain level of quality of LERM and by doing so is an important step to increase trust between demolition contractors, crushers, manufacturers and building clients.



The introduction of Tracimat would in practice mean an additional cost for the contractor (and therefore the building client/owner), whilst also ensuring that legal obligations are complied with. Tracimat should therefore provide an added value in the monitoring of demolition sites and the enforcement of the legal obligations. However, to make the system self-regulating, it was identified that the additional cost of following the Tracimat procedures must at least be compensated by the price difference between LERM and HERM, which currently depends upon market conditions. Market forces in turn are partly determined by the confidence of the crushing firms in the tracing system and the enforcement of the legislation on LERM and HERM.

The impact assessment also noted that it is usually impossible to ensure in an economical way that no more disturbing substances are present in the stony fraction of the waste. The question therefore is: which pollutants will be accepted by the Tracimat management organization and in what quantity? The amount of disturbing substances still present in the stony fraction will depend on the recommendations of the expert and the choices made by the contractor in the execution of the demolition works.

It was also noted that crushing companies will need to reorganize at the crushing site, as they will have to make the distinction between LERM and HERM for the incoming stony fraction. This will provide a social benefit but at an economic cost.

The impact assessment identified that the success of Tracimat could be hindered by non-alignment of regulation in bordering areas. The fact that a huge amount of stony waste originates from the Brussels Capital Region, where Tracimat currently has no authority, is a risk for the actual application of tracing and certifying selective demolition waste practices. It is expected that some Walloon crushing firms (situated in the south of the Brussels Capital Region) would benefit from the implementation of the new acceptance and processing policy (LERM vs HERM) in Flanders, because there is no incentive yet to separate LERM and HERM in the Walloon region. Policy alignment between the three Belgian regions is therefore recommended. Similar experiences have been acquired during the implementation of the Energy Performance of Building Directive (EPBD) in the early 2000. Each Belgian region has enforced different policy rules (e.g. other energy performance thresholds) leading to regionalised building practices, with EPB advisors, architectural and engineering firms specialised in regional regulation. Even though EPBD policy measures have been (better) aligned within Belgium over the last years, this regional specialisation is still active. It is unclear what the effect on the economy of de-regionalisation would be.

Opportunities

The main purpose of Tracimat is to enhance the quality of recycled aggregates, in order to be used for high value recycling applications. The introduction of Tracimat can ensure that legal obligations are met, such as the obligation to draw up a waste demolition and asbestos inventory and the mandatory removal of hazardous substances. This improvement is required by law today, but is not applied to its full potential yet. It is estimated that for only 1 in 10 demolition works where a demolition inventory is mandatory, the inventory is actually



present. For the asbestos inventory this is the case for 1 in 20 demolition works. Moreover, hazardous waste is not always disposed of separately (e.g. fluorescent lamps).

The new acceptance policy (LERM versus HERM) for producers of recycled aggregates is designed to ensure a certain level of quality of LERM. The increased trust resulting from this, might influence the current barriers for high quality applications of recycled aggregates. In general, it was concluded that there is a huge opportunity for improvement in the upcycling potential. However, the market demand needs to follow, in order to upscale alternative applications, to replace decreasing demand for construction of new roads.

Historically, the lack of enforcement of the waste demolition inventory and asbestos inventory regulations has resulted in a large percentage of actors ignoring the requirements. The implementation of the Tracimat supply chain tracing system aims to provide an added value in the monitoring of demolition sites and the enforcement of the legal obligations. The higher purpose of Tracimat is to enhance the quality of recycled aggregates for high value recycling and therefore to create purer waste streams with a greater upcycling potential. This objective is primarily supported by recent changes made within the Flemish environmental regulation for sustainable management of material cycles and waste (cf. VLAREMA) and the new acceptance policy measure of August 2018 (cf. LERM vs. HERM). Both policy measures will lead to development and better monitoring of waste management plans for all demolition works requiring an environmental permit.

The Impact Assessment identified several social impact opportunities in terms of employment and training, alongside new jobs for the management organisation of Tracimat itself for development of the system, as well as training, inspection and evaluation.

The lack of up-to-date and reliable data on the production and quality of recycled aggregates currently leads to failure to understand the current situation and to monitor the effectiveness of regulations on that aspect of CDW. The implementation of the Tracimat system is considered to provide an opportunity to gather such data. The proper collection and analysis of data could lead to the development of the Tracimat management organization as a knowledge center, who can share experiences and know how. This could result in the availability of very useful databases with figures about the quantities and applications of CDW originating from demolition of buildings and construction works. The expansion to other types of waste materials than stony fraction (such as timber waste and electronic waste) is currently being investigated by the Tracimat management organization. Where possible, the organisation's field of activity will be expanded in the future.

5.5 Programme Régional en Economie Circulaire (PREC) (2016-2020)

The Brussels Capital Region's Programme Régional en Economie Circulaire (PREC) (2016-2020) aspires to make a structural transformation of the Brussels' economy, transforming it into not only a circular economy but a low-carbon one, which creates employment and added value while respecting the environment and quality of life of Brussels' inhabitants. It defines the circular economy as an economic system of exchange and production, which, at all



moments in the lifecycle of products (goods and services), aims to increase the efficiency of the use of resources and drastically reduce their waste, reduce the environmental impact of products, and develop the well-being of individuals. The Program has 3 general objectives: transform environmental objectives into economic opportunities, anchor the Brussels' economy in Brussels to produce locally when possible, and contribute to the creation of jobs. To achieve these general objectives, 111 measures have been outlined across 4 strategic areas – transversal measures, sectoral measures, territorial measures, and governance measures. By 2019, the PREC aims to provide a complete support package for this transition, including but not limited to:

- Subsidies
- Economic aid for businesses
- Access to loans and other regional incentives for circular investments
- Evaluation of jobs to be created
- Training
- 50% of relevant public procurements are to contain clauses for circularity

The measures and approach of the PREC are inspired by a study commissioned and published by Brussels Environment in 2015 on the urban metabolism of the region, its flux, actors, activities and possible routes for resource optimisation. The study was led by EcoRes, ICEDD, and BATir (ULB). Using figures and statistics, this study illustrated the importance of the construction sector for the Brussels Capital Region to transition towards a circular economy. According to the study, construction is responsible for 20% of resources coming into Brussels, it produces a large amount of waste (34% of the region's non-household waste), and is the largest stock (84% of the total mass) of materials in the region (EcoRes et al., 2015). Recognizing the necessity of tackling this sector to achieve Brussels' circular objectives, the PREC announces a series of specific sectoral measures for construction, including a measure to put into place a monitoring tool for the sector and its evolution. To do this, it is foreseen to rely on data from no one source but various sources, and to then harmonize the data to come to a complete illustration of the sector.

5.5.1 Conclusions of the Impact Assessment

The Impact Assessment for the PREC looked at past policies related to data collection on construction and demolition waste and their impact on data collection for circularity objectives, in particular the PREC.

The European Commission has identified the lack of data on construction and demolition waste in general, as well as on the quality and the quantity of specific waste streams, as an important issue for qualitative waste management and the transition towards a circular economy in the built environment.

Based on the role given to data in the development of the PREC through the urban metabolism study, as well as the importance given to developing indicators for monitoring the sector as the Brussels region works to transition to a circular economy, the impact assessment



identified success or fail factors regarding data collection for waste policy which can be extended to recommendations in circular contexts.

The different laws that have been assessed build upon one another.

Barriers and Opportunities

The Ordinance of '91 concerning the prevention of waste develops a reporting obligation for hazardous waste that could be extended to other types of waste. This enabled extending the reporting obligation to construction and demolition waste and the obligation to recycle debris (stony fraction construction and demolition waste) with the aim to achieve 70% recycling of construction and demolition waste as stated in the 1995 law relative to the mandatory recycling of certain construction and demolition waste. Furthermore, the 1997 law on the waste registry defines the required maintenance of a waste registry enabling the control and monitoring of infractions.

Initially, the ordinance of '91 aimed to allow assessing quantities and waste flows and to facilitate planning. However, these objectives have been adapted along the way for different reasons:

- The accuracy of data and difficulties to extrapolate statistics
- The lack of resources required for the administration to verify the quality of the data and to process and analyse the data

As a result, the data cannot be used to monitor the flows and types of construction and demolition waste and their potential recycling and reuse. Therefore, the data within the registry cannot be used to assess the current situation and to fix realistic circularity targets.

The laws mentioned above have been brought together with 8 additional laws on waste management into the 2016 Law on waste management, (implemented since 01/01/2018). This law aims to simplify the administrative burden for the actors and administration, and to extend the list of actors targeted by the reporting obligations, incorporating the waste producers, in order to make sure that the whole supply chain is covered. Furthermore, the law will enable improving the traceability of the waste. However, no adaptation/extension has been foreseen to enable using the gathered data for monitoring or planning.

The importance of accurate data that can support the monitoring and definition of circularity targets is identified by different members of the Brussels administration for environmental management (Brussels Environment, previously IBGE). However, the administrative burden is also acknowledged for the different actors who have to provide, collect, process and analyse the information. To accept this burden, the data provided must offer a clear added value. This means that the following all must be aligned: the objectives of the data collection, the clarity of the data requested to meet those objectives, the different stakeholders that need to be involved, and the adequate financial and HR means.

It is noted that the SMARTWaste system, highlighted in the Site Waste Management Plan IA above, does not impose the same level of administrative burden for data gathering. Data



gathered through SMARTWaste was used in the *Resource Efficient Use of Mixed Wastes: Improving Management of construction and demolition waste* (2017) commissioned by the European Union.¹⁸

An idea was proposed to possibly imagine a multi-step process towards more complete data. The sector is shifting to a data focus for various aspects of its activities (BIM, MPs). In the long-term, policy makers can capitalize on that data for policy purposes as well. Nevertheless, in the short/middle-term, we can continue to try to make effective circular policies relying on alternative, less broadly applied methods (qualitative and quantitative) and/or incentive schemes. One of these alternatives is the conduction of punctual studies and surveys defining the materials flows for the built environment.

5.6 Incorporação de 5% de Materiais Reciclados (2011)

Prior to 2008, there was no specific policy or framework for CDW in Portugal. In 2008, a CDW framework was implemented in response to European legislation. This was further updated as part of the review of the national waste management legal framework in 2011 (D.L. 73/2011). For the first time, a measure of green public procurement was introduced, which stipulated that “at least 5% of recycled materials or materials containing recycled components, should be incorporated in public construction works, regarding the total amount of raw materials used in public construction works”.

From this point, the measure was to be included in public tenders, being integrated in the design stage and verified during the construction stage of public buildings.

The measure is one of a number of green public procurement measures in place in the public sector in Portugal, which are designed so that public authorities provide an example for private corporations.

The policy is under the umbrella Environment Agency, Portugal’s environment ministry.

5.6.1 Conclusions of the Impact Assessment

To date, there is no official indicator or study to evidence if the 5% required target has been achieved and therefore it is impossible to know how successful this policy has been. Indeed, in 2016 the Environmental Agency surveyed the public construction industry, not to assess/measure the percentage of recycled material, but to gain information on the level of understanding of recycled materials by the different actors involved. This study identified that the regulation did not contain a definition of recycled materials or materials containing recycled components. The Environmental Agency published a clarification in July 2016 (Circular 01/2016/DRES-DFEMR, APA¹⁹) with information to clarify non-compliance.

Primary research conducted by BAMB partners for the Impact Assessment has concluded that there is a lack of awareness, technical information and monitoring across the industry in

¹⁸ <https://publications.europa.eu/en/publication-detail/-/publication/78e42e6c-d8a6-11e7-a506-01aa75ed71a1/language-en>

¹⁹ http://www.apambiente.pt/_zdata/Politiclas/Residuos/Circulares/Circular_1_2016.pdf



Portugal, with nearly 30% of respondents saying that they did not know about the existence of the measure. For those who were aware and for whom the legislation was applicable, 52% of respondents admitted that they did not comply. They identified main barriers as the lack of verification, control and demand by public organisations (ultimate responsible by the projects), lack of will and lack of technical knowledge. Only 5% identified the target as a measure that is difficult to implement

Barriers

As part of the Impact Assessment, a stakeholder consultation exercise and a survey were conducted which identified a number of barriers to the successful implementation of this green public procurement measure:

There is no enforcement of the regulation by the public institutions. Indeed, there is a lack of ownership of the measure and without a regulatory body for construction and demolition waste, no department takes responsibility for ensuring that the relevant construction firms adhere to the regulation, or ensures that the requirement that has been written in to contracts has been applied to the projects. This is considered to be a contributory factor to the low awareness rate of the policy and the apparent lack of engagement.

Lack of awareness was also concluded to be a serious barrier to implementation. This extends to local authorities and government departments, who, as the customers for public construction projects, would be well placed to enforce the requirement for recycled materials to be included in projects. Indeed, the general lack of awareness was identified as extending across the entire supply chain and all stakeholders.

The impact assessment identified a lack of data as a serious barrier. Currently, the Portuguese government does not know the extent to which recycled materials are being used within public construction projects and the regulation is being complied with. High quality data would allow the impact of the measure to be quantified and benefits to be captured and communicated to stakeholders. The impact assessment has also identified a lack of technical knowledge by industry professionals over how to measure and monitor the 5% targets themselves.

Environmental topics/subjects are still not widely considered by designers, architects and engineers and it is unclear where the responsibility across design teams for the implementation of this measure lies.

The cost of implementation was also considered to be a barrier. The construction industry in Portugal in 2017 mainly consists of micro, small and medium companies (98.2%²⁰) that represent 66.2% of total value of the public contracts. These companies have a lack of capacity to respond to and include new requirements in their processes.

Opportunities

Several key opportunities for better implementation of the *Incorporação de 5% de Materiais Reciclados* were identified by the Impact Assessment. In particular, it was noted that the

²⁰http://www.impic.pt/impic/assets/misc/relatorios_dados_estatisticos/Relatorio_Anuar_ContratosPublicos_2017.pdf



legislation is currently being reviewed and this provides a window of opportunity to make changes to the measure which would support its success. These could include:

- Identification of an ‘owner’ for the measure who would be responsible for measuring, monitoring and reporting on its implementation.
- More effective communication of the requirement to use 5% recycled materials. Communication of the measure across the supply chain and all stakeholders would ensure that awareness was raised and would encourage its take-up. Additionally, case studies demonstrating the benefits of the measures could be developed which would support the implementation of the measure.
- Requirements for monitoring, which would allow better understanding of the level to which the measure is being implemented and its impacts.
- Setting clear objectives for the measure. This would provide a strong message for the construction industry and enable advantages to be identified and communicated more effectively.

The impact assessment identified that there are opportunities to enforce the measure through engaging local authorities. They can act as ambassadors for the use of recycled content in construction, both as customers and inspectors, using the planning permission process during design stage.

It was noted in the impact assessment that one of the drivers for implementing this measure has been when the construction projects are using a certification process (such as BREEAM or LEED) or when they are receiving international funds.

5.7 Conclusions and recommendations

There are a number of conclusions which can be drawn from the Impact Assessments regarding the critical success factors of policy regulation.

Data

From the Impact Assessments, it was noted that an important critical success factor for a policy is the quality and quantity of data available. This has an effect on the impact of the policy in a number of ways:

- High quality data is required for the meaningful definition and monitoring of targets. As identified in both the Site Waste Management Plan IA and the PREC, without high quality data, it is impossible to know if the policy or regulation is achieving what it set out to achieve and to adapt targets as required.
- The data required needs to be well-defined and standardised to maximise its value and allow for effective benchmarking and monitoring, as identified in the Site Waste Management Plan IA.
- Stakeholders need to understand the objectives of data collection, and what added value that data provides. Gathering and supplying data in a standardised format comes



with a financial and time cost to organisations, so only the data which is required should be requested.

- Sufficient resources need to be allocated to verify the quality, to process and to analyse the data, as identified by the IA of the PREC.
- The value network and all actors required for data collection, processing and analysis need to be considered to avoid data gaps.

Alignment

Alignment at different governmental/ geographical levels was also identified as a success factor of a policy. From the experience of Tracimat, it was viewed that, as the neighbouring Brussels Capital region is not participating in the scheme, this will reduce the positive impact as some CDW waste will be processed across the regional border.

The Swedish Environmental Objectives also highlighted the danger of non-alignment at different governmental levels. The implementation of the system is left to individual ministries and their actions may not be sufficiently ambitious to reach the objectives.

Enforcement

The presence of an enforcement structure was also identified as a critical success factor of regulation. The Portuguese procurement policy was noted to have not had impact, as there was no enforcement. In part, this was due to a lack of ownership for the regulation.

Cost of compliance

A further conclusion was that the cost of compliance with a policy or regulation should not outweigh the cost of non-compliance. This was identified in the Tracimat IA which concluded that there needed to be a price differential between LERM and HERM to provide a clear incentive to comply.

Clear objectives

The benefit of clear objectives was highlighted through the IAs. Clarity of communication and better understanding of the policy are key benefits. It was noted in the Swedish Environmental Objectives IA that some of the objectives were more clearly stated than others; for example, the Good Built Environment covers such a broad area that the objective remains visionary rather than a clear goal.

6 CONCLUSIONS OF THE BEST PRACTICES

6.1 Methodology

Examples of best practices were sought from the BAMB consortium partners, from the BAMB Stakeholder Network, and from workshops in Brussels and at EcoBuild in London. Basic information on each identified best practice was collated, including the geographical area of coverage, the topic and type of measure.

With over 40 best practices identified, a scoring methodology was developed to provide an initial sift of the policies/regulations to focus attention on those with the most relevance to the BAMB project and in particular to the BAMB Systemic Changes (see Figure 5):

Change in design culture from mono-functional buildings to material banks

Change in value definition from financial cost & benefit to societal added value

Change in collaboration across all actors from a chain to a network.

SYSTEMIC CHANGES

...in design culture



...in value definition



... in collaboration across all actors



Figure 5: The BAMB Systemic Changes

The methodology considers alignment to the BAMB Systemic Changes, as well as the level of innovation and relevance to promoting a change towards Circular Economy:

Promotes a change in design culture

Promotes a change in value definition

Promotes collaboration across all sectors

Score 1-10 (1=not aligned to BAMB Systemic Change, 10=Completely aligned to BAMB Systemic Change)

Level of innovation, Score 1-10 (1= 'everyone is currently doing this', 10 = 'nobody else is currently doing this')

Promotes a change towards CE/impact Score 1-10 (1= likely to have no impact on uptake of CE principles; 10= likely to embed CE principles into Business as Usual)



The policies/ regulations were scored then discussed and verified in group sessions to ensure alignment. Based on the collated scores, the best practices with the highest overall scores were identified using the following equation:

$$\textit{Design culture} + \textit{Value definition} + \textit{Collaboration} + \textit{Innovation} + \textit{Circular Economy} = \textit{TOTAL}$$

In order to ensure that policies/ regulations which only addressed **one** of the three systemic changes were not missed, scores were also collated for each systemic change individually to identify policies which might have the potential for promoting change in one or more areas:

$$\textit{Design culture} + \textit{Innovation} + \textit{Circular Economy} = \textit{total for design culture systemic change}$$

$$\textit{Value definition} + \textit{Innovation} + \textit{Circular Economy} = \textit{total for value definition systemic change}$$

$$\textit{Collaboration} + \textit{Innovation} + \textit{Circular Economy} = \textit{total for collaboration systemic change}$$

Through this selection process, 16 best practices were prioritised as having the most relevance for the BAMB project and were selected for further analysis. The scoring matrix is contained in Appendix B. In addition, it was considered that Demolition and Deconstruction Permits in use in Seattle, USA, and the Green Demolition Bylaw in Vancouver, Canada, should also be examined, as no demolition/ deconstruction policies would otherwise be considered based on the top aggregate scores alone.

Taken overall, the selected best practices represent a wide range of measures, as shown in Table 1 below:

Best practices	Country	Measure																			
		Actor-based targets/ milestones	BIM format requirement	Building Passport	Financial/ tax incentives	Guidelines	Indicators	Inspirational demonstration	LCA methodology/ tool	Monitoring	Permit e-system	Permit requirements	Planning requirements	Principles	Public procurement requirements	Reuse incentive	Salvage guidance	Third party verification	Timing incentive	Visionary goals	Voluntary traceability
Act for the Promotion of Long-life Quality Housing	Japan			x	x																
Be.Circular/ PREC	Belgium	x		x		x	x		x											x	
Rijkswaterstaat Purchasing and Procurement	Netherlands													x							
Circular Buildings Green Deal	Netherlands		x		x														x		
Level(s)	EU				x	x			x											x	
BREEAM	International				x	x			x								x		x		
Design for Change	Belgium				x		x	x													
Circular Peterborough	UK	x																		x	
Procura +	EU				x																
Tracimat - VLAREMA	Belgium																				x
ISO 20887 (Draft)	International				x	x								x							
London Plan - Circular Economy	UK												x								
Leading the Cycle - Finnish roadmap to a Circular Economy	Finland																			x	
BIM Singapore	Singapore	x								x											
Demolition and Deconstruction Permits	USA			x							x	x							x		
Green Demolition Bylaw	Canada			x											x	x			x		

Table 1: Measures represented by the best practices included in this framework

6.2 Best practices

Three best practice examples had the highest overall scores, and which were therefore assessed as: being most innovative, promoting a change towards circular economy thinking and showing closest alignment to the three BAMB systemic changes:

- Longer Life Housing Law (Japan)
- Be.Circular (PREC) (Brussels, Belgium)
- Public Procurement Rules, Rijkswaterstaat (Netherlands)

These three are considered first, followed by those which show a close alignment to either one or two of the systemic changes.

6.2.1 Best practices showing alignment to all three BAMB Systemic Changes

Act for the Promotion of Long-life Quality Housing 2009²¹

The Japanese Act for the Promotion of Long-Life Quality Housing is designed to support the development of housing stock which has an extended useful life. According to the Japanese government, the average age of a house at demolition in Japan is just over 30 years, compared to nearly 67 in the USA and 80 in the UK. The Long-life Housing Law was therefore

²¹<https://app.box.com/s/lixli1y11y11x3tpc1pah27rg575qh9n>



implemented to encourage the construction of high quality housing which can be easily maintained, “Long-Life Quality Housing”.

Long-Life Quality Housing is defined as superior housing with features to support long-term use in good condition. The legislation establishes an approval system for plans concerning construction and maintenance. Approved housing is eligible for exemptions from income taxes, registration taxes, and reductions in real estate acquisition taxes and fixed asset taxes. Other initiatives to promote the shift to long-life housing include the subsidized project for the development of long-life housing, the development of housing history records, and the improvement of housing finance.

This long-life-quality housing act is strongly related with the decades of experience in Japan regarding Open Building. Open Building is a design strategy taking into account the need to adapt the building during its life time, according to technological evolution and changes in user needs. One of the most important concepts within the Open Building is the disconnection of ‘support’ and ‘infill’ elements within the building. The support groups all elements within the building that represents communal responsibility, and the infill (or fit-out) as the aspect that stands for individual control. For housing the 'support and infill' concept means that dwellers have more control on design decisions regarding their own fit-out of the building. According to [Seiichi Fukao \(2008\)](#), the Open Building design strategy marries well the Japanese culture, because of the centuries old wooden building tradition in which Japanese carpenters build houses reflecting the requests of the residents. Some examples of Open Building in Japan are given by Fukao and [BRIQS](#). One of the most famous is the [NEXT21 pilot project](#), an experimental multi-family housing project constructed in 1994, in which each 7 years the building is completely refurbished according to the latest technological insights regarding energy performance (with experimental infill systems) and changing lifestyles of new groups of inhabitants.

Alignment with BAMB Systemic Changes

The Long-Life Housing Law provides a set of technical guidelines which promote a change in **design** culture. These include guidelines regarding ease of maintenance and renewal of services, particularly with respect to the disconnection of support and infill elements in a building with the requirement to be able to access service functions from outside the house. Adaptability is also considered important, with the fit-out giving great flexibility for individual residents and being configured to allow for refurbishment as required. Initiatives include:

- Minimum height between floor slabs to allow space for services to accommodate modification of the original room layouts
- Support for continuous customization in the life time of the building
- Free Plan Rental Housing with the fit-out owned by residents.

From a **value** perspective, the Long-Life Housing Law uses a mixture of legislative, taxation and budgetary measures to promote the transition from “*build and scrap*” attitudes to housing construction to the development of durable and high-quality housing stock.



In terms of a systemic change towards a change in **collaboration** across all actors, the law and the resulting adaptability has led to a high level of industrialisation of the building components. Japanese industrialised house and infill producers are taking advantage of information technology to make it possible for their customers to feel they are designing their house by themselves.

Circular Economy impact

The lengthening of the life of a house will reduce the consumption of natural resources and the economic burden of housing expenses for families and should contribute to the solution of global environmental issues and the impacts of waste in the future. The adaptability promoted by the Long-Life Housing Law should also encourage a move to a circular approach to residential property.

Recommendations

This regulation is considered to be unique in its scope and ambition. It considers design aspects to increase the lifespan of housing, as well as the adaptability, and quality of construction. It responds very well to the needs of Japanese housing in the 21st century. Since the 1990's Japan has been experimenting with Open Building design concepts, supported by the building industry. With the introduction of the Long-Life Quality Housing Act, it is expected that Open Building will only gain in importance. In Europe, some countries such as the Netherlands, Belgium and Finland also experimented with Open Building. However, this was never mainstream.

Exceptional elements of the policy include concern for spatial aspects, for example in specifying a minimum height between floor and ceiling, which allows sub-flooring for technical functions, piping, and electricity. Also notable is the requirement to access piping and utilities from outside the house. These kinds of requirements could be integrated in construction or permit regulation requirements.

Financial and tax incentives are coupled to the regulatory requirements, providing a positive cost rationale for compliance.

It is also noted that a side effect of the regulation is market facilitation. Companies are developing modular systems for the infill or fit-out of the houses in response to the laws.

Be.Circular / PREC²²

This policy programme, the Regional Programme for Circular Economy (PREC), applies to the Brussels Capital Region of Belgium and runs from 2016 to 2020. It has 3 overall objectives:

- Turn environmental objectives into economic opportunities.
- Anchor the economy in Brussels – to produce locally when possible, reduce transport distances, optimize land use and create added value for Brussels.

²² http://document.environnement.brussels/opac_css/elecfile/PROG_160308_PREC_DEF_FR



- Support job creation.

In order to reach these objectives 111 measures have been defined within 5 sectors: Construction, resources and waste, logistics, retail and food.

The policy programme is considered innovative. The actions undertaken with regards to the transition towards a circular and dynamic built environment are based on an analysis of the current situation within the Brussels Capital Region and the barriers and opportunities this offers in order to provide concrete measures and actions to be implemented. These are developed in close cooperation with the different stakeholders and based on experiments, stimulation of research and the monitoring of the suggested actors. Meanwhile, targets and actions targeting specific actors have been developed in collaboration with those actors.

Alignment with BAMB Systemic Changes

Different initiatives aim to support a change in **design**, integrating different principles of circular economy. For example:

- The vision document emphasises the importance of a change in design in order to meet circular economy objectives
- The “Appel à projet Be Circular - volet Chantiers Circulaires” (Be.Circular Call for circular building sites) initiative aims to support circular building construction and refurbishment, to support changes in design which will integrate principles of (in-situ) reuse, repair and remanufacturing. It provides a financial incentive as well as an inspiration/ stimulation for the market.

With respect to **collaboration**, there are a number of initiatives which align with the BAMB Systemic Changes, including the development of a platform for the stakeholders active in the reclaimed materials and products sector. Furthermore, the definition of objectives, indicators and the actions to be taken to achieve these objectives are based on a participative process integrating different types of stakeholders.

Circular Economy Impact

The policy and related initiatives directly support the move to a circular economy in the five target sectors by engaging citizens, industry and government through a range of measures.

Recommendations

From the construction industry perspective, the development of the PREC has included engagement with construction professionals, including designers and contractors. Together with the sector, the public authority is defining goals and indicators, which will make implementation easier.

Different working groups have been developed to develop actions, for example, on training. Overall, the implementation of the PREC is an example of *awareness raising* amongst professionals



For business and environmental aspects, the PREC takes into account the need for monitoring, and indicators²³ are currently being developed.

Rijkwaterstaat Purchasing and Procurement (Rijkwaterstaat – Inkoopbeleid en aanbestedingen)^{24,25}

The Purchasing and Procurement Rules of the Rijkwaterstaat (the Ministry of Infrastructure and Water Management) is a national policy adopted by the ministry responsible for the design, construction, management and maintenance of all Dutch infrastructure, including roads, canals and water systems, such as dykes.

The Purchasing and Procurement rules reflect three pillars of sustainability: environmental, economic and social. The scoring is set so that higher positive scores for environmental and social aspects of a contract reduce the weighting factor for the cost.

Alignment with BAMB Systemic Changes

From a **design** perspective, contractors are given the opportunity to come up with innovative design approaches, as the Rijkwaterstaat makes use of solution-free requests (performance-based rather than prescriptive objectives), using functional specifications wherever possible.

Additionally, Rijkwaterstaat makes use of the MKI value (Milieu Kosten Indicator), or environmental costs indicator, which quantifies the environmental impact of a civil engineering project - the lower the value, the less environmental impact. Designs that differ considerably in terms of materials also differ in terms of environmental quality. The MKI is calculated using a system called DuboCalc, developed by the ministry to compare the sustainability **value** of design alternatives.

The MKI can be integrated into the calculation of the EMVI (Economisch Meest Voordelige Inschrijving), or Economically Most Advantageous Submission, so that the lower the environmental impact, the higher the economically most advantageous criteria. The Rijkwaterstaat aims to reserve a high percentage of the EMVI criteria for environmental quality.

CO₂ reduction is also encouraged, and is calculated through another Rijkwaterstaat tool, the CO₂-performance ladder. This is a certification system, through which contractors demonstrate the level to which they limit CO₂ emissions in their company and their projects.

The Rijkwaterstaat has introduced a new way of thinking about the division of roles between client and contractor which results in a more **collaborative** approach. BVP (best value

²³ http://document.environnement.brussels/opac_css/elecfile/PROG_160308_PREC_DEF_FR

²⁴ <https://www.rijkswaterstaat.nl/zakelijk/zakendoen-met-rijkswaterstaat/inkoopbeleid/duurzaam-inkopen/>

²⁵ <https://www.rijkswaterstaat.nl/zakelijk/zakendoen-met-rijkswaterstaat/inkoopbeleid/aanbesteden/index.aspx>



procurement) means a shift of 'control and manage' to 'let go and trust', of 'directed by the client' to 'guided by the contractor'. This means that the Rijkswaterstaat facilitates and lets the contractor take the lead. The expertise of the contractor is key as well as making the results achieved transparent for both client and contractor.

This leads to:

- A better use of the expertise of the contractor as well as better cooperation over the value chain.
- Transparency and monitoring in the performance and thus quicker learning for both the client and the contractor

Circular Economy Impact

The Purchasing and Procurement policy does not directly focus on the Circular Economy, although the use of DuboCalc promotes the reuse of materials and reductions in the use of raw materials. At this stage, multiple uses of materials are not included in the calculations. It is recommended that the Dutch Government (and others) consider implementing the CBA methodology to further support circularity instead.

It is noted that the Rijkswaterstaat is aiming to be climate-neutral and circular by 2030 and the policy has great potential for impact if Circular Economy assessment criteria are included in future.

Recommendations

Regarding value definition, the procurement policy works on three different pillars: price, environmental and social aspect. The public procurement process quantifies the environmental and social impacts and integrates external costs into the total price. Thus, if you decrease environmental and social costs, there is a higher tolerance for price. This has a clear impact on value definition.

That the Rijkswaterstaat can stipulate the performance of buildings, rather than pre-identifying solutions, encourages collaboration and innovative approaches. It can ask contractors to provide solutions and present a risk analysis which considers things which may not have been foreseen by the procuring entity.

Once a contract is ongoing, there are weekly reports to follow up and be sure that there is no deviation. If there is a problem, the procuring entity and contractor find a solution together, thus sharing the risk. This can be used to flag problems at a very early stage. There's a higher likelihood of risk as they are implementing innovation, so there may be unforeseen issues which haven't been anticipated by the procuring entity.

The experience of the Rijkswaterstaat demonstrates the principles of Green Public Procurement (GPP) in practice and its potential to become the default option (with the inclusion of circularity) at a wider scale.

The procurement system has four tools to support decision making. Given the likely future objectives in relation to circular economy, and the ability to reduce environmental impact



through circular building scenarios, there should be potential to add BAMB's Circular Building Assessment (CBA) into this process or adapt/build upon the BAMB learning and outcomes related to decision making support.

6.2.2 Best practices showing strong alignment to two or one systemic changes

The best practices in the following section show strong alignment to either two or one of the BAMB Systemic Changes

Circular Buildings Green Deal²⁶

The Circular Buildings (CB) Green Deal in the Netherlands is one of a number of Green Deals in the construction sector. Initiated by the 'Rijksdienst voor Ondernemend Nederland', an executive department of the Dutch Ministry of Economic Affairs, this CB Green Deal lasted three years, from January 2015 to December 2017. It engaged 59 Dutch organizations (governments, knowledge institutes and businesses) to conceive circular buildings:

- using the smallest possible amount of new resources and products.
- retaining products and resources within the chain (for high-quality applications) for as long as possible. This also involves extending the life of buildings by making them as adaptable as possible.

Through the CB Green Deal a common framework was developed involving a 'building passport' in which details of essential circular building features are measured and recorded. The tool – applicable for new and existing buildings - and its manual are now freely available through the website of the CB Green Deal. Both instruments have been tested on 6 pilot projects. Insights and lessons-learned have been captured and disseminated through the website.

Although the Green Deal itself has now closed, new initiatives have started in the Netherlands. One of them is the [CB23 platform](#), in which different Dutch protagonists of circular buildings joined forces to support the transition to circular economy in the built environment, by (1) knowledge gathering, (2) inventory and disseminating barriers, and (3) developing broad sectorial agreements. This platform has started in 2018 and will last 5 years, hence the name CB23 Platform. Three action teams have been set up, looking at:

1. a framework for circular building: towards a clear understanding of Circular Building and its principles
2. measuring circularity: towards a uniform and effective assessment method
3. passports for the building: towards harmonization of different building and materials passports initiatives.

The objectives of the CB23 platform are in line with the Green Deal Circular Building, and also the BAMB projects. The three action teams can be easily matched with the development of a Common Language, reversible building design tools, the Circular Building Assessment and Materials Passports in the BAMB project.

²⁶<http://www.greendeal-circulairegebouwen.nl/producten>



Alignment with BAMB Systemic Changes

The CB Green Deal is particularly strongly aligned with the BAMB systemic change in **design**. Using the building passport assessment tool, designers are encouraged to approach design in a different way and critical questions are asked of the design proposal to encourage circular thinking. There is additional focus on how to make existing buildings circular during their lifespan.

With regards to **value**, the goal of the CB Green Deal is to make building components reusable and buildings adaptable, so that their value is better conserved through time, strengthening the business case for long-term investors. It is also noted that sustainability aspects go beyond the economic impacts. Themes for building elements include: adaptability, disassembly, origin of materials, end-of-life (EOL) of materials, extended lifetime / maintenance, energy consumption, financial continuity, health, and safety.

Considering issues of data and **collaboration**, ‘Building circularity’ indicators have been developed in the passport, regarding used products and materials, management and maintenance, refurbishment and adaptability of the building in the future. The passport can serve as a tool for both governments and market players who want to assess the circularity of a building during its operational phase and who want to contribute to the realisation of circular buildings.

Circular economy impact

The policy programme has great potential for circular economy impact. The building passport records essential features of circular buildings. Based on the shearing layers concept²⁷, introduced by Frank Duffy and further elaborated by Stewart Brand, important design criteria have been developed for the location of the building, its bearing structure, the building skin, technical services, space plan furniture and other utility items. The use of the building passport has been tested on 6 pilot buildings. Useful insights and lessons-learned were captured, providing insight into the different processes and steps that must be followed.

It was noted that the policy is broad and neutral. Whilst it provides some critical questions for the stakeholders (mainly in the operational phase) regarding a building’s features (adaptability etc.), the framework is voluntary and contains no practical guidelines on how the designer can influence the circularity of the building, nor does it provide clear practical technical examples. The building passport developed within the framework of the Green Deal Circular Building must be seen as a first voluntary step in the Netherlands towards an open assessment method of circular building features. Already other initiatives have been started meanwhile, such as the CB23 platform and the BREEAM NL framework for Circular Building, providing more technical insights and validation of the work of the Dutch Green Deal Circular Buildings.

²⁷ The Shearing layers concept views buildings as a set of components that evolve in different timescales; Frank Duffy summarized this view in his phrase: “*Our basic argument is that there isn't any such thing as a building. A building properly conceived is several layers of longevity of built components*” (quoted in Brand, S. (1994). *How Buildings Learn*. New York: Viking)



Recommendations

The Green Deal focuses on building passports which can be used to assess the circularity of the building during the operational phase. However, these passports remain very broad and only used to assess qualitative characteristics of (circular) buildings. A simplified form of the Circular Building Assessment (CBA), incorporating quantitative indicators such as transformation capacity and reuse potential of the building, its spaces and components, could be brought into the building passports to embed circular economy thinking (e.g. a checklist). If the idea of building passports were to become more widespread, they could become a way of obtaining data on the value of the building stock.

Level(s)²⁸

Level(s) is being developed to be a Europe-wide voluntary reporting framework and is currently being trialled. It is designed to improve the sustainability of buildings. Using existing standards, Level(s) provides a common EU approach to the assessment of environmental performance in the built environment.

Level(s) is an assessment framework (integrating different tools), supporting design and construction decisions. Indicators use Life Cycle Assessment and Life Cycle Costing principles to assess environmental performance. The indicators are directly linked to EU policy goals to allow users of the Level(s) framework, or schemes or tools that are aligned with the framework, to know that they are contributing to meeting these goals.

Macro objectives which are particularly aligned to BAMB are:

- Greenhouse gas emissions along a buildings life cycle
- Resource efficient and circular material life cycles
- Optimised life cycle cost and value.

There are three levels of performance assessment:

1. Checklist
2. Comparative assessment
3. Optimisation of performance assessment.

The Level(s) framework makes it possible to report on building performance by using building specific indicators at the following project stages along the life cycle of a building:

- Design stage (based on calculations, simulations and scenarios)
- Implementation stage (based on as-built drawings, specifications and tracking)
- Completion stage (based on commissioning and testing)
- Operation stage (based on measured performance and occupant satisfaction)

²⁸<http://ec.europa.eu/environment/eussd/buildings.htm>



Level(s) is currently in the testing phase (scheduled to end in March 2020) and is being trialled on residential buildings and offices.

Alignment with BAMB Systemic Changes

Level(s) is broadly aligned to the BAMB system change on **design**, as it promotes adaptability, as well as making consideration of the impact across the whole building life cycle at the design stage. It takes a holistic approach to the building, including for example embodied carbon as well as energy performance. Amongst the tools which are available, Level(s) provides life cycle tools which promote changes in design through consideration of three scenarios:

- Building and elemental service life planning
- Design for adaptability and refurbishment
- Design for deconstruction, reuse and recyclability.

From a **value** perspective, Level(s) seeks to optimise the life cycle cost and value of buildings. It takes into consideration the potential *to recover, reuse and recycle major building elements*²⁹.

Recommendations

Through the Level(s) testing phase, data is being captured on buildings across Europe. This could be used to develop benchmarking tools at a later date.

The BAMB consortium should continue to engage with Level(s) for possible alignment with BAMB objective and potential for provision of additional tools to realise Level(s) objectives.

BREEAM

BREEAM stands for BRE Environmental Assessment Method. Established in 1990, it was the world's first commercial sustainability assessment method for master planning projects, infrastructure and buildings. It recognises and reflects the value in higher performing assets across the built environment lifecycle, from new construction to in-use and refurbishment. BREEAM does this through third party certification of the assessment of an asset's environmental, social and economic sustainability performance, using standards developed by BRE.

At the time of writing (Dec 18), over 566K certificates have been issued, 2.275 million buildings have been registered for assessment, in over 79 countries. Technical standards (against which developments are assessed) exist for Communities, Infrastructure, New Construction, In-Use, Refurbishment & Fitout.

In 2017, BRE published a report which mapped the resource efficiency related criteria in BREEAM Schemes³⁰.

²⁹

http://susproc.jrc.ec.europa.eu/Efficient_Buildings/docs/170816_Levels_EU_framework_of_building_indicators_Parts.pdf



Key features related to material efficiency in the New Construction (2014) scheme include credits for responsible construction practices, design for durability and resilience, material efficiency (optimized during the design process) and construction waste management. Changes were made to this scheme (2018) that will further enhance Design for Disassembly and Adaptability (Wst 06).

In October 2018, the Dutch Green Building Council (the DGBC), who manage the BREEAM NL scheme, launched a publication called *A Framework for Circular Buildings: Indicators for possible inclusion in BREEAM*. The report identifies six crucial indicators to potentially include in BREEAM-NL. These are:

- Accountability and substantiation of building volume
- Design for reassembly
- Maximize amount of reused materials
- Maximize amount of renewable materials
- Availability of information (element, component, material)
- Building design embodies no or minimal toxicity

The work developed by DGBC and published in October 2018 will be reviewed and discussed with BRE in the near future.

Alignment with BAMB Systemic Changes

As a tool for designing and constructing sustainable buildings, BREEAM is well-aligned to the BAMB Systemic Changes, particularly regarding design and value.

Design – BREEAM has great focus on the planning and design process, this is where the most impactful decisions are made in terms materials selection and design strategies that could impact on ability to transform in-use, or deconstruct post-use.

Value – This is less impacted by BREEAM but does kick start a conversation through aspects like the pre-demolition and refurbishment audits. Further tightening of requirements for these audits to be undertaken earlier and through independent (of selected contractor) evaluation should improve outcomes here. Driving demand for reclaimed products and materials could also be a result (especially in Excellent and Outstanding categories).

Data – increasingly the use of data (via BIM) is used to determine various environmental and economic results, including options appraisals. BREEAM is a key driver to create a growing number of dedicated, BIM enabled, tools developed in the last few years – such as LCA related software. The requirement for evidence is also relevant, and environmental reporting tools, such as smartwaste.co.uk, have also been boosted by BREEAM requirements to measure and monitor performance.

Circular Economy Impact

BREEAM already has a good impact on aspects of circular economy, especially in those projects seeking Excellent or Outstanding ratings (where it is challenging to meet the

³⁰<https://www.brebookshop.com/samples/327792.pdf>



requirements without addressing as many categories as possible), as various aspects can be mapped across and cover many of the best practices being promoted as Circular Economy.

As BREEAM is so widely used, it has the potential to support the transition to Circular Economy further, with the further integration of circularity indicators and reversible building design criteria.

Recommendation

Based on insights and developed work within the BAMB project (BRE being a partner in the consortium), with the DGBC, with other BRE projects and BREEAM stakeholders, BRE may provide a wider and deeper emphasis on Circular Economy in future updates of BREEAM standards. This may be scattered throughout the existing structure, or potentially aggregated into a dedicated section. The next update of BREEAM New Construction will start in 2019 and, as usual, will be open to several rounds of stakeholder consultation prior to finalisation.

Design for Change^{31,32}

The Design for Change (DfC) assessment and transitional framework has been developed in the Flemish region of Belgium encouraging an alternative way of designing buildings, neighbourhoods and building elements, in order to create a built environment that supports change in a more efficient and effective way, e.g. by extending the life time of high-quality buildings and using building components multiple times. The assessment framework includes a qualitative and quantitative part, assisting decision-makers.

The qualitative part of the assessment framework consists of a set of 24 practical Design for Change guidelines (see Figure 6 below). Each design principle is discussed and illustrated on a separate sheet, available online, allowing designers, developers and policymakers to get acquainted with existing solutions and at the same time provide them with an understanding of the importance of applying the principle. Each principle also includes key questions in order to assess a design option and potential alternatives.

The synchronous treatment of three scales (building elements, buildings and neighbourhoods) ensures a holistic approach.

³¹<http://www.ovam.be/veranderingsgerichtbouwen>

³²<http://www.ovam.be/sites/default/files/atoms/files/TWOL-Design-for-change.pdf>

	Interfaces	Sub-components	Composition
Element	Reversibility Simplicity Speed	Durability Reused Compatibility	Pace-layered Independence Prefabrication
Building	Accessibility	Demountability Reusability Extensibility	Versatility
Neighbourhood	Clear Adaptable	Retrofitted Dimensioned Removable	Unified Multipurpose Diverse Densifiable

Figure 6: overview of 24 Design for Change guidelines (OVAM, 2015)

The quantitative section focuses on Lifecycle Analysis. Both initial and entire lifecycle impacts are calculated in financial and environmental terms. This quantitative assessment includes the analysis of different transformation and EOL scenarios. This is in line with the Circular Building Assessment (CBA) developed through the BAMB project.

DfC is considered to be very innovative. For the development of the framework, state of the art design for change principles were applied. The design guidelines were tested within a research project in two ongoing construction projects (and 3 more projects afterwards). To validate the new insights and improved assessment framework, two consultancy programmes were started and successfully completed for specific construction projects. For each trajectory, basic information was provided to the architects, a qualitative assessment of their design proposals was made, and quantitative lifecycle analyses were performed. In addition to disseminating the added value of Design for Change through real construction projects, this consultancy clarified potential long-term financial and environmental impact or gains.

Design for Change is one of the five transitional paths the OVAM (the Flemish Public Waste Agency) has put forward in its policy program “Material Conscious Building in Circuits”. The transitional approach means learning by doing and doing by learning. Hence, short-term experiments that can propel a major social shift are also needed. For example, the OVAM is supporting the use of the 24 Design for Change guidelines in a number of blackfield³³ projects. The use of the Design for Change assessment framework is currently on a voluntary basis. The 24 DfC guidelines are straight forward and can be applied by the involved designers or other stakeholders. For the environmental and financial life cycle assessment,

³³ Blackfields - like brownfields - are underutilised sites where redevelopment is required, but where - unlike brownfields - the soil is so heavily polluted that project developers and investors no longer see the possibility of a profitable project. In these cases it is therefore up to the government to take initiatives, otherwise there will be no redevelopment of these lands.



currently some professional advice is still required. OVAM, is currently looking at ways how to integrate a circular LCA into TOTEM, a free and open LCA tool for architects.

Alignment to BAMB Systemic Changes

Design for Change is particularly closely aligned to the **Design** systemic change identified through the BAMB project. General design guidelines have been developed in the programme. Additionally, a breakdown by scale (element, building, neighbourhood) and by theme (interfaces, sub-components, composition) makes it possible to establish a comprehensive and clear qualitative assessment of the design and construction of a building.

Circular Economy Impact

Design for Change (or dynamic building) can play a key role in reducing the environmental impact of the construction industry. By anticipating future changes today it is possible to fulfil the ever-changing needs and demands of individual users and society with less polluting and less material-intensive construction works. Moreover, when the possibility exists to disassemble and recycle - or, even better, reuse - building elements, a lot of material loops can be closed.

At the building level, Design for Change supports adaptable and multi-use projects, including principles such as “support-and-infill” and “generality”. At the building element level, Design for Change supports application of prefabricated and dismountable construction systems that enable the reuse of building elements or their components.

Recommendations

The BAMB Reversible Design Protocols could be adopted within the 24 Guidelines to develop DfC into a more quantitative assessment.

This assessment and transition framework could be scaled up to other European countries.

A number of transition projects have been defined and it is recommended that policymakers define and run experimental projects before developing policies.

Circular Peterborough³⁴

The aim of the Circular Peterborough Commitment is to transform the city of Peterborough in the UK into a truly circular city by 2050. It is part of the Future Peterborough programme, delivered in joint partnership by Opportunity Peterborough and Peterborough City Council. The commitment was developed taking a collaborative approach and enables individuals, communities and businesses to pledge their support to the initiative. The Circular City Roadmap³⁵ details short term actions to 2021 and longer term ambitions to 2050 and has a 7 Rs approach, including rethink, redesign, repair and repurpose. Enabling change, implementing projects, and monitoring and learning, along with KPIs, key milestones and a Circular City Maturity Matrix are all crucial parts of the roadmap. Aspects of particular

³⁴ <http://www.futurepeterborough.com/circular-city/circular-peterborough-commitment/>

³⁵ <http://www.futurepeterborough.com/circular-city/circular-city-roadmap/>



interest to circular and dynamic buildings include the development of a systems thinking approach that evolves over time, the circular infrastructure & digital technology/connectivity objectives and their respective milestones. This is an ongoing programme of work with case studies and the network being developed continually. It is expected that progress by 2021 will be an important milestone in this long term city vision.

Alignment to the BAMB Systemic Changes

Circular Peterborough is most closely aligned to the **Value** and **Collaboration** systemic changes. However, one of its approaches is to encourage redesign to promote the move towards Circular Economy principles. The city is planning a Circular School Buildings project, to begin in 2019.

In terms of value, Circular Peterborough is working with stakeholders to changes processes, so that the life of infrastructure can be extended.

Collaboration is at the heart of the Circular Peterborough principles. It has engaged a group of Circular City Champions, which include Skanska and Viridor, who, as organisations, are working to embed circular principles into their businesses.

The systems thinking approach could also develop into an interesting case study on how the built environment and stages of its life cycle can be optimised at a city scale. This has scope to be closely aligned to all areas of identified systemic change – design, value, collaboration and data integration.

Circular Economy Impact

The city aims to be truly circular by 2050. It is taking a collaborative approach, engaging citizens, communities and businesses, and led by a partnership which includes the city council. If the ambitions set out within the roadmap are realised, this could have significant impact within the city, but also be replicated elsewhere, e.g. Peterborough are part of a small cities network through which further impact could be realised.

Recommendations

Collaboration with stakeholders is a key pillar of Circular Peterborough. Meaningful engagement with all sectors should make implementation easier and raise awareness at all levels. Progress in realising the objectives of the Roadmap should be monitored as well as lessons learnt from success and lack of success.



The Procura + Manual and Case Studies^{36,37}

The Procura + manual provides guidelines to implement sustainable procurement. It provides suggestions for procurement in general, not exclusively public procurement. It builds on the EU 2014 Procurement directive.

16 Case studies presenting best practices in sustainable (public) procurement are presented on the Procura + website. Each best practice report contains a summary, background, development of the approach, implementation of the approach, results and lessons learned. The Case studies cover different sectors as well as different aspects of sustainability and provide exemplary innovative approaches for public procurement. Examples include:

- Promoting responsible purchasing (Nantes, France)
- Reuse and refurbishment of furniture through circular economy procurement (Public Health Wales)

Alignment with BAMB Systemic changes

The Procura + Manual aligns closely with the BAMB systemic change on **collaboration**. The Manual supports a different way of collaborating between contracting authorities and suppliers, but also between different contracting authorities.

Suggestions are made regarding the pre-procurement process, including how better dialogue, market investigation etc. can support better understanding, market engagement and resulting quality and sustainability.

Different procurement procedures offering more flexibility and enabling information exchange and discussion are suggested: *pre-commercial; procurement; innovation partnership; competitive dialogue; competitive procedure with negotiation*

The Procura + Manual also supports frameworks, central and joint purchasing. Larger volumes of demand can help incentivise suppliers to meet requirements, especially where there are up-front costs involved in attaining certification or auditing supply chains. These strategies also allow smaller authorities, or those with fewer resources, to access the sustainable procurement expertise offered by larger organisations.

Additionally, by integrating environmental and social aspects in the procurement, the **value** of the provided service or product encompasses more than financial aspects. The Manual supports Lifecycle Costing and Social Return on Investment. Examples of alternative ownership models are provided.

Circular economy impact

The Manual does not specifically focus on circular economy but could provide a significant impact when introducing the right circular economy assessment criteria.

³⁶http://www.procuraplus.org/fileadmin/user_upload/Manual/Procuraplus_Manual_Third_Edition.pdf

³⁷<http://www.procuraplus.org/case-studies/>



Recommendations

It is recommended that procuring bodies integrate environmental and social aspects in their procurement. There is also considerable value in the Procura+ approach of sharing best practice through a Manual and Case studies.

Tracimat – VLAREMA³⁸

To stimulate the practice of selective demolition in Flanders, Tracimat (TRACIng MATerials), a voluntary demolition tracing system, was set up. Tracimat is a non-profit neutral construction and demolition waste (CDW) management organisation that certifies the selective demolition process by issuing a "certificate of selective demolition" for demolition waste that has been selectively collected and subsequently gone through a tracing system, thereby assuring the processing company of the quality of the recycled demolition waste.

If the CDW is accompanied by a "certificate of selective demolition" the processor can accept the demolition waste as "low environmental risk material" (LERM) and can therefore process it separately from waste streams with a high environmental risk (HERM).

Tracimat is legally incorporated into the Flemish environmental regulation VLAREMA for Sustainable Management of Material Cycles and Waste, which is the implementing order of the Flemish Materials Decree. Tracimat operates in feedback with the Common Regulation for Recycled Aggregates, allowing it to trace construction and demolition materials down to the crusher.

A new acceptance and processing policy (LERM vs HERM) for producers of recycled aggregates came into force in August 2018. From this point, all producers of recycled aggregates shall differentiate between materials with high and low environmental risk.

Alignment with BAMB Systemic Changes

The Tracimat system aims to enhance the quality of recycled aggregates for high **value** recycling. Purer waste streams with a low environmental risk have a greater upcycling potential. This in turn would open up opportunities for incorporation into more high-quality applications than are currently possible. The CDW management organisation also aims to enhance trust and collaboration and to stimulate professional selective demolition practices.

Tracimat aligns with the **collaboration** systemic change: The tracing process starts with the preparation of a demolition waste inventory and waste management plan prepared by an expert prior to the disassembly work and selective demolition. To guarantee the quality of the waste inventory and waste management plan, they must be prepared according to a specific procedure. Tracimat checks the quality of the waste inventory and waste management plan and issues a declaration on its conformity.

³⁸<http://www.tracimat.be>



Circular economy impact

The lack of trust (e.g. the current lack of trust in the quality of recycled aggregates) between stakeholders within the building value network is found as one of the main obstacles of a circular economy within a built environment. The introduction of the new acceptance policy (LERM versus HERM) for producers of recycled aggregates should ensure a certain level of quality of LERM and by doing so is an important step to increase trust between demolition contractors, crushers, manufacturers and building clients.

Recommendations

The system could be scaled up to other countries, especially countries with high amounts of stony fraction, as well as including other fractions such as wood. In addition, it could be further developed to promote reuse and not just recycling.

The effectiveness of Tracimat might benefit from alignment of regulation in bordering areas

The collection and analysis of data captured through Tracimat provides an opportunity for the government to gain a greater understanding of the levels and quantities of waste products in demolition.

Comparison, or possible integration, with construction site waste/ environmental reporting systems, such as BRE's Smartsite³⁹, could provide a further data detail & standardization, refinement of End of Life scenarios, and provision of benchmarks to target and monitor performance.

ISO 20887 Design for Disassembly and Adaptability of buildings and civil engineering works – principles, requirements and guidance (DRAFT)

ISO 20887 is an international standard currently under development by the International Organization for Standardization (ISO), a federation of national standards bodies. Based on the Canada Code of Practice, ISO 20887 is intended to provide a framework for the Design for disassembly and adaptability (DfD/A) principles and the key issues that should be considered by those involved in a project. The ISO will provide guidance for decision making and illustrative examples.

Alignment with BAMB Systemic Changes

The key alignment of ISO 20887 to the BAMB systemic changes is in its potential to influence construction at the **design** phase. The ISO will standardise principles for overcoming barriers to disassembly and adaptability, such as difficulty of access to components and services, use of unnecessary finishes and interdependence of components. It will also encourage consideration of circular economy business models.

Recommendation

It is recommended that the ISO standard 20887 should be promoted through standards such as BREEAM and Level(s) as well as through public procurement and other channels, so that it

³⁹ <https://www.bresmartsite.com/products/smartwaste/>



becomes widely understood and accepted. The measurement side of Design for Disassembly and Adaptability is still poorly defined, so the Reversible Building Design protocols developed by BAMB could be potentially referenced in the final standard (depending on timings of both outputs).

London Plan - Circular Economy Statement⁴⁰

The Circular Economy Statement applies to ‘Referable’ planning applications in London.

The London Plan is a strategic policy instrument which sets out the spatial development strategy for London. The draft new London Plan, currently under consultation, will require planning applications of a certain size to promote circular economy outcomes and aim to be net zero-waste. Applications will be required to include a Circular Economy Statement, demonstrating how they will meet the required criteria:

1. How all materials arising from demolition and remediation works will be reused and/or recycled
2. How the proposal’s design and construction will enable building materials, components and products to be disassembled and reused at the end of their useful life
3. Opportunities for managing as much waste as possible on site
4. Adequate and easily accessible storage space to support recycling and reuse
5. How much waste the proposal is expected to generate, and how and where the waste will be handled.

Guidelines for development of the CE statement are currently being produced and should be available spring 2019.

Alignment with BAMB Systemic Changes

It is considered that the requirement for a Circular Economy Statement could have a large impact on **design**, if the focus and targets are set out to change design. It is currently unclear if this will be a requirement or a ‘nice-to-have’.

The Circular Economy Statement could have an impact on **collaboration**, as it will necessarily stimulate discussions in the design process. However, it is unclear if these discussions will extend beyond this to include the client, contractors, demolition companies and other stakeholders.

Work is now underway to establish specific requirements and guidance to be referenced and followed when the final plan is published.

Circular Economy Impact

It is anticipated that the Circular Economy Statement could have a significant impact. With no other local authorities currently requiring Circular Economy assessments and provision

⁴⁰<https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/draft-new-london-plan/chapter-9-sustainable-infrastructure/policy-si7-reducing-waste-and-supporting>



necessary in order to get planning permission, the introduction of this requirement could act as a driver and example for other Local Authorities in the UK and beyond to follow.

Recommendation

It is recommended that other local authorities consider the introduction of a Circular Economy Statement and review how it might be implemented under their particular planning framework.

Leading the cycle - Finnish road map to a circular economy 2016-2025^{41,42}

The target of the Finnish government and the road map is to make Finland a global leader in the circular economy by 2025. The road map was drafted under the direction of Sitra, the Finnish innovation fund, in co-operation with the Ministry of the Environment, the Ministry of Agriculture and Forestry, the Ministry of Economic Affairs and Employment, the business sector and other key stakeholders in Finland.

The upper level targets:

- **Economy:** The circular economy will be a new cornerstone for the Finnish economy
- **Environment:** Finland as a model country for the challenge of resource scarcity
- **Society:** From adapter to pioneer

There are five initial focus areas, of which the three most relevant to BAMB are:

- **Forest-based loops:** *Global competition will increase with new commercial products, services, co-operation models and digital technology.*
- **Technical loops:** *Minimising the use of virgin raw materials and maximising the length of material and product lifecycles create a competitive edge.*
- **Common action:** *Legislators, companies, universities and research institute, consumers and citizens, and vibrant regions are all need to achieve systemic change.⁴³*

Alignment with BAMB Systemic Changes

Although the construction sector is not a specific focus of the initial plans for Finland's circular economy, its consideration of technical loops supports the systemic change in **value** sought by the BAMB project. The plan considers that minimising the use of virgin raw materials creates a competitive edge. Additionally, Finland seeks to maximise the length of life cycles of materials and products, as well as increasing opportunities for reuse and changing business models to encourage use of services rather than goods.

⁴¹<https://www.sitra.fi/en/publications/leading-cycle/>

⁴²<https://media.sitra.fi/2017/02/24032659/Selvityksia121.pdf>

⁴³https://media.sitra.fi/2017/02/27052129/sitra_kiertotalous_infografiikka_some_en-1.jpg



In terms of **collaboration**, the road map emphasises the need for all levels of society to participate to achieve the required rate of change. It also identifies the importance of being able to identify and separate materials at the end of a product's lifecycle, encouraging high value reuse.

Circular Economy Impact

Although only five areas have been selected for initial focus (Sustainable Food Systems, Forest-based loops, Technical loops, Transport and logistics and Common action), the Finnish Circular Economy Roadmap has potential for great impact. Working at a national level demonstrates leadership and buy-in from the government, which aims for Finland to be a leader nation in the move to circular economy and to demonstrate the economic benefits of developing businesses based on the circular economy.

Recommendation

Finland has set a highly ambitious goal through the 'Leading the Cycle' policy. Governments should consider adopting ambitious visions, with the potential to create change through leadership.

BIM Singapore^{44,45}

This relates to BIM e-submission for building permits. With effect from 19 October 2016 (for architectural plans) and 01 October 2017 (for C&S/MEP Engineering plans), BCA accepted voluntary BIM e-submissions in Native BIM format.

Alignment with BAMB systemic values

There is currently little alignment with BAMB systemic values other than data sharing and **collaboration**, which could be said for all BIM related activities, especially with data is open and transparently available. This is included as an example of all such activities and the potential that it offers.

Circular economy impact

Currently, there is no circular economy link to this policy/activity. BAMB has developed the possible approach and structure to enable BIM data to be combined with other data to provide semi-automated Circular Building Assessments (Reversible Building design, Environmental Assessment and Economic Assessment). However, this is generally BIM enabled, rather than focussed on the Singapore BIM e-permitting example.

Recommendation

⁴⁴<https://www.bca.gov.sg/bim/bimlinks.html>

⁴⁵[https://www.corenet.gov.sg/general/building-information-modeling-\(bim\)-e-submission.aspx](https://www.corenet.gov.sg/general/building-information-modeling-(bim)-e-submission.aspx)



BIM Singapore was selected for review as it represents a trend in the right direction.

The generic recommendation for BIM is to continue to standardise and promote the digitalisation of construction information from feasibility, design, construction and asset management, through to end of life and subsequent reuse or rehoming into future assets.

Best practices of interest but not strongly aligned to the BAMB Systemic Changes

Demolition and Deconstruction Permits^{46,47}

In Seattle, USA, a permit system has been implemented which allows deconstruction of a domestic building to begin before a building permit has been issued. If a building is to be demolished, work can only start once the building permit has been issued. Minimum reuse and recycle rates for deconstruction are set by the city and all asphalt, brick, and concrete is required to be reused or recycled to be compliant.

A recent update has tightened the requirements for reuse to require a minimum (20%) reuse by weight, excluding certain materials. This is a positive step towards more circular economy thinking.

Green Demolition Bylaw^{48,49}

In Vancouver, Canada, demolition permits for domestic buildings constructed before 1940 include recycling requirements. The system is enforced through the requirement for a \$14,650 deposit, paid when applying for a demolition permit. There is a sliding scale for return of the deposit depending on the recycling rate achieved. For houses not designated by the city as 'Character houses', 75% of the waste (measured by weight) must be reused or recycled for full return of the deposit. Guidance on salvaging and reusing materials is provided by the city authorities.

From January 2019, this law will cover all homes pre-1950 – which account for around 70% of demolition. In addition, pre-1910 homes will have to reuse at least 3 tonnes of timber. Support for a deconstruction hub is also sought.

Alignment with BAMB Systemic Changes

⁴⁶<http://www.seattle.gov/dpd/permits/permittypes/residentialdeconstruction/default.htm>

⁴⁷<http://www.seattle.gov/DPD/Publications/CAM/cam337.pdf>

⁴⁸<http://vancouver.ca/home-property-development/demolition-permit-with-recycling-requirements.aspx>

⁴⁹<http://vancouver.ca/files/cov/green-salvage-guide.pdf>



These two measures are not considered to be particularly aligned to the BAMB Systemic Changes in their current form.

Circular economy impact

These two permit systems are considered to be unusual in the scope and nature of the incentivisation. Although currently they only affect existing buildings, they could have significant impact if they were linked into targets for reuse in subsequent developments.

Additionally, the type of incentivisation could prove an interesting model for supporting circular economy policies.

Both areas have recently updated (or plan to update) the regulatory requirements to expand and tighten the levels of deconstruction and reclamation occurring. This reflects, to a certain extent, a lack of reuse happening when left as a voluntary objective. It is clear from these examples that their markets are not yet sufficiently developed or incentivized to maximise reuse over recycling. It will be interesting to follow these newly defined regulatory baselines to see if this provides the stimulus needed to do things that are different to current business as usual.

Recommendation

The two measures identified here could be expanded to allow linkage for targets for reuse in future developments.

Innovative financial instruments, such as these, can be utilized to change attitudes towards waste materials in the construction sector.

6.3 Conclusions and recommendations

The best practices analysed above fall into four categories of mechanism (see Table 2 below):

- **Regulate** (through the implementation of hard legislation)
- **Realise** (by using mechanisms such as public procurement to drive change)
- **Stimulate** (e.g. through providing exceptions in regulations in order to encourage experimentation)
- **Inspire** (by disseminating good practice, or by providing leadership)

	Function				Systemic change		
	Regulate	Realise	Stimulate	Inspire	Design culture	Value definition	Collaboration
Best practices							
Act for the Promotion of Long-life Quality Housing	x	x	x		x	x	x
Be.Circular/ PREC			x	x	x	x	x
Rijkwaterstaat Purchasing and Procurement		x	x		x	x	x
Circular Buildings Green Deal		x		x	x	x	x
Level(s)		x		x	x	x	x
BREEAM		x		x	x	x	x
Design for Change		x		x	x		
Circular Peterborough		x	x	x		x	x
Procura +			x	x		x	x
Tracimat - VLAREMA	x		x			x	x
ISO 20887 (Draft)		x			x		
London Plan - Circular Economy	x		x	x	x	x	
Leading the Cycle - Finnish roadmap to a Circular Economy	x	x	x	x		x	x
BIM Singapore		x	x	x			
Demolition and Deconstruction Permits	x		x				x
Green Demolition Bylaw	x						

Table 2: mechanisms and systemic change of each best practice analysed

The best practices identified provide a very diverse selection of mechanisms which have the potential to drive a move to a dynamic and circular built environment.

By reviewing policies, regulations and standards from a broad geographical the research has uncovered a number of useful examples which could provide models for implementation elsewhere. One example, the Act for the Promotion of Long-life Quality Housing, demonstrates a strong focus on design elements which is closely aligned to BAMB. Its use of financial instruments to implement desired outputs is also particularly noted.

Procurement policy is another notable element which is introduced through the best practices. The Rijkwaterstaat Purchasing and Procurement Rules provide a good example of use of public procurement to drive a value change away from purely financial elements. The



collaborative nature of the rules, encouraging the contractor to become a trusted partner in delivery, is another noteworthy feature.

Analysis of the best practices has also identified that there are a number of gaps in policy, standards and regulation, which could be addressed:

Gap identified	Recommended solution
Framework programmes were found to tackle collaboration rather than design change.	Consider if the programmes might be re-framed to consider the design stages of construction in order to maximise the opportunities for the circular economy.
Procurement is also generally less focused on design change.	The adoption of Reversible Building Design tools in the procurement process might also provide an opportunity to establish circular principles at an early stage.
Assessment tools were not considered to contribute to the systemic change for collaboration.	As they target stakeholders at the beginning of the build process, they could provide an opportunity for capturing and sharing data and promoting collaborative processes.
Standards were found not to be driving the value definition	Focusing on environmental and social value of construction would enable a change in value definition
Demolition best practices were, as expected, focused on the end-of-life of a building.	BAMB is well-placed to support changes in these practices to enable circular design to be considered from the earliest stage of a construction project.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The policies, standards and regulations which have been examined in this report can be divided into the four categories of Regulate, Realise, Stimulate and Inspire.

Regulate

Across the research conducted for the Framework on Policies, Standards and Regulations, it is concluded that some of the instruments which regulate result in barriers to circular and dynamic building. For example, the emphasis on energy performance of buildings, through the *Energy Efficiency Directive* has the potential to promote solutions in building design and materials which do not allow for deconstruction and reuse of materials (see Section 3). The *EU Waste Framework Directive*, through lack of clarity over definitions provided, also presents a barrier to implementation of circular economy principles, in part through the different interpretations across Europe of key terminology such as ‘recovery’. Indeed, fragmentation of regulation across different geographic areas and at different levels is concluded to currently be a barrier to circular and dynamic building.

Regulation does, however, provide opportunity. In Section 3, we identify that the current legislative frameworks for energy performance, waste management and construction product regulation are well placed to be extended to include Materials Passports and Reversible Buildings principles, which would therefore create a regulatory background more favourable to circular and dynamic building. However, it is also noted that an holistic approach to regulation is required to ensure that legislative drivers are not opposed to each other.

Realise

Policies, standards and regulations which realise, by using mechanisms such as public procurement to promote change, are identified as having great potential. The Rijkwaterstaat Purchasing and Procurement Rules provide an excellent example of this (see Section 6), using a change in value definition to stimulate solutions which have a social and environmental (rather than financial) impact, as well as promoting innovation.

However, it is also noted that policies, standards and regulations which realise need to be well framed and monitored to ensure that the desired outcomes are achieved. For example, regarding the public procurement rules for construction in Portugal (Section 5), there is a lack of awareness, technical information and monitoring across the industry for the policy. As a result, there is no definitive measure of its success.

Stimulate

A number of policies and regulations are identified as stimulating a move to dynamic and circular building design. These include the PREC in the Brussels Region of Belgium (Section 5 and Section 6). Engagement of stakeholders across the programme, for example in



involving actors in developing their own targets, results in a participative process with a high level of buy-in. Tracimat (Section 5 and Section 6) is also regarded as a policy which stimulates change, by requiring producers of recycled aggregates to differentiate between material with low and high environmental risk. This measure should lead to enhancement of high value recycling, as trust in the quality of the aggregates will be increased.

Inspire

Amongst all the policies, standards and regulations examined, the ‘generational goal’ of the Swedish Environmental Objectives is considered to be the most inspiring (see Section 5). It is closely linked to the Brundtland definition, combined with the understanding that what happens within one country influences others.

7.1.1 Success factors and gaps

Drawing on the work carried out in the State of the Art, interactions with other policy frameworks, best practice review and impact assessment of specific policies a number of common themes and areas which should be considered for future policy recommendations have been identified. These themes take into account success factors of existing policies, as well as gaps in policy making which illustrate why some policies and regulations have failed to make significant impact. The themes are explained in the table below:

Data	Data for monitoring; data consistency; provision of data repositories as knowledge centres; ability to update policy based on better information from monitoring and measuring
Benchmarking	Use of quantitative tools to allow meaningful evaluation
Enforcement	Requirements for meaningful monitoring; sanctions for non-compliance or incentives for compliance; consistency of enforcement approach and interpretation
Impact evaluation	Understanding the cost and the benefits and broader value of the policy; articulating the cost of compliance compared to the cost of non-compliance for stakeholders
Internalisation of external costs	Accounting for external costs to society and environment in calculating value of a project so that financial value creation is not the only consideration in decision making
Consistency	Overcoming issues of fragmentation at different levels of policy implementation (supra-national, national, regional, city); and reducing the likelihood of perverse effects caused by siloed thinking
Time	Noting that policy implementation takes time and that time can be utilized to maximise policy impact, e.g. through communication, stakeholder engagement; foresight for policy provided through tools and assessment, experimentation
Stakeholder input	Encouraging buy-in; engaging different perspectives to spot potential issues, including loopholes
Communication	Effective communication of policies, clarity in the policy and the use of experimentation as a means to communicate
Flexibility, adaptability and experimentation	Remaining open to different approaches which support the overall ambitions of the policy; ability to adapt the policy if required to optimise impact or respond to changing conditions; policy framework should encourage innovation, variation in approaches, experimentation and demonstration
Out of the box	Regulations and policies which take a unique approach and can provide inspiration and leadership

Figure 7 shows the themes as a dynamic system, with interactions and varied levels of significance in time:

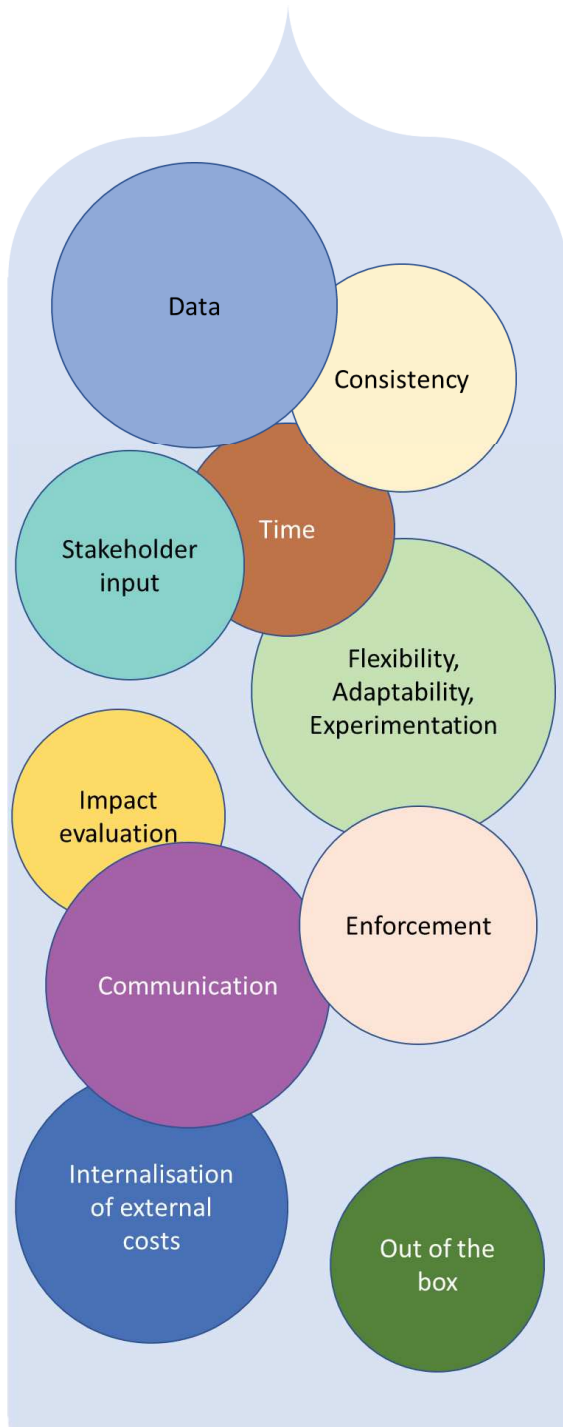


Figure 7: Themes for policy recommendations shown as a dynamic system

It is also considered that there are strong linkages between these themes, which taken together support moves to circularity. The linkages are identified in Table 3 below:

Cross-mapping of themes and their relevance in other contexts	Data	Benchmarking	Enforcement	Impact Evaluation	Internalisation of external costs	Consistency	Time	Stakeholder engagement	Communication	Flexibility, adaptability	Out of the box, experimentation
Data											
Benchmarking											
Enforcement											
Impact Evaluation											
Internalisation of external costs											
Consistency											
Time											
Stakeholder engagement											
Communication											
Flexibility, adaptability											
Out of the box, experimentation											

Table 3: Cross-mapping of themes and their relevance in other contexts

Data

Throughout the research, high quality data has consistently been identified as a key element of a good policy, with lack of clear consistent data often contributing to lack of impact. The importance of data covers the whole policy cycle (see Figure 8): from the need for high quality data to support the development of policy, through collection of consistent data sets to monitor implementation and to enforce compliance, to data to understand the impact of a policy and inform future policies, or to support adaptation of policies where they are being less successful.

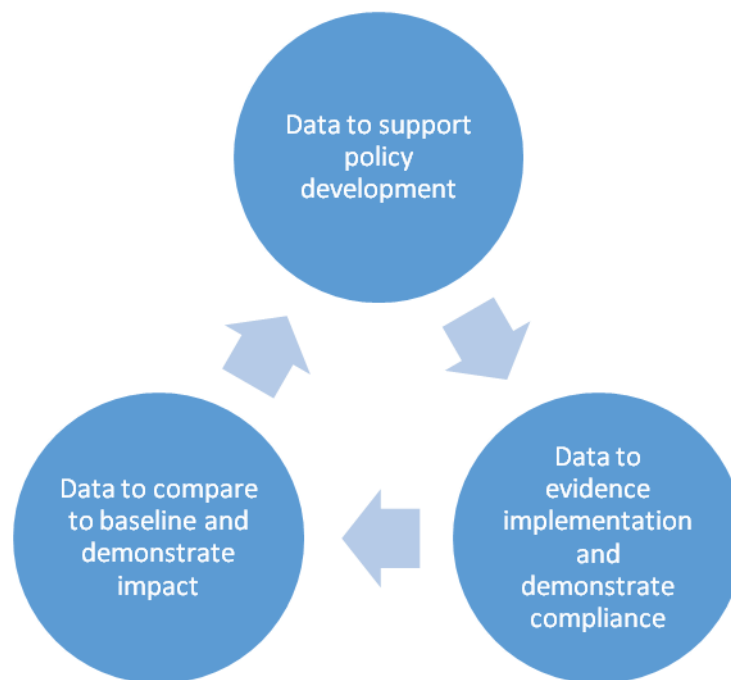


Figure 8: Data at the key stages of the policy cycle

In terms of monitoring, our research has uncovered several examples of policies where data is simply not collected at all. For example, the Portuguese government does not know the extent to which recycled materials are being used in public construction projects in line with its *Incorporação de 5% de Materiais Reciclados* policy, and therefore does not have information on the extent to which the policy is being complied with. Nor is there any evidence to support the assessment of the impact of the policy at any level. This is considered to have severely weakened the potential impact of the policy.

In the case of policy development, it was also identified that, in the Flanders region of Belgium, there is currently very little data on the production and quality of recycled aggregates. This will make it difficult to assess the impact of the new policy on the industry, as no data exists to use as a benchmark. However, once the new policy is in place, the requirement to conduct an inventory of waste from demolition is expected to lead to improved compliance with other legal requirements such as an asbestos inventory.

Lack of high quality data on construction and demolition waste is considered to be a barrier in the transition to the circular economy. This is evidenced in the Impact Assessment carried out for the PREC in the Brussels Region, which highlighted the lack of accuracy of data and resources required to process and analyse it, was hampering the ability to identify and fix targets for circularity.

The study has identified that a trusted repository of data presents a number of opportunities to support development and implementation of policies. By gathering data in a central location, as in the Tracimat example in our Impact Assessments, that data can be used to understand the



actual impact of a policy, can be fed into further policy adaptation, new policy development and helps to establish an authoritative database which can be used as an industry resource.

Benchmarking

Consistent and high quality data is also important for benchmarking. The use of a central repository of data, such as that in the Tracimat system, will assist with benchmarking. As identified in the Site Waste Management Plan IA, the required data needs to be well-defined and standardised to maximise its value and to allow for benchmarking and monitoring to be meaningful. These regulations supported widespread uptake of BRE's Smartsite system which enabled the production of construction waste generation benchmarks. These benchmarks contribute to the setting of thresholds for related waste minimisation credits in BREEAM.

Enforcement

This theme is closely related to that of data, as strong enforcement is usually linked to good data gathering (which in turn allows data to be collected to monitor, which can then be used to support policy development in a virtuous loop). Our research has identified that lack of enforcement for a policy can result in a lack of engagement and conformity. The example given above of the Portuguese Incorporação de 5% de Materiais Recicladós policy is a case in point. With no official data on levels of compliance, our own Impact Assessment found that over 50% of those aware of the policy were not complying. The Impact Assessment identified that no one organisation was responsible for enforcing or providing leadership for the policy and concluded that if an 'owner' for the measure were appointed, who was responsible for measuring, monitoring, enforcement and reporting there would be increased compliance.

It is also important to have consistency in the enforcement approach and interpretation and not to inadvertently create loopholes, which can result in negative outcomes in other dimensions.

In addition, rewards for compliance, or sanctions for non-compliance, can be considered. These can be monetary, as in the case of the Green Demolition Bylaw in Vancouver, Canada, or reputational, such as higher scoring in the BREEAM certification scheme. Across the European Union the 'polluter pays' principle has been a strong driver for reduction of landfill. However, no strong legal penalties were identified in the scope of the policies and regulations considered, although fines through the courts are implemented in other areas, for example, in Health and Safety and Environmental non-compliance.

Impact evaluation

Impact evaluation should be an essential part of the project cycle, as it allows authorities to understand the costs and benefits of a particular policy. It can also allow for value judgements to be made about the cost of compliance compared to the cost of non-compliance, or the economic/social value of pursuing a particular policy path. The clear quantification of value also supports take-up and buy-in from stakeholders at all levels. For example, the DG Environment project on the Resource Efficient Use of Mixed Wastes identifies that the



statistics on recycling do not take account reuse and therefore the waste that has been prevented is not given a value. Its recommendations include measures to promote better and more detailed data collection as well as promoting higher value recycling.

Internalisation of external costs

Internalisation of external costs is an important element of the Value systemic change identified by BAMB. The Rijkswaterstaat Purchasing and Procurement Rules provide a good example of how public procurement can be used to stimulate a change in the value system. The calculation of social and environmental costs provides a balance to economic cost when the overall pricing of a project is assessed.

Consistency

Fragmentation, or lack of consistency, was particularly evident in the state of the art as a barrier to the successful implementation of policies, both across different policy levels as well as between different policy domains. Examples include the way that Sweden's building regulations, which are defined on a national level, which tie local authorities to less ambitious policies for construction and buildings and prevent a move towards adopting more ambitious circular policies at a local level. Other examples across different areas of a country, for example in Belgium, where the implementation of the Tracimat system to identify and track construction and demolition waste in the Flanders Region may be circumvented by organisations who can access waste dealers across the regional border in Brussels. A third example is the implementation of the Level(s) framework for the sustainability of buildings, which is closely linked to the macro objectives of EU policy goals related to environmental performance in the built environment.

Consistency across the different policy areas is also important. As identified in the State of the Art, the energy efficiency policies implemented in the European Union are having perverse effects on the adoption of circular building principles. It is therefore important that the impact of a policy on other areas be considered. The likelihood of these perverse effects can be reduced by taking an holistic approach to the development of policy and by conducting a thorough impact assessment which includes related policy areas.

Consistency can also be promoted through certification schemes such as BREEAM. The externally verified approach allows for a consistency of building performance to be recognised, with aspects of dynamic and circular building design contained within the ratings. A further important element of consistency is that policies should remain stable over time to have impact. From the Swedish Environmental Objectives IA, it was noted that a strength of the system is its cross-party support, which should ensure its continuation regardless of the governing party in power.

Time

It was noted in the research that policy implementation takes time. Indeed, time should be taken to develop and plan policy to ensure the greatest impact. However, the time used to develop a policy can also be an opportunity to maximise its impact. This could be done through a range of strategies such as communication, stakeholder engagement, and experimentation to demonstrate proof of concept.



The development of a demonstrator project, either as a precursor to policy development, or independently, such as the BAMB project pilots is also considered worthwhile. An example where this is the case is the implementation of the Design for Change policy and framework in the Flanders region of Belgium. Design guidelines to be implemented through the framework were tested in two construction projects. Insights gained during the demonstration phase were validated and an improved assessment framework developed. The demonstrator also provided the opportunity to assess the long-term financial and environmental impact of designs developed using the guidelines.

Such demonstrators can be upscaled to a greater geographical area, and if linked to policy initiatives, also allow for the policy to be refined should initial problems be identified. A demonstrator or pilot can also provide strong counterfactual evidence which can be used in assessing the value of the project in the Impact Assessment phase.

Stakeholder engagement

Early engagement with stakeholders is considered to increase buy-in at all levels and helps ensure that the design of policy is workable for those required to implement it. An example is the Regional Programme for Circular Economy (PREC) in the Brussels Capital region of Belgium. Stakeholders have been engaged at all levels in development. For example, in areas related to the construction sector, industry professionals including designers and contractors have been engaged by the government to ensure that they contribute to the development of the policy, as well as contributing to the definition of goals and indicators. This is also the case for the Finnish Roadmap to a Circular Economy, where the Finnish Innovation Fund has engaged key stakeholders from business, as well as government, to develop a strategy to move towards a circular economy.

Circular Peterborough is also highlighted as a best practice which includes strong stakeholder engagement. A number of Circular City Champions have been appointed, including large businesses, to promote and provide leadership on the application of circular principles in the city.

Communication

Communication has been identified as a vital tool for the effective impact of policy and regulation. The example of the Portuguese Incorporação de 5% de Materiais Reciclados policy shows how important the communication of a policy is. Our own impact assessment identified that 30% of stakeholders are unaware of the policy's existence, which means that there is no likelihood of them conforming.

Collaboration and discussion with networks, trade associations and other bodies is also important in developing policy, standards and regulation. These can be used as champions for innovative approaches and can be used to identify case studies. Procura +, which builds on EU procurement law, hosts a number of case studies of sustainable public procurement which can be accessed by procuring entities. These include implementation, results and lessons learned, allowing others to identify success factors in similar circumstances.



Clarity in the way the policy is written is also considered important and can have result in a disconnect between the actual and perceived success of a policy. Analysis of the *EU Waste Framework* identified that key definitions are poorly defined. As a result, in the case of construction waste, high recovery rates recorded in many countries actually respond to down-cycling of stony fraction for use in road foundation, rather than recovery and retention of value at the highest possible level.

Experimentation can also be used as a means to communicate. Through demonstration projects, the art of the possible can be explored and boundaries tested. This can also be done in a virtual way, as in the Circular Flanders reburg.world website (see Section 6), which provides a space to illustrate the challenges and insights of implementing circular economy from the perspective of different stakeholders.

Flexibility and adaptability

It is considered that policy makers should remain open to different approaches which support the overall ambitions of the policy. In the case of the Swedish Environmental Objectives System, government departments and agencies have a great deal of autonomy in deciding how they should meet the objectives and milestones. This gives them a sense of ownership over the solution and how to reach the goals. However, it should be noted that this flexibility can also be a negative, as the solutions chosen are not necessarily sufficiently ambitious to meet the objectives.

The ability to change direction if the policy is not having the desired effect is also considered to be highly desirable. This could be linked to impacts reviewed in the policy Impact Assessment, and certainly requires the collection of high quality data which can be analysed to provide evidence for changes.

However, flexibility and adaptability should not be at the cost of a consistent approach, as stakeholders will be reluctant to commit time and effort if they are not sure that a measure will be kept in place for any duration.

Thinking outside the box

The BAMB policy work has identified two particularly strong examples of different approaches which support the application of dynamic and circular building design:

- The Act for the Promotion of Long-Life Quality Housing (Japan, 2009)
- Rijkwaterstaat Purchasing and Procurement Rules (Netherlands)

These two different policies/ regulations are not directly addressing circularity, but each takes a novel approach which could be harnessed for circularity in the built environment.

The Act for the Promotion of Long-Life Quality Housing takes into account design aspects to increase the lifespan of housing and includes requirements such as that piping and utilities be accessible from outside the house. These are elements could easily be incorporated into



construction regulations outside Japan. In addition, the Act is coupled with financial and tax incentives, providing clear monetary drivers for take-up (see Enforcement). A further positive of the Act is the way that it enables innovation and facilitates a market.

The Rijkwaterstaat Purchasing and Procurement Rules for the Ministry of Infrastructure and Water Management in the Netherlands demonstrate an innovative approach to procurement to ensure that cost is not the over-riding factor for selection. Scoring for procurements is set so that higher positive scores for environment and social aspects of a contract reduce the weighting factor for cost. The traditional value definition for public procurement is therefore disrupted, by allowing a higher tolerance for price if environment and social value are positively addressed. Additionally, procurement is solution agnostic where possible and is based on functional specifications to allow innovative approaches.

Both the Japanese Government and the Ministry of Infrastructure and Water Management in the Netherlands have adopted policies which provide inspiration for others and a model which can be adapted for dynamic and circular building design.

In addition, policy initiatives at smaller geographical scale can provide significant impact and demonstrate the art of the possible. Initiatives such as Circular Peterborough, identified in the Best Practices section of the report, provide valuable leadership and enable a proof of concept to be developed which may have potential to be scaled to a higher level.

A further area in which innovative approaches are useful is that of resourcing. Funds accrued from policies/ regulations with a tax element (such as the Landfill Tax) can be ring-fenced for use to offset the impact of actions. For example, the Aggregate Levy in the UK enables a community fund, which can be accessed by those communities impacted by the aggregate industry.

7.2 Summary of recommendations

Given the length of time taken to develop new policies, it is recommended that circular economy principles be embraced within existing policy wherever possible. There are a number of opportunities which were noted through the research. These include:

- At a Europe-wide level, the *Energy Efficiency Directive* sets a requirement for a strategy for renovation of residential and commercial buildings, as well as the renovation of 3% of public buildings owned and occupied by government, public procurement focusing on high energy performance of buildings and the reduction of embodied energy. These provide an opportunity to move towards circularity in the built environment.
- The current development of ISO20887 Design for Disassembly and Adaptability of buildings and civil engineering works. The ISO is closely aligned to the BAMB systemic changes in its potential to influence construction at the design phase. The ISO, once released could be adopted through BREEAM and other certification systems, as well as being integrated into public procurement requirements.

- BREEAM – as schemes are revised (there is an update of BREEAM New Construction scheduled to begin in 2019), there is an opportunity to feed circular economy principles into new versions.
- London Circular Economy – the Circular Economy statement could lead the way for cities to require elements of circularity in new construction projects.
- Changes should be made to CPR so that it does not present a barrier to trade.

To enable the BAMB systemic principles to be embedded in future thinking, there are some key examples which should be taken into consideration when planning policy and regulation for the circular economy. These are shown in the tables below:

Recommendations: Change in design culture ⁵⁰		Comment
Regulate	Existing EU level laws on energy performance, waste management and construction product regulations (by integrating Material Passports and Reversible Building Design Principles) should be extended to support the implementation of dynamic and reversible buildings.	See Section 3 for analysis of State of the Art in policy and regulation.
	The design link of the value chain needs to be targeted by regulation. This might include consideration of material loops from the perspective of design to transition from a value chain to a value network.	This has been identified as a barrier to circular economy principles in Sweden under the Environmental Objectives system (Section 5). It is also noted that a number of Circular Economy packages and strategies have recently been adopted (at EU and sub-national level) but that they do not currently address design. (section 3)
	Clear and measurable objectives should be set to ensure impact and to declare overall ambition	For example, the objectives of the circular economy plan of the Netherlands states that by 2030 the use of virgin resources needs to be reduced by 50% and that the Dutch economy needs to be fully circular by 2050. This has led to innovation in design and in development.
Realise	Provision of a set of technical guidelines by a government should be considered	The Act for the Promotion of Long-life Housing in Japan

⁵⁰ <https://www.bamb2020.eu/topics/blueprint/vision/design/>

	as a mechanism to promote a change in design culture	(Section 6) provides an example of government action to realise change
	Policy should be considered which enables experimentation and supports lighthouse projects in order to realise and stimulate change	The Chantiers Circulaires of the PREC in Brussels (Section 6) is an example of a framework which supports circular building construction in this way.
Stimulate	Public procurement should be used to promote change: for example using solution-free requests (performance-based) rather than prescriptive specifications stimulates innovation	Rijkwaterstaat Purchasing and Procurement policy (Section 6) provides the background for innovative solutions to be presented
Inspire	Innovative policy instruments should be given space for implementation. Implementing mechanisms which promote change in design can act as a driver and example for other authorities to follow.	The London Plan Circular Economy Statement (Section 6) is an example of leadership, using the planning framework to design in circular economy outcomes to construction projects.

Recommendations: Change in value definition ⁵¹		Comment
Regulate	External environmental and societal costs should be integrated in the value calculation of any new policy	Although the Rijkwaterstaat Purchasing and Procurement system is not regulation, its weighting of external costs is noted (Section 6)
	Quantitative (rather than qualitative) milestones should be used as they are more effective in promoting change	For example, BREEAM has specific targets to meet to gain waste minimisation credits, based upon benchmarks produced by industry through online reporting software.
Realise	A framework which requires accurate data to support monitoring and definition of targets should be part of regulation to ensure value definition can be defined.	The experience of the PREC in Brussels (Section 5) also concludes that there must be a clear added value to stakeholders if they are to be required to provide data.
	The use of a mixture of legislative, taxation and budgetary measures should be considered in order to promote the transition to dynamic building	Japan's Act for the Promotion of Long-life Quality Housing is an example where a range of measures have been combined

⁵¹ <https://www.bamb2020.eu/topics/blueprint/vision/value/>

		to positive effect (Section 6)
	Public procurement policies should be harnessed as a mechanism to internalise external costs	The Rijkwaterstaat best practice example (Section 6) demonstrates at the public sector can lead on creating a change in value definition
Stimulate	Authorities should ensure that room for experimentation is included in policy and regulation.	(as above)
Inspire	The setting of an overarching vision should be considered, as it provides strong leadership for action	The Finnish Roadmap to a Circular Economy (Section 6) provides an example of an inspirational vision, by identifying the value to the country which could be achieved through adopting the actions defined.

Recommendations:		Comments
Change in collaboration across all actors⁵²		
Regulate	Enforcement of regulations is key to their take-up and there needs to be a clear line of responsibility for the regulation to ensure compliance	Impact Assessments on policies in the UK and Portugal concluded that enforcement is vital to the success of a hard policy, but that without a direct ‘owner’, enforcement is unlikely to be carried through (section 5)
	All actors should be actively engaged in the development of regulation in order to avoid a missing link which would result in reduced impact	The PREC IA (Section 5) identified that the inclusion and active involvement of stakeholders at an early stage is a key success factor in a policy. This is currently being implemented in the PREC within the Be.Circular call for circular building sites (Section 6)
Realise	Assessment tools target stakeholders at an early stage of the construction lifecycle. They could therefore be used to promote data collection and sharing and collaborative processes.	Section 6 identified this as a gap which is not currently addressed.
	Collection, assurance and analysis of high quality data should be sought, as it	The Tracimat system (Section 5) demonstrates how this can be

⁵² <https://www.bamb2020.eu/topics/blueprint/vision/collaboration/>

	increases trust between different parts of the value network and promotes interaction between stakeholders.	achieved for CDW.
	Policy and regulation provides an effective way for agencies to work together and to cooperate, particularly where solutions are not articulated at a higher level	The Swedish Environmental Objectives (Section 6) were considered to have resulted in stakeholders engaging with each other.
	Public procurement should be used to effect a change in division of roles between client and contractor, for example by giving the (expert) contractor the freedom to provide innovative solutions to difficult problems; it should also support new types of business models and ownership which will lead to other types of collaboration	The example of the Rijkwaterstaat Purchasing and Procurement policy is considered to have promoted a change in collaboration by moving from prescriptive objectives and requiring an ongoing dialogue between contractor and commissioning body.
	Development of platforms and tools for industry stakeholders should be considered, as these bring actors together and allow for collaboration and knowledge-sharing.	Circular Flanders (Section 4) provides an example of a range of initiatives which stimulate experimentation and collaboration.
Stimulate	High profile frameworks and policies should be harnessed as an effective tool for communication and collaboration amongst stakeholders	The Swedish Environmental Objectives (Section 5) and the Finnish Road Map to a Circular Economy (Section 6) illustrate this at a national level.
	A collaborative approach in developing policy should be taken to ensure that policy changes take into account the reality of stakeholder groups and that targets set for actors are appropriate and likely to be adopted	Circular Peterborough (Section 6) provides an example of stakeholder engagement which includes close links with local industry; the PREC in Brussels Capital Region (Sections 5 and 6) includes the setting of actor specific targets developed by the actors themselves
Inspire	Public authorities have an important role in sharing information on best practices to demonstrate leadership and inspire.	The Procura + case studies highlighted in Section 6 provide an example of this.



Appendix A

Impact Assessments

WP5 A3

Impact Assessment Report

Site Waste Management Plan Regulations (2008) (England)

1. Introduction

The Site Waste Management Plan (SWMP) Regulations were implemented in England in April 2008. The Regulations required SWMPs to be developed for construction projects over £300,000 (equivalent to approximately €339,000) in project value. According to the Regulations, SWMPs should be undertaken prior to the commencement of the project, with a forecast of waste generated and how it will be managed. The SWMP should be updated regularly throughout the project in terms of the how much waste is generated and how it is being managed and a review taken after the project finishes. If projects were over the value of £500,000 (equivalent to approximately €565,000), a more detailed SWMP was required. The Regulations put duties on the client and principal (main) contractor. Prior to this there was a Voluntary Code of Practice for SWMPs, which was recommended for projects over £200,000 (equivalent to approximately €226,000) in value, which was adopted mainly by the larger contractors. The Regulations were repealed in December 2013 as part of the English Government's 'Red Tape Challenge' as they were viewed as 'not fit for purpose'. However, many businesses continue to undertake SWMPs and they are also a requirement in sustainability building standards such as BREEAM.

SWMPs were made a legislative requirement due to two reasons. Firstly, to help to address the illegal dumping of waste (fly-tipping); in 2007/08, there were an estimated 1.28 million fly-tipping incidents, with 7% as identified as construction, demolition and excavation waste¹. Secondly, to increase construction resource efficiency. In 2008, the amount of construction, demolition and excavation waste generated in England was 101 million tonnes², and of this, 12.55 million tonnes was landfilled³.

The purpose of this Impact Assessment is to investigate the structure of the SWMP Regulations and their effectiveness. This is to put forward good practice for BAMB to promote circular economy policies and practices in the construction and reuse of buildings. This Impact Assessment has been undertaken by reviewing previous impact assessment documents and related surveys as well as obtaining primary data through a workshop and interviews.

2. Background

Purpose and structure

SWMPs were a legal requirement in England. There were two main purposes for mandating them. Firstly, the reduction of fly-tipping, by restricting the opportunities available for the illegal disposal of

¹ https://www.gov.uk/government/uploads/.../wrfg21_Natfly_201516-publication.ods

²

<http://webarchive.nationalarchives.gov.uk/20130124170002/http://www.defra.gov.uk/statistics/files/20110617-waste-data-overview.pdf>

³ http://www.greenconstructionboard.org/otherdocs/CD&E_waste_from_landfill_2011_Report.pdf

waste by ensuring compliance with existing legal controls and providing a full audit trail of any waste that is removed from a construction site. Secondly, improving materials resource efficiency, by promoting the economic use of construction materials and methods so that waste is minimised and any waste that is produced can be re-used, recycled or recovered in other ways before disposal options are explored. The projected impacts from the implementation of the Regulations were reported in the official impact assessment as:

- Reduction in illegal disposal of waste (fly tipping).
- Level playing field for the construction industry by adding cost thresholds.
- Estimated net benefit of €300M (Net present value) over 3 years. This includes benefits of improved material resource efficiency, reduced waste disposal, carbon savings etc.
- Direct benefit to businesses is estimated to be €121m a year.
- Regulators should see a decreased workload tackling fly tipping.
- Property buyers may see a slight reduction in property prices as construction costs fall.
- Environmental benefits should be seen (less virgin material, less waste and less flytipping).
- Primary financial benefits seen in reduction in waste disposal costs, resource efficiency gains and increased salvage values.

The SWMP Regulations required the following:

Before construction commenced, the SWMP should include (all projects over £300K):

- Any decision taken on waste minimisation in relation to: project nature, design, construction method and materials employed
- Describe and estimate the quantity of the waste types produced during the course of the project
- Identify the waste management action proposed for each waste type including: re-use, recycling, recovery and disposal
- Declaration that the client and the principal contractor will take all reasonable steps to ensure: All waste from site is dealt with under the waste duty of care legislation and materials will be handled efficiently and waste managed appropriately

During construction, the SWMP should be updated (projects over £500K):

- When any waste is removed from site the principal contractor must record:
 - The identity of the person removing the waste
 - Waste carrier registration number
 - A copy, or reference to the written description of the waste
 - The site the waste is being taken to and whether the site holds a permit or is exempt
- As often as necessary to ensure the plan accurately reflects the progress of the project (not less than every six months):
 - Review the plan
 - Record the types and quantities of waste produced
 - Record the types and quantities of waste that have been: 1. Re-used (on or off site) 2. Re-cycled (on or off site) 3. Recovery (on or off site) 4. Landfill 5. Otherwise disposed of
- If necessary produce a further plan making changes to reflect the progress

After construction, the SWMP should (projects over £500K)

- Within 3 months of work being completed:
 - Confirmation that the plan has been monitored on a regular basis to ensure that work was progressing to the plan and has been updated
 - Comparison of the estimated quantities of each waste type against the actual quantities
 - An explanation of any deviation from the plan
 - Estimate of cost savings that have been achieved from the SWMP
 - A copy must be given to the client
- The principal contractor must keep the plan for 2 years after the completion of the project at their principal place of business or at the site of the project

Context

SWMPs were a legal requirement in England only. The Regulations were aimed at the construction project level. Those projects below £300,000 in value were not legally required to undertake a SWMP. Those projects between £300,000 and £500,000 in value, had to do a basic plan, and those over £500,000 a more detailed plan, with more information required on waste licences, waste types and management routes as well as a more thorough review at completion.

Whilst the SWMPs were a legal requirement, there were also requirements in schemes such as BREEAM, to undertake a SWMP, as well as meeting targets for diversion of waste from landfill and waste minimisation, in order to gain credits for waste management. The requirements within BREEAM were greater than that required within the SWMP Regulations. Another important legislative driver related to the Code for Sustainable Homes in England, for which there was a mandatory requirement to carry out an SWMP assessment from 2007 to 2010. Additionally, the SWMP Regulations did not replace other Regulations which covered Duty of Care requirements, which still applied. Other drivers for SWMPs included the business case, with companies going beyond the requirements of the legislation, as by doing this, some showed significant cost savings.

Key stakeholders

The key stakeholders for SWMP Regulations were:

Legally obligated

- Construction client –legally responsible for ensuring a SWMP was started before construction work commenced. If a client did not appoint a principal contractor, then the obligations fell on them
- Principal contractor – legally responsible for updating, reviewing and keeping copies of the SWMP

Enforcement and review

- Local authorities and environmental regulator (Environment Agency) – these were given powers for enforcing the Regulations
- National Government (Department for Environment, Food and Rural Affairs (Defra)) - responsible for the legislation and review of it.

Impacted

- Designers - whilst these were not obligated under the Regulations, there was a requirement to consider waste minimisation actions within the SWMP before work commences.

- Waste companies – whilst these were not obligated under the Regulations, they would have to provide information to the principal contractor on the types and amounts of waste produced and the facility it went to.
- Subcontractors - whilst these were not obligated under the Regulations, if they were managing their own waste, they would have had to provide information to the principal contractor on the types and amounts of waste produced and the facility it went to.
- Planners – may require the development of a SWMP or be interested in the SWMP; especially if it contributes to the overall quality of the local environment and wider policies and targets.

In addition there may be a number of other stakeholders that could have been impacted including construction product manufacturers and suppliers, whom may have been encouraged to provide products that are less wasteful or offer take back services; trade and professional associations in the provision of guidance and Government funded programmes, or other companies such as BRE, which sought to provide tools and best practice guidance.

Timescales

The SWMP Regulations in England came into force from April 2008 until they were repealed in December 2013; they were therefore in place for 5 Years and 7 months. There was also a voluntary code of practice for SWMPs which was issued in 2004.

3. Approach

Methodology

Listed below are a number of documents that were used to support this Impact Assessment:

Impact Evaluations (official)

- Regulatory Impact Assessment for introducing SWMP Regulations including a cost benefit assessment to determine the project threshold
- Regulatory Impact Assessment for repealing the SWMP Regulations
- Consultation documents and responses for the Regulations and their repeal
- Regulatory Impact Assessment for the Code for Sustainable Homes (includes SWMPs)

Other surveys and impact studies

- WRAP - Impacts survey 2011
- CRWP – Local Authority SWMP Implementation report
- CRWP – Survey of three stakeholder groups on SWMPs
- WRAP – SWMP Events Regional Report

There are also a number of reports, prior to the 2008 Regulations:

- Envirowise – Regional SWMP events report 2005-2006
- Envirowise – SWMP event reports 2008
- WRAP – Adoption of SWMP Voluntary Code of Practice Report 2005-2006

Academic papers

- Adjei, S., Ankrah N., & Issaka N, and Searle D. (2015). Voluntary Compliance and Regulatory Enforcement: the case of site waste management plans. *International Postgraduate Research Conference 2015, At Media City, Salford UK, Volume: 12*
- Ajayi S.O., Oyedele L.O., Bilal M., Akinade O.O., Alaka H.A., Owolabi H.A. and Kadiri K.O. (2015) Waste effectiveness of the construction industry: Understanding the impediments and requisites for improvements. *Resources, Conservation and Recycling*, 102, pp.101-112
- Clarke-Hagan D.M.J., Spillane J.P. and Coates R. (2014) Waste Management and Sustainability during the Design Phase of a Construction Project: A Qualitative Review *Journal of Civil Engineering and Architecture Research*, vol 1, no. 1, pp. 1-13.
- Price T. (2010) Site waste management plans, the designer and the CDM principal contractor. In: *Egbu, C. (Ed) Procs 26th Annual ARCOM Conference, 6-8 September 2010, Leeds, UK*, Association of. Researchers in Construction Management, 1381-1390.
- Shiers D., Weston J., Wilson E., Glasson J. and Deller L. (2014) Implementing new EU environmental law: the short life of the UK Site Waste Management Plan Regulations, *Journal of Environmental Planning and Management*, 57:7, 1003-1022.
- Williams I.D., Turner D., Cossu R., He P. and Kjeldse P. (2011) Waste management practices in the small-scale construction industry. *Proceedings of the 13th International Waste Management and Landfill Symposium, S. Margherita di Pula, Cagliari, Sardinia, 2011*, Cisa Publisher, Padova, Italy

A number of data sources were also accessed:

- Government data for construction, demolition and excavation waste – arising's and amount to landfill (from pre-2010 to 2015).
- BRE's SMARTWaste data – trend analysis for waste generation benchmarks and waste diverted from landfill (from 2010 to 2016)
- National Federation of Demolition Contractors annual survey to members with figures for diversion of waste from landfill (from 2010 to 2016)

Additionally a workshop was held with principal contractors and subcontractors as part of the Chartered Institute of Waste Management Construction and Demolition Waste Management Group, an interview with the Regulator, the Environment Agency, and a further interview with a principal contractor.

4. Assumptions and limitations

The assessment is based on reports and interviews, making the analysis reasonably robust. However there are a number of limitations including the length of time since the Regulations were in force (4 years ago) which may have an impact on the interviewee responses and the overall context for the Regulations (i.e. construction industry performance, waste management etc) is likely to have changed since then. At the time of the SWMP Regulations, there were other Regulations in place, which would have had an influence on construction waste management, such as Landfill Tax and Environmental Permitting; therefore it is difficult to assess the effect of SWMP Regulations in isolation. In addition, funding support was available to the construction industry to assist in diverting waste from landfill, as well as the development of waste infrastructure. The waste data

should be treated with caution as the various sources of data (national statistics, BRE's SMARTWaste and industry data) have their own methodologies, assumptions and limitations and therefore cannot be compared. Lastly, in-depth SWMPs were a requirement within building assessment schemes such as BREEAM, which may have affected a company's approach to the Regulations.

Research questions

The following research questions were identified:

- Were the SWMP Regulations successful in meeting their objectives?
- Are the SWMP Regulations an effective policy in enabling circular economy in the building sector and could they be improved?
- Has the impact on waste management practices extended beyond the life of the regulation itself?

5. Analysis and interpretation

5.1 Pre -Regulations

Prior to the SWMP Regulations, there was a Government Voluntary Code of Practice for SWMPs. The effectiveness of this code is questionable. A survey showed that around a third of respondents (400) were aware of it (which was higher amongst larger companies), with only 3% using them. However, the workshop, the majority of the attendees were implementing them in some form, prior to the legislation, though in a limited manner. The drivers for their use included client demand, rising costs of waste disposal and the then BREEAM scheme. Those that were using them generally agreed that cost savings were made, but it was difficult to quantify as it is difficult to compare projects and to attribute savings specifically to the SWMP. Awareness raising sessions assisted in the uptake of the Voluntary Code, with for one event series, 57 out of 100 delegates implementing SWMPs activities after the event.

Two policy options were considered for the introduction of the Regulations: (1) continue with the existing voluntary approach for SWMPs, perhaps with greater promotion and (2) introduce SWMPs on a mandatory basis by laying regulations. The Government chose the second, largely with the reasoning that it would create a level playing field for the construction industry by requiring plans for all projects above the value threshold, rather than being an 'opt in' measure. 75% of respondents to the Regulation consultation supported mandatory SWMPs, including 58% of industry respondents.

5.2 Implementation by companies

There are a number of mixed findings for the implementation of the SWMP Regulations by companies. This is backed up by the consultation for the repeal of the SWMP Regulations having an even position in terms of those that agreed (49%) and disagreed (49%). A major weakness of the Regulations was the lack of engagement with the client and designers, which was one of the reasons to repeal. At the workshop, attendees agreed that the clients were not involved or interested in SWMPs and they were left to the contractors to write and implement them, and many clients did not sign their part of the declaration. According to a WRAP survey, only 32% reported that the client reviewed the SWMP during the construction. Whilst 6 clients and 8 architects/designers responded to the SWMP repeal consultation, 72 contractors responded with comments, which would seem to support industry assertions that generally the client passes the plan onto the contractor to deal with.

As a result, the SWMPs were too late in the construction process, for any major impact to be made.

The information from the designer on the quantity and type of waste, which the principal contractor is expected to manage once the construction phase commences was thought to be largely lacking. According to Price (2010) an improvement would have been to require relevant SWMP-related information on substantial residual design risks to be given to the Construction and Design Management (CDM) co-ordinator to insert into the health and safety file. (Price, 2010). The workshop attendees believed that the relationship between the client and the designer was not well defined and that a major barrier was the name 'Site WMP', as it was misconstrued to be site based and therefore contractor-based.

Studies have shown that the formation of SWMPs was viewed as complicated and as such a barrier to their implementation. However this is thought to be largely related to a lack of understanding by staff. Assistance was provided to companies for implementing the Regulations which proved to be effective. This included the provision of awareness raising events to industry, guidance and templates. Events were deemed to be particularly successful, for example, out of 100 respondents, 98 said a WRAP series of events had helped them understand the requirements of the new SWMP regulations. Whilst the use of generic templates were seen as useful initially, providing essential guidance on assisting in the implementation of a SWMP, subsequently they had to be tailored to suit individual needs.

According to the Repeal Summary, some respondents felt SWMPs added little waste management aspects beyond what is already in Duty of Care legislation, conversely others claimed that they helped as an administrative tool, as a means of keeping all waste requirements within one document, including requirements found in Duty of Care legislation. It was proposed that the SWMP should relieve the administrative burden of construction projects as they will provide the framework for bringing together a range of documentation required by existing legislation. Other barriers to their effective implementation included the lack of space for segregation of skips on some sites, cost of implementation, time and administration requirements and the need for a culture change.

On the other hand, surveys have shown, that many companies have benefitted from their introduction including increased cost savings and profitability, better legal compliance, reduced environmental impact, integration with existing environmental policies, better health and safety and working practices. Particularly highlighted are the environmental benefits and ensuring compliance with waste legislation. There are also other recognised business benefits identified from the use of SWMPs including improved corporate image, corporate social responsibility, increased tendering success, better management and quality systems and better site conditions. At the workshop, attendees emphasised, the usefulness of the data forecasts and data collected, stating '*waste data has never been so available and accurate*' and the consistency of waste reporting. They also believed that SWMPs provided a means to discuss waste management with the client, becoming part of the pre-contract discussions and '*provided a formal structure and some 'weight' to activities that were already occurring*'. Increased transparency in waste costs led to more informed decisions and enabled the commercial part of the business to take a greater interest. Additionally, placing a requirement to implement a SWMP encouraged innovation within the industry, such as developing new methods for recovering aggregates or developing take back schemes, and drove improvements in the subcontractor supply chain but did not significantly affected methods of construction.

However, the attendees at the workshop felt that the SWMPs eventually became a tick box exercise, by the time Regulation was repealed, their impact was drastically reduced as the general awareness of waste had vastly improved generally, and that advances in material manufacture, waste processing and design led to a natural progression that overtook the SWMP ambitions. This is supported by a contractor stating *'the SWMP is absolutely used for ticking boxes. We however take its implementation serious only when we want to use it for achieving BREEAM points'* (Ajayi et al., 2015).

Key learning points from the implementation of the Regulations include:

- Assigning responsibility for waste management activities on-site is an integral part of effectively implementing an SWMP.
- The approach to the SWMP will be different for every project and the focus should be on putting in place the most appropriate plan for their sites.
- Forecasting waste enables the early identification of waste materials that will arise on site and the most appropriate form of waste minimisation and management options available according to the waste hierarchy.

Although there were negatives such as the cost and time spent on calculations and plans and their complexity, these are believed to outweigh the benefits. To overcome some of these barriers, more emphasis on their use should have been made including a better understanding of them and a cultural change in the industry in relation to their implementation and use.

5.3 Business costs and savings

As part of the impact assessment for the introduction of the Regulations, the cost benefits were determined resulting in the thresholds being developed to avoid disproportionate burdens on businesses. However, establishing these costs was difficult, particularly to quantify the cost of implementation on site. Suggestions were that the cost of SWMPs were less than 1% of project cost; however some already implementing SWMPs prior to the Regulations were achieving waste reductions of 10-60% per site. Domestic sector implementation was estimated to be cost effective on projects above £250,000, with more detailed SWMPs delivering cost savings on projects above £400,000. For demolition projects, SWMPs were expected to provide cost benefits at all levels - with greater savings on projects over £150,000. For non-domestic new build projects high cost savings were expected on projects averaging £400,000, and breaking even at £250,000. A single set of thresholds was preferred for simplicity of interpreting and applying the Regulations, both for those required to produce SWMPs and those exercising their powers to enforce them.

There is very little data available regarding the specific costs and savings attributed to the different activities associated with the introduction of the plans. Indeed, the workshop attendees thought it was difficult to attribute a financial burden or gain to SWMPs. However evidence, suggests that generally, the SWMP Regulations led to financial benefits, particularly for larger projects. The cost benefits have resulted from lower waste disposal costs, reduced materials wastage by better materials management and ordering systems, improved materials handling and improved storage, better segregation, just in time deliveries, reduced over-ordering, better planning and greater awareness. A survey from WRAP, identified savings in the range of £1001-£10,000 by

26% of respondents, with 31% reporting minimal savings (cost neutrality). Nationally, the construction sector paid an estimated £1 billion in landfill tax from 2008 to 2012 but saved £144 million from diverting construction, demolition and excavation (CD&E) waste from landfill. Clarke-Hagan et al (2014) found that as a percentage of project costs, the smaller the project, the larger the SWMP costs. These costs included: staff training, awareness raising, waste champions, use of improved waste contractors, recycling costs and the time spent on implementing, using and reviewing SWMP. Their research shows that the realized savings on larger projects outweighed the negative cost impacts but that the opposite is true for smaller projects.

For smaller companies, a lack of resources and time to undertake a SWMP was identified as a major barrier to their implementation, with smaller projects gaining little financial benefits. According to the SWMP review, a key benefit of the repeal was to avoid administrative and implementation costs, particularly relevant for SMEs, which were valued to be £18.3million in Net Present Value savings over 5 years; it was also noted that they may act as hindrance to business growth. However, respondents didn't all agree that repealing SWMPs would save money as they found that they more often saved them more than the administrative activities cost. Therefore they found the estimated 5 year saving of £18.3million to be overstated. Indeed, cost savings were cited as a reason to continue using them. It should be noted that the Government did admit a high degree of uncertainty in impacts of repealing SWMPs due to a lack of empirical evaluations following their implementation.

4.4 Implementation and enforcement by Government agencies and local authorities
Survey results show that there was a significant lack of awareness of the SWMP Regulations amongst local authority planning, building control and waste management officers. The SWMP Regulations was implemented by different local authorities in varying ways and that there was therefore a lack of consistency in approach. According to Shiers et al. (2014) by allowing local authorities to devise their own administrative procedures for the SWMPs, there was a high risk of inaction, confusion and inconsistency between different local authorities (i.e. some property owners and contractors could find that neighbouring properties on which they were working could be in different local authority jurisdictions and therefore be subject to different procedures).

Defra's Guidance Note on SWMPs proposed that local authority planners were to act as the facilitators of the Regulations, explaining the purpose of the new laws to stakeholders and helping architects and developers to create more waste-conscious designs and specifications. The Guidance Notes also make clear that Defra wished all local authorities to incorporate the new Regulations into their planning policies and approval procedures. However, a number of issues over resources were raised. If the local planning authority was considered to be the appropriate part of the local authority to monitor and enforce the SWMP Regulations, then a special fee should have been made available to cover the additional work. Staff were already considered 'stretched' and it was thought unlikely that the new work could be absorbed without instigating training and hiring additional staff. The Government did agree that local authorities will be able to retain the receipts from Fixed Penalty Notices issued for the offence of failing to produce an SWMP. Moreover, one local authority said that although they worked closely with the Environment Agency who provided some technical support, the planners were not confident that they could meet the correct technical standards required in the implementation of the Regulations. As such, there was little evidence of effective communication or forward planning between the Government and the Agencies. Indeed, implementation and enforcement through the planning system was widely thought to have been the most appropriate mechanism.

A major weakness of the Regulations was the lack of enforcement, which was inconsistent, and no-one was prosecuted. Indeed the WRAP Survey reported that the majority of respondents (74%) SWMPs were not inspected by either the local authority or the Environment Agency. The Repeal consultees believed that the lack of enforcement to be a reason contributing to the failure of the regulations. Even those that were against the repeal believed that if enforcement had been more effective than the Regulations would be more successful.

When interviewed, the Environment Agency noted that there was a lack of clarity of who the actual regulator was, and there was never funding to enable the enforcement. Funding for enforcement were expected to materialise from savings in fly tipping clean up, however these did not sufficiently materialise and therefore local authorities and the Environment Agency have not had sufficient resources to provide national coverage for enforcement. SWMPs were not deemed a priority by the Environment Agency, and as such were only checked by them if something had happened. Moreover, the Environment Agency does not have a direct relationship with construction sites as they do not issue permits, unlike local authorities. However, local authorities may have less interest in SWMPs as they have no impact on municipal waste, which they are responsible for. Additionally, most local authorities do not know the value of projects and are therefore unaware of which projects would fall into the category of requiring a SWMP.

As the Regulations were not enforced, it is assumed that compliance levels were low for small and medium sized firms. Enforcement approaches need to capture non-compliance and ensure that the cost of non-compliance is higher than the cost of compliance. Indeed, enforcement is viewed as more important for these firms, as many of the larger companies implemented SWMPs before they became mandatory. There was an evident lack of clear detail regarding which agency would ultimately be responsible for driving through and enforcing the new Regulations and how this would be achieved. Furthermore, there appears to have been no clear consensus as to which local authority department or other agency would be ultimately responsible for their administration and enforcement.

4.4 Illegal disposal of waste

The primary aim of the Regulations was to reduce the number of incidents of the illegal disposal of waste and realise associated environment benefits. As reported in the Repeal Consultation document evidence shows that as a proportion of Local Authority fly-tipping occurrences, construction waste stayed at a fairly constant level from the years 2008-2012, as shown by Table 1 (at around 6% of all incidents). The Government comments that for the Regulations to be deemed successful, there should have been an improvement above and beyond the seen trend, as such a repeal would not have any adverse effects on the illegal disposal of waste. However, it is noted in the consultation response that whilst the levels haven't decreased, they could have increased without it, therefore fly-tipping rates could increase without SWMPs being compulsory. The data for fly tipping for 2012-2016 disputes this, as the proportion of incidents related to C,D&E waste remains unchanged at around 6%. A common suggestion from the contractors was that the £300k limit was a flaw as they felt fly-tipping was generally carried out by those working on projects of a value less than £300k, though there is little evidence to collaborate this. This was noted in the original Government consultation, however, the Government reasoned that some of these will be subcontracted to larger building projects so their waste management practice would be controlled by an overarching plan for that development.

Table 1: Local Authority Fly-tipping incidents in England

4.5 Waste minimisation

The waste minimisation aspect of the Regulations was viewed to be weak as there was no legal obligation to reduce waste at the design stage, only to record decisions that were made. This is in despite of numerous studies showing that the design phase has the greatest impact on waste minimisation. Indeed, the Government acknowledged the weakness in their Repeal Consultation document stating that *'more work is needed to reduce the waste arising in the first instance. This means the design phase of construction is vital in achieving the aim. SWMPs tend to be produced after the design phase'*. Moreover, they argued that making SWMPs as optional would allow them to be a tool in a whole lifecycle approach. The lack of ownership from clients and engagement from the design community is a key factor in waste minimisation opportunities being missed. Surveys with designers have shown that they lack understanding and commitment to waste reduction and that responsibilities for waste reduction are left to the principal contractor once they arrive on site, unless they are specifically asked to do so. During the workshop, the contractors agreed that it was difficult to get input from the designers. Additionally, it was noted, that it was hard to identify and subsequently quantify waste minimisation activities and that a number of these may have been driven more so by economic or technical factors.

An intended benefit of the Regulations was for less waste to be produced. Data from BRE's SMARTWaste⁴ system has been analysed to establish the trends of waste generation during the Regulations and after their repeal. Robust data is not available pre-2011. Figures 1 and 2 shows that from 2011 to 2012 there was a significant decrease in the tonnes of construction waste produced relative to floor area. This downward trends generally continues to 2017, though there is a slight spike in 2013. Figure 3, also shows the same downward trend of tonnes of construction waste generated relative to project value, with a sharp decrease in 2012. Therefore, based on the data available, there is a substantial waste reduction from 2011 to 2013 (when the Regulations were in effect); since 2013, waste arisings have reduced, though at a lower rate. Anecdotal evidence suggests that SWMPs may have assisted in this waste reduction particularly by providing companies with a better awareness and understanding of their waste, though there are likely to be other contributors factors such as the increase in waste management costs, Government funded support available for waste minimisation activities and waste minimisation credits within BREEAM.

⁴ For more details: www.smartwaste.co.uk

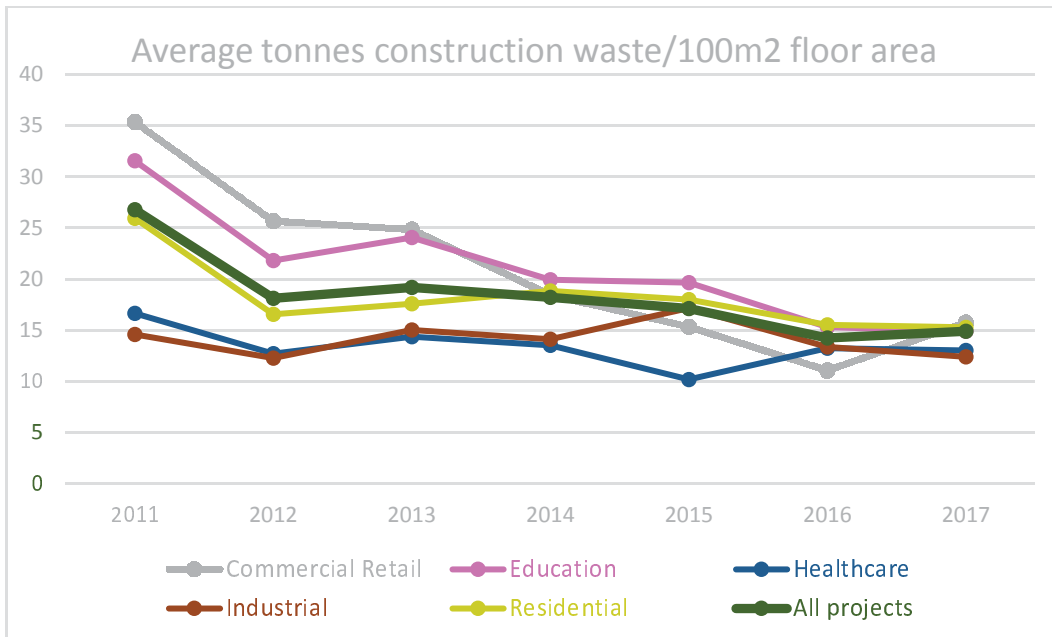


Figure 1: Construction waste arising relative to floor area from BRE SMARTWaste

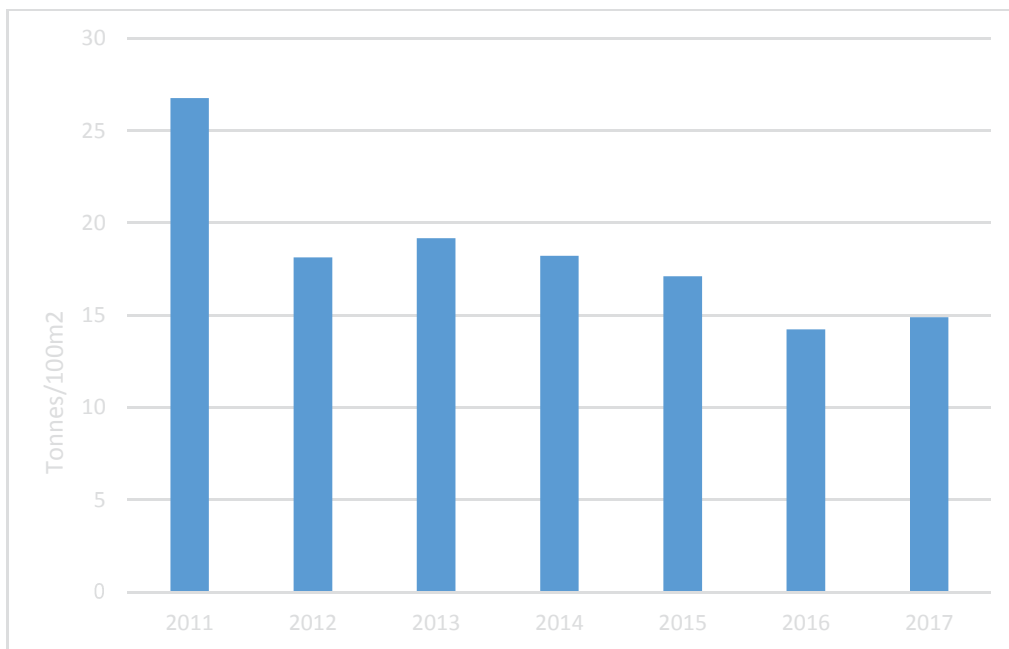


Figure 2: Average waste generation (t/100m²) across all projects from BRE SMARTWaste

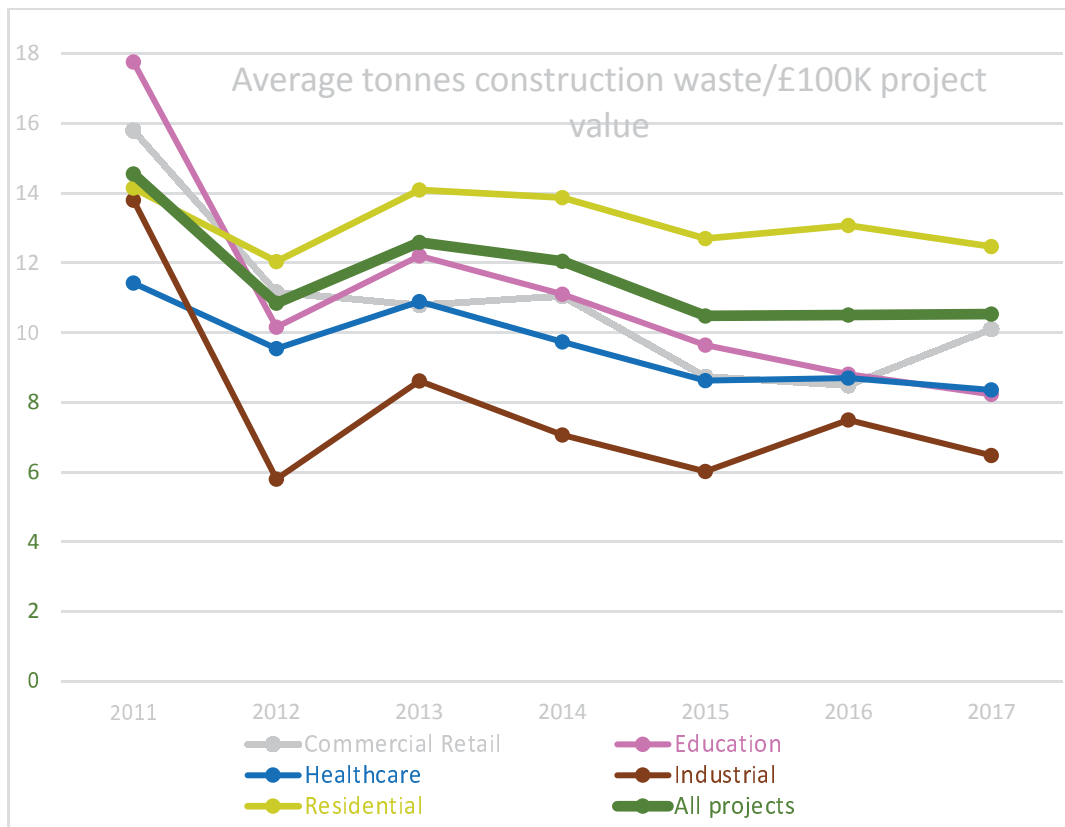


Figure 3: Construction waste arising relative to project value from BRE SMARTWaste

4.6 Diversion of waste from landfill

An intended benefit of the Regulations was to increase the amount of C,D&E waste diverted the from landfill, as a result of a better understanding and the improved management of waste. During the workshop, the contractors agreed that the main benefit of the SWMPs initially was better onsite management of waste such as segregation and use of recycling organisations and more applications for waste, though it was thought that this could also be due to the evolving nature of the construction industry and the rising costs of waste. Table 2 shows that for C&D waste the national recovery rate has increased from 90.5% to 91.4% over 5 years (2010 – 2014); indicating that SWMPs may not have much of an effect, as recovery rates, were already high.

Data from BRE’s SMARTWaste shows a slightly different picture, as shown by Figure 4, there was a significant rise in the C,D&E waste that was diverted from landfill from 2008 compared to 2009; however a trend is unclear for the rest of the years, with significant falls in 2013 and 2017. Figure 5 shows SMARTWaste data for construction waste only, with a wide variation from 2008 to 2013; however there is an upwards trend from 2014, with 86% of construction waste diverted from landfill in 2017.

Table 2: Recovery Rate from Non-Hazardous Construction and Demolition Waste, UK and England, 2010-14 (Source: Defra statistics⁵, excludes excavation waste)

(million tonnes mt)	2010	2011	2012	2013	2014
C&D waste generated	43.9	44.1	45.3	46.3	49.1
C&D waste recovered	39.7	39.9	41.3	42.1	44.9
C&D recovery rate (%)	90.5	90.6	91.1	91.1	91.4

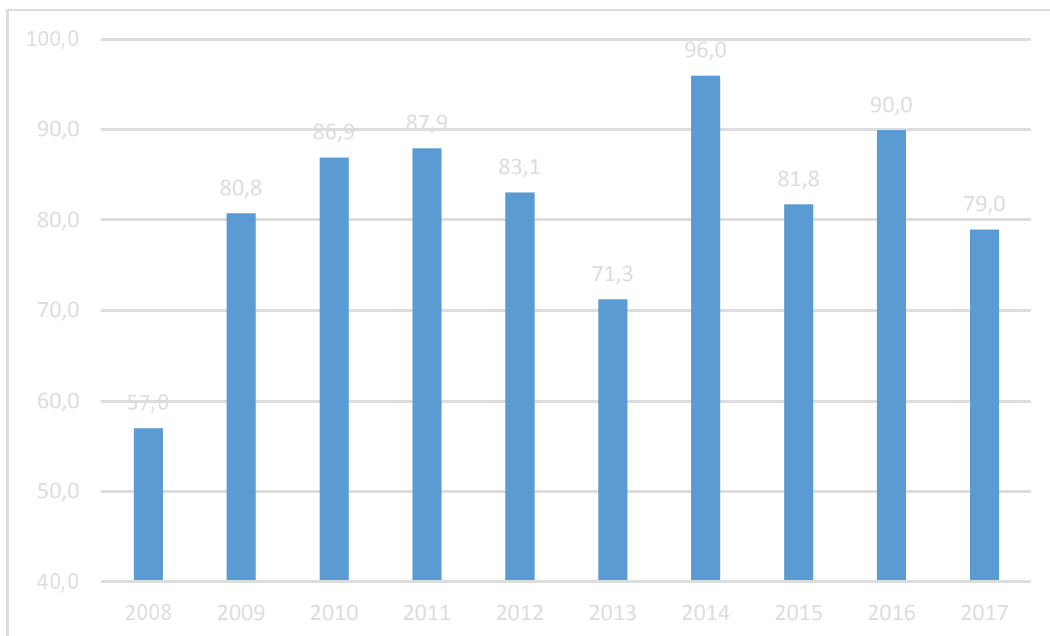


Figure 4: Construction, demolition and excavation waste diverted from landfill (% of total waste generated) from BRE SMARTWaste data

⁵

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/593040/UK_statsonwaste_statsnotice_Dec2016_FINALv2_2.pdf

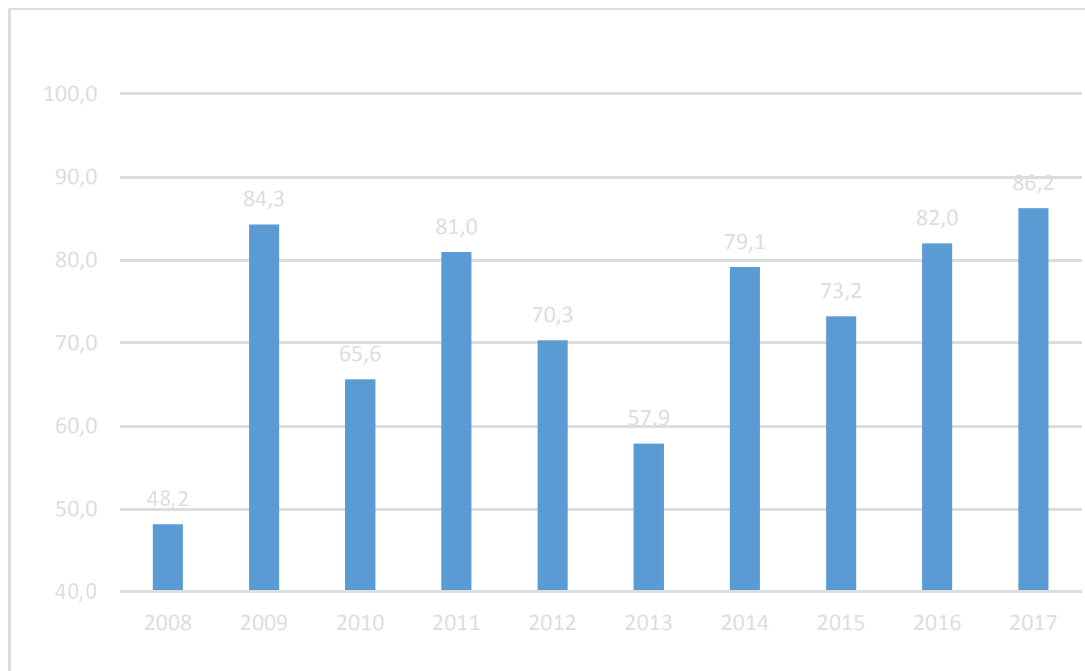


Figure 5: Construction waste diverted from landfill (% of total waste generation) from BRE SMARTWaste data

Another data source is from the work of the Green Construction Board which since 2008 has monitored the amount of C,D&E and construction and demolition (C&D) waste to landfill, due to a joint Government/Industry target to reduce the amount of C,D&E waste to landfill by half by 2012 based on a 2008 baseline. Figure 6 shows that generally for C,D&E waste there has been more of an upward trend in the amount that has been landfilled; though this is largely due to excavation waste. For C&D waste, there is a clear upward trend of diversion of waste from landfill relative to construction output, as shown by Figure 7. As summarised in a findings report⁶, covering the performance from 2008 to 2012:

- There has been a 29% reduction in the amount of C&D waste landfilled
- The proportion of CD&E waste landfilled that is hazardous has decreased to 5%
- The total amount of CD&E waste entering waste facilities has increased by 12%
- The amount of mixed C&D waste entering both landfill and waste facilities has decreased substantially
- The amount of CD&E waste landfilled from waste facilities has decreased by 21%

⁶ www.greenconstructionboard.org

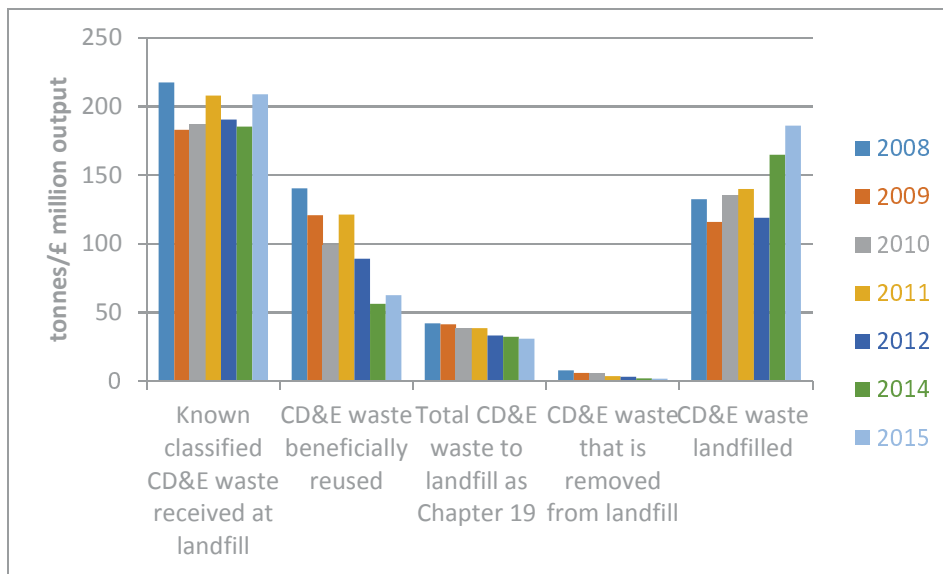


Figure 6: C,D&E waste landfilled from 2008 to 2015 based on the Green Construction Board methodology

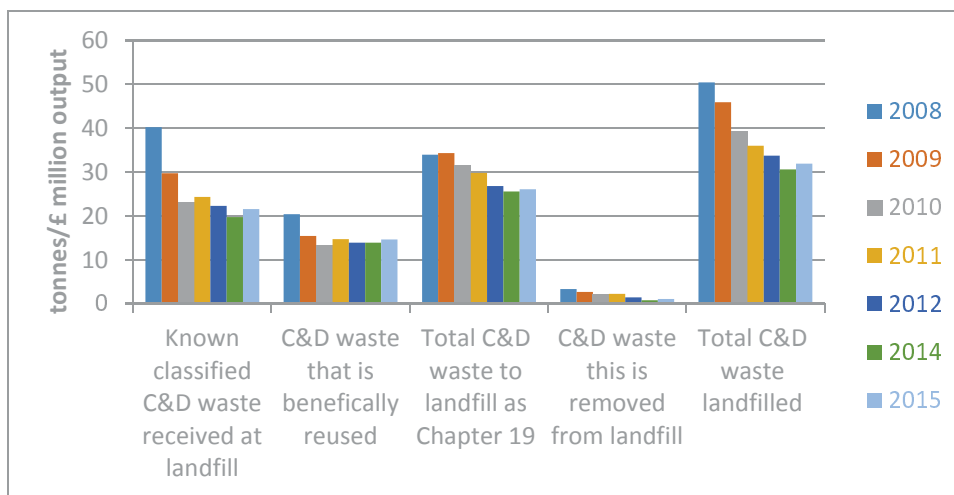


Figure 7: C & D waste landfilled from 2008 to 2015 based on the Green Construction Board methodology

As part of the SWMP Review, the Government indicated that a repeal of the Regulations could hinder commitment under the Revised Waste Framework Directive to recover at least 70% of construction and demolition waste by 2020, particularly as post-war buildings come into the waste stream (materials such as asbestos and blown foams); though this is unlikely as the recovery rates remain high (over 90%). Figure 8, shows data from the members of the National Federation of Demolition Contractors⁷, with the amount of hazardous waste (asbestos) landfilled increasing (for 2016 a sharp increase is apparent), whilst the amounts of other types of waste to landfill remain similar. Additionally, the amount of insulation waste has risen since 2012/13, from 67,422 tonnes to

⁷ <http://demolition-nfdc.com/>

82,606 tonnes in 2015/16. This suggests that the demolition of post-war buildings is starting to take effect.

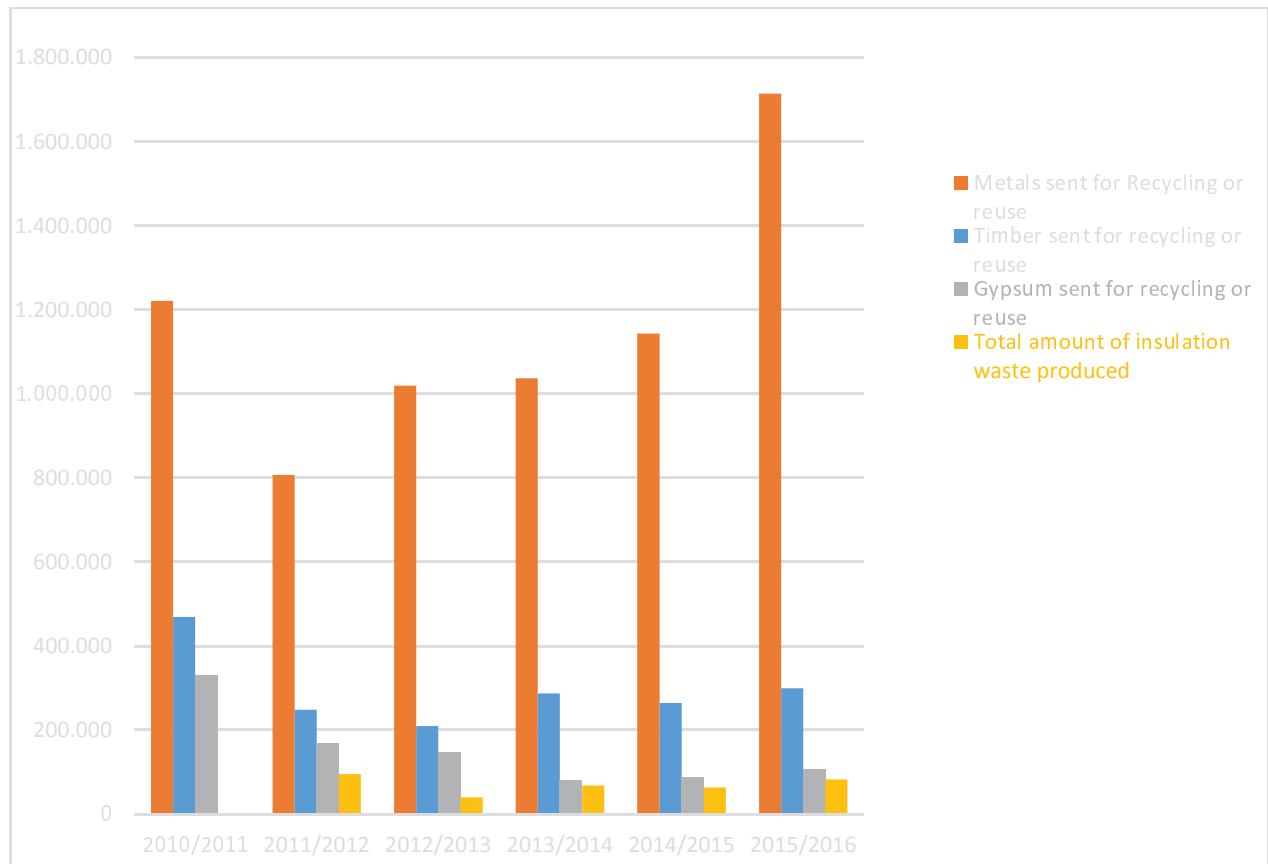


Figure 8: Types of demolition waste landfilled by the NFDC members from 2010/11 to 2015/16

The data reviewed suggests that generally there has been an upward trend in the amount of C&D waste that has been diverted from landfill from 2008, however there seems to be no discernible pattern for when the Regulations were in place or not, indicating contributing factors such as rising costs of landfill, improved waste infrastructure and recovery routes and better segregation of waste on site. Factors for the increase of excavation waste being landfilled include a change in Permitting Regulations, a number of major infrastructure projects and the need for this type of material to fill landfill voids.

4.7 Continued use

The Government suggested that, by repealing the SWMP Regulations, it would give businesses the option to use them in full, or in part to suit their business needs. Indeed the Government emphasized that deregulating SWMPs was not to ban their use, but to allow business to balance the costs and benefits of using them based on their previous experience. Encouragingly, 75% of the contractors that responded to the consultation repeal, said they would continue to them, as did 55% of private businesses. Quotes included: *‘Yes we would as a responsible construction company - it has been a superb tool to gauge our waste streams from site and build up a better waste management ethos amongst our Project Managers.’* Another stated *‘We would advise our members that they are good business practice and help underline a company’s environmental credentials.’* The UK

Contractors Group (UKCG) (now part of Build UK) agreed to continue with their use, stating *'we have agreed to continue to use SWMPs on projects as we believe that by forecasting waste streams and quantities we are better placed to reduce them and increase diversion from landfill.'*

Based on the workshop findings, the majority of the attendees continue to use SWMPs. For principal contractors, SWMPs are evolving into Resource Management Plans (RMPs), as they cover other issues such as water and energy and were believed to be more effective in involving the client and designers, as well as generating cost savings. One contractor interviewed has integrated the SWMP into their Project Environmental Plan, which focuses much more on waste avoidance and reuse, and provides clear accountabilities on the designer and the client. However, according to another contractor *'the RMP to date has had mixed successes due to designers not having ownership or an obligation to assist'* - a continuation of one of the main weaknesses of the SWMP Regulations. The subcontractors represented at the workshop, are still largely focused on the SWMP as this is where they have more of an impact, and they are asked by principal contractors to provide waste information.

All of the attendees agreed that they are still required to produce SWMPs by certain clients at the tender stage, especially for large infrastructure projects, though they doubted whether the clients would take into account the content or the actions listed. BREEAM is a major driver for their use and various local authorities require them as a part of planning applications, usually dependent upon the size of the project. One contractor voiced the opinion that *'the waste agenda had slipped since the SWMP is not a legal requirement, largely due to the type of procurement, where the price is fixed and there is no cost benefit from reducing waste'*.

5 Conclusions and recommendations

Whilst the SWMP Regulations were generally thought to be clear in the two-fold objectives of decreasing illegal waste and increasing construction resource efficiency and well-written, there were various issues which contributed to an overall lack of effectiveness. This included not targeting the key stakeholders (clients and designers), little enforcement of Regulations and unclear responsibilities for this, the perceived cost of undertaking SWMPs, particularly from smaller companies and the lack of recognised benefits from their adoption, particularly for illegal waste. Therefore their effectiveness was limited, which led to their repeal. However, they were thought to improve waste performance, particularly for larger contractor companies, through providing a greater understanding of waste arising, how it is managed and the cost of it, combined with a framework to enable change. This is evidenced by their continuation in use particularly by the larger contractors and via building assessment schemes such as BREEAM, although they are more so combined with other site issues such as energy and water, as 'Resource Management Plans'. Moreover, there is still a prevalent view from the contractors, that clients and designers continue to be disengaged from these plans, which limits their full effectiveness, as by the time construction commences on site the opportunity to reduce waste is much less. Recommendations for future policy development in the area of circular economy based on the review of the SWMP Regulations are:

- There needs to be clear ownership and responsibility of Regulations both in terms of their implementation and enforcement; by allowing local authorities to devise their own administrative procedures there could be inaction, confusion and inconsistency between

different local authorities. It also allowed local authorities and the Environment Agency to 'pass the buck'.

- There should be some form of 'piloting' of the legislation in order to identify and address any implementation and enforcement issues. This could also assist in obtaining better impact assessment data.
- Raising awareness through training, guidance and tools is important for the success during initial implementation; this should also be available for those enforcing the legislation
- Put simply, Regulations need to be enforced, particularly for smaller companies to ensure compliance. Non-compliance costs need to outweigh compliance costs
- There needs to be a consensus between central Government departments on the requirements for the legislation and how it should be implemented as well as additional resources (for example, requiring SWMPs through planning would have been a sensible approach).
- More emphasis needs to be put at the top of the waste hierarchy i.e. waste minimisation by putting a legal requirement on clients and designers.
- Responsibilities need to be clearly defined, both in terms of those that have duties (client, principal contractor) and those enforcing it. More emphasis needs to be put on the client duties.
- The requirement for waste forecasting, collection and subsequent monitoring is essential in driving improvements in performance.
- The naming of Regulations is important – the use of 'Site' gave the impression that the Regulations were only required at the construction site stage and that they were the responsibility of the contractor, with no involvement from the designer or client.
- The socio-economic and environmental advantages need to be fully researched and captured by the industry and Government. The SWMPs Regulations provided a perfect (but missed) opportunity to capture centrally much waste and other related data.
- There needs to be full consideration of how smaller and larger companies will implement legislation and their associated drivers. Whilst larger companies could see benefits, smaller companies often didn't, viewing SWMPs as a burden. Capacity building and awareness rising for smaller companies is important. The focus of the legislation may need to be different for smaller and larger companies (for example, smaller companies focusing on compliance and larger companies focusing on best practice).
- Having two-fold objectives needs to be clearly thought out; each objective may suffer if they are not aligned (for example, the emphasis within the Regulations was more so on the Duty of Care rather than the resource efficiency aspects, which lessened their importance). The cost threshold may be different for these two objectives.
- There needs to be clear and direct linkages between the policy makers and the implementation bodies, otherwise there is a lack of control and competing policies may hinder its uptake.
- Regulations such as these, may need to be updated at some point, once they become common practice, as to require more activities (e.g. setting and meeting of waste target) otherwise they can become a tick box exercise and their value is lost.



The Swedish Environmental Objectives as a structure to further CE practices in construction and reuse of buildings - an Impact Assessment

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1 Introduction

SWEDISH ENVIRONMENTAL OBJECTIVES – IN BRIEF

In 1999 the Riksdag (the Swedish Parliament) adopted a number of environmental quality objectives to give clear structure to environmental action. This has led to what is now called the environmental objectives system:

- A generational goal defining the direction of the changes in society that are needed within a generation in order to achieve the environmental quality objectives.
- Environmental quality objectives describing the state of the Swedish environment that environmental action is to result in. These objectives are to be met by 2020 and, in the case of the climate objective, by 2050.
- Milestone targets directing the way to the changes in society needed to achieve the environmental quality objectives and the generational goal.

The desired national environmental quality is to be achieved without increasing environmental or health problems of other countries. The environmental objectives system form part of the foundation for Sweden's implementation of the UN's 2030 Agenda and its Global Goals for Sustainable Development.

The environmental objectives are followed up on a regular basis, with annual reports to the Government as a basis for the Budget Bill. An in-depth evaluation of environmental action and the prospects of reaching the objectives is performed once every parliamentary term. The evaluation aims to address whether existing policy instruments are sufficient, or if adjustments and new measures are needed in order to achieve the objectives.

A number of government agencies are responsible for following up and evaluating specific environmental quality objectives. The Swedish Environmental Protection Agency, working with all the agencies with responsibilities within the environmental objectives system, prepares the overall reports to the Government.

(Naturvårdsverket, Oct 2015, p. 11)

The purpose of this Impact Assessment is to investigate the structure of the Swedish Environmental Objectives system including its effectiveness. The assessment will provide evidence to support recommendations for the future development of policies and standards that will better favour the applicability of dynamic and circular building design. This Impact Assessment will be undertaken by obtaining primary data through interviews as well as reviewing previous impact assessment documents and related surveys.

2 Background

2.1 Generational Goal

The overall goal, the generation goal, of the Swedish Environmental Objective system is to hand over a society in which the major environmental problems in Sweden have been solved for the next generation, without increasing environmental and health problems outside Sweden's borders.

This generational goal is to provide guidance regarding the values that are to be protected and the changes in society that are needed if the desired quality of the environment is to be achieved. The values to be achieved are specified as (in bold the most relevant to this study):

- Ecosystems have recovered, or are on the way to recovery, and their long-term capacity to generate ecosystem services is assured.
- Biodiversity and the natural and cultural environment are conserved, promoted and used sustainably.
- **Human health is subject to a minimum of adverse impacts from factors in the environment, at the same time as the positive impact of the environment on human health is promoted.**
- **Materials cycles are resource-efficient and as far as possible free from dangerous substances.**
- **Natural resources are managed sustainably.**
- The share of renewable energy increases and use of energy is efficient, with minimal impact on the environment.
- **Patterns of consumption of goods and services cause the least possible problems for the environment and human health.**

<https://www.miljomal.se/Environmental-Objectives-Portal/Undre-meny/About-the-Environmental-Objectives/Generation-goal/>

2.2 16 Environmental Objectives

Several of the 16 Environmental Objectives (Ds2000:61, 2000) (Regeringens Proposition, 2009/10:155) are relevant for CE practices in the building sector. This assessment will focus on the three most directly linked objectives, *Reduced Climate Impact*, *A Good Built Environment* and *A Non-toxic Environment*. For a list of all objectives, see for example:

<http://www.miljomal.se/Environmental-Objectives-Portal/>

2.2.1 Reduced Climate Impact

"In accordance with the UN Framework Convention on Climate Change, concentrations of greenhouse gases in the atmosphere must be stabilised at a level that will prevent dangerous anthropogenic interference with the climate system. This goal must be achieved in such a way and at such a pace that biological diversity is preserved, food production is assured and other goals of

sustainable development are not jeopardised. Sweden, together with other countries, must assume responsibility for achieving this global objective."

There are no specifications directly relevant to the BAMB project and its outputs tied to this objective. The end game is:

"No net emissions of greenhouse gases latest 2045, and after that negative emissions."

<https://www.miljomal.se/etappmalen/Begransad-klimatpaverkan/>

2.2.2 A Good Built Environment

"Cities, towns and other built-up areas must provide a good, healthy living environment and contribute to a good regional and global environment. Natural and cultural assets must be protected and developed. Buildings and amenities must be located and designed in accordance with sound environmental principles and in such a way as to promote sustainable management of land, water and other resources."

Specifications relevant to the BAMB project and its outputs:

- the built environment is based on and supports people's needs, facilitates experiences of beauty and pleasure, and offers a varied range of housing, workplaces, services, and culture,
- people are not exposed to harmful air pollution, chemical substances, high noise levels, radon concentrations, or other unacceptable health or safety risks,
- energy, land, water and other natural resources are used in an efficient, resource-saving and environmentally-friendly manner aiming to minimize their use and primarily choose renewable energy sources and
- waste management is efficient for society and easily used by consumers, waste is diminished, while the resources in waste are better used, and the impact of waste on health and environment are minimized.

<http://www.swedishepa.se/Environmental-objectives-and-cooperation/Swedens-environmental-objectives/The-national-environmental-objectives/A-Good-Built-Environment/>

2.2.3 A Non-Toxic Environment

"The occurrence of man-made or extracted substances in the environment must not represent a threat to human health or biological diversity. Concentrations of non-naturally occurring substances will be close to zero and their impacts on human health and on ecosystems will be negligible. Concentrations of naturally occurring substances will be close to background levels."

Specifications relevant to the BAMB project and its outputs:

- total exposure to chemical substances via all sources of exposure is not harmful to people or biodiversity,
- as far as possible, particularly dangerous substances are no longer used,
- there is very little spread of unintentionally produced substances with hazardous properties, and information is available concerning the formation, sources, emissions, and spread of the most significant of these substances and their degradation products,

- knowledge about the environmental and health properties of chemical substances is available and sufficient for the purposes of risk assessment, and
- information is available about substances hazardous to the environment and health that are present in materials, chemical products, and articles.

<https://www.miljomal.se/etappmalen/Begransad-klimatpaverkan/>

2.3 Milestone targets

The 24 milestone targets, developed between 2010 and 2017 indicate steps along the way to the environmental objectives and the generational goal. The four most relevant milestone targets for this investigation are:

Information about dangerous substances in articles,

“Regulations or agreements within the European Union or internationally are to be applied in such a way that information about substances hazardous to health and the environment that are present in articles is available to all parties concerned by 2020.

The regulations are to be introduced gradually for different product groups, and children’s health is to be given particular focus in the information.

Information about substances hazardous to health and the environment that are present in materials and articles is to be made available throughout the entire product life cycle through harmonised systems that cover prioritised product groups.”

Non-toxic and resource-efficient ecocycles

“The safe use of recycled material from a health and environmental perspective through, as far as possible, avoiding the recirculation of dangerous substances while resource-efficient ecocycles are sought. This is to be achieved through an overall action strategy within the EU, which, by 2018 at the latest, is to result in a number of measures, including:

the finalisation and coordination of EU regulations on waste, chemicals and goods so that they steer towards non-toxic and resource-efficient ecocycles

the establishment of the principle of high and uniform requirements on the content of dangerous substances in newly produced and recycled materials, through a decision where appropriate.”

Reducing children's exposure to dangerous chemicals

“Decisions are made by 2018 at the latest concerning existing and, if necessary, new regulations and other policy levers which will bring about a significant reduction in the health risks to children as a result of overall exposure to chemicals. The risk reduction is to be assessed in comparison with the situation in 2012.”

Construction and demolition waste

“Measures are to be taken so that, by 2020, at least 70 per cent by weight of non-hazardous construction and demolition waste is prepared for reuse, recycling and other material recovery”

This milestone target was declared to have been reached in the evaluation published in 2017 (Naturvårdsverket, 2017).

<http://www.swedishepa.se/Environmental-objectives-and-cooperation/Swedens-environmental-objectives/Milestone-targets/>

The Swedish Environmental objective System has been set up in a way to both encourage and enable collaboration and mutual effort from many players and to keep track of the aim and keep monitoring and adjusting the direction to make sure the effort leads to where it is intended. (Skrivelse, 2013/14:145)

The primary instruments are the Objectives and continued evaluation with accountability for responsible parties (Naturvårdsverket, Oktober 2015). Activities, development of incentive and policies etc. are instigated continuously to keep steering in the right direction (Naturvårdsverket, Oct 2015).

2.4 Granularity and context

The Swedish Environmental Objectives system is vision- and results- oriented, whilst also setting the direction and aims for the overall national, regional and local Swedish environmental work (Naturvårdsverket, Oct 2015) . The system is used in national budget propositions and as a guide for agencies, regions and municipalities. The sustainability challenges which the environmental goals are addressing are complex and encompass most parts of society (Naturvårdsverket, 2017).

The Environmental Objectives system is closely linked to Sweden’s Environmental Code and the Climate Policy Framework (Naturvårdsverket, Oktober 2015). It is currently being connected to the Agenda 2030, UN sustainability goals (Sweden, 2017).

2.5 Key stakeholders

To reach the Environmental Objectives, the plan is for the Swedish Parliament, Government, Agencies, regional authorities, municipalities, business community, stakeholder organisations and civil society to join forces and take responsibility together, using the Environmental Objectives system as a guide. The main focus is on government and regional/local government and this impact assessment concentrate only on government agencies.

- The parliament, the highest political executive authority in Sweden, has ratified the Environmental Objectives. The Government has the overarching responsibility to reach the objectives but has delegated part of this responsibility to eight national agencies responsible for one or several objectives.
- Eight national agencies are responsible for follow-up and evaluation of the objectives. Other national agencies work in their respective fields to reach the objectives.

- An All Party Committee on Environmental Objectives was set up in 2010 to secure broad political consensus on environmental issues. The committee is tasked with providing the government with suggestions on how the Environmental Objectives may be reached. The Committee, known as Miljömålsberedningen, encompasses political representatives from most political parties, as well as appointed experts. The aim is to achieve long-term stability and broad consensus in the environmental work in Sweden.
- In 2010 the Minister of the Environment set up a council, consisting of a governor and executive officers of the 25 government agencies, with responsibilities in the Environmental Objectives system. In 2014 the Environmental Objectives Council was adapted and is now a platform for the heads of the 17 government agencies that are strategically important for achieving the Environmental Objectives.
- Regional authorities have the overarching monitoring responsibility at the local/regional level, overseeing that municipalities, business and other organisations fulfil their parts, and encouraging voluntary activities.
- The municipalities are responsible for implementing the Environmental Objectives at the local level. Schools are obliged to educate children and students about sustainability, with the Environmental Objectives as part of the curriculum.
- Several of the objectives can only be solved with international or European cooperation. Part of the objectives ask Swedish actors to take measures to ensure international and/or EU cooperation.

<http://www.miljomal.se/Environmental-Objectives-Portal/Undre-meny/Who-does-what/>

2.6 Timescales

The Swedish Environmental Objectives, first adopted in 1999, were reviewed in 2009 and the Swedish Parliament decided on a new structure for the environmental objectives on the 22 June, 2010 (Regeringens Proposition, 2009/10:155) (Ds2000:61). The overarching environmental concerns were transformed into the generational goal, described by 7 specifications (see above). The Objectives were kept but descriptions, responsible parties and milestones were updated and revised. 2020 was set as the goal year. (Regeringens Proposition, 2009/10:155)

- The first in-depth evaluation after the restructure was done in 2012.
- In 2012, the description of some of the goals were rephrased and the structure of milestone targets was revised and heavily restructured. The government adopted 13 milestone targets, one of them a milestone target for building and construction waste.
- Five more milestone targets concerning toxic substances were adopted in 2013.
- The second in-depth evaluation after 2010 was undertaken in 2015.
- In the annual review in 2017, the milestone for building and construction waste was declared to have been met.
- The next in-depth evaluation is scheduled to take place in 2018.

<https://www.miljomal.se/Miljomalen/Miljomalssystemets-historia/>

3 Approach

3.1 Methodology

This study focuses on the Swedish Environmental Objectives System at national government level and the role of governmental agencies.

The three agencies identified for participation in the research were:

National Board of Housing, Building and Planning, Boverket:

“Boverket – the Swedish National Board of Housing, Building and Planning – is a central government authority assorted under the Ministry of Enterprise and Innovation. We review developments within the fields of housing, building and planning.

We gather relevant facts and statistics in Sweden and internationally to describe, understand, forecast and make policy suggestions. We undertake evaluations and impact assessments of policy initiatives at national and regional levels. Boverket supervises town and country planning in Sweden from legislative, procedural and architectural perspectives. Development of sustainable regions and communities and for quality of life is always in focus in various parts of our work. Examples are infrastructure and transport, the importance of urban environment and social issues, and development of the planning process and its instruments. The circulation of best practice is an important part of our work.”

<http://www.boverket.se/en/start-in-english/about-boverket/>

Swedish Chemicals Agency, Kemikalieinspektionen:

“The Swedish Chemicals Agency is a supervisory authority under the Government of Sweden, and is responsible for ensuring that companies and society at large conduct controls of chemicals in an acceptable manner.

We help develop legislation and other instruments. We do this by conducting our own investigations and providing suggestions to help the Swedish Government tighten the rules on chemicals at both national and EU level. We also do this through our extensive work at international level...

We also provide guidance regarding enforcement and inspections to municipalities and county administrative boards.”

<https://www.kemi.se/en/about-us/our-work>

Environmental Protection Agency, Naturvårdsverket:

“ We are the public agency in Sweden that is responsible for environmental issues. The Agency carries out assignments on behalf of the Swedish Government relating to the environment in Sweden, the EU and internationally.



The Agency's remit is threefold:

- Compiling knowledge and documentation - to develop our own environmental efforts and those of others
- Developing environmental policy - by providing the Government with a sound basis for decisions and by giving an impetus to EU and international efforts
- Implementing environmental policy - by acting in such a way as to ensure compliance with the Swedish Environmental Code and achievement of the national environmental objectives”

<http://www.swedishepa.se/About-us/>

Due to the complexity and breadth of the Environmental Objectives System, and the scope of this inquiry, the Impact Assessment was undertaken as a qualitative study based on deep semi-structured interviews. Representatives for the 3 agencies responsible for the objectives and milestones relevant for the BAMB project were selected. The agencies responsible for each relevant objective are also the main legislative bodies (preparing and suggesting new policies, regulations and support structures) in their respective areas. The interviewees were recommended by the person in each agency in charge of the environmental objectives. This makes them part of the system, highly informed but not impartial and conflicts of loyalty could exist. The interview questions were set up to encourage reflective assessments.

The interviews were conducted over the phone, recorded with the interviewee's permission and transcribed. The transcriptions were added together one question at the time. Meaning bearing sentences were identified and categorised. The categories and meaning bearing sentences (in Swedish) were reviewed by at least two reviewers during the process.

Summaries were created in English and compiled in section 4, Summary of data from interviews, together with quotes from the interviews. The quotes have been translated to English.

The results are discussed in regards to topic, literature and the BAMB project.

3.1.1 Assumptions and limitations

The Environmental Objectives system was reworked in 2010. This research primarily focused on the period between 2010 and 2017.

One of the cornerstones of the Swedish Environmental Objectives system is its encompassing nature, functioning as an umbrella for all major environmental issues and the holistic view of the environmental work in Sweden. However, three of the 16 goals are deemed of direct relevance for CE in the built environment. Therefore they were the focus of this investigation. Other objectives and milestones may have been relevant.

The Swedish Environmental Objectives have been active for an extended period of time, with reviews and updates regularly. This gives rise to much available information. Due to the limited resources available for this impact assessment only a selection of available background data was included. The main focus was on the interviews with agency representatives. As identified in 3.1, the involvement of the interviewees in delivering the Environmental Objectives makes them highly informed, but not impartial in their assessments of the effectiveness of the Swedish Environmental Objectives system.

This, together with the complexity of causalities warrants caution in regards to conclusions.

3.2 Available data

The available background information and possible input for this study is encompassing and not all available information was included due to time constraints. Among the available information was:

- Official government decisions, propositions, reports, evaluations, websites,
- Four in-depth evaluations
- Annual follow-ups
- Budget propositions/budgets
- Regional and local adaptations and annual follow-ups

It would not have been practical to answer the question this study set out to answer with quantitative measures. With so many layers interacting with each other, to establish reasonable causality links would have been questionable. Therefore, it was considered that the views of representatives for the responsible agencies involved in these processes would hold the best available knowledge about how the Environmental Objectives system works within both the bigger picture and in the more narrow scope of the circular economy in the building sector.



3.3 Research questions

The following research questions were identified:

- Is the structure of the Swedish Environmental Policy effective at promoting, facilitating and/or enabling circular economy in the building sector?
- Based on the view of representatives for the responsible agencies, how does the Environmental Objectives system relate to circular economy aspects in the building sector today?

4 Analysis and interpretation

4.1 Summary of data from interviews

4.1.1 The Environmental Objectives system

The interviewees describe the Swedish Environmental Objectives system as a ‘management by objectives’ system, with 16 objectives defining the desired environmental quality. They mention the overarching generational goal and put emphasis on the role of the Specifications (preciseringar, in Swedish), Milestones and Indicators to make it more concrete. They state that these environmental issues will take time to solve, so it is a long term commitment. The evaluation is therefore an important tool to see if the development is going in the desired direction.

An important strength in the system is, according to the interviewees, that the objectives in the system are decided by the Parliament (riksdagen) with a broad political consensus, making them stable regardless of which party is in power.

”Regeringen och riksdagen har lagt fast det här, vilket är en jättestor styrka, det skiftar inte mellan olika regeringar utan detta är något vi håller fast vid oavsett partifärg i regeringen och det tycker vi har varit en stor styrka och viktigt.”

”The Government and the parliament have stipulated this, which is hugely important, as there is no shift between different governments but something we hold on to regardless of which party is in power.”

The interviewees describe the Environmental Objectives system as a way for the government to bring environmental issues onto the agenda for their own work as well as for that of the 8 responsible agencies and the 26 agencies with direct instructions to contribute to fulfilling the objectives. It also acts as a steering mechanism through demands for environmental management systems consistent with the objectives system for 185 governmental agencies.

”Det är ju liksom statens styrning av den egna verksamheten.”

”This is the Government governing its own operation.”

They describe that the purpose of the system is to be a driving force for actions towards the objectives and to point out responsible governmental agencies and organisations. On the other hand they also emphasise that the bulk of action needed is with other parts of society, mainly the business sector.

”Sen är det ju tanken att miljömålen ska inspirera andra till att vidta åtgärder, kommuner, företag, andra organisationer men det finns ju intet tvingande krav.”

”The basic thought is that the Environmental Objectives are meant to inspire others to take action, municipalities, companies and other organisations, but there are no mandatory requirements.”

They state that even if the objectives system is not mandatory for other actors, it works as a compass and shows business, municipalities and organisations where the development is heading. If they then want to take proactive measures, they are better prepared when legislation catches up. The interviewees mention better communication and more concrete targets would be needed to get business on board. However, the building sector is described as already engaged. The system

enables and encourages cooperation between government agencies and with other actors. Within the system the government puts pressure on its agencies to make strategies and actions together to encourage holistic action and cooperation with evaluation and assessment.

4.1.2 Purpose and function of the system

The Environmental Objectives system is described as a starting point for development of incentives and actions, but also a stable common ground and vision, enabling long term actions and strategies. It gives something to communicate from and to tie together actions for environmental sustainability.

"Vi har haft jättestor nytta utav allt tänk som känns förankrat som vi kan driva på alla nivåer på vårt arbete då både i lokalt, eu och nationellt"

"All the thought-work that is anchored in the system that we can use to drive these questions on all levels, locally and nationally, has been hugely helpful to us."

"Man kan säga att det har varit är en utgångspunkt när vi tar fram styrmedel och åtgärder och att det har varit den här stabila grunden för att långsiktigt på alla arenor"

"You can say that it has been the starting point when we create guides and measures and that it has been the stable foundation for long-term action on all arenas."

The interviewees also describe that the system helps to put environmental issues higher on the agenda and to not lose them as easily in negotiations. The objectives system is used to develop indicators to follow-up the environmental contribution/burden associated with the building sector. This, in turn, is a starting point for conversations with the building sector on how they work with environmental issues.

The Environmental Objectives system makes it clear where Sweden wants to go and what needs to be accomplished, and gives a sense of clarity and common ground in these issues. The annual and quadrennial evaluations makes the development visible and give something to relate to. Before the Environmental Objectives system was decided in 1998-1999, Sweden had many different environmental goals scattered in a way that made an overview almost impossible.

The Environmental Objectives and, to some extent, the Milestones and Specifications, are described as visionary, and sometimes woolly and unclear.

"Det inte helt lätt att kommunicera (miljömålen) varken internt eller externt då det är lite väl fluffigt"

"It is not entirely easy to communicate (the Environmental Objectives System) internally nor externally. since it is a bit too fuzzy."

At the same time, they are described as complicated and complex, but it is also stated that it would be difficult to make the system easier without losing some of its rigor.

"... men i grunden är det ett bra system även om det är komplicerat och jag är inte säker på att det går att förenkla det så mycket mer utan att det blir urvattnat."

"...but basically it is a good system even if it is complicated and I am unsure if it can be simplified very much more without watering it down."

Some objectives are seen as more complex than others, especially Good Built Environment, as it encompasses such a broad topic. It is considered that the majority of the objectives will not be reached in time, and that the nature of the objectives being visionary and not always crystal clear is a contributing factor.

Overall, the respondents are positive towards the Environmental Objectives system, accepting that, although it is visionary and complicated at times, it is overall a good and useful system, helping environmental development in the right direction.

The interviewees describe that their agencies relate to the Environmental Objectives system in different ways. It is described as the backbone or framework, as the foundation to work from or vision to work towards, and as a secondary policy, influencing the work at the agency to some extent, but not constituting its main area of responsibility.

4.1.3 Material cycles and toxic free loops

The interviewees explain that the Environmental Objectives clearly state that dangerous substances are to be phased out. Several of the milestone targets concern dangerous substances, information about chemicals and substances in materials, etc.

”Det är tydligt att vi ska sträva efter att fasa ut särskilt farliga ämnen och farliga ämnen... särskilt farliga ämnen har ju så farliga egenskaper så där är det en tydlig kompasskurs som vi jobbar med och lägger ner mycket tid och resurser på att försöka fasa ut för dom har så allvarliga egenskaper”

”The environmental objectives system clearly states that we are to strive for phasing out especially dangerous substances and dangerous substances... the severe properties of especially dangerous substances makes it a clear course of action for us. We are spending a lot of time and resources on trying to phase them out because of the serious effects they can have”

The interviewees describe that it is primarily in response to the milestones, specifications of the objectives or other legislation that they work with issues regarding toxic free loops or cycles. The overarching generational goal, which also describes less toxic material loops or cycles is less of a driver for the agencies. In regards to toxic free or less toxic materials loops or cycles, the interviewees emphasise the importance of trying to phase out dangerous and very dangerous chemicals from materials and buildings, both in regards to indoor environment and in regards to recycling.

They describe ongoing work to inform the building sector about toxic chemicals in building materials, mainly through industry associations. Chemicals and toxic materials are a central focal point for the environmental objectives. The cycles or loops are primarily addressed through the focus on waste and recycling. The interviewees describe initiatives and statements in the objectives about sorting of waste. The agency responsible for waste is also seen as responsible for loops/ cycles.

”Det finns olika aspekter när vi pratar giftfria kretslopp, det ena är när vi pratar om att det här påverka innemiljön negativt, det är ju en speciell fråga och där har vi ju byggreglerna som även om kraven är funktionskrav, man ska inte bli sjuk i byggnader så är det ju lite svårt eftersom det inte finns så mycket att gå på, när uppnår man ett visst gränsvärde, när är det farligt? Det är ju den ena delen och där har vi ju ett styrmedel som ändå jobbar mot det men sen är det det här att alla ämnen som kan vara farliga behöver ju inte vara farliga när dom finns i byggnaderna, men kan vara ett problem när de till exempel återvinns.”

“There are different aspects when we are discussing toxic free cycles. One is the negative effects on the indoor environment, which is a specific issue and where we have the building regulation, where even if the requirements are based on function – i.e. buildings should not make you ill – it is a bit difficult since it is a bit intangible - when is a limit value reached, when is it dangerous? For this aspect there are rules and guides but then the issue is that all substances that may be dangerous do not need to be dangerous when used in a building but still can be a problem during, e.g, recycling.”

The interviewees also mention that circular economy aspects like material loops or cycles are part of the objectives, but are also described as issues which are less connected to legislation or government funding, instead falling under the ‘polluter pays’ principle and personal consumption, not regulated by the state and that this makes it more difficult to work with these issues as a governmental agency.

“Vi har ju flera uppdrag kopplat till giftfrihet och kretsloppsfrågor där vi har ansvar för vägledning både kopplat till den lagstiftning som finns och kring avfallshanteringen, men sen är det ju konsumtionsfrågorna som är relativt svåra att arbeta med och om man tittar på cirkulär ekonomi och kretsloppsfrågor kommer man in på flera delar av samhället som vi inte reglerar på det sättet som den personliga konsumtionen den privata konsumtionen och hur man bidrar till resurssnålhet, juridiska verktyg är ju inte så verksamma där för att man ska upprätthålla personliga integriteten.”“We have several assignments connected to toxic free environments and cycles where we are responsible for providing guidance, both regarding the legislation that exists and around waste management, but then there are the consumer issues which are especially difficult to work with and if you look at circular economy you enter into several parts of the society which we don’t regulate. Like personal consumption and how to contribute to resource efficiency. Legal tools are not so effective in this area since personal integrity needs to be upheld.”

There are some guiding documents and information available concerning loops and cycles of building materials.

In regards to the built environment, toxic free/less toxic loops and cycles are addressed with guidance regarding toxic materials in demolition waste, impact on indoor air quality and recycling.

The interviewees describe that they do work with material cycles and toxic free loops, but that it is a challenging area where it is needed to work together more closely. From the interviews it seems the agencies have different perspectives on circular material loops depending on their responsibilities.

4.1.4 Circular economy and toxic free (or less toxic) material loops or cycles

The Environmental Objectives ask for toxic free (or less toxic) material loops or cycles and responsible resource management. The interviewees describe the focus of the environmental objectives and the circular economy as very similar. Circular economy adds a financial aspect to the traditional Swedish way of striving for loops, and the interviewees emphasise the importance of not losing the qualitative aspects of what is used and reused, e.g. chemical content. They regard that it is not only about the amount of material recycled, but also about content, keeping track of the dangerous substances, not spreading them and making sure they are phased out of the cycles in the long run. They also mention the gain of doing things “right” from the beginning, designing for a circular economy, thinking long term, not just one more cycle.

They also describe that circular economy thinking might be more attractive for industry and business, taking a more modern outlook, i.e. an update of the loops and cycles that have been discussed since the 70’s in Sweden. There is a hope among the interviewees that the Swedish

Environmental Objectives can help support a long term perspective in regards to circular economy and material loops, safeguarding or putting quality aspects like material content up for more discussion.

The interviewees see it as a key issue for truly making a circular economy work, to have materials and products free of dangerous or toxic substances to as large degree as possible. This makes the process easier, less expensive and safer.

”Vi tror att det går hand i hand med att man har kontroll på dom farliga ämnena och att man vet var dom finns, det är ju en nyckel fråga att vi vet och har kontroll på var vi använder farliga ämnen och fasar ut dom som är särskilt farliga. Då tror vi att det kommer att vara mycket enklare att återanvända och återvinna och så vidare. Så vi ser det som att det går hand i hand på lite längre sikt”

”We believe that circular aspects and being in control of dangerous substances and knowing where they are goes hand in hand. It is a key issue that we know and control where we use dangerous substances and phase out the especially dangerous ones. We believe this will make it much easier to reuse, recycle etc. Thus, in the longer term, it goes hand in hand.

In addition to the Swedish Environmental Objectives, they also describe this to be part of the EU's strategies.

4.1.5 Long-term and relevant

The interviewees describe the Objectives within the system to be stable, with the vision staying the same, but milestones, activities and actions changing over time. They describe that it has been the plan all along to let the system evolve with the changing times, and with knowledge and lessons learned from the evaluations. They view this as necessary, but also sometimes a factor that makes the system more difficult to implement and use, as well as more time consuming to keep up to date with. The interviewees therefore consider that it is beneficial that the system is not updated too often.

They describe that the Environmental Objectives system is currently going into a period of renewal. Many milestones are reaching their time limit or have been achieved and the government has decided to keep working with the system, developing new milestones.

”Nu har vi kommit in i en fas man funderar mycket kring hur miljömålssystemet kan leva vidare. Det är ju först nu, sista hösten som det blev tydligt att regeringen pekar ut en riktning dit man vill att miljömålssystemet lever vidare och att det ska utvecklas.”

”Now we have entered a phase where a lot of thought is put into how the Environmental Objectives System can live on. It is just recently, last fall, that it has become clear how the government wants the system to live on and evolve.”

A new climate objective has been put in place and, following work done comparing the Swedish Environmental Objectives system with the Agenda 2030 goals, the government has decided to adopt the Objectives system as the path to Swedish implementation of the environmental Agenda 2030 goals.

4.1.6 Heavy focus on evaluation

Interviewees consider that the system needs to be closely monitored to ensure that development moves in the right direction. However, this also constitutes a risk, with the potential that too much emphasis is put on follow-up, and fewer resources are left for pro-active actions.

"Jag kan uppleva att tyngdpunkten hamnat lite mycket på den utvärderande delen av systemet och att det finns en risk med att ha många indikatorer som följs upp årligen. Den delen av systemet kräver ju ganska mycket resurser. Det åtgärdsinriktade arbetet kanske inte riktigt utvecklas på samma sätt.

"I can feel that the emphasis is slightly too much on the evaluated part of the system and that there is a risk involved with having too many indicators which are followed up yearly. That part of the system does require quite a lot of resources. The action oriented work may not evolve quite in the same way."

The interviewees describe a further risk with the heavy focus on evaluation, if the agencies do not see that they can use the evaluation to plan and implement actions. If effort is focused on evaluation and follow-up, the Objectives system might not be as effective a driving force as intended.

4.1.7 Milestones

The interviewees describe several milestones and specifications which have a connection to toxic free building practices and circular material flows in the building sector, most of which are about chemicals and substances.

The milestone for reducing waste and increasing the recycling from building and demolition waste is described as a non-typical milestone for the Environmental Objectives system. This milestone is not generated from a desired environmental objective. It is an implementation from the EU waste legislation, with a political background.

"Den här var annorlunda, det är ovanligt att det finns ett etappmål på det viset, jag kan inte bakgrunden riktigt, men det känns lite konstigt, ja någon sorts politisk bakgrund, ett problem med den är ju att där finns inte riktigt det där med kvalitén med"

"This one is different, it is quite unusual to have a milestone target in that way. I do not really know the background but it feels a bit odd, like some sort of political agenda, and a problem with that is that quality is not really part of the considerations."

The interviewees describe it as lacking the emphasis on quality that is typical for the Environmental Objectives, instead focusing on quantity in a way that the interviewees consider does not lead in the right direction. They also mention that there has been some controversy around how this goal should be calculated. The interviewees describe an uncertainty around if this milestone has affected the recycling rates or prevented waste from the building sector in any significant way.

However, they also describe that the Environmental Objectives system as a whole has definitely had an impact on levels of construction and demolition waste and has contributed to the great numbers on recycling of building and demolition waste in Sweden. The agencies have worked in close cooperation with the building sector with dialogues around these issues to phase out dangerous substances and prevent unsorted waste. The milestone is considered reached, but since it originates from an EU directive with end date 2020, the interviewees mention that further development of the

milestone or setting new targets might be put off in wait for the development of the waste directive.

4.1.8 Cooperation and global focus

One of the main advantages the interviewees describe with the Environmental Objectives system is that it forces agencies to work together and cooperate around sustainability issues. The agencies with most responsibility for the Environmental objectives are propelled to take action together in joint ventures reported yearly. Since the circular aspects are overarching the interviewees stress the importance of collaboration.

The interviewees express the view that international cooperation is important in environmental issues, in particular with regard to working with chemicals and substances. They mention Agenda 2030 as an interesting umbrella under which to cooperate. They identify cooperation within the EU as being very important, even if countries such as China have a larger impact with regards to dangerous substances.

They believe that there are risks and difficulties when contemplating developing an EU environmental objectives system based on the Swedish model, but rather they see cooperation around specific issues and initiatives. On the other hand, when things go through, even if they are not perfect, e.g. the EU chemical regulation REACH, they see that as having a huge impact.

”Det finns nog ganska stora risker och svårigheter att få fram något gemensamt för att det är lätt att det blir urvattnat men å andra sidan när man väl lyckas så är det riktigt bra och då när EU står gemensamt, då är vi en riktigt stark röst. Rätt som det är finns det ett fönster.”

”There probably are quite large risks and difficulties to create something common as it may become watered down, but on the other hand, once you succeed it is really good and then, when the EU is united, we are a really strong voice. All of a sudden there is a window.”

The overarching function could be better facilitated with a more general instrument along the lines of the Agenda 2030 goals, rather than the detailed environmental objectives of the Swedish system. It is considered that it would be too complex and complicated to get multiple governments to agree to the objectives, without them being watered down and losing their edge.

They also question if the focus on environmental issues in the EU as a whole is strong enough to make it a priority issue.

At the same time they also describe that they see a shift here, with the climate changes getting more and more attention and the gravity starting to show in the debate. The positive opportunities more often highlighted in the sustainability discourse could also make a difference for getting the sustainability issues on the agenda according to the interviewees.

Interviewees describe that they often get much positive feedback when they describe the Swedish Environmental Objectives system to parties they cooperate with within the EU and elsewhere. However, other parties are intimidated by the thoroughness of the system, since they do not have anything similar and therefore have a harder time knowing what they want to achieve.

4.1.9 Activities and initiatives

The interviewees mention many different initiatives, activities, reports and policy suggestions developed in connection with the Environmental Objectives system with relevance to circular economy in the building sector.

In the indicators designed to monitor the environmental impact from the building sector, the use of toxic chemical substances as well as waste and recycling are included, even if there is awareness that waste not necessarily is the best resource-use indicator. These statistics are then used to have a dialogue with the building sector to see how they can improve their impact. There seems not to be a broader discussion about design issues of buildings and circular practices within the agencies. There have been some initial conversations concerning the readiness of the market for the introduction of LCA on a larger scale, building information logs and design for deconstruction. These topics are currently being worked with in an ongoing oversight of the Swedish building regulation with the aim to modernise the Swedish building regulation.

There have been reports on, and suggestions for, building logbooks, emissions from building materials, toxic waste from isolation materials, guidelines for sorting of building and demolition waste etc.

The interviewees describe how dialogues with the building sector are one of their most important tools to move towards the environmental objectives in the building sector. Over the last few years, the different agencies have supported the building federations with workshops on waste sorting issues and circular economy aspects. They also mention some cooperation activities they are required to develop, including developing guidance for the business sector in regards to toxic free and resource efficient cycles.

”Ända sedan 90-talet har vi ju haft en jättepositiv dialog, ända sedan kretsloppsrådets dagar med byggsektorns kretsloppsråd och senare bygga bo dialogen, framväxandet utav basta, byggvarudeklarationer, alltihop detta tycker jag har varit väldigt bra.”

”Ever since the 90’ies we have had a very positive dialogue, all the way back to the days of the building sectors cycle council (kretsloppsrådets) and later the “bygga bo” dialogue, the emergence of BASTA and building material declarations. All of this has, in my opinion, has been very good.”

The interviewees describe that there is a high level of awareness of the issues around chemicals and toxic materials in buildings in Sweden, since they have been under consideration for a long time, especially amongst frontrunners, but also that there still is much to do. In Sweden, there are several successful waste entrepreneurs dealing with building and demolition waste, so, even if there is a high cost for manual labour in Sweden, the interviewees state that we sort a surprisingly large amount of waste at our building sites. In regards to indoor air quality and emissions from materials, the interviewees express that we have been too reliant on good ventilation and too unaware about emissions from materials, and lack behind several other EU countries.

4.1.10 Milestone targets

There are different views among the interviewees on the milestone targets in the system. The milestone targets are generally thought to create a sense of urgency, and for some milestone targets they are perceived to make the objectives more concrete.

"Miljökvalitetsmålen är på gränsen till visionära och behöver ju preciseras och för att få driv i miljömålsarbetet så behöver vi etappmål"

"The environmental objectives are borderline visionary and need to be specified. To get drive in the work with the environmental objectives we need milestone targets."

"Etappmålen har inte alltid varit sådär tydliga som man skulle kunna hoppas"

"The milestone targets have not always been as clear as one would have hoped"

"Det är ju bra att etappmålen är konkreta och tydliga... dom är ju viktiga, det är ju där man konkretiserar"

"It is good that the milestone targets are concrete and clear... they are important since that is where the specification work is done"

For other milestone targets, they seem to create confusion instead, since they reside outside of the environmental objectives structure, with one milestone relating to several objectives and the responsibilities sometimes becoming unclear. For some objectives, the milestones seem easier to engage with, whereas for others the specifications of the objectives (preciseringarna) seem to fill this function instead.

"Det är enklare när man kommunicerar att utgå ifrån preciseringarna för dom vänder sig till alla och samtliga preciseringar täcker in det väsentliga."

"When communicating, it is easier to base it on the specifications since they are for everyone and since all specifications cover the essentials."

Before the milestone targets that are in the system today, there were sub goals, with the main function being to turn the objectives into something tangible. Some of these sub goals were transformed into the objective specifications instead when the sub goals were removed and replaced with the milestone targets. The milestone targets are described to be more dynamic and inspiring for society and the business sector, but also more political, and less relevant to the business sector and others. The milestone targets are identified as being of importance in relating the Environmental Objective system to Agenda 2030.

5 ANALYSIS AND CONCLUSIONS

5.1 Analysis

5.1.1 Scope of objectives

The objectives in the Swedish Environmental Objective system are considered to be positive, stating the desired quality of 16 aspects of the environment (Naturvårdsverket, Oct 2015). The quality focus in the objectives could be a good way to keep track of the real questions concerning environmental sustainability and not get lost in the solutions. The annual and quadrennial evaluations look at indicators covering both the actual environmental state of the aspects covered within the 16 objectives and actions taken to progress towards them (Naturvårdsverket, 2017).

The system is comprehensive, collecting all environmental objectives under one roof. For a country like Sweden, with a long history of regulating environmental issues, this makes sense, as it makes sense from an environmental point of view, since the environmental aspects are interrelated.

This investigation chose to look at three of the objectives:

- Reduced Climate Impact
- A Good Built Environment
- A Non-Toxic Environment

These three objectives connect to the aims of the BAMB project. Circular material and product flows, less waste and less need for virgin material are important tools to reduce the impact on the climate. Circular economy in the building sector has a clear connection to A Good Built Environment, both through the obvious sustainability aspects, and also in regards to a more flexible built environment, where the environmental benefits of less waste through more flexible building design also give social gains by making it easier to adapt buildings to users' needs for a lesser cost. There are also social gains by making it easier and less costly to repair buildings and components. A non-toxic environment, apart from being something we all want and need for health reasons, is also an important factor in making circular material flows efficient and cost-effective. Information as in materials passports are key to making sure the built environment is as toxic free as possible, as is our product and material cycles.

The interviewees were all involved with:

- A Good Built Environment
- A Non-Toxic Environment

The responsible person for the Reduced Climate Impact objective declined participation and the responsible agency referred to a person responsible for evaluation of the Environmental Objectives system instead who participated in the study.

Most of the objectives in the system will not be reached in time (Naturvårdsverket, 2017). The interviewees give some thoughts on why this could be, i.e. too visionary or unspecific objectives and too heavy in the back end, with a too heavy focus on evaluation of the objectives, leaving less room and resources for pro-active measures. Important to note, however is that the development in the Swedish society, as well as in Europe and in the world at large is going in the same direction. The Swedish Environmental Objectives system has not yet managed to stop climate change or create a

circular economy or restored our ecosystems, but that does not by default mean the Environmental Objectives system is not working. There are still too few actions, activities and incentives to be able to reach the goals in time (Naturvårdsverket, 2017), but momentum is building. The interviewees describe many different initiatives ongoing. These interviewed agencies do not have the capacity to solve the issues on their own, but they can contribute in shaping the game plan, to make it easier to adopt circular economy business models or adopt sustainable building practices. The Environmental Objectives system seems to give them leverage and incentives to work towards more circular economy aspects in the building sector. It seems that when the agencies instructions and the objectives and milestone targets from the Environmental Objectives system match and are clear enough, they are more than happy to do so.

5.1.2 Circular economy aspects

In the interviews there are some indications that the role of design for resource efficient cycles or loops are considered, but not in regards to building design to its full extent. Loops and cycles are most often mentioned as a waste issue. Using the BAMB project as a starting point, there is much more to circular use of building parts, products and materials (www.bamb2020.eu), and it is obvious that the work needs to be shifted to earlier in the process. Circular aspects do not only concern the recyclers, it concerns the architects, the owner, the user, the plumber, the electrician and so forth. The design perspective is crucial to incorporate circular aspects like reversibility, transformation capacity and reusability in new buildings as well as in refurbishments. Reversible building design could be one way to tackle these challenges.

The interviewees mention design for deconstruction and LCA, describing discussions concerning if there is a maturity for bringing these aspects into the Swedish building regulations. They describe a lack of a thorough knowledge base concerning e.g. reversible building design which impedes the integration of the aspects into policy and legislation.

Stronger focus on design as a building block to ensure material loops and circular economy in the building sector, could open up for more impact on building rules and standards.

Some of the agencies seem to be more closely interlaced with the system, with the Environmental Objectives close at heart and well connected to the instructions they are to follow, and others less so. It seems to make a difference if the agency perceives the Environmental Objectives as something they are to work for and with or something to comply with.

This indicates that the direct applicability and mandatory aspects are of importance for the ability to guide the work of the agencies. If the agencies are to use the Environmental Objectives as the vision and foundation of their work, they need to be instructed and there by allowed to do so.

5.1.3 Impact

Issues clearly tackled in the specifications, objectives or milestone targets, seem to have significant impact on the propositions, activities and reports the agencies work with. Therefore the Environmental Objective system seems to have influence in the governmental structures, assuming that the political government and parliament make decisions accordingly. This would imply that more specific references to building design for circular practices like reversible building design and demands for information for reusability for building parts, products and materials would trickle down into policy and regulation, creating clear incentives for reversibility in building design and

more information. The interviewees also mention that one of the important functions with the system is to make it clear to the business sector and other parts of society where the development is headed, to make it easier to dare to develop and invest. The milestone on recycling of waste from the building and construction sector seems to have instigated an oversight of statistic measures.

5.1.4 EU and the world

The interviewees did not see it as realistic to put in place a similar system for all of the EU. The reasons were explained to be practical, e.g. difficulty to agree on such a complex structure without watering it down too much, not enough value put on the environmental topics within EU and so forth. They found it more realistic and fruitful to work together on one topic at the time. On the other hand, for many of the topics concerning circular economy, the Environmental Objectives system seems to refer to the development within EU, e.g. as with developments of building product/materials information.

The agenda 2030 was lifted as a potential umbrella, which could make it possible for more countries to adopt similar systems to work with their environmental issues, using the agenda to work together and cooperate. Circular economy and built environment are on the outskirts of environment, i.e. natural ecosystems, connecting into financial and social spheres of society which makes it less straight forward than ecosystems of different kinds. This is also noticeable in the comments from the interviewees, where a Good Built Environment is considered as a more complex and complicated objective than others.

5.2 Conclusions

5.2.1 Is the structure of the Swedish Environmental Objectives system effective at promoting, facilitating or enabling circular economy in the building sector?

This study can only bring forth some indications on the impact of the Environmental Objectives system. The system has been in place for almost 20 years. It has evolved during this time, is continuously evaluated and even so, the objectives are to a large part not going in the right direction (Naturvårdsverket, 2017). It does seem though that the Environmental Objectives system has impact on the agencies investigated. It also seems to have impact on initiatives from the government. This system does not contain any solutions for the problems that need to be tackled. The solutions need to be added as an answer to the objectives and milestones. The system seems to create both pressure and allowance for these agencies to look for and suggest solutions to the objectives, milestones and descriptions made clear in the Environmental Objectives system, but maybe not to the degree necessary for all actors needed. These agencies then in turn are part of shaping the playing field for the building sector in Sweden. Overall, the focus on circular aspects are a central part of the generational goal and the objectives. The degree to which the Environmental Objectives system is mandatory and prescribed to be at the forefront of the specific agencies work seems to have influence on how much the Environmental Objectives system has influence over initiatives taken and developments of rules and regulations. Here it seems important that the agencies governmental instructions correlates with the Environmental Objectives system.



5.2.2 How does the Environmental Objectives system relate to circular economy aspects in the building sector today?

The Environmental Objectives system, as this study has indicated, clearly relates to circular economy aspects in general, and to some extent towards the building sector. Emphasis is on toxic free loops as well as waste reduction and recycling. The design aspect, making products or buildings fit for a circular use from the beginning is not developed fully. There have been initiatives the last years, stemming partly from the Environmental Objectives, which indicates a movement in the direction of more focus on building and material information (LCA, Building logs etc.), design for deconstruction and oversights of the building regulation with regard to more modern building regulations including health and sustainability issues. Thus, it seems that the current version of the Environmental Objectives system does further a development in a more circular direction. Having said that, there is also some indication that a more prescriptive and clear guidance towards circular practices in the building sector, and a clear direction from the government to these agencies about the importance of sustainability issues in the building sector would add to the case.

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Annex 1 Interview questions used

6.1 Government agency representatives:

The interviews were conducted in Swedish, recorded and transcribed.

1. How would you describe the Swedish environmental goals system in a few words? (Purpose, targets, how it works)

Hur skulle du kort beskriva det svenska miljömålssystemet? (Syfte, mål, så funkar det)

2. How important are the environmental goals in your opinion? Please describe!

Hur viktiga är miljömålen tänker du? Beskriv gärna!

3. If I would state that the environmental goals are the frame for the work of your agency, how would you answer to that?

Om jag, lite tillspetsat, skulle beskriva det som att miljömålen var ramen för ert arbete, hur skulle du svara på det?

4. The intentions for the generational goal point toward resource efficient materials cycles as far as possible free from dangerous substances, what impact does that have and how does it affect your work?

Strecksatserna i generationsmålet pekar mot giftfria kretslopp, vad innebär det och hur påverkar det ert arbete?

5. How do you view the connection between the toxic free loops and better resource management that the goals ask for and circular economy?

Hur ser du på kopplingen mellan de giftfria kretslopp och hushållande med resurser som miljömålen pratar om och cirkulär ekonomi?

6. The Environmental Objectives System has an organic changeable structure and is continuously updated.

- Do you share this view?

- In what way is it positive or negative that the system is changeable?

Det Svenska Miljömålssystemet har en relativt organisk eller föränderlig struktur.

- Delar du den uppfattningen?

- Vad är bra eller dåligt med att det är ett föränderligt system?

7. There is a milestone target about reducing waste from the building and construction sector that is considered reached, to what extent have the environmental goals been the driver for reaching this milestone?

- Could you describe?

Det finns ett etappmål för återvinning av bygg och rivningsavfall som bedöms som uppnått, anser du att miljömålen har bidragit till att detta delmål uppfyllts?- Kan du beskriva?

8. The milestone target about reducing waste from the building and construction sector is considered reached, but no new targets have been set, is that correct?

- Why do you think this is?

Etappmålet för återvinning av bygg och rivningsavfall anses uppnått, men man har inte valt att gå vidare med nya delmål, stämmer det?

- Hur tror du att det kommer sig?

9. Much of what the environmental goal system wants to achieve needs to be done on a broader scale, at least throughout the EU, how do you perceive the value of and/or risk with an environmental goal system on EU level

Mycket av det som de svenska miljömålen syftar till behöver göras i större skala, åtminstone i hela EU, vad anser du skulle vara värdet av och/eller risken med ett miljömålssystem för hela EU?

10. Which different initiatives are you aware of from different government agencies concerning/promoting toxic free material loops in the building and construction sector?

(Connected to material better information, depth and quality or easier access to information, easier to reuse buildings, parts, products and materials, less waste from building construction and demolishing sector)

Vilka olika initiativ känner du till från olika myndigheter de senaste åren som skulle kunna ha betydelse för giftfria materialkretslopp i byggsektorn och bättre hushållande med resurser?

(Kopplat till bättre materialinformation, mer tillgänglig materialinformation, bättre möjligheter att återanvända byggnader, produkter och material, minskade mängder avfall från bygg och rivningssektorn)

11. I have a view that we in Sweden are good at collecting and using material information in our building sector, especially compared to other EU countries, what do you think about that?

Jag har en bild av att vi i Sverige är bra på att samla och använda materialinformation i byggsektorn, särskilt jämfört med andra EU-länder, vad tänker du om det?

12. In which way, if at all, do the environmental targets encourage your agency to work towards toxic free material and product loops in the built environment?

På vilket vis, om alls, bidrar miljömålen till att er myndighet driver frågor kring giftfria kretslopp i den byggda miljön?

13. How important are the milestones in the environmental goals system in your opinion for a topic to gain attention?

- Why?

Hur stor roll spelar delmålen i miljömålssystemet för att en fråga ska få ökat fokus?

- Varför?

WP5 A3

Impact Assessment : Brussels Capital Region

Regional Program for Circular Economy: An analysis of data's collection for circular policy purposes

1) Introduction

- *A brief description of the policy/ regulation and its context*
- *Approach of assessment/enquiry*

The Brussels Capital Region's Regional Program for Circular Economy ([Le PREC – Programme Régional en Economie Circulaire, 2016-2020](#)) aspires to make a structural transformation of the Brussels' economy, transforming it into not only a circular economy but a low-carbon one, which creates employment and added value while respecting the environment and quality of life of Brussels' inhabitants. It defines the circular economy as an economic system of exchange and production, which, at all moments in the lifecycle of products (goods and services), aims to increase the efficiency of the use of resources and drastically reduce their waste, reduce the environmental impact of products, and develop the well-being of individuals. The Program has 3 general objectives: transform environmental objectives into economic opportunities, anchor the Brussels' economy in Brussels in order to produce locally when possible, and contribute to the creation of jobs. To achieve these general objectives, 111 measures have been outlined across 4 strategic areas – transversal measures, sectoral measures, territorial measures, and governance measures. By 2019, the PREC aims to provide a complete support package for this transition, including but not limited to:

- Subsidies
- Economic aid for businesses
- Access to loans and other regional incentives for circular investments
- Evaluation of jobs to be created
- Training
- 50% of relevant public procurements are to contain clauses for circularity

The measures and approach of the PREC are inspired by a study commissioned and published by Brussels Environment in 2015 on the [urban metabolism of the region, its flux, actors, activities and possible routes for resource optimisation](#). The study was led by EcoRes, ICEDD, and BATir (ULB). Using figures and statistics, this study illustrated the importance of the construction sector for the Brussels Capital Region to transition towards a circular economy. According to the study, construction is responsible for 20% of resources coming into Brussels, it produces a large amount of waste (34% of the region's non-household waste), and is the largest stock (84% of the total mass) of materials in the region (EcoRes et al., 2015). Recognizing the necessity of tackling this sector in order to achieve Brussels' circular objectives, the PREC announces a series of specific sectoral measures for construction, including a measure to put into place a monitoring tool for the sector and its evolution. To do this, it is foreseen to rely on data from no one source but various sources, and to then harmonize the data in order to come to a complete illustration of the sector. Over the course of 2017, a series of workshops led by Brussels Environment have resulted in the selection of indicators to conduct a monitoring exercise, as well as have resulted in the compilation of a 'wish list' of indicators and data that would provide further clarity of the sector and its degree of circularity.

Furthermore, the European Commission has identified the lack of data on construction and demolition waste in general but also on the quality and the quantity of specific waste streams as an important issue towards a qualitative waste management and transition towards a circular economy in the build environment.

Based on observation of the European Commission and the role given to data in the development of the PREC through the urban metabolism study, as well as the importance given to developing indicators for monitoring the sector as Brussels works to transition to a circular economy, the purpose of this assessment is to identify success or fail factors regarding data collection for waste policy which can be extended for recommendation in circular contexts.

To do this, we would like to study the impact of past policies related to the monitoring of construction waste objectives and the collection of relevant data. We would like to investigate questions such as : What is the objective of data collection? Does data inform better circular policies? How and what data is regularly collected? How is the data collected utilized? What are its limits? Are there opportunities to transform existing registries to meet the needs of data collection for the targeting/monitoring of circular economy measures and objectives in the construction sector? What are the existing data gaps? What would be the data gaps for regularly monitoring circularity (and not a linear sector)? What are the needs for data? Would additional or more complete data on circularity permit further targeted actions? What are the arguments against regularly (and publically) collected data? Based on the experience of Brussels, the goal of this study is to be able to identify success (or fail) factors regarding data collection for circular policy, which can then be generalized for recommendation in other contexts.

2) Approach

- Methodology

This assessment will be undertaken by relying on mixed methods of enquiry – literature review, group interviews, the analysis of existing workshop results and the comparison of conclusions with the results of network analysis within the BAMB project. Literature review will include the analysis of construction waste policies and legislation preceding the PREC, as well as their preparatory documents, and studies that have been commissioned in regards to data collection and data gaps for waste and materials flows. Group interviews will be held with Policy administrators as well stakeholders active in the sector in order to get their practical feedback on the current situation, the ideal to strive for, and the pros and cons of detailed data collection for policy purposes. Finally, input from previous workshops such as those of the PREC will serve to orient our enquiry, and our conclusions will be compared with what has been learned already within the BAMB project in order to formulate suggestions.

- Assumptions and limitations
 - *Identify the assumptions which are being made in this Impact Assessment; how the effect of the assumptions is being minimised (ie by use of mixed methods, supporting interviews, contextual information etc) [BRE will provide support with this section]*
- Available data and documents that can be consulted

Related legislation:

Directive 75/442/CEE du Conseil du 15 juillet ;
Directive 91/156/CEE du Conseil du 18 mars 1991;
Ordonnance du 7 mars 1991 relative à la prévention et à la gestion des déchets
Arrêté du 2 juillet 1992
Circulaire relative à la réutilisation de débris dans les travaux routiers et d'infrastructure (9 MAI 1995) ;
Plan de prévention et de gestion des déchets (Mai 2010) (previously plan from 91') – the 91' set a 70% goal, the 10' sets a 90% goal (which could be interpreted as including reused material) ;

Ordonnance relative aux déchets (14 juin 2012) ;

Arrêté du Gouvernement de la Région de Bruxelles-Capitale déterminant les règles de mise en œuvre de l'obligation de tri pour les producteurs ou détenteurs de déchets autres que ménagers (21 JUIN 2012) ;

Analyse de modèles urbains innovants liés à la gestion des déchets de déconstruction et démolition sélective et aux flux de chantier dans leur contexte et l'identification des actions pertinentes à adapter à la Région Bruxelles-Capitale (2015) ;

Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif à la gestion des déchets (1 Décembre 2016) ;

Strategy for Re-use of construction and demolition materials (2016)

Directive 91/689/CEE du Conseil du 12 décembre 1991 relative aux déchets dangereux, notamment l'article 4;
Décision de la Commission du 20 décembre 1993 établissant une liste de déchets conformément à l'article 1er, a) de la Directive du Conseil 75/442/CEE relative aux déchets (94/3/CE);
Arrêté de l'Exécutif de la Région de Bruxelles-Capitale du 19 septembre 1991 réglant l'élimination des PCB, notamment les articles 15 et 16;
Arrêté de l'Exécutif de la Région de Bruxelles-Capitale du 19 septembre 1991 réglant l'élimination des huiles usagées, notamment les articles 20 et 21;
Arrêté du 19 septembre 1991 réglant l'élimination des déchets dangereux, notamment les articles 19 et 20;
Arrêté de l'Exécutif de la Région de Bruxelles-Capitale du 19 septembre 1991 relatif aux déchets de l'industrie du dioxyde de titane, notamment les articles 12 et 13;
Avis du 15 avril 1996 du Conseil de l'Environnement pour la Région de Bruxelles-Capitale;
Lois sur le Conseil d'Etat coordonnées le 12 janvier 1973, notamment l'article 84, alinéa 1er, 2°, remplacé par la loi du 4 août 1996;
Avis du Conseil d'Etat, donné le 17 décembre 1996;
Arrêté du Gouvernement de la Région de Bruxelles-Capitale établissant la liste de déchets et de déchets dangereux (25 AVRIL 2002)

Preparatory documents of legislation

We also have access to some of the preparatory documents of these instruments, which provide clarity on the motivation behind their content.

Waste Plan

- [Quatrième plan de prévention et de gestion des déchets en Région de Bruxelles-Capitale](#) approuvé le 11 mars 2010) : les prescriptions développant une approche intégrée « Eco-construction » se trouvent aux pages 39 à 41

Reports by Brussels Environment

- [Rapport d'incidences environnementales du projet du 4^{ème} plan déchets](#), sept. 2008, 126 pages
- [Guide de gestion des déchets de construction et de démolition](#), déc. 2009, 82 pages
- [Région de Bruxelles-Capitale : Métiers en transition dans le secteur de la construction. Constats et compétences à acquérir par métier](#), juin 2010, 15 pages
- [Evaluation intermédiaire du 4ème plan déchets](#), sept. 2012, 29 pages et [Annexe au rapport](#)

Other Brussels Environment Publications

- [La partie 'Déchets' du Guide Bâtiment Durable](#) (the 'waste' part of the Sustainable Building Guide)
- [Inventaire déchets](#), fév. 2011, 5 pages

Studies commissioned by Brussels Environment

- RDC-Environnement, fév. 2006. [Estimation des quantités de déchets non ménagers générés et traités à Bruxelles](#), 72 pages.
- CERAA, 2008. L'application des principes de la maison passive en RBC
- CERAA-ROTOR, mai 2012. [Etude sur l'analyse du gisement, des flux et des pratiques de prévention et de gestion des déchets de construction et de démolition en RBC](#), 207 pages
- PWC, mai 2012. [Analyse des emplois existants et potentiels dans le secteur des déchets en Région de Bruxelles-Capitale](#), 129 pages
- ROTOR, nov. 2012. [Projet d'activation des filières de réemploi des matériaux de construction en région de Bruxelles-Capitale](#), 80 pages (=Opalis 1)
- ROTOR, 2012. [Etude contenants : Encadrement technique pour l'élaboration d'un appel à projet sur la collecte des déchets sur les petits chantiers en région de Bruxelles-Capitale](#), 48 pages
- ROTOR, décembre 2013. [Projet d'activation des filières de réemploi des matériaux de construction en région de Bruxelles-Capitale](#), 112 pages (=Opalis 2)
- Ressources-CIFFUL-Confédération de la construction, 2013. [Réemploi/Réutilisation des matériaux de construction, Guide pratique](#), 48 pages

- Ressources-CCW-CIFFUL, 2013. Outils pratiques (= annexe au Guide pratique): www.cifful.ulug.ac.be/ > Développement > → Réemploi de matériaux
- Ressources-CCW-CCBC-CIFFUL, 2013. Développement d'une filière de réutilisation et de recyclage des matériaux de construction
- ARCADIS, 2009. [Beheer van afvalgegevens. Voorbereiding nieuw besluit en nieuwe structuur voor gegevensbeheer.](#) Study to identify gaps in waste data, though not specific to construction.
- Indicators identified for the monitoring of PREC's (Regional Circular Economy Plan) construction objectives, and their limitations. List of indicators compiled in 2017.

3) Literature and Policy Review

To begin an investigation of the impact of past policies related to the monitoring of construction waste objectives and the collection of relevant data, we look to the Ordinance of 91' concerning the prevention of waste. This Ordinance set the scene for both the law

[Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif au recyclage obligatoire de certains déchets de construction ou de démolition \(16 MARS 1995\)](#) and the law [Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif au registre de déchets \(30 JANVIER 1997\)](#).

This 91' ordinance set out to transpose and apply the EU directive 75/442 and 78/319 regarding waste. In 1990 Belgium was condemned for having an absence of tri-annual reports for the Brussels Region on waste, hazardous waste, used oils and PCB-PCT. The ordinance set out to be the first of a series of instruments to set up the necessary framework to meet the Region's EU obligation related to waste. The ordinance recognized the importance of tackling the problem of increasing waste (in tonnes) in the Brussels Capital Region and aimed to prevent waste, assure reuse when possible, and guarantee the definitive elimination of waste when not.

The ordinance addressed reporting obligations for hazardous waste and recognized that the transfer of such information to IBGE was meant to allow assessing quantities, the flux, and facilitate planning. It also gave the power to IBGE to extend reporting obligations to other categories of non-household waste, and it recognized that by fulfilling its obligation to maintain a waste registry, the Executive could complete its tasks of surveillance.

With this background ordinance in mind, **the 1995 law relative to the mandatory recycling of certain construction and demolition waste** ([Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif au recyclage obligatoire de certains déchets de construction ou de démolition \(16 MARS 1995\)](#)) can be understood as a direct extension of the objectives set out by the 91' ordinance, as well as of the waste prevention and management plan approved by *the law of 2 July 1992*, which included the objective to recycle 70% of construction and demolition waste.

The 1995 law defines the following key terms:

- Construction and demolition waste – waste coming from the construction, renovation or demolition of buildings, art works, roads or other installations
- Debris - stony fraction construction and demolition waste
- Recycling – the transformation of 'debris' to permit their use as primary or secondary materials

This law also makes it mandatory for all builders/contractors/(developers) charged with the execution of construction works resulting in debris to assure the recycling of these debris, unless no recycling facility is available within a 60 km radius of the construction site.

To further set clear obligations regarding the collection of data pertaining to waste, the **1997 law on the waste registry** ([Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif au registre de déchets \(30 JANVIER 1997\)](#)) obliges the following individuals to maintain a waste registry:

- all producers of dangerous waste;
- all producers of special waste resulting from health care activities
- all persons that:
 - collects or transports waste for another party
 - exports their waste to another region
 - treats waste

According to this law, persons concerned by the collection, transportation, exportation to another region or waste treatment, must abide by the following minimum registry requirements :

1. code and the name of the waste according the European Waste Catalogue ;
2. the amount of the waste, expressed by weight or by volume;
3. the name of the recipient;
4. the code and the name of the waste treatment method;
5. the total amount of waste eliminated per month, recipient and treatment method.

The name and addresses of the producers and recipients are to be included in an annexe.

The registry is to be sent every 3 months to IBGE-BIM. Registry is to be saved for 3 years and be able to be consulted by IBGE-BIM on demand.

Additional requirements were asked of producers of hazardous waste.

Data from this registry has been used to assess waste flows of construction and demolition waste and whether Brussels is meeting its objectives. However, the registry was not originally meant for the creation of statistics but rather the monitoring of individual companies. Thus, it alone has not been able to provide sufficient information and studies have relied on various methods of calculation in the past years.

Between 1991 and today, multiple laws addressing various aspects of waste management have been drafted, approved and put into force. In order to simplify the situation, a new law on waste management brings together and replaces 11 previously existing laws, including the law from 1997 regarding the waste registry. The new **2016 law on waste management** ([Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif à la gestion des déchets \(1 Decembre 2016\)](#)) is in force since January 13, 2017. The repeal of the 1997 law on the registry will be effective as of January 1, 2018. The new law takes steps forward in regards to preventing waste, reuse, preparation for reuse, recycling, and recognizing that something categorized as 'waste' may lose this title based on its valorization. The 2016 law also has more detailed requirements for the traceability and registry of waste. Beyond the registry requirement previously imposed by the 1997 law, the 2016 law imposes a three-part system composed of a traceability document, the waste registry and reports.

The traceability document is to be created by the holder of waste who transports or commissions the transportation of his/her waste, or by the collector, the negotiator, or the broker/middleman. The document is to include:

1. The date of transportation, delivery, or frequency

2. The name and professional details of the holder of waste,
3. The name and professional details of the collector/negotiator/broker
4. The name and professional details of the transporter
5. The name and professional details of the facility that receives the waste
6. The nature of the treatment of the waste
7. The quantity (tonnes, kilos or mu)
8. The description of the waste
9. The code of the waste

In addition to the information recorded via the traceability document, information on waste treated by the producer his/herself if also to be recorded in the registry, as is proof of waste management. A registry is to be held by all holders of waste, transporters, collectors, and collection or treatment facilities.

Finally, an annual report of all waste flows is also to be submitted by all collectors, negotiators, brokers or the collection/treatment facilities.

4) Group Interviews

- Group Interview with Policy Administrators within Brussels Environment
- Participants:
 - Molly Steinlage - Dpt. Stimulation technique bâtiments durables
 - Nathalie Perrault - Dpt. Stimulation technique bâtiments durables
 - Corinne Bernair - Dpt. Stimulation économique bâtiments durables
 - Isabelle Sobotka - Dpt. Stimulation économique bâtiments durables
 - Nicolas Scherrier - Dpt. Déchets
 - Catherine Van Nieuwenhove - Dpt. Contrôles intégrés
 - Jonas Eyllenbosch – Dpt. Contrôles intégrés
- Research questions and notes to guide the discussion
Identify the questions developed for survey/ interviews and the techniques for gathering data used for each stakeholder group
Responses in blue (translated).

Data and Policy

- We see in the PREC, as well as passed legislation, an increasing interest to rely on data for the targeting and monitoring of policies and actions in the construction sector. Nevertheless, there are known limitations to current data sources (accuracy, gaps, etc.) and some have expressed the opinion of mandatory data collection being a burden that can hinder progress. **What is your opinion on data and policy? What are the pros and what are the cons? Is the cost (administrative, opportunity cost of actors, etc.) proportional to the benefits?**

(Catherine/Jonas)- Data used to monitor infractions. For it to be useful, you need to have a legal obligation to collect/report the data. Without an obligation, not complete. However, as soon as we mention more obligations, actors (sector + administration) become afraid and declare that we need to simplify processes, be more flexible.

(Nicolas) – Not necessary to only rely on quantitative data to make good policies. We can also rely on qualitative data, which is easier to collect (good and bad experiences). The problem with

quantifiable statistics is that the sector does not want any more rules or obligations. The construction sector already has a lot of constraints and a heavier reporting process would be difficult for the sector to deliver. It could be a barrier. In addition, more data results in more work for the administration (Brussels Environment), and if there are no means foreseen to fully exploit the results, would all of the extra effort really be worth it? If there's not enough HR to do the follow-up and analysis, we'll just lose the data and the work done.

- **What are the needs for data? Monitoring? Targeting?**

(Isabelle/Corinne) – One of the aims of the PREC is to put in place a monitoring system of the construction via a selection of indicators (number of jobs, job seekers, flows are waste, the materials going in/ the materials going out of a construction site...).

For the PREC, there's a need to know where we're at today in order to be able to fix realistic objectives. For example, an objective of 80% reuse in the sector by 2030, is it realistic or not?

(Nicolas) – If we had the numbers on reuse in construction, it would be very interesting politically. We could show the importance and make the figures talk.

- **Will data help us move towards 0 construction waste and a circular sector in BCR?**

(---) – Reuse in minor compared to recycling because of the high cost of labour in our area.

(Catherine) – Sorting centres (would) require a lot of space, there's not enough space in Brussels. The lack of space results in sorting/treatment centres being outside of Brussels. (> employment for Brussels' inhabitants?)

- Passed studies, such as the CERAA/ROTOR study published in 2012 and the work done by the ULB team as part of the ongoing work on the PREC, have indicated the difficulties of obtaining regular and recurring figures on CDW in Brussels, which would permit a dynamic evaluation, year after year, of the flows of construction waste and materials in Brussels. Within the work on measure CD02 of the PREC, a list of possible indicators has been proposed as the result of a consultation workshop (many of the participants attended) in order to monitor progress towards circularity (see excel). Sources for these indicators have also been identified, and are notably punctual studies that have been done in past years. To limit our scope and our discussion, let's focus on indicators related to the urban metabolism and material flows. In this category, a possible option that has been presented for future data collection is to again launch a study and survey as done by [CERAA/ROTOR in their 2012 study](#). In this study the limitations of available data are also addressed, and a series of recommendations and opportunities for data collection are identified. One such opportunity is the waste registry managed by Brussels Environment, which could be a resource for regularly collected data. In theory, such a registry could hold a trace of all waste in/out/around Brussels, however a series of problems are identified in regards to using the registry for statistical extrapolation. The study notes that use of the registry tends towards controls, blocking (both technically and legally) its use for

statistical extrapolation. It also notes issues of the registry's reliability regarding no-reported data, as well as double counting. The study notes that raw data from the registry must be manipulated and interpreted.

- **What is your reaction to this? How do you see statistical extrapolation from the waste registry? Technical issues? Legal issues?**

(Catherine/Jonas) – big problems with extrapolation and data comparisons due to the particularities of BCR's context. (ex: Wallonia – lots of agriculture, Flanders – industry...Hamburg has been used in some studies to extrapolate BCR data, but is that really a close comparison?). Punctual statistic extraction from the waste registry is ok, but extrapolation is problematic/

- **What is needed in order to enable the use of data from the current waste legislation for statistics?**

(Isabelle) – question: Is it not contradictory to put the focus on waste legislation when BAMB is aiming to go towards 0 waste?

(Molly)- It's not possible to assess the impact of recent legislation like the PREC, and no regular data legislation on reuse up to this point. This here the goal is to extract success/fail factors been analyzing past policies and legislations, learn from them, and make suggestions for circular policy.

- **Do you see other policy instruments that could support the data collection? E.g. a pre-demolition / pre-refurbishment audit, others?**

Current Legislation

- **As an administrator what is your perception of the current waste legislation (95', 97', 16') in regards to monitoring and data collection?**
- **In practice, what is the objective of the waste registry?**
 - In the preparatory documents of the Ordinance of 91', which laid the groundwork for the 95' and 97' laws (and consequently the 16'), in regards to hazardous waste, reporting obligations and the transfer of such information to IBGE was presented as a means to allow assessing quantities and flows, and facilitate planning. The Ordinance also gave the power to IBGE to extend reporting obligations to other categories of non-household waste. To the contrary, the discussions with colleagues to date have indicated that in practice, the primary objective of the waste registry is one of control. **Do you agree with this, or do you find in practice that data collected within the registry is also serving to assess quantities and flows, and facilitate planning?**

(Catherine) – In the beginning the registry was nearly voluntary and used as a political tool. At that time it fell under the Department of Waste of the administration. Realized that this was perhaps too 'light', particularly to show the importance of obligations. The ambition thus changed. After 2000 (exact year to be verified), the waste registry was transformed to the Department of Inspection. Now it's used as a monitoring tool and control instrument for infractions. For such a mechanism of data collection to work, 3 things need to be foreseen : legal basis making it a

requirement, personnel foreseen to follow its implementation (sufficient according to ambition), rapporteur to be designated to ensure follow-up.

- **How? Following what processes?**

(Catherine/Jonas) – There's no foreseen procedure or tool obligating the use of the registry data for political/planning purposes. The registry hasn't been set up to monitor the sector in detail or provide a detailed statistical report regularly. Nevertheless, punctual statistical extractions are done based on requests from the Department of Waste. Such detailed reporting from the registry is only done on demand, but technically it is possible for them to extract statistics to analyse if the 'pie' or construction's portion of the pie is varying. It would be difficult to impose much more because they don't have the means to do more (personnel or adequate tool).

- **More, generally what do you feel has been (historically) the impact of the various levels of data reporting required on waste generation.**
 - **In practice, what is your appreciation of the effectiveness of the procedures for data collection set out in the 95' and 97' (and 16') legislation? Are there obstacles and issues with the current data collection (ex. Double counting, territorial barriers due to waste context of Brussels (treatment outside BCR, etc.) ? Significant resulting gaps in the registry data? (ex: gaps identified in study by Arcadis)**
 - **What is the level of compliance?**
 - **Accuracy? Is data verified? If yes, how so?**

(Jonas) – The quality of data is not optimal. Corrections have to be made. Errors occur when data is furnished/reported. Errors also occur at IBGE when encoding the data in the registry.

It's also difficult to do controls, and we don't have the necessary means for quality control.

(Catherine) – No means to do quality check. There's nobody assigned to validate the quality of the data. However, the critique of 'double counting' is exaggerated. The data is not so poor, and they do the best they can with the means that they have.

- **What could be other benefits/drawbacks/impacts from the legislation? The higher recycling rates, ...**
 - **Is it possible and how do you quantify these impacts?**
- **What led to the changes for reporting in the '16 legislation (administrative simplification, addressing gaps, etc.) ? Do you think these will resolve any of the current issues and obstacles in order to collect complete data?**
- **Concretely, will there be significant changes to how and what data is regularly reported and collected? Changes in its use?**

(Catherine)- We hope to have a new data base in place by 2020. The 2016 legislation (BRUDALEX) replaces the previous 97' legislation on the registry and will be in effect by 01/01/2018. Previously, producers (or the source of the waste) wasn't collected. Current legislation requires the collection points and the type of waste to be collected (collectors does the reporting), but once in a container, no way of identifying % coming from construction sites vs. hospitals or other sites. This should change. New legislation makes the link between waste and producers (this more detailed approach is already in place for hazardous waste). With the BRUDALEX legislation all relevant

actors are to be capable of reporting, operators and producers. However, not obligatory for all. Nevertheless, a producer should be able to report all flows for 2018 in 2019 if they are requested to by the administration.

(Molly)- It's interesting to note the objective of realizing all pertinent actors weren't targeted by the original legislation and that's action is being taken to target additional actors in the new legislation. This is a question that we have for PREC or circularity data collection. If something like the registry or another collection system is developed for circularity flows, do the solutions proposed target all relevant actors? This is something to keep in mind in regards data for circularity.

Data For Circularity

- **Assuming that the waste registry was expanded and resources allocated for the statistical tracking of the flows of construction materials and waste via a publically managed and mandatory registry, what adaptation would be needed to fit a circular approach? (additional actors (which ones), additional categories (reuse etc.).**
 - **What would be necessary to go from a waste management to a resource management and thus from down-cycling to re-use and upcycling?**

(Isabelle) – Need to know detailed flows in and flows out, waste isn't interesting for her work. For example, the in-out flows of a construction site would be interesting statistics to be able to evaluate a circular economy policy. The ULB study did this based on 3 building typologies, then did an extrapolation to the regional level.

(Molly) – Yes, but important to note that this is also a punctual study and won't permit a dynamic evaluation over time.

(Catherine) – Does the construction confederation or the CSTC (Center for Technical and Scientific Construction) not have these statistics?

(Isabelle/Nicolas) – No. Often the amount of waste generated on a site is greatly under-estimated and at the end of construction there may even be twice as much waste than originally planned for. In addition, often excess and scraps that still have value are treated as waste, they're not sent back to the suppliers.

(Catherine) – Currently the waste registry only looks at waste. If something is still considered a product, it's not included/tracked.

It's nearly impossible to never have waste. Currently, almost all demolished buildings even have hazardous waste.

We'll never have this type of in-out statistics in the waste registry managed by Brussels Environment. There are not enough resources and the registry has not been set up to do such a detailed monitoring.

If there ever is such an 'in-out' registry, it would be wise to make sure that the codification system is the same that is used to report to Europe (Europe waste codes). That would make it possible to prevent making some coding mistakes, as well as possibly permit using the 'in-out' registry as a tool to verify the waste registry and vice versa.

- **Current registry – from the moment something is categorized as waste, how to change this?**
- **Are you convinced of the regular monitoring of flows and the urban metabolism for targeted and effective circular policy? Why/why not?**

See above in regards to PREC's needs for targeting objectives + avoiding adding too much reporting in the sector.

- **What are the arguments for/against regularly and publically collected data?**
- **Do you have ideas for alternative solutions (other than public registry) for the regular monitoring of materials flows?**

(Isabelle) – At this point in time, we're at the phase assessing what's there and what's possible. One idea would be to come up with a monitoring solution in steps [note: list of steps compiled from the discussion and elements mentioned by various participants]:

1. *(Corinne) – studies commissioned, or statistics against payment (done by actors like FEMA, ROTOR, CERAA)*
2. *(Nicolas) – another idea would be to subsidize a number of constructions sites to make it economically interesting for them to collect all different kinds of waste and share information. However, not only \$ is interesting. One idea would be to set up a small scale collect and delivery service – trucks that could supply a number of sites at once, and recuperate valuable waste. This would provide an opportunity to have direct access to information on quantities, which could then be extrapolated to represent a larger group and/or the service could be expanded.*
3. *(Nicolas) – one more idea would be focus on data that could be collected by putting more emphasis on expanded producer responsibility. In certain cases - as for roofing, PVC window frames, fiber glass – products are already recuperated because it's financially interesting, not because it's an obligation. We could perhaps make it obligatory or push eco-conception further. In parallel, we could take advantage of the collected data.*
4. *(Isabelle) – Further down the line we could imagine relying on BIM, Materials Passports, or pre-demolition audits to collect data. BIM could be used creatively to illustrate flows. She doesn't think that it would be necessary to make it obligatory. A test, financially supported by Brussels Environment, has been launched on 6 small construction projects.*

Catherine asked for clarity on what BIM is. Discussion illustrated that while the sector is moving to BIM, the level of BIM required to think of using flows would most likely be several years off for broad implementation. Nevertheless, an option could still be to propose BIM and voluntary reporting now, and in the meantime fall back on other steps in this multi-step vision.

(Catherine) – She noted that there's no ambition to transform the current waste registry into a registry for circularity. It would be too much in terms of heavy administrative processes for the sector, as well as for Brussels Environment. However, if steps like those discussed become real, and possible use of BIM to track flows, it would perhaps be possible to reduce the amount of reporting required for the registry in parallel.

- **Do you think such data is the most important for circularity, or rather other indicators (already suggested or not) are of more value to inform and target circular policies and actions.?**

- Summary/Workshop Results

Major lessons:

1. There's a need to be realistic in regards to the ambition of data collection systems and selected indicators. The waste registry's ambition and use has changed since its initial launch, and it is going to continue changing (new legislation) both to better cover all actors and to lighten up the administrative obligations.
2. The added value needs to equal extra burden, both on the sector and on the authorities in charge of data collection and controls.
3. There's a need to thoroughly assess if all necessary actors are targeted by data collection systems put in place for policy purposes (ex: legislation change to now also include producers). In terms of circularity, this means assessing if all necessary actors of the value network are included in order to best assess the sector and determine opportunities for targeting circular policies.
4. An idea was proposed to possibly imagine a multi-step process towards more complete data. The sector is shifting to a data focus for various aspects of its activities (BIM, MPs). In the long-term, policy makers can capitalize on that data for policy purposes as well. Nevertheless, in the short/middle-term, we can continue to try to make effective circular policies relying on alternative, less broadly applied methods (qualitative and quantitative) and/or incentive schemes.

-
- Group Interview with key stakeholders (combined with VITO's group interview)
 - Participants:
 - Caroline Henrotay (Brussels Environment)
 -
 - Research questions to guide the discussion
 - *Identify the questions developed for survey/ interviews and the techniques for gathering data used for each stakeholder group*
 - Summary/Workshop Results

5) Analysis and interpretation

- Summary of data
 - *A combination of data gathered from official sources, professional bodies, etc and from surveys/ interviews conducted for this Impact Assessment*
- Analysis of data
 - *Analysis of data conducted as appropriate, including statistical analysis and supported by contextual information*

6) Conclusions and recommendations

- Conclusions

The European Commission has identified the lack of data on construction and demolition waste in general, as well as on the quality and the quantity of specific waste streams, as an important issue for qualitative waste management and the transition towards a circular economy in the built environment.

Based on the role given to data in the development of the PREC through the urban metabolism study, as well as the importance given to developing indicators for monitoring the sector as the Brussels region works to transition to a circular economy, the purpose of this assessment is to identify success or fail factors regarding data collection for waste policy which can be extended to recommendations in circular contexts.

The different laws that have been assessed build upon one another.

The Ordinance of 91' concerning the prevention of waste develops a reporting obligation for hazardous waste that could be extended to other types of waste. This enabled extending the reporting obligation to construction and demolition waste and the obligation to recycle debris (stony fraction construction and demolition waste) with the aim to achieve 70% recycling of construction and demolition waste as stated in *the 1995 law relative to the mandatory recycling of certain construction and demolition waste*. Furthermore, the *1997 law on the waste registry* defines the required maintenance of a waste registry enabling the control and monitoring of infractions.

Initially, the ordinance of '91 aimed to allow assessing quantities and waste flows and to facilitate planning. However, these objectives have been adapted along the way for different reasons:

- The accuracy of data and difficulties to extrapolate statistics
- The lack of resources required for the administration to verify the quality of the data and to process and analyse the data

As a result, the data cannot be used to monitor the flows and types of construction and demolition waste and their potential recycling and reuse. Therefore, the data within the registry cannot be used to assess the current situation and to fix realistic circularity targets.

The laws mentioned above have been brought together with 8 additional laws on waste management into the 2016 Law on waste management, (implemented since 01/01/2018). This law aims to simplify the administrative burden for the actors and administration, and to extend the list of actors targeted by the reporting obligations, incorporating the waste producers, in order to make sure that the whole value chain is covered. Furthermore, the law will enable improving the traceability of the waste. However, no adaptation/extension has been foreseen to enable using the gathered data for monitoring or planning.

The importance of accurate data that can support the monitoring and definition of circularity targets is identified by different members of the Brussels administration for environmental management (Brussels Environment, previously IBGE). However, the administrative burden is also acknowledged for the different actors who have to provide, collect, process and analyse the information. To accept this burden, the data provided must offer a clear added value. This means that the following all must be aligned: the objectives of the data collection, the clarity of the data requested to meet those objectives, the different stakeholders that need to be involved, and the adequate financial and HR means.

An idea was proposed to possibly imagine a multi-step process towards more complete data. The sector is shifting to a data focus for various aspects of its activities (BIM, MPs). In the long-term, policy makers can capitalize on that data for policy purposes as well. Nevertheless, in the short/middle-term, we can continue to try to make effective circular policies relying on alternative, less broadly applied methods (qualitative and quantitative) and/or incentive schemes. One of these alternatives is the conduction of punctual studies and surveys defining the materials flows for the built environment.

- Recommendations (combined across all Impact Assessments)

Based on the above impact analysis the following recommendations can be made:

- Data is crucial to support the monitoring and definition of circularity targets
- The objectives of the data collections have to be clear for all stakeholders as well as its added value
- The type of data required to meet the objectives needs to be clearly defined and minimised to what is really needed and what adds value for policy
- The whole value network and all actors required for the data collection, processing and analysis needs to be taken into account to avoid data gaps, which would hamper the accuracy of data and the analysis

WP5 A3

Impact Assessment Outline (draft for guidance)

Acronyms

CDW: Construction and demolition waste

HERM: High environmental risk material

LERM: Low environmental risk material

TRACIMAT: TRACInG MATerials

Introduction (1 page)

A brief description of the policy/ regulation and its context

Construction and demolition waste (CDW) originates from demolition of buildings and construction works, as well as during construction and breakdown of roads and pavements. When the stony fraction of this CDW is processed by the crusher, 'recycled aggregates' are produced. These aggregates originate from the mechanical processing of inorganic material from construction works (VLAREMA, art. 1.2.1).

When buildings are demolished, new materials are created that are eligible for reuse or recycling. Their field of application is, to a large extent, determined by their purity. Thanks to selective demolition, pure fractions are collected on site. To stimulate the practice of selective demolition, **Tracimat** (TRACInG MATerials), a voluntary **demolition tracing system**, was set up.

Tracimat is a non-profit neutral construction and demolition waste (CDW) management organisation that will certify the selective demolition process by issuing a "**certificate of selective demolition**" for demolition waste that has been selectively collected and subsequently gone through a tracing system, thereby assuring the processing company of the quality of the recycled demolition waste.

In Flanders, if the CDW is accompanied by a "certificate of selective demolition" the processor can accept the demolition waste as "**low environmental risk material**" (LERM) and can therefore process it separately from waste streams with a high environmental risk (HERM).

Tracimat will initially **focus on the stony fraction**, which in terms of weight by far represents the greatest portion of the CDW in Flanders and Belgium. The processor of the stony fraction of the waste, i.e. the crusher, produces 'recycled aggregates'. Tracimat will trace selectively collected stony demolition waste from its point of origin down to the crusher, thereby requiring to distinguish between LERM and HERM at the time of acceptance and assuring the crusher of the environmental quality of the input demolition waste. Where possible, the organisation's field of activity will be expanded in the future to include other types of CDW materials, e.g. timber waste.

Tracimat is legally incorporated into the Flemish environmental regulation **VLAREMA** for Sustainable Management of Material Cycles and Waste, which is the implementing order of the Flemish Materials Decree. Tracimat operates in feedback with the **Common Regulation for Recycled Aggregates**, allowing it to trace construction and demolition materials down to the crusher.

A new acceptance and processing policy (LERM vs HERM) for producers of recycled aggregates will come into force in August 2018. From then onwards, all producers of recycled aggregates should differentiate between material with high and low environmental risk.

For stony material with low environmental risk (LERM), the origin is guaranteed and there is a limited or low risk, after processing the waste, to produce contaminated recycled aggregates. On the other hand, for stony material with high environmental risk (HERM), there are insufficient guarantees about the origin and, consequently, about the environmental-hygienic quality of the stony fraction. This means that the contamination risk of the recycled aggregates is considerable.

It is expected that the difference in processing and rejection procedure as a result of this distinction in LERM and HERM will give rise to a substantial price difference in the acceptance of HERM flows as compared to the acceptance of LERM flows.

Given that the conditions for storage, processing and control of HERM are more extensive, the treatment cost of HERM is expected to be a multiple of the treatment cost of LERM. This price difference would be a motive for selective demolition.

[Sources: Tracimat (2018), HISER (2017), VITO (2016)]

Purpose of the Impact Assessment (to identify structures for policies/ regulations which have been previously effective and might be put forward by BAMB to promote CE practices in the construction/ re-use of buildings)

The Tracimat demolition tracing system and the new acceptance and processing policy measure behind it, which will be applicable in August 2018, are the object of study for this impact assessment. The purpose of this ex ante assessment is to identify likely (intended and unintended) economic, social and environmental impacts of Tracimat in a qualitative way, why they would occur and who would be affected.

Background

Purpose and structure of the policy/ regulation

- What are the intended impacts/ outcomes/ outputs? (see the Logic Model for help with identifying these)

The purpose of Tracimat is to **enhance the quality of recycled aggregates for high value recycling**. Purer waste streams with a low environmental risk have a greater upcycling potential. This in turn would open up opportunities for incorporation into more high-quality applications than are possible today.

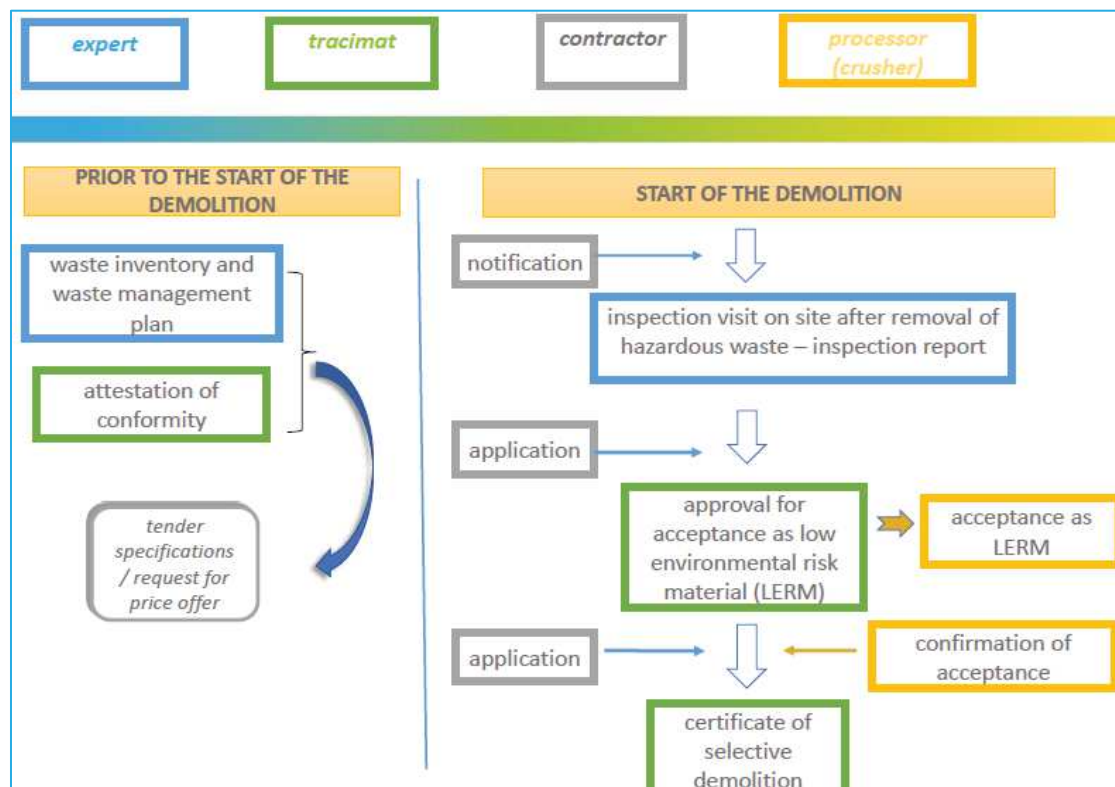
The CDW management organisation also aims to **enhance trust and collaboration** and to **stimulate professional selective demolition practices**. The demolition waste comes with a certificate issued by a recognised and independent organisation, which is designed to enhance trust not only in the quality of the material, but also in the quality of the demolishing company. It could also boost trust in the recycled product, resulting in improved and more widespread marketing of recycled products.

The [Tracimat website](#) lists the following advantages for three different stakeholders :

- **Advantages for the owner of the existing building and/or building client:**
 - High-quality demolition inventory available when tendering for the demolition works so that the demolition contractor can set his price in a well-informed way
 - Risk of unexpected costs decreases thanks to a high-quality demolition inventory
 - The stony fraction can be processed at a lower price
 - Guarantee that all waste materials are disposed of in a legal manner
 - Contributing to a chain care system that further shapes the circular economy
- **Advantages for the demolition contractor:**
 - High-quality demolition inventory available when tendering for the demolition works to be able to set a price in a well-informed way

- Less chance of dishonest competition
- Fewer discussions regarding unforeseen demolition works
- Purer material flows and consequently lower processing costs
- Commercial advantage in view of the quality assurance
- **Advantages for the crusher, i.e. producer of recycled aggregates**
 - Improves the quality of the incoming stony fraction, which reduces the risk of non-compliant recycled aggregates
 - Confidence in the quality of the aggregates will increase
 - Increased quality as a step towards more high-end applications

Figure 1 shows the different step of the Tracimat tracing procedure.



To be able to demolish selectively and to trace demolition waste materials, the materials must first be inventoried. Therefore the tracing process starts with the preparation of a demolition waste inventory and waste management plan prepared by an expert prior to the dismantling work and selective demolition. To guarantee the quality of the waste inventory and waste management plan, they must be prepared according to a specific procedure. Tracimat will check the quality of the waste inventory and waste management plan and issue a declaration on its conformity. The waste inventory and waste management plan and its attestation of conformity are added to the tender specifications for the selective demolition works

When the demolition works start, the contractor notifies Tracimat. After the hazardous waste is removed, an inspection visit on site (to confirm removal of the hazardous waste) is performed by the expert and an inspection report is drawn up. Once the inspection report is approved by Tracimat, the demolition contractor can apply for an approval for acceptance as low environmental risk material, allowing to deliver the stony demolition waste as LERM to the crusher. Once the demolition works are finished, Tracimat checks - based on a desk control of the discharge certificates/processing documents, as well as random intermediate inspections at construction sites - whether both the hazardous waste and the non-hazardous waste that complicates the recycling of the stony

fraction of the demolition waste material, have been selectively and properly disposed of. If so, Tracimat will issue a certificate of selective demolition, thereby confirming the quality of the stony demolition waste as well as the quality of the demolition contractor who performed the selective demolition works.

[Sources: Tracimat (2018), HISER (2017)]

Tracimat is a voluntary initiative. The new acceptance policy (LERM versus HERM) for producers of recycled aggregates will come into force in August 2018. From then onwards, all producers of recycled aggregates will have to differentiate between material with high and low environmental risk. Contractors, however, will not be obliged to follow the Tracimat procedure. If they don't do so, their CDW would automatically be accepted as HERM. The desired effect of the policy is that these contractors would have to pay a higher fee to get rid of their stony demolition waste, making their services more expensive and thus pricing themselves out of the market. Note of VITO: The aim of the policy maker is that these price differences will push contractors to **change their practices**. Although selective demolition has already been stimulated) since May 2009 (almost 10 years ago), through the introduction of the demolition inventory, according to VLAREMA (Article 4.3.3), some demolition contractors are being very creative in mixing other (non-hazardous) waste fractions into the stony waste fraction, in order to optimise financial gains/costs out of the demolition works. As long as high quality constraints are set on the LERM stony fraction and the demand of recycled aggregates for high applications rises, the price difference with the HERM stony fraction should engage demolition contractors to separate waste fractions in a more strict way.

The policy operates in Flanders at the level of the demolition process. Tracimat will initially focus on the stony fraction, which in terms of weight by far represents the greatest portion of construction and demolition waste in Flanders and Belgium.

It should be noticed however that a the sizeable proportion of stony fraction that is being treated into recycled aggregates in Flanders, comes from construction and demolition sites situated outside the Flemish region. It is assumed that, in 2013, 1 to 1.5 Million ton of CDW originating from the Brussels Capital Region was being treated in Flanders, as there are **no licensed crushers in Brussels**. *[Source: MDO (2013)]*

- *Are there other related policies, regulations, external influences or drivers? (This is important for identifying if there might be other causes for the impacts seen)*

The selection of the Tracimat demolition tracing system – or better said the new acceptance and processing policy measure which will be applicable in August 2018 – is the study object for this impact assessment.

Relevant Flemish policies concerning the Tracimat system:

- Eligibility criteria from VLAREMA, the implementing order of the Flemish Materials Decree
- Common Regulation for Recycled Aggregates
- Recognition decree: 24 August 2017. – Recognition of Tracimat vzw as demolition waste management organisation, Belgian Official Journal 29 September 2017
- Ministerial decree of 24 August 2017 amending the appendix to the ministerial decree of 25 July 2011 on the approval of the Common Regulation for Recycled Aggregates, Belgian Official Journal 29 September 2017

- Ministerial decree of 3 February 2017 determining the conditions for a tracing system regarding the implementation of Article 4.3.5, §3 of the Decree of the Flemish Government of 17 February 2012 establishing the Flemish regulations concerning the sustainable management of material cycles and waste, Belgian Official Journal 4 May 2017

Tracimat is legally incorporated into the Flemish environmental regulation **VLAREMA** for Sustainable Management of Material Cycles and Waste, which is the implementing order of the Flemish Materials Decree ('*Materialendecreet*').

Since 2009, according to VLAREMA (Article 4.3.3), a **waste demolition inventory** ('*sloopinventaris*') is required to demolish or dismantle buildings that had a, wholly or in part, non-residential function, and with a building volume larger than 1000 m³, in order to stimulate selective demolition in Flanders. The waste demolition inventory maps hazardous and non-hazardous waste that will be released at the demolition works. Selective demolition itself is, however, not mandatory. The law was not always respected when it comes to the inventory of demolition. VITO (2016) describes that, according to interviews with contractors and with the Belgian Confederation of Contractors of Demolition and Deconstruction Works (CASO), only 1 out of 10 construction works which are obliged to create a demolition inventory actually have one.

VLAREMA 6 contains two important mandatory changes with regard to selective demolition, namely the introduction of a waste management plan and of a quality assurance system. This means that Article 4.3.3 (mandatory waste demolition inventory) is replaced. According to the new definition, a waste management plan is required for:

- 1° demolition, renovation or dismantling works on buildings for which an environmental permit is required and whose total building volume exceeds 1000 m³ for all non-residential buildings to which the permit relates, or more than 5000 m³ for all mainly residential buildings, with the exception of single family dwellings, to which the permit relates;
- 2° demolition, renovation or dismantling works in the context of infrastructure works for which an environmental permit is required; and maintenance works on infrastructure for which an environmental permit is required and whose volume exceeds 250 m³.

This implies that for all demolition works requiring an environmental permit, a waste management plan is mandatory. These VLAREMA 6 changes were published in the Belgian Official Journal on 23 February 2018 and are in force since 5 March 2018.

Tracimat operates in feedback with the **Common Regulation for Recycled Aggregates** (ER: '*Eenheidsreglement voor gerecycleerde granulaten*'), allowing it to trace construction and demolition materials down to the crusher. The ER entered into force in 2011, by Ministerial Decree. In the ER, which establishes the requirements to be met by crushers and aggregates in Flanders, a significant amendment has been introduced which requires crushers to distinguish between materials with a low environmental risk (LERM) and materials with a high environmental risk (HERM) at the time of acceptance. The ER also provides that LERM streams can be processed more cheaply than HERM streams.

Under the Common Regulation for Recycled Aggregates, a new **acceptance** and processing **policy** for producers of recycled aggregates will come into force in August 2018. From then onwards, all producers of recycled aggregates will be required to differentiate between material with high and low environmental risk.

Moreover the different **certification regulations** of Copro (www.copro.eu) and Certipro (www.certipro.be) apply to recycled aggregates. These impartial bodies check whether the requirements, as described in the Common Regulation, are met for the certification of the environmental-hygienic quality of the aggregates.

The **ministerial decree of 3 February 2017** determines the conditions for a tracing system regarding the implementation of Article 4.3.5, §3 of the Decree of the Flemish Government of 17 February 2012 establishing the Flemish regulations concerning the sustainable management of material cycles and waste. The ministerial decree ('*Ministerieel besluit van 3 februari 2017 tot bepaling van de voorwaarden voor een traceerbaarheidssysteem houdende de uitvoering van artikel 4.3.5, §3 van het besluit van de Vlaamse Regering van 17 februari 2012 tot vaststelling*

van het Vlaams reglement betreffende het duurzaam beheer van materiaalcringlopen en afvalstoffen, BS 4 mei 2017') was published in the Belgian Official Journal on 4 May 2017. This decree determines the conditions the traceability system must meet. A distinction is made between (1) a tracing procedure for demolition and dismantling of buildings; (2) a simplified tracing procedure for the demolition and dismantling of buildings with a construction volume less than or equal to 1000 m³; (3) a tracing procedure for infrastructure works.

The **ministerial decree of 24 August 2017** amending the appendix to the ministerial decree of 25 July 2011 on the approval of the Common Regulation for Recycled Aggregates, was published in the *Belgian Official Journal on 29 September 2017* ('Ministerieel besluit van 24 augustus 2017 tot wijziging van de bijlage bij het ministerieel besluit van 25 juli 2011 houdende de goedkeuring van het eenheidsreglement gerecycleerde granulaten, BS 29 september 2017'). Although the minister republished the complete Common Regulation for Recycled Aggregates, this decree only doubled the term from 6 months to 1 year from when a distinction will be made between HERM and LERM CDW.

Finally, the **recognition decree of 24 August 2017**, published in the Belgian Official Journal on 29 September 2017 ('Erkenningsbesluit: 24 Augustus 2017. – Erkenning van Tracimat vzw als sloopbeheerorganisatie, BS 29 september 2017'), recognizes Tracimat as a demolition waste management organization. This decree also implies that the new LERM-HERM acceptance policy at the crusher will enter into force one year after the recognition of Tracimat.

[Sources: Tracimat (2018), HISER (2017), OVAM (2018), Immospector (2017), Emis (2011), Certipro (2018), Minaraad (2017)]

Key stakeholders

- *To whom does the policy/ regulation apply? Who are the primary actors implementing the policy?*

The Tracimat tracing system applies to the demolition contractors in Flanders.

Tracimat is a CDW management organization, whose activities include training and inspection of the experts, evaluation of conformity of demolition surveillance plans, advisory role etc.

Tracimat is an initiative of the following actors:

- Flemish Construction Federation: VCB (*Vlaamse Confederatie Bouw*)
- Belgian Confederation of Contractors of Demolition and Deconstruction Works: CASO (*Confederatie van Aannemers van Sloop- en Ontmantelingswerken*)
- Belgian Federation of Producers of Recycled Aggregates: FPRG (*Federatie van producenten van Recycling Granulaten*)
- Sector Federation of Consultancy and Engineering companies: ORI, representing the Belgian engineers (*Representatieve Organisatie van de Advies- & Ingenieurssector*)

- *Who is impacted by the policy?*

Within the supply chain:

- Demolition expert
- Building owner/client
- Demolition Contractor
- Crusher, i.e. producer of recycled aggregates

Other stakeholders include:

- Belgian Building Research Institute (BBRI)
- Public Flemish Waste Agency (OVAM)
- Recycling and sorting companies (if other than crusher)
- Communal waste depots ('container park')
- Concrete producers etc.
- Verification companies for the inspection of recycled aggregates: Copro and Certipro
- ...

Timescales

- *How long has the policy been in place? Has the policy/ regulation been updated? Is an update planned? Or is there a consideration that the policy/ regulation might be withdrawn?*

Tracimat was recognized as a CDW management organization on 24 August 2017. The new LERM-HERM acceptance policy at the crusher will therefore enter into force at the end of August 2018, which will be one year later.

[Source: Tracimat (2018)]

Approach

- Methodology [BRE will provide assistance with this section] [to be added at the end of the assessment]
 1. Literature review
 2. Expert judgement (demolition experts, contractors, VITO experts etc.)
 3. Approach of Impact Assessment: Ex-ante impact assessment: the likely effects (economic, social and environmental impacts) of Tracimat are analysed
- Assumptions and limitations
 1. *Identify the assumptions which are being made in this Impact Assessment; how the effect of the assumptions is being minimised (ie by use of mixed methods, supporting interviews, contextual information etc) [BRE will provide support with this section]*

Tracimat applies to buildings and road works, but given the BAMB focus on buildings, this assessment does not include impacts of recycled aggregates related to road works. Furthermore, the requirement of a waste management plan (according to Vlarema 6) does not apply to all buildings but only to the demolition of buildings whose total building volume exceeds 1000 m³ for all non-residential buildings, or more than 5000 m³ for all mainly residential buildings, with the exception of single family dwellings. Therefore it would be interesting to investigate the impact of making a waste management plan mandatory for all buildings. This, however, is not part of the scope of this assessment.

- Available data
 - *Describe possible data sources that could be used/ existing mechanisms in place to measure the impact (eg is the policy-maker assessing its impact? Are there academic studies/ Professional bodies carrying out monitoring for their members??)*

An ex ante Impact Assessment was carried out as the policy is not yet in force. The new acceptance policy (LERM vs HERM) for producers of recycled aggregates will come into force on 24 August 2018.

Data is available, but it is spread out over different stakeholders.

Data of likely impacts will be collected using expert judgement (demolition experts, contractors, VITO experts etc.) and by studying literature available.

Literature study → See References at the end of the document

- **Research questions**

Identify the questions developed for survey/ interviews and the techniques for gathering data used for each stakeholder group

Main research questions:

1. What is the impact of Tracimat to reduce CDW and to support the circular economy within the construction industry?
2. Which measures should be taken to help both policy and practice for construction, demolition, recycling and reuse?
3. How can the exchange of information ensure that the policy and CDW practices grow closer together and support each other with common objectives?

Supporting research questions:

- What are the main objectives for the construction / demolition / recycling and recycling sector?
- What information is needed to evaluate these objectives? Which data are valuable for the sector / for you?
- What experiences do you have to date with the inventory of data?
- Which data do you think can be easily retrieved?
- What are the barriers to collect these data?
- If efforts are required to collect the necessary data, what would you be willing to do? What would you expect in return?
- What steps do you expect from the government / knowledge institutions to help your organization in collecting data?
- Which evaluation criteria should be determined to evaluate whether policy measures are effective?
- Which data must be inventoried to implement a good policy?
- How would you contribute to the transition to a circular economy? Which steps should you take for this?

Analysis and interpretation

Summary of data

As the new LERM-HERM acceptance policy at the crusher will only enter into force in August 2018, an ex-ante impact assessment is performed, meaning that the likely effects of this initiative are analysed. The potential future environmental, economic and social impacts of Tracimat are identified and structured. A qualitative analysis is made and, whenever data are available in the existing literature, a quantitative estimate of expected benefits and costs is made. Given the BAMB focus on buildings, this Impact Assessment only includes construction and demolition waste (CDW) that originates from demolition of buildings and construction works. The mechanical processing of the stony fraction of this CDW results in recycled aggregates. .

We consider the following streams, which are produced within Flanders at the following amounts (MDO,2015):

- Concrete aggregates: 4.453 kton
- Mixed aggregates: 5.077 kton
- Brick aggregates: 350 kton
- Crusher sieve sand: 2467 kton

Tabel 2.2t: Berekening inzet van gerecycleerde granulaten in Vlaanderen in 2015

Bron	Hoeveelheid (ton)				
	Asfalt-granulaat	Beton-granulaat	Meng-granulaat	Metselwerk-granulaat	Zeefzand
Leveringen in Vlaanderen door producenten, inclusief voor eigen verbruik	1.291.375	4.453.442	5.076.576	350.473	2.504.776
Import van buiten Vlaanderen door verbruikers	6.015	89.315	37.631	1.050	0
Totale inzet in Vlaanderen in 2015	1.297.390	4.542.757	5.114.207	351.523	2.504.776
└ Sector stortklaar beton	15.517	1.370.184	70.470	0	381.171
└ Sector betonwaren	0	93.760	0	0	0
└ Asfaltsector	726.464	0	0	0	0
└ Keramische sector	0	0	0	0	0
└ Glassector	0	0	0	0	0
└ Sector aannemerij	555.409	3.064.509	5.007.310	348.723	2.123.605
└ Sector stortplaatsen	0	0	0	2800	0
└ Sector overig verbruik	0	14.304	36.427	0	0

Concrete aggregates are used in foundation layers, surface paving and as supplement (68%) and for high quality applications such as lean concrete, ready-mixed concrete, stabilized sand and concrete products (32%). **Mixed aggregates** consist of concrete and brick with a ratio of 40/60 to 60/40 and are mostly used in foundation layers (74%), surface paving (14%) or as a supplement (10%), rather than in high quality applications. **Brick aggregates** originate from bricks and roof tiles and are also mostly used in foundation layers (83%), as a supplement (8%) and in surface paving (7%), not in high quality applications. Crusher sieve sand is used in foundation layers (38%), as a supplement (43%) and in surface paving (7%), but also in stabilized sand and lean concrete (15%).

The following stream is only used for roads (MDO,2015) and therefore not considered in this Impact Assessment:

- Asphalt aggregates: 1.291 kton

Asphalt aggregates can be used for the production of new asphalt for roads, or to produce grind that can be used for the foundation layers of roads. Tracimat does not apply to sorting sieve sand and aggregates.

ENVIRONMENTAL IMPACTS

The environmental impacts of producing streams of Low environmental risk material (LERM) and High environmental risk material (HERM) are described.

1. Higher quality of recycled aggregates from LERM

The main purpose of Tracimat is to enhance the quality of recycled aggregates for high value recycling. By avoiding contaminants in the recycled aggregates, an environmental improvement is achieved that allows incorporation into more high-quality applications than are possible today Tracimat (2018).

The introduction of Tracimat can ensure that legal obligations are met, such as the obligation to draw up a waste demolition and asbestos inventory and the mandatory removal of hazardous substances. This is required by law

today, but is not applied to its full potential yet (e.g. in practice it turns out that not all fluorescent lamps are removed selectively) (VITO, 2016).

▪ **Current situation**

Very little data is available on the production and quality of recycled aggregates. Currently producers of recycled aggregates do not keep data.

VITO (2016) states that it is usually impossible to completely avoid the presence of non-conformities in CDW. Which non-conformities will be allowed and in which quantities, is up to Tracimat to define.

Non-conformities can be physical or chemical. According to BBRI (2013), 2.75% of the monsters showed non-conformities during external monitoring by COPRO in 2012. 12.83% of the checked samples showed physical contamination, while in 3.6% of samples chemical contamination was determined: mostly high levels of copper in concrete aggregates and mineral oil in sieving sand. Non-conformities are even more abundant in mixed aggregates, no less than 30% of the samples did not conform. BBRI (2013) also suggests to create a database from the data that is gathered during external reviews, since this demands very little additional effort for the crushers. By adding anonymous company characteristics, the effect of these aspects to the final aggregates quality could be analyzed (WTCB, 2013).

The technical guideline PTV 406 currently sets limits to contaminations in stony waste (VITO, 2016). The study adds that several projects do not comply with these limitations, due to the presence of gypsum contaminations. While the quality of sieving sand and crusher sand could be drastically increased by selective separation of gypsum during demolition, the additional economic cost would be high, namely €6/m² for removal and disposal (VITO, 2016).

Produced materials also have to comply to VLAREMA annex 2.3.2, which contains contamination standards of heavy metals and organic contaminants. If these norms are to be extended to different materials such as sulphate (according to VLAREMA 4bis), selective sorting of gypsum will be required in order to comply (VITO, 2016).

From some inventories on demolition and asbestos removal it seems that the law is not always respected when it comes to the inventory of demolition. VITO (2016) describes that, according to CASO and contractors, only 1 out of 10 construction works which are obliged to create a demolition inventory actually have one. For an asbestos inventory this is even worse: for 1 out of 20 works the inventory is made.

▪ **Future situation – Impacts of Tracimat**

Tracimat aims at increasing the quality of the recycled aggregates and its use in high quality applications through encouraging lower processing costs of LERM than of HERM.

VITO (2016) writes that the correct application of Tracimat will result in production of waste and processing of recycled aggregates that will comply to the acceptance policy and VLAREMA.

Due to the lack of data, it is difficult to quantify the impact Tracimat can achieve through the new acceptance policy (LERM versus HERM) for producers of recycled aggregates. A possibility to quantify the potential impact is to consider two alternative, extreme scenarios:

- a) Worst case scenario: 0% improvement, contaminants remain the same
- b) Best case scenario: maximum improvement, contamination is removed to an acceptable level

In order to do this, several assumptions need to be made and certain data is required. For example, the best case scenario needs to be defined in detail. What is an acceptable level? What level of contamination and what type of contaminants are allowed? How are the contaminants disposed of? Over which time period is the improvement achieved?

To answer these questions, more data is needed on the quality of recycled aggregates. Once these questions are answered and a realistic estimate is available of the actual quality improvement in recycled aggregates, the impact of Tracimat on this topic could be quantified.

2. Trust in the recycled product coming from LERM

▪ Current situation

Currently, there is very little trust in the quality of recycled aggregates (VITO expert, 2017). Because of that, technical standards on the quality of recycled aggregates are more demanding than might be technically required for certain applications. For example, for the production of new concrete, the Belgian standard NBN B 15-001 only permits 20% of recycled concrete aggregates as raw materials, whereas higher percentages of aggregates would be technically feasible (VITO expert, 2017).

▪ Future situation – Impacts of Tracimat

The new acceptance policy (LERM versus HERM) for producers of recycled aggregates will ensure a certain level of quality of LERM. This guarantee could increase the trust of architects and clients in this material, which forms an important basis for the definition of legal requirements and decision making during the design of construction works.

3. Greater upcycling potential

▪ Current situation

Currently, recycled aggregates are often used in foundation for new roads (MDO, 2015). However, the market demand for new roads will decrease in the future (VITO expert, 2017), which means that the recycled aggregates will be available for other applications. Increasing the upcycling potential would allow various high quality applications.

According to Gillabel J. *et al.* (2016), secondary aggregates from stony CDW usually enter the market as waste, instead of being produced to be reused as a raw material. Therefore these waste streams are often **not compliant with technical and environmental quality requirements for primary raw materials**. Whether the recycled aggregates are used in high or low quality applications, depends on a few aspects: economic, construction requirements and certification requirements (Gillabel J. *et al.*, 2016).

- **Economic:** In some cases, recycled aggregates can be processed to increase its quality by removing contaminations through specific steps including sorting, crushing and purification. This recycling of course results in higher costs. The additional cost depends on the number of processing steps needed to achieve a certain quality, the complexity of the recycling process, and the distances over which the waste needs to be transported (logistical costs). Together with the market demand for recycled aggregates, this influences whether the recycled aggregates are used in either high or low quality applications.

- **Construction requirements:** Various construction standards and specifications define requirements on the quality of recycled aggregates. For example, the Flemish standard “Standaardbestek 250” on construction road works, allows the use of recycled asphalt aggregates in low quality road applications, but not in high quality applications, even though this is already possible.
- **Certification requirements:** Construction materials often require a certain certification, such as the BENOR-certificate, which ensures the architect and client that the quality of the material is assured by a third party, and can also be used to get insurance contracts. This certification also poses certain requirements to the material, which often undervalues the quality and possibilities of recycled aggregates. A separate certification procedure for recycled building materials is currently missing in Flanders/Belgium.

It is interesting to note that the amount of concrete aggregates used in high quality applications increased from 16% in 2013 to 32% in 2015 (MDO, 2013; MDO, 2015).

- **Future situation – Impacts of Tracimat**

The demand for the construction of new roads is decreasing, and hereby also the application of recycled aggregates in the foundation of roads. Therefore new opportunities will arise for alternative applications.

The new acceptance policy (LERM versus HERM) for producers of recycled aggregates is designed to ensure a certain level of quality of LERM. The increased trust resulting from this, might influence the current barriers for high quality applications of recycled aggregates as described above.

According to MDO (2015), more than 95% of Flemish CDW is recycled, while the additional fraction (<5%) is landfilled. In 2015, 4.660 kton concrete aggregates were produced in Flanders, of which 4.543 kton was used as an alternative input material in Flanders and some was exported. 32% of these concrete aggregates were used in high quality applications, which is 1.454 kton. The remaining 3.089 kton is used in low quality applications. The mixed aggregates, brick aggregates and crusher sieve sand are 100% used in low quality applications, respectively 5.077 kton, 350 kton and 2.467 kton.

In general, there is a huge opportunity for improvement, 10.983 kton of recycled aggregates are currently used in low quality applications. Especially if you keep in mind that demand for new roads will decrease and therefore there will be a need for alternative applications. The potential will be there, but the market demand needs to follow.

4. Impact on environmental performance of LERM-based products

Studies have shown that using recycled aggregates instead of primary aggregates in high quality applications such as structural concrete, does not contribute much to a better environmental performance of those construction products (Gillabel J. *et al.*, 2016). The main reason for this is that the relative environmental benefit by avoiding primary granulates is outweighed by the environmental impact related to traditional (Portland) cement production, which is CO₂ intensive. To lower the environmental impact of concrete building products, combined alternative solutions should be looked for to replace primary granulates by recycled ones and replace traditional CO₂ intensive binders by low carbon alternatives, such as binders made from metal sludge (Gillabel J. *et al.*, 2016).

ECONOMIC IMPACTS

Overview of costs when following the Tracimat procedure

In September 2016, VITO conducted a study commissioned by the Flemish public waste agency OVAM: 'Final report Pilot projects selective demolition - Analysis of the feasibility of selective demolition and the working procedures for demolition management'. In this study Tracimat's tracing procedure has been tested in practice before the system came into force. The system was tested for the four demolition site types in Flanders distinguished in Tracimat: a private home, an apartment building, an industrial building and infrastructure works. One pilot project was assessed for each demolition site type.

The following is an overview of the costs related to Tracimat (VITO, 2016):

- Impact (enforcement costs) for the CDW management organization Tracimat
 1. Verification of the discharge to the crusher (but also of other routes, via the sorting installations and container parks)
 2. Verification of the proper functioning of contractors (removal of hazardous and disturbing substances) and experts (layout of waste management plan and control)
 3. Provide for a penalty regulation and / or an insurance system

- Impact for the crusher
 1. Annual contribution for crushers (currently no information available on contribution amount)

- Impact for the owner of the existing building and/or building client
 1. Annual contribution for client/owner (currently no information available on contribution amount)
 2. Tracimat results in a more qualitative demolition inventory, which reduces the risk of unexpected costs.

- Impact for the demolition contractor
 1. Additional costs for the contractor
 - Annual contribution for contractors (currently no information available on contribution amount)
 - Additional costs for drawing up a waste management plan compared to current legal obligations (asbestos and demolition inventory). Additional costs vary between €300 and €1750 depending on the type of building and the expert. For buildings larger than 1000m³ with partly non-residential function, an asbestos inventory and demolition inventory is already mandatory.
 - Additional costs for monitoring moments (visit + report)
 - due to additional administrative work
 - due to delays for the contractor, i.e. delays at the demolition works (rent of large equipment, man hours) (e.g. renting a crane costs up to €4000/day)
 - Additional administrative tasks
 - for administrative staff (e.g. processing of coupons, request for processing allowances)
 - for the site managers (e.g. collecting coupons, attendance at monitoring moments)
 - Additional costs for the demolition works
Little additional costs for the demolition itself according to the contractors, because a large part of it is already being selectively demolished.

The follow-up of the pilot projects shows, however, that not all hazardous substances are currently being removed by default (e.g. fluorescent lamps). The tracing system could thus in practice increase the cost of the demolition works.

2. Profits for the contractor

- Economic advantage (if the stony fraction is classified as LERM) determined by the price difference between LERM and HERM.
- However, the stony fraction is classified as HERM, there is an economic disadvantage for the contractor.

Theoretically, the **additional cost** of following the Tracimat procedures for the studied cases ranges from **€0.5 to €2 per ton of disposed stony material** (VITO, 2016). Estimations of the extra cost of the Tracimat version in comparison with a business as usual (BAU) version were made for the pilot projects studied. As BAU implementation, it was assumed that all current legal obligations are met (removal of hazardous substances, inventories present if necessary). No account was taken of the contribution that must be paid to become a member of Tracimat or any profits or costs resulting from the selective removal of materials. The indicated additional costs are site-specific and based on estimates from the experts, site managers and experts from VITO. For the calculation of the theoretical additional cost, the sum was made of the additional costs for drawing up a waste management plan, the administration costs related to Tracimat (see above) and costs due to delays at the demolition works. Both for the apartment building and the infrastructure works, this resulted in an additional cost of €0.5 per ton of disposed stony material. For the private home, the additional cost was estimated at €1.1/ton and for the industrial building at €2/ton.

In practice, however, **the additional costs are higher**. The legal obligations are usually not met. For example, a demolition and asbestos inventory is not always available. This can represent a reasonable cost (roughly €1000-€3000). Estimates from the Belgian Confederation of Contractors of Demolition and Deconstruction Works (CASO) and the contractors describe that for only 1 in 10 demolition works where a demolition inventory is mandatory, the inventory is actually present. For the asbestos inventory this is the case for 1 in 20 demolition works. Moreover, the pilot projects of the study conducted by VITO in 2016 show that hazardous waste is not always disposed of separately (e.g. fluorescent lamps). The introduction of Tracimat will thus in practice mean an additional cost for the contractor (and therefore the building client/owner), but will also ensure that legal obligations are complied with. In this way, Tracimat provides an added value in the monitoring of demolition sites and the enforcement of the legal obligations.

To make the system self-regulating, the additional cost of following the Tracimat procedures must at least be compensated by the price difference between LERM and HERM. This price difference is determined by the price charged by crushers and depends on market conditions at the crushers. The market forces are partly determined by the confidence of the crushers in the tracing system and the enforcement of the legislation on LERM and HERM.

The estimated **price difference between LERM and HERM** for demolition works in accordance with Tracimat is **rather limited** (\leq € 1.1/ton for the removal of the waste) if two conditions are met:

- 1) the contractor complies with the legal obligations if the Tracimat system is not applied,
- 2) the demolition site should not be delayed or shut down for monitoring or because the necessary documents are not ready.

Condition 1 is currently not always met. Condition 2 depends on the operation of Tracimat and the flexibility of the inspection visits.

Tracimat could in practice significantly increase the cost of the demolition works if these conditions are not met, but at the same time ensures better enforcement of the legislation regarding hazardous waste. It is usually

impossible to ensure in an economical way that no more disturbing substances are present in the stony fraction of the waste. The question here is which pollutants will be accepted by the CDW management organization and in what quantity they will be accepted. The amount of disturbing substances still present in the stony fraction will depend on the recommendations of the expert and the choices made by the contractor in the execution of the demolition works (VITO, 2016).

Difficulties to dispose of HERM

▪ **Current situation**

According to Gillabel J. *et al.* (2016), CDW is generally a heavy and voluminous material stream. Therefore, associated logistical costs are high and waste is often processed locally as a result (within ± 30 km of the demolition site). Currently 10% of 13 million ton is being dumped illegally, risking a penalty of 100€/ton [MDO → *Source to be checked*].

▪ **Future situation – Impacts of Tracimat**

If Tracimat succeeds in making HERM more expensive than LERM, this might result in higher levels of illegal waste dumping in order to avoid processing costs. Moreover, if less HERM is produced, less facilities might provide the HERM waste treatment service, resulting in longer transport distances, which could also increase the price of HERM treatment and might affect illegal dumping.

SOCIAL IMPACTS

Potentials shifts in employment were discussed with the CDW management organization Tracimat. The biggest social impact identified is the creation of the job of a Tracimat expert. An independent expert is appointed for the preparation of a waste management plan and to follow up the (selective) demolition works. However, at the moment, very few people have enough experience in this. Due to the Vlarema 6 changes which imply that for all demolition works requiring an environmental permit, a waste management plan is mandatory, there is now a huge demand for Tracimat experts. The management organization Tracimat is therefore training a lot of people in order to be able to meet the high demand (Tracimat expert, 2018). The expert has to have the necessary knowledge of current and past building materials and building techniques. Knowledge of the environmental policy and regulation (applicable in the region and/or country), specific regulation on demolition and demolition waste treatment, as well as insight in asbestos and other types of hazardous waste, and the applications these materials have been used in, is equally important. The expert also needs to know how (selective) demolition is performed: what is feasible, which fractions are collected separately given the market, etc. The expert has to be neutral and independent from the demolition company performing the demolition works (Tracimat, 2018).

Furthermore, new jobs were created for the management organization itself, whose activities include the development of the Tracimat system and procedure, training and inspection of the experts, evaluation of conformity of demolition surveillance plans, advisory role etc. Also, the job of ‘demolition coordinator’ (comparable to the job of building coordinator) could potentially be created. This person’s role could be to optimize the selective demolition process in terms of material flows, phasing and follow-up of the demolition process etc. Finally, the crushers will need to reorganize at the crushing site, as they will have to make the distinction between LERM and HERM for the incoming stony fraction (Tracimat expert, 2018). (Tracimat expert, 2018).

Conclusions and recommendations

Through this regional ex ante impact assessment study potential economic, social and environment impacts of the application of the Flemish Tracimat demolition tracing system and the new acceptance and processing policy behind it were identified. Some of the impacts are intentional and are objectives of the policy, other impacts are unintended. A structured, qualitative analysis of these impacts was made, based on the literature available and interviews with key actors (such as the Public Waste Agency in Flanders and the Flemish Building Confederation). However, quantitative conclusions, could not be drawn, due to restricted data access.

A next step is to convince actors involved in the scattered demolition and recycling practices to collect and share data in order to perform an in-depth analysis of the most significant impacts. This would enable quantitative estimation of expected benefits and costs.

The selection of the Tracimat demolition tracing system – or better said the new acceptance and processing policy measure which will be applicable in August 2018 – as object of study for this impact assessment was not an easy one. After a thorough analysis of all (36) waste an circular economy policy measures currently applied in Flanders, it was clear that for all current measures – most of the policy measures have been introduced in the last 10 years, and the circular economy measures only in the last 5 years or later – quantitative data lacked to perform a thorough impact assessment.

In consultation with the Public Waste Agency of Flanders (OVAM), it was decided to assess the impact of the new acceptance and processing policy measure (cf. adoption of LERM and HERM) which will be applicable in August 2018. VITO has performed in the recent past some (technical, environmental and financial) studies on the current Tracimat system, which provides useful quantitative and qualitative information for this ex ante impact assessment study.

Conclusions Environmental Impacts

The main purpose of Tracimat is to enhance the quality of recycled aggregates, in order to be used for high value recycling applications. The introduction of Tracimat can ensure that legal obligations are met, such as the obligation to draw up a waste demolition and asbestos inventory and the mandatory removal of hazardous substances. This improvement is required by law today, but is not applied to its full potential yet. It is estimated that for only 1 in 10 demolition works where a demolition inventory is mandatory, the inventory is actually present. For the asbestos inventory this is the case for 1 in 20 demolition works. Moreover, hazardous waste is not always disposed of separately (e.g. fluorescent lamps).

Very little data is available on the production and quality of recycled aggregates. Currently producers of recycled aggregates do not keep data. Due to this lack of data, it is difficult to quantify the impact Tracimat can achieve through the new acceptance policy (LERM versus HERM) for producers of recycled aggregates.

It should be noted however, that studies have shown that using recycled aggregates instead of primary aggregates in high quality applications such as structural concrete, does not always contribute much to a better environmental performance of those construction products. The environmental profile of most (structural) concrete products is still dominated by impacts from cement production, rather than impacts related to the acquisition of stony aggregates.

As already discussed in the synthesis of state-of-art report (D1) and the Blueprint (D2), the lack of trust between stakeholders within the building value network is found as one of the main obstacles of a circular economy within a built environment. A good example is given by the current lack of trust in the quality of recycled aggregates. We believe that the introduction of the new acceptance policy (LERM versus HERM) for producers of recycled aggregates will ensure a certain level of quality of LERM and by doing so is an important step to increase trust between demolition contractors, crushers, manufacturers and building clients.

The demand for the construction of new roads is decreasing, and hereby also the application of recycled aggregates in the foundation of roads. Therefore new opportunities will arise for alternative applications. The new acceptance policy (LERM versus HERM) for producers of recycled aggregates is designed to ensure a certain level of quality of LERM. The increased trust resulting from this, might influence the current barriers for high quality applications of recycled aggregates as described above. In general, there is a huge opportunity for improvement in the upcycling potential. However, the market demand needs to follow, in order to upscale alternative applications.

Conclusions Economic impacts

Based on a study conducted by VITO in 2016, where Tracimat's demolition tracing system was tested for the four demolition site types in Flanders, the economic impacts related to some demolition projects were identified for the different stakeholders: the CDW management organization Tracimat, the crushing company, the owner of the existing building and the demolition contractor. Further analysis with more cases is needed after the implementation of Tracimat.

Theoretically, the additional cost for the demolition contractor of following Tracimat procedures ranges from €0.5 to €2 per ton of disposed stony material. In practice, however, some additional costs may occur, such as setting up a waste management plan, administration costs and potential delayed demolition activities. In total this can end up in extra costs of €1000- €3000 for a single demolition project.

The introduction of Tracimat would thus in practice mean an additional cost for the contractor (and therefore the building client/owner), but will also ensure that legal obligations are complied with. In this way, Tracimat provides an added value in the monitoring of demolition sites and the enforcement of the legal obligations. To make the system self-regulating, the additional cost of following the Tracimat procedures must at least be compensated by the price difference between LERM and HERM. This price difference is determined by the price charged by crushing firms and depends on market conditions, i.e. the demand of high quality recycled material. The market forces are partly determined by the confidence of the crushing firms in the tracing system and the enforcement of the legislation on LERM and HERM. The estimated price difference between LERM and HERM for demolition works in accordance with Tracimat is rather limited (\leq € 1.1/ton for the removal of the waste) if two conditions are met: (1) the contractor complies with the legal obligations if the Tracimat system is not applied, and (2) the demolition site should not be delayed or shut down for monitoring or because the necessary documents are not ready. Condition 1 is currently not always met. Condition 2 depends on the operation of Tracimat and the flexibility of the inspection visits.

It is usually impossible to ensure in an economical way that no more disturbing substances are present in the stony fraction of the waste. The question here is which pollutants will be accepted by the Tracimat management organization and in what quantity they will be accepted. The amount of disturbing substances still present in the stony fraction will depend on the recommendations of the expert and the choices made by the contractor in the execution of the demolition works.

Conclusions Social impacts

The identified social impacts of Tracimat are shifts in employment. The biggest impact is the creation of the job of an independent Tracimat expert, who is appointed for the preparation of a waste management plan and to follow up the (selective) demolition works. However, at the moment, very few people have enough experience in this and there is a huge demand. The demolition tracing management organization Tracimat is therefore training a lot of people in order to be able to meet the high demand. Furthermore, new jobs were created for the management organization itself, whose activities include the development of the Tracimat system and procedure, training and inspection of the experts, evaluation of conformity of demolition surveillance plans, advisory role, etc. Also, the job of 'demolition coordinator' (comparable to the job of building coordinator) could potentially be created. This person's role could be to optimize the selective demolition process in terms of

material flows, phasing and follow-up of the demolition process etc. Finally, crushing companies will need to reorganize at the crushing site, as they will have to make the distinction between LERM and HERM for the incoming stony fraction.

General conclusions and recommendations

Historically, the lack of enforcement of the waste demolition inventory and asbestos inventory regulations has resulted in a large percentage of actors ignoring the requirements. The implementation of the Tracimat demolition tracing system aims to provide an added value in the monitoring of demolition sites and the enforcement of the legal obligations. The higher purpose of Tracimat is to enhance the quality of recycled aggregates for high value recycling and therefore to create purer waste streams with a greater upcycling potential. This objective is primarily supported by recent changes made within the Flemish environmental regulation for sustainable management of material cycles and waste (cf. VLAREMA) and the new acceptance policy measure of August 2018 (cf. LERM vs. HERM) Both policy measures will lead to development and better monitoring of waste management plans for all demolition works requiring an environmental permit.

The success of Tracimat in enhancing the quality of recycled aggregates depends on the success of enforcement but also on an economic driver, namely the ability of the market to be self-regulating and the value differential of LERM against HERM providing sufficient incentive. Two years after the implementation of the new acceptance policy, an evaluation by OVAM of the results of the Tracimat procedure is planned (Tracimat expert, 2018). This will give information about the compliance to the obligation to set up waste management plans and the effect on the quality of recycled aggregates.

The lack of data on the production and quality of recycled aggregates currently leads to failure to understand the current situation and to monitor the effectiveness of regulations on that aspect of CDW. It also hinders the quantification of the impacts the Tracimat system can achieve through the new acceptance policy (LERM versus HERM) for producers of recycled aggregates. BBRI (2013) suggested to create a database from the data that is gathered during external reviews, since this demands very little additional effort for the crushing firms. By adding anonymous company characteristics, the effect of these aspects to the final aggregates quality could be analyzed.

The proper collection and analysis of data could lead to the development of the Tracimat management organization as a knowledge center, who can share experiences and know how. This could result in the availability of very useful databases with figures about the quantities and applications of CDW originating from demolition of buildings and construction works. The expansion to other types of waste materials than stony fraction (such as timber waste and electronic waste) is currently being investigated by the Tracimat management organization. Where possible, the organisation's field of activity will be expanded in the future.

The success of Tracimat could be hindered by non-alignment of regulation in bordering areas. The fact that a huge amount of stony waste originates of the Brussels Capital region, where Tracimat has no authority (yet?), is a risk for the actual application of tracing and certifying selective demolition waste practices. VITO expects that some Walloon crushing firms (situated in the south of the Brussels Capital Region) would benefit from the implementation of the new acceptance and processing policy (LERM vs HERM) in Flanders, because there is no incentive yet to separate LERM and HERM in the Walloon region. Policy alignment between the three Belgian regions is therefore recommended. Similar experiences have been acquired during the implementation of the Energy Performance of Building Directive (EPBD) in the early 2000. Each Belgian region has enforced different policy rules (e.g. other energy performance thresholds) leading to regionalised building practices, with EPB advisors, architectural and engineering firms specialised in regional regulation. Even though EPBD policy measures have been (better) aligned within Belgium over the last years, this regional specialisation is still active. It is unclear what the effect on the economy of de-regionalisation would be.

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WP5 A3

Impact Assessment Report

Public procurement element of Construction and Demolition Waste policy (Portugal)

6. Introduction

The construction and use of buildings in the European Union (EU) account for about half of all our extracted materials and energy consumption and about a third of our water consumption. The sector also generates about one third of all waste and is associated with environmental pressures that arise at different stages of a building's life cycle including the manufacturing of construction products, building construction, use, renovation and the management of building waste. It is important to promote a more efficient use of resources and to reduce their overall environmental impacts throughout the full life cycle⁸.

Recently, resource efficiency and sustainability of built environment is undergoing an intense study and Portugal has already some initiatives in place that need to be reinforced by the authorities and engaged by the value chain in the construction industry. Construction and Demolition Waste (CDW) management is affected by an extensive range of initiatives, policies and legislation as a consequence of their societal role and impact. The diversity and number of stakeholders and the different issues covered also characterise the construction industry and it is important to mention that, in the last 5-10 years, the number of recommendations, policies and regulations has increased significantly across the industry.

Portugal has had a CDW framework since 2008 and in 2011 a Green Public Procurement (GPP) measure was put in place. This measure, *“incorporating at least 5% of recycled materials or materials containing recycled components, should be incorporate in public construction works, regarding the total amount of raw materials used in public construction works”* has been chosen as the subject of this Impact Assessment.

This measure stipulates that public construction works should incorporate at least 5% of recycled materials, or materials containing recycled components, regarding the total amount of raw materials used. Public tenders should include this measure and developers should integrate this in the design stage and verify during the construction stage.

During the Impact Assessment research, we could not identify any monitoring of the measure until 2016 and we found that there is a lack of awareness, technical information and monitoring across the industry in Portugal regarding this measure.

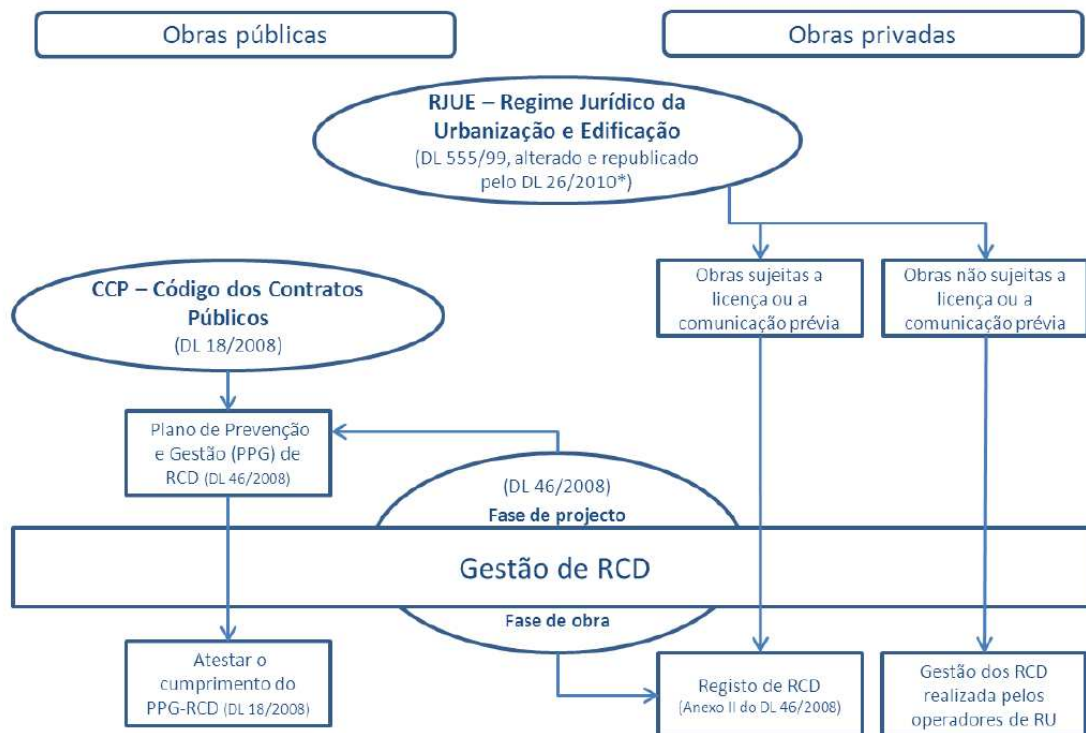
As part of the Impact Assessment, a stakeholder consultation exercise and a survey were conducted which identified a number of barriers and opportunities to the successful implementation of this green public procurement measure.

⁸ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on *Resource Efficiency Opportunities in the Building Sector*, <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0445&from=en>

7. Background

Portugal, as one of the Member States of the European Union, needs to translate European directives to the national context and the following paragraphs present the most relevant regulation related to CDW in Portugal. Environment and construction can be complex and diverse subject and is not easy to be up to date and aware about all the regulations in particular, when they are scattered, and often related with other subjects.

Portugal published the first Construction and Demolition Waste (CDW) Framework in 2008, Decreto - Lei n.46/2008 12 of March. Before this, CDW was managed following general waste management measures, most of the time not applicable for this typology of waste. Larger corporations developed and implemented best practices to reduce their environmental impact. Figure 2, provides an overview of the legal framework for CDW management.



* Alterado pela Lei 28/2010, de 2 de setembro

Figure 2 – Legal Framework for CDW Management in Portugal. (FCT-UNL, 2013)⁹

⁹ FCT-UNL – Faculty of Science and Technology of NOVA University of Lisbon (2013), Study on the Sustainable Management of CDW in North Interior Region - 1st Stage, <http://www.ccdr-n.pt/servicos/ambiente/159/estudo-da-ccdr-n-propoe-reciclagem-dos-residuos-de-construcao-e-demolicao>(in Portuguese)

The Portuguese CDW framework has defined a few initiatives just applicable to public construction works. Green Public Procurement (GPP) is defined by the European Commission (EC) as a voluntary instrument defined as "a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured"¹⁰."

The idea behind the GPP is that public authorities set an example for private or corporate consumers. The EC has identified the construction sector as a priority sector for GPP for a long time, and authorities at all levels can provide incentives for promoting the use of C&D recycled materials¹¹.

In Portugal, it is mandatory that the design project of public construction works include a Plan for Prevention and Management of CDW (PPGRCD) for the construction stage. This plan is developed at the design stage and should identify the typologies and quantities of CDW expected to be produced, as well as identify the measures to prevent and manage CDW. The PPGRCD is then included in tender documentation for the public construction works and has a mandatory requirement to be implemented by the constructor during construction stage. The PPGRCD needs to follow the specifications defined by the Environmental Agency.

It is the responsibility of the constructor to apply the PPGRCD and promote reuse and incorporation of recycled CDW during the construction stage. The compliance with the PPGRCD should be demonstrated with the final documentation, after the construction stage is finished, and sent to the public developer in charge of the work, as demanded by the public procurement code, CCP Decreto - Lei 18/2008¹².

Decreto -Lei 73/2011 was published in 2011 and it is the review of national regulation that transposed the Waste Framework Directive 2008/98/EC (WFD). The public procurement measures are aligned with the Article 11 Re-use and Recycling n. 1 "*Member States shall take measures, as appropriate, to promote the re-use of products and preparing for re-use activities (...) the use of economic instruments, procurement criteria, quantitative objectives or other measures.*

The second measure of GPP was published under this new regulation and says that "*incorporating at least 5% of recycled materials or materials containing recycled components, should be incorporate in public construction works, regarding the total amount of raw materials used in public construction works*".

This measure should be included in tenders and should be integrated at the design stage and verified during the construction stage. To date, there is no official indicator or study that shows if this percentage has been achieved. However, even if briefly, some stakeholders have started to suggest that this percentage should be increased. By default, public tendering documents don't include any other measures to enforce the use of recycled materials.

The Ministry of Environment is the authority responsible for the implementation, monitoring and verification of this measure.

¹⁰ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0400:FIN:EN:PDF>

¹¹ http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=8983&lang=pt

¹² MOPTC – Ministry of Public Works, Transport and Communications (2008) *Public Procurement Code*. Decree-Law 18/2008 of 29 January (in Portuguese)

Granularity and Context

As mentioned before, there is no official indicator or study to evidence if the 5% required target has been achieved and therefore it is impossible to know how successful this policy has been. Indeed, in 2016 the Environmental Agency surveyed the public construction industry, not to assess/measure the % of recycled material, but to gain information on the level of understanding of recycled materials by the different actors involved.

The survey was developed by the Environmental Agency with the Institute of Public Procurement, Real Estate and Construction (IMPIC) in the Portal for Public Contracts (Portal Base) a form dedicated to this matter. However, it was identified that there was varied interpretation of what is a recycled material or material containing recycled components, and the Environmental Agency therefore published a clarification note in July 2016, 5 years after the measure was put in place, (Circular 01/2016/DRES-DFEMR, APA¹³). This note ends with information about non-compliance with the measure: a fine, ranging from € 2.000 to € 18.000 in case of negligence and from € 6.000 to € 36.000 in case of fraud.

The CDW framework established that the incorporation of CDW in the same construction work is possible, if it complies with National or European recycling standards. The National Laboratory for Civil Engineering (LNEC) created to date, seven standards for use of recycled CDW:

- LNEC E 471:2009 – Guide for the use of coarse recycled aggregates in concrete
- LNEC E 472:2009 – Guide for the production of recycled hot mix asphalt
- LNEC E 473:2009 – Guide for the use of recycled aggregates in unbound pavement
- LNEC E 474:2009 – Guide for the use of recycled materials coming from construction and demolition waste in embankment and capping layer of transport infrastructures
- LNEC E 483:2016 – Guide for the use of recycled aggregates recovered from bituminous mixtures in unbound pavement
- LNEC E 484:2016 – Guide for the use of recycled materials from construction and demolition waste on rural and forest roads
- LNEC E 485:2016 – Guidelines for the use of recycled materials from construction and demolition waste in filling ditches

The majority of construction companies do not have the means (technical and/or economic), to comply with these standards. The majority of constructors are small and medium enterprises (SMEs) and they do not have the resources that allow them to prioritise a recycling operation following one of the LNEC standards, instead of choosing the landfill option, or acting against the regulation by “reuse” of soils and debris in the same work without any compliance or control.

Despite all the potential benefits (environmental and economics) of recycling CDW, large parts are still landfilled or used as backfill. In Portugal, the CDW legal framework indicates that CDW landfilling can only be performed once sorted.

As explained by the European Commission on the communication about Resources Efficiency Opportunities in the Building Sector¹⁴, the barriers that recycling of CDW faces, when compare with

¹³ http://www.apambiente.pt/_zdata/Políticas/Resíduos/Circulares/Circular_1_2016.pdf

¹⁴ <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0445&from=en>

landfilling is that environmental damage cost is neither internalised in the landfill fees nor in the cost of virgin materials, which can result in recycled material being more costly than virgin material; and the split incentives in the CDW value chain where the cost of dismantling, separation and processing the waste is mostly born at the phase of demolition while the potential benefits from using the recycled materials generally accrue at the production phase. These market failures, together with gaps in the waste management infrastructure in a large number of Member States prevent investment in deconstruction and separation operations and landfilling or backfilling remain preferred alternatives. In some cases, technologies enabling recycled materials that meet all the technical, safety and environmental requirements for construction products are still lacking, which makes landfill an easy choice.

In Portugal, a landfill tax is applicable but there is no other fiscal incentive to use recycled CDW, like in Czech Republic where the VAT is reduced for recycled materials, an aggregate levy in United Kingdom, or a ban on landfilling in place in Denmark since 1997.

The latest values across EU on landfill tax, shown that there are Member States where the fees are around 110 €/ton (United Kingdom) which drives the recycling market for this type of waste (93% of CDW recovered against 2% landfilled) and countries where the fees are 3 €/ton (Spain).

The landfill tax for Portugal for every type of waste, in the next years is presented in the next table.

Table 1 – Landfill tax in Portugal. (Adapted from APA website and Law n. 9 82-D/2014)

Portugal presents a low cost of landfill as well as low cost raw materials (in Portugal, aggregates and other natural raw materials scarcity is not a problem). On the other hand, the price of recycled materials is still higher than natural raw materials, and the major construction companies (which are SMEs) are still recovering from the last financial crisis.

The waste and demolition facilities do not cover the entire territory and costs associated with transportation are not competitive when compared with the costs of landfill. Another aspect is the lack of knowledge and awareness for recycling in some companies, even developers that only identify landfill as the option available for CDW. The risk of been caught during illegal dumping of CDW is not high and the penalties do not discourage companies to continue to do it. In small and more local works, neighbours ask for the debris to be used in earthworks and landscaping without any control by the local authorities.

Key stakeholders

The key stakeholders contacted for the Impact Assessment of this GPP measure in Portugal were:

- Agência Portuguesa do Ambiente (Environmental Agency);
- Portal Base do Instituto dos Mercados Públicos, do Mobiliário e da Construção (Institute of Public Procurement, Real Estate and Construction);

- Ordem dos Engenheiros (Portuguese Society of Chartered Engineers);
- Laboratório Nacional de Engenharia Civil (National Laboratory for Civil Engineering);
- Universidade Nova de Lisboa - Faculdade de Ciências e Tecnologia - Departamento de Ciências e Engenharia do Ambiente (Waste R&D group);
- Universidade do Minho - Departamento de Engenharia Civil (Civil Engineering Department);
- Consultancy company responsible for the Circular Economy Action Plan for Portugal (Augusto Mateus & Associados);
- Associação Smart Waste Portugal (responsible for the Circular Construction project).

The stakeholders are public/government organisations, academia, professional institutions, private companies and industry associations. They were contacted between March 2017 and September 2018. They provided a better understanding of the current situation of the implementation of the GPP measure as well as technical information, data and guidance.

Timescales

The 5% GPP measure came into force in June 2011 when Decreto-Lei 73/2011 was published. The first review since 2011 is now underway by the Environmental Agency and this provides a window of opportunity to make changes to the measure which would support its success.

In November 2018, a public consultation was launched for a new strategy that will regulate green public procurement in Portugal. This document was in public consultation until the end of December 2018. For this reason, this document was not considered on this assessment, although it is noted that there is a dedicated chapter for GPP measures for new buildings and refurbishments.

8. Approach

Methodology

As part of the Impact Assessment, a stakeholder consultation exercise was conducted that provided an overview and understanding of the implementation of this GPP measure. The stakeholders provided overviews about the implementation of the measure as well as documents and data. The main contributions came from the Environmental Agency and academia.

Listed below are a number of documents that were used to support this Impact Assessment:

- Decreto-Lei n. 73/2011 - Waste Management Framework
- Decreto-Lei n. 46/2008 – Construction and Demolition Waste Framework
- Decreto-Lei n. 18/2008 – Public Procurement Code
- Green Growth Commitment
- National Action Plan for Circular Economy
- 2016 – State of the Environment Report, published December 2016
- Environment Agency Circular 01/2016/DRES-DFEMR, Use of recycled materials in public works
- Environment Agency Frequently Asked Questions, use about CDW (update April 2016)

- European Commission, Communication from the Commission to the European parliament, the council, the European economic and Social Committee and the Committee of the Regions Public Procurement for a Better Environment
- European Commission, Construction and Demolition Waste management in Portugal V2 – September 2015, Resource Efficient Use of Mixed Wastes: Improving management of construction and demolition waste.
- EU Construction & Demolition Waste Management Protocol
- FCT-UNL – Faculty of Science and Technology of NOVA University of Lisbon (2013), Study on the Sustainable Management of CDW in North Interior Region - 1st Stage,
- IMPIC (2016) Public Procurement in Portugal 2015
- IMPIC (2017) Construction Sector Companies - Economic and Financial Analysis - 2015 Year

A survey was developed to better understand how the policy has been integrated by design teams, constructors, etc. as well as understanding if this measure was known across the industry. The survey questions and results are presented in section 9.

The survey was published in March 2018 and presented in several workshops in Portugal and disseminated by the BAMB Stakeholder Network, as well as by the stakeholders mentioned in section 7.

Available Data

There is no data available to date that indicates if this 5% measure has been achieved.

However, it is important to present some context data to help to better understand the construction industry in Portugal as well as the results of the survey conducted by the Environmental Agency related with the interpretation of what is a recycled material or material containing recycled components. The data available is presented below.

Construction Industry

Data available, from the Portal Base and presented in the 2017 report about public procurement in construction industry from Institute of Public Procurement, Real Estate and Construction (IMPIC), the structure of the Portuguese construction industry (constructors with a licence) is shown in **Figure 3**.

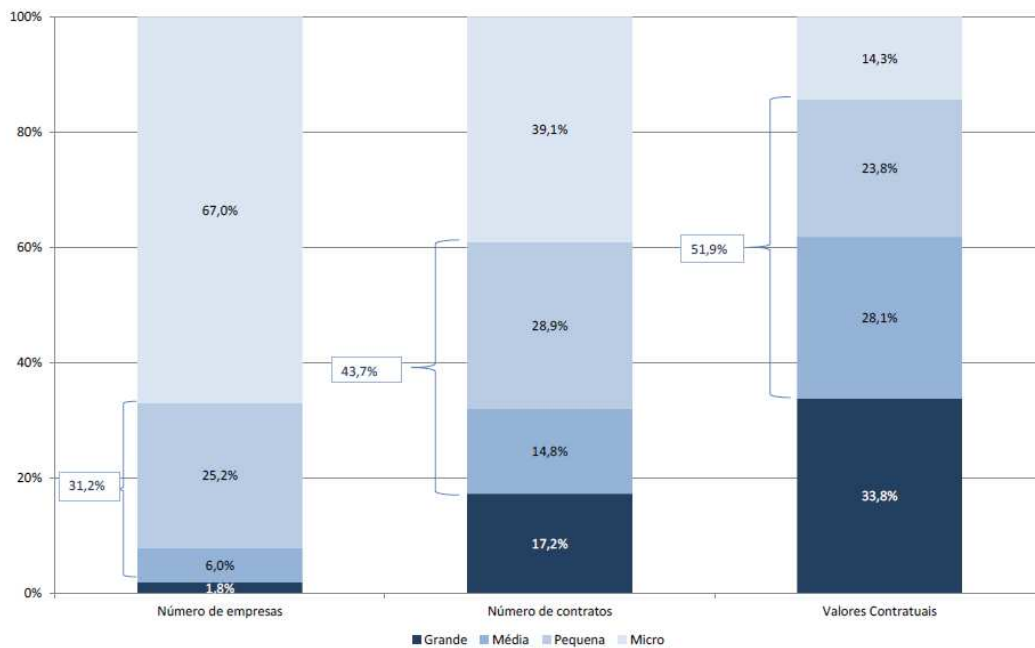


Figure 3 – Representativeness of contractors, by size of contract value. (Contratação Pública em Portugal 2017 report)¹⁵

In a sample of 37 988 companies (47.3% of public contracts), 67.0% were micro companies and 31.2% were small and medium enterprises. The construction industry can then be characterised as 98.2% been micro, small and medium companies. These companies represent 66.2% of total value of the public contracts.

The micro companies are defined by having fewer than 10 employees and a turnover $\leq 2M\text{€}$ and according to the CDW framework they are not obliged to declare the waste production.

The cost of implementation of a 5 % measure can be considered and these companies have a lack of capacity to respond to and include new requirements in their processes.

Environmental Agency survey – interpretation of the 5% GPP measure

The survey was developed by the Environmental Agency with the Institute of Public Procurement, Real Estate and Construction (IMPIC) in the Portal for Public Contracts (Portal Base). It was identified that the interpretation of what is a recycled material or material containing recycled components were not correct.

Table 2 below presents the results collected during 2016 and the first semester of 2017 using data from the public contracts published during this period. It shows the percentage use of recycled materials, or materials containing recycled components, against the number of contracts with information about incorporating recycled materials within the reporting period.

¹⁵ http://www.impic.pt/impic/assets/misc/relatorios_dados_estatisticos/Relatorio_Anual_ContratosPublicos_2017.pdf

Table 2 – Use of recycled materials or materials containing recycled components regarding the total amount of raw materials used in public construction works.

N. ° of contracts with information about incorporating recycled materials	13740	7600
N. ° of contracts with “Final Report submitted (sample considered)”	4654	991
N. ° of contracts that reported that they included at least 5% of recycled materials	1418 (30%)	261 (26%)

(data provided by Environmental Agency, 2017)

This data shows that in 2016 only 30% of the contracts submitted reported that they included at least 5% of recycled materials and that in the first semester of 2017 was 26%.

The Environmental Agency published a clarification note in July 2016, but during this assessment no other survey or measure was identified which had been put in place to support the industry in complying with the 5% GPP measure.

9. Analysis and interpretation

As part of the Impact Assessment, a stakeholder consultation exercise and a survey were conducted to try to respond to questions that were identified without data or information related with the implementation of this green public procurement measure.

The survey, in Portuguese “Avaliação de Impacto de Políticas e Normas Portugal - Utilização de 5 % de materiais reciclados em Obras Públicas” (Impact Assessment of Policies, Portugal - Use of 5% of recycled materials in public construction works) was published in March 2018 and a total of 37 answers were received.

The survey was allocated on an online platform and contained 7 questions and an extra of “any other comments”. The survey was presented in Portuguese.

This survey was presented in two presentations in Portugal, in Lisbon, March 2018 (in Portuguese) and in Vila Real, June 2018 during the Circular Construction Seminars. Around 100 delegates attended in total the two seminars. It was also disseminated across the BAMB Stakeholder Network as well as by different Stakeholders in Portugal (see Table 3).

Table 3 –Portuguese stakeholder dissemination.

Organisation	Dissemination
Agência Portuguesa do Ambiente	Website
Universidade do Minho - Departamento de Engenharia Civil	Maillist
Associação Smart Waste Portugal	Website and newsletter

The questions of the survey are presented below along with the results and data analysis.

Summary of Data

Participants were asked to first answer a question about the organisation they belong to, to characterise the stakeholder.

Question 1: In which of the following institutions you fit as a professional?

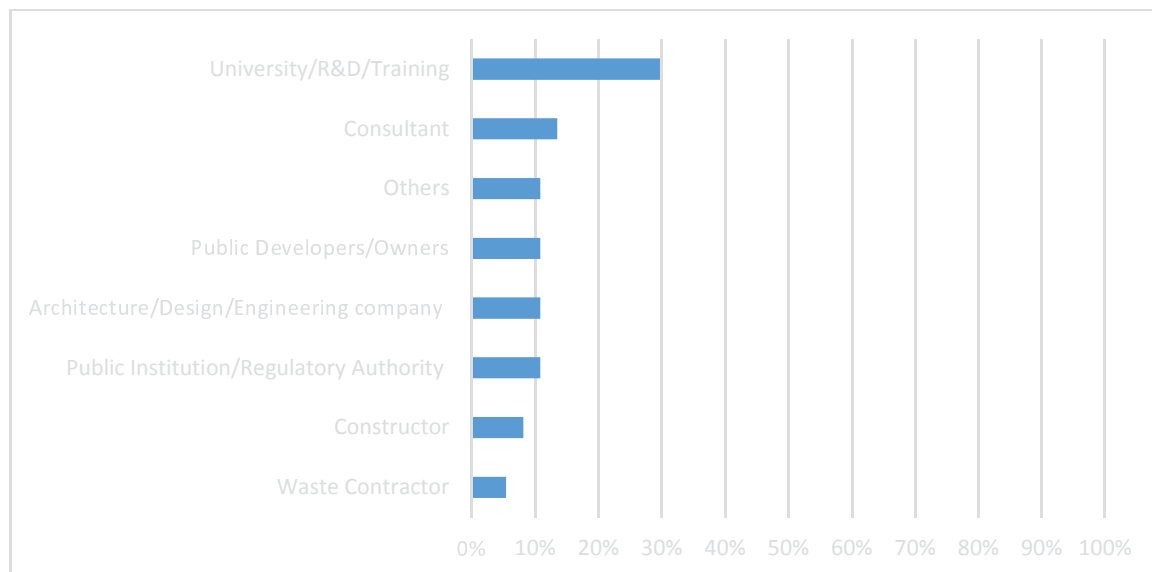


Figure 4 – Q1: In which of the following institutions you fit as a professional? Results.

The majority of the answers (29.73 %) belong to Universities, Research and Development centres or training organizations.

Only 7 answers (18.92%) were provided by the main professions responsible for implementation of this measure, architecture, design and engineering companies along with constructors, and another 5 answers (13.51%) by consultants.

The category “others” were answered by NGO’s, Audits and Inspection company and a lawyer.

Question 2: As a professional, were you aware of the measure defined by the Decreto-Lei n. 73/2011 of June 2017, which requires the use of at least 5% of recycled materials or materials containing recycled components, in public construction works, regarding the total amount of raw materials used?”.

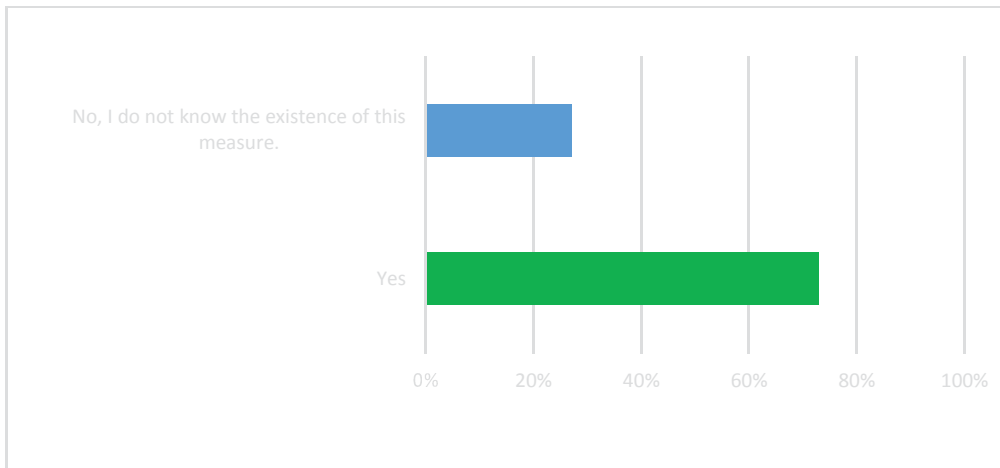


Figure 5 – Q2: Aware of the GPP measure. Results.

The majority (72.97%) answered positively that they were aware of this measure. However, 27.03% mentioned that “I do not know the existence of this measure”.

Question number 3 was just applicable for the negative answers from question number 2.

Question 3: If not, what is the reason?

Table 4 – Question 3 results.

I have never heard about this measure.	69.23%
Not applicable to my work.	23.08%
Other reason, please specify.	7.69%

The reason identified by 69.23% was that they have never heard about it and 23.08% referred that this was not applicable to their scope of work.

Question 4: If applicable, have you ever included this measure in your projects /contracts?

Table 5 – Question 4 results.

Yes	48.28%
No	51.72%
Total of answers	29

29 in total answered that this measure was applicable but only 48.28% included this measure in their projects/contracts. More than 50% referred that they are not including this measure.

Question 5: If Yes, did you find the compliance with the measure accessible and easy to apply?

Table 6 – Question 5 results.

Yes	66.67%
No (please specify)	33.33%
Total of answers	18

The negative answers identified as the main reasons for not complying with the measure that it is not always possible to apply the measure, it is difficult to estimate the quantities of recycled materials and that there is no CDW authority to regulate the sector and give benefits to the companies that comply with this measure.

Question number 6 was just applicable for the negative answers from question number 5.

Question 6: If not, what is the reason?

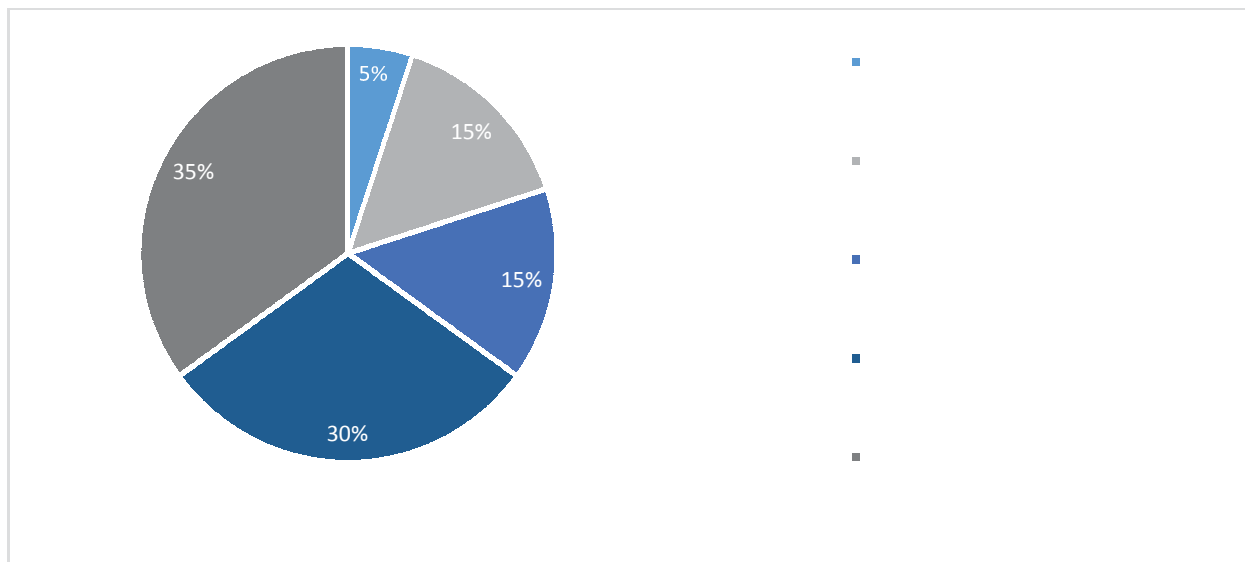


Figure 6 – Q6: Reasons for noncompliance with the measure.

The majority of the responses (35%) identified other reasons for non-compliance with the measure. The reasons presented were the lack of will and that the measure has not been considered since the beginning of the design stage of the projects. No requirement, verification, inspection and audit by the authorities and developers was another reason identified by 30% of the answers for non-compliance.

Question 7: Existing data indicate that this% of recycled materials have not been integrated into a significant number of Public Construction Works. Please select the options that might reinforce their implementation.

Table 7 and Figure 7 presents the reinforcement measures identified by the survey. Measures like increasing control and accountability, awareness and information raising for the different professionals across the industry presented results above 60%.

Table 7 – Q7: Reinforcement measures – results.

Increased control and accountability	69.44%
Awareness/ information raising for the representatives Public Construction Works.	63.89%
Awareness/ information raising for architects, designers and engineers.	61.11%
Dissemination/ information of this subject during training and qualification of professionals.	47.22%
Awareness/ information raising for constructors.	44.44%
More training/skills for professionals across the industry.	41.67%
Dissemination and promotion of the measure.	41.67%
Awareness/ information raising for materials suppliers.	27.78%
Others (please specify)	11.11%
Total of responses	36

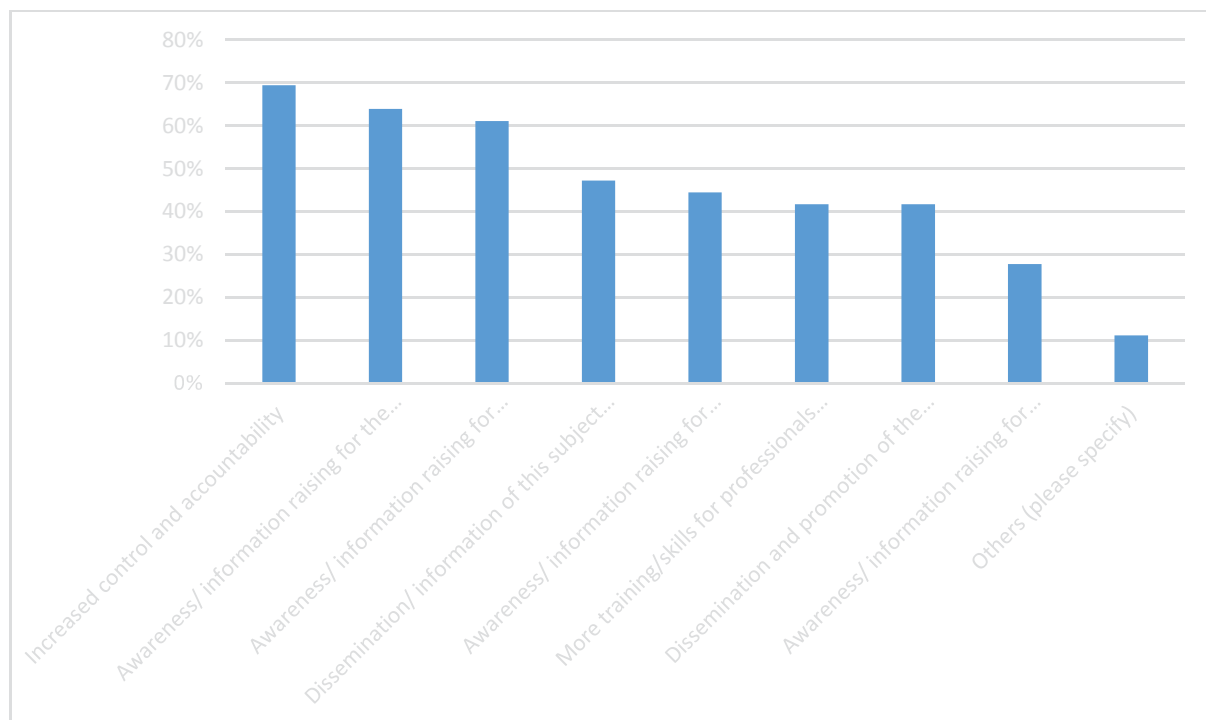


Figure 7 – Q7: Reinforcement measures.

The other measures identified by the survey were costs of implementation, lack of normalization and standards, no benefits for complying with the measure, e.g. tax/fees reductions and a misunderstanding on responsibilities.

The last question, number 8 was open to other comments and a few suggestions were mentioned:

- Due to the know-how and R&D projects related with the use of recycled CDW and materials, 5% is not an ambitious measure;

- There is poor compliance with basic quality control rules;
- The Ministry of Environment has recently been presented with a proposal for a regulatory authority.

Analysis of survey data

The survey results demonstrate that there is a lack of awareness, technical information and monitoring across the industry in Portugal, with nearly 30% of respondents saying that they did not know about the existence of the 5% GPP measure. For those who were aware and for whom the legislation was applicable, 51% of respondents admitted that they did not comply.

Almost 70% of respondents admitted that the measure is accessible and easy to apply. A few comments were added related with difficulties to estimate the quantities of recycled materials.

They identified main barriers as the lack of verification, control and demand by public organisations (ultimately responsible by the projects), lack of will and lack of technical knowledge. Only 5% identified the target as a measure that is difficult to implement.

The survey also identified reinforcement measures like increasing control and accountability, raising awareness/information and dissemination and training and qualification need across the industry. A few comments were added at the end of the survey related with the 5% measure not been ambitious, costs of implementation, lack of normalization and standards and no benefits for complying with the measure.

The survey was answered by 37 people in total, but a wider study could be appropriate to have a better understanding of the implementation of the measure. Also, the survey could be disseminated wider across the industry to have a more representative response from stakeholders like constructors, designers and engineers, etc.

Analysis of the stakeholder consultation

The majority of stakeholders consulted believe that the implementation of this measure is considered straightforward and that the 5% target can easily be reached considering the metal materials used, which normally contain a high percentage of recycled material. There were some indications that 25% could be a target to be achieved.

A lack of awareness and information from the industry players was mentioned by all respondees, as well as the lack of will for the measure to be implemented by the industry. This extends to local authorities and government departments, who, as the customers for public construction projects, would be well placed to enforce the requirement for recycled materials to be included in projects. Indeed, the general lack of awareness was identified as extending across the entire supply chain and all stakeholders.

In terms of monitoring, our research has uncovered that data has not been collected and that the Portuguese government does not know the extent to which recycled materials are being used in public construction projects in line with its Incorporação de 5% de Materiais Reciclados policy. It therefore does not have information on the extent to which the policy is being complied with. Nor is there any evidence to support the assessment of the impact of the policy at any level. This is considered to have severely weakened the potential impact of the policy.

There is no enforcement of the regulation by the public institutions. Indeed, there is a lack of ownership of the measure and without a regulatory body for construction and demolition waste, no department takes responsibility for ensuring that the relevant construction firms adhere to the regulation or ensures that the requirement that has been written in to contracts has been applicable into the projects. This is considered to be a contributory factor to the low awareness rate of the policy and the apparent lack of engagement.

Environmental topics/subjects are still not widely considered by designers, architects and engineers and it is unclear where the responsibility across design teams for the implementation of this measure lies.

The cost of implementation was also considered. The construction industry in Portugal in 2017 mainly consists of micro, small and medium companies (98.2%¹⁶) that represent 66.2% of total value of the public contracts. These companies have a lack of capacity to respond to and include new requirements in their processes. The Portuguese construction market is no longer bigger construction and infrastructure projects but is mainly characterised by small works in buildings, refurbishments, demolitions, reparations, etc., where the CDW production is not high but can be very specific and diverse.

Finally, the construction industry highlighted that standards are defined for new materials, but not for reclaimed and/or recycled materials, making it difficult to access information about the feasibility of these materials.

10. Conclusions

Barriers

The impact assessment identified the lack of data as a serious barrier. Currently, the Portuguese government does not know the extent to which recycled materials are being used within public construction projects and the regulation is being complied with. High quality data would allow the impact of the measure to be quantified and benefits to be captured and communicated to stakeholders. The impact assessment has also identified a lack of technical knowledge by industry professionals over how to measure and monitor the 5% targets themselves.

There is no enforcement of the regulation by the public institutions. Indeed, there is a lack of ownership of the measure and without a regulatory body for construction and demolition waste, no department takes responsibility for ensuring that the relevant construction firms adhere to the regulation or ensures that the requirement that has been written in to contracts has been applicable into the projects. This is considered to be a contributory factor to the low awareness rate of the policy and the apparent lack of engagement.

Lack of awareness was also concluded to be a serious barrier to implementation. This extends to local authorities and government departments, who, as the customers for public construction projects, would be well placed to enforce the requirement for recycled materials to be included in

¹⁶ http://www.impic.pt/impic/assets/misc/relatorios_dados_estatisticos/Relatorio_Anuar_ContratosPublicos_2017.pdf

projects. Indeed, the general lack of awareness was identified as extending across the entire supply chain and all stakeholders.

Environmental topics/subjects are still not widely considered by designers, architects and engineers and it is unclear where the responsibility across design teams for the implementation of this measure lies. The industry also does not recognise value to use recycled materials.

The cost of implementation was also considered to be a barrier. The construction industry in Portugal in 2017 mainly consists of micro, small and medium companies and these companies represent more than half of total value of the public contracts. These companies have a lack of capacity to respond to and include new requirements in their processes.

These type of policies and measures need to be reviewed periodically to allow adjustments by the industry and to progress and promote new initiatives. The 5% measure has been in place since 2011 without a proper monitoring instrument and without been assessed and reviewed since.

Opportunities

Several key opportunities for better implementation of the *Incorporação de 5% de Materiais Reciclados* were identified by the Impact Assessment. In particular, it was noted that the legislation is currently being reviewed, as well as a new public procurement document being prepared and this provides a window of opportunity to make changes to the measure which would support its success. These could include:

- Identification of an 'owner' for the measure who would be responsible for measuring, monitoring and reporting on its implementation.
- More effective communication of the requirement to use 5% recycled materials. Communication of the measure across the supply chain and all stakeholders would ensure that awareness was raised and would encourage its take up. Additionally, case studies demonstrating the benefits of the measures could be developed which would support the implementation of the measure.
- Requirements for monitoring, which would allow better understanding of the level to which the measure is being implemented and its impacts.
- Setting clear objectives for the measure. This would provide a strong message for the construction industry and enable advantages to be identified and communicated more effectively.

The impact assessment identified that there are opportunities to enforce the measure through engaging local authorities. They can act as ambassadors for the use of recycled content in construction, both as customers and inspectors, using the planning permission process during design stage.

It was noted in the impact assessment that one of the drivers for implementing this measure has been when the construction projects are using a certification process (such as BREEAM or LEED) or when they are receiving international funds.



Appendix B

Best practices scoring table

**Matrix for the Assessment of Best Practice in Policy/ Legislation
WP5 A3**

Policy	Geographical area	Description	Reference	Topic	Type of policy/ regulation	BAMB Systemic Changes			Innovation	Circular Economy	TOTALS	Total Score Per Systemic Category			
						Promotes a change in design culture	Promotes a change in value definition	promotes collaboration across all sectors				Level of innovation	Promotes a change towards CE/impact	Promotes a change in design culture	Promotes a change in value definition
					select type of policy/ regulation instrument	Score 1-10 (1=not aligned to BAMB Systemic Change, 10=Completely aligned to BAMB Systemic Change)	Score 1-10 (1= 'ever yone is curr ently doin g this', 10 = 'nob ody else is curr ently doin g this')	Score 1-10 (1= likely to have no impact on uptake of CE principles; 10= likely to embed CE principles into Business as Usual)				Score = score for stated systemic change + innovation + circular economy			

Longer life housing law 2009	Japan		https://ac.els-cdn.com/S1876610216307639/1-s2.0-S1876610216307639-main.pdf?_tid=0c699234-0804-11e8-974e-00000aab0f01&acdnat=1517567591_642afdd328e84c53e97fe3abb59fc33			10	5	5	8	8	36	26	21	21
Innovation Deals	EU		https://ec.europa.eu/research/innovation-deals/index.cfm?pg=news	?	facilitate	0	0	8	5	3	16	8	8	16
L'article 88 de la loi LCAP du 7 juillet 2016 « Permis de faire » Le décret n° 2017-1044 du 10 mai 2017	France	Law that enables to provide certain deviation possibilities regarding the urban development regulations in order to support innovation . It provides a 'permit to do' instead of a 'permit to build'.	https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000034679142&categorieLien=id								0	0	0	0
BIM	Singapore	BIM e-submission for building permits	https://www.corenet.gov.sg/genera/building-information-modeling-(bim)-e-submission.aspx	BIM		4	0	9	7	4	24	15	11	20
			https://www.corenet.gov.sg/media/2032994/1_cp_for_bim_esubmission_gr_v1.pdf									0	0	0
pre-demolition inventory	Flanders (OVAM)		https://navigator.emis.vito.be/mijn-navigator?woid=44297	demolition inventory		1	3	2	5	1	12	7	9	8
Demolition and Deconstruction permits	Seattle	In Seattle the demolition can only start once the building permit has been issued. When deconstructing the building it is possible to start the deconstruction before the building permit is issued.	http://www.seattle.gov/dpd/permits/permitypes/residentialdeconstruction/default.htm	demolition and deconstruction permit	stimulate, inspire etc..	2	4	2	8	7	23	17	19	17
			http://www.seattle.gov/DPD/Publications/CAM/cam337.pdf									0	0	0
Green Demolition Bylaw	Vancouver	demolition permits with recycling requirements (pre-1940)	http://vancouver.ca/home-property-development/demolition-permit-with-recycling-requirements.aspx	demolition permit	regulate	2	3	2	8	6	21	16	17	16

Public Procurement strategy Package	EC		http://www.europarl.europa.eu/committees/en/imco/subject-files.html?id=20180129CDT01981	procurement														0	0	0	0
BOOSTING INNOVATION IN CITIES TO DELIVER BETTER PUBLIC SERVICES	European centre for government transformation - College of Europe		http://www.lisboncouncil.net/component/downloads/?id=1155	case studies	inspire	0	0	0	3	1	4	4	4	4							
Luxembourg Circular Economy plan	Luxembourg		http://environnement.public.lu/fr/offall-ressourcen/principes-gestion-dechets/Economie_circulaire.html	policy program	inspire, stimulate	1	5	5	7	7	25	15	19	19							
De Groene Zaak /Green Deal	The Netherlands	offers a responsive service to companies that ask for help in realising circular economy opportunities and face implementation barriers Merged with MVO Nederland since 01/01/2018	http://degroenezaak.com/	supporting organisation for SMEs	stimulate/facilitate/inspire	1	3	2	5	5	16	11	13	12							
a circular economy in the Netherlands by 2050	The Netherlands		https://www.government.nl/documents/policy-notes/2016/09/14/a-circular-economy-in-the-netherlands-by-2050	policy program							0	0	0	0							
Leading the cycle - finnish road map to a circular economy 2016-2025	Finland	ex. Eco3 (forest based loop); Arctic sustainable building	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=CIRCWASTE_Presentation_EN.pdf	policy program		3	4	8	7	8	30	18	19	23							
CIRCWASTE		7 year program. 7 goals. 6 of the goals are related to waste management	https://www.sitra.fi/en/projects/leading-the-cycle-finnish-road-			2	2	5		3	12	5	5	8							

		and circular economy. 2 themes of particular interest to BAMB - resource efficient construction +	map-to-a-circular-economy-2016-2025/															
circular economy Canada	Canada		https://www.circulareconomycanada.net/	experimentation	faciliate	1	2	3	4	3	13	8	9	10				
Circular Buildings Green Deal (one of a number of Green Deals in the construction sector)	The Netherlands	<p><i>The Circular Buildings Green Deal focuses on the development of a "buildings passport" outlining a building's circularity.</i></p> <p><i>The 'Circular Buildings' Green Deal focuses on minimising the use (and maximising the reuse) of resources in a building's construction and usage phase. A broad and diverse group of more than fifty parties are participating. One of their goals is to use the smallest possible amount of new resources and products. Another goal is to retain products and resources within the chain (for high-quality applications) for as long as possible. This also involves extending the life of buildings by making them as adaptable as possible. The development of a common framework involving a 'building passport' in which details of essential circular features are recorded could be a useful</i></p>	<p><u>a number of Green Deals (https://www.greendeals.nl/wp-content/uploads/2015/06/Progress_reoport_2011_2015_Green_Deals_ENG.pdf) have been concluded regarding circular economy in the construction sector.</u></p> <p><u>The Circular Buildings Green Deal (http://www.greendeal-circulairegebouwen.nl/producten) focuses on the development of a "buildings passport" outlining a building's circularity.</u></p> <p><u>Under the Circular City Green Deal, public and private parties are collaborating at the local level to close the materials cycle in the construction sector.</u></p> <p><u>The Biobased Building Green Deal was concluded in December 2015; The Infra-Nature Green Deal provides best practices and knowhow regarding the implementation of natural solutions in the construction of S&CE infrastructure.</u></p> <p><u>With the Sustainable S&CE Green Deal, this experience is widely disseminated to the other parties (principals and contractors) in the S&CE sector.</u></p> <p><u>Under the Urban Green and Blue Values City Deal, pilots are carried out involving the use of natural rather than technical solutions in area developments</u></p>	policy program	realise	8	5	3	8	8	32	24	21	19				

		<i>mechanism to facilitate this transition. In a subsequent phase, pilot projects will be carried out to test the effectiveness of the completed passport in practice.</i>	<u>and new construction projects. This generates savings in the use of raw materials and cuts the cost of, for example, reducing heat stress or pluvial flooding.</u>															
Circular Economy Route Map	London	The route map recommends actions for a wide range of stakeholders. The route map also focusses on the construction sector identifying the challenges to be : design; managing building materials; operating buildings	https://www.lwarb.gov.uk/what-we-do/circular-london/circular-economy-route-map/ https://www.lwarb.gov.uk/wp-content/uploads/2015/04/LWARB-London%E2%80%99s-CE-route-map_16.6.17a_singlepages_sml.pdf	policy program		2	3	4	5	6			20	13	14	15		
Livre Blanc de l'économie circulaire du grand Paris	Paris			policy program		2	2	2	2	4			12	8	8	8		
Circular Peterborough	Peterborough	Circular city by 2050	https://www.opportunitypeterborough.co.uk/events/circular-peterborough/			4	6	6	7	8			31	19	21	21		
	Vancouver		http://www.vancouvereconomic.com/focus/green-economy/										0	0	0	0		

Greenest City Action Plan 2015-2020		Zero waste, green buildings, green economy	http://vancouver.ca/green-vancouver/greenest-city-action-plan.aspx	policy program	inspire,	1	2	1	3	2	9	6	7	6
RESOLUTION ADOPTING A DATE OF 2020 FOR SAN FRANCISCO TO ACHIEVE THE GOAL OF ZERO WASTE TO LANDFILL AND DIRECTING THE DEPARTMENT OF THE ENVIRONMENT TO DEVELOP POLICIES AND PROGRAMS TO INCREASE PRODUCER AND CONSUMER RESPONSIBILITY IN ORDER TO ACHIEVE THE ZERO WASTE GOAL.	San Francisco	zero waste policy for the city, interesting to note that as part of this policy SF Environment is to continue to advocate for state legislation and partner with producers to develop a producer responsibility system, where producers design better products and take responsibility for the entire life-cycle of a product, including take-back and recycling.	https://sfenvironment.org/sites/default/files/editor-uploads/zero_waste/pdf/resolutionzerowastedate.pdf https://sfenvironment.org/zero-waste-by-2020	policy program		3	2	2	4	6	17	13	12	12
China has chosen to stimulate the use of secondary materials in production processes by reducing by 50–100% the VAT on goods produced from them	China		source: EMF - Policy Maker Toolkit	product design							0	0	0	0
Public Procurement rules - Rijkswaterstaat	NL	Procurement embraces 3 pillars - Economic, Environmental & social - the higher the score for the environmental &	https://www.rijkswaterstaat.nl/zakelijk/zakendoen-met-rijkswaterstaat/inkoopbeleid/duurzaam-inkopen/	procurement		7	10	8	8	6	39	21	24	22

		social pillar the higher the reduction factor for the cost																	
			https://www.rijkswaterstaat.nl/zakelijk/zakendoen-met-rijkswaterstaat/inkoopbeleid/aanbesteden/index.aspx													0	0	0	0
			https://www.rijkswaterstaat.nl/zakelijk/zakendoen-met-rijkswaterstaat/inkoopbeleid/aanbesteden/economische-meestvoordelige-inschrijving.aspx													0	0	0	0
			https://www.rijkswaterstaat.nl/zakelijk/zakendoen-met-rijkswaterstaat/inkoopbeleid/duurzaam-inkopen/duurzaamheid-bij-contracten-en-aanbestedingen/dubocalc/index.aspx	procurement												0	0	0	0
			https://www.rijkswaterstaat.nl/zakelijk/zakendoen-met-rijkswaterstaat/inkoopbeleid/duurzaam-inkopen/duurzaamheid-bij-contracten-en-aanbestedingen/co2-prestatieladder.aspx													0	0	0	0
The procura + manual	ICLEI		http://www.procuraplus.org/fileadmin/user_upload/Manual/Procuraplus_Manual_Third_Edition.pdf	procurement			3	7	8	7	6					31	16	20	21
Procura Case studies			http://www.procuraplus.org/case-studies/	procurement			0	8	8	8	6					30	14	22	22
Level(s)	EC	Level(s) is a voluntary reporting framework to improve the sustainability of buildings. Using existing standards, Level(s) provides a common EU approach to the assessment of environmental performance in the built environment. Level(s) is a tool for designing and constructing sustainable buildings. Related to circularity and BAMB, macro-objectives No.2	http://ec.europa.eu/environment/eussd/buildings.htm	assessment tool			7	7	5	6	7					32	20	20	18

		(Resource efficient and circular material life cycles), No.6 (Optimised life cycle cost and value) and No.7 (Cradle to cradle Life Cycle Assessment (LCA)) are relevant																
Public procurement for a circular economy			http://ec.europa.eu/environment/gpp/pdf/Public_procurement_circular_economy_brochure.pdf	procurement		0	8	8	3	8	27	11	19	19				
Circular procurement best practices			http://www.sppregions.eu/fileadmin/user_upload/Resources/Circular_Procurement_Best_Practice_Report.pdf	procurement		6	6	6	3	8	29	17	17	17				
Financial policy interventions	The Netherlands	the paper outlines the monumental task that the Dutch government is facing, including the financial bottlenecks that are impeding the circular transition and what the government can do to remedy this.	https://www.circle-economy.com/report-financial-policy-interventions-for-a-circular-economy/#.WnSMuXzvK00			1	5	1			7	1	5	1				
BIM	Finland	Finland is also a frontrunner in regard to the BIM developments		BIM							0	0	0	0				
COMMENT EXTRAIRE LES MATÉRIAUX DE CONSTRUCTION RÉUTILISABLES AVANT OU PENDANT LE MARCHÉ PUBLIC DE TRAVAUX (IBGE/BIM)	Brussels (IBGE/BIM)	Report on how to introduce re-use in public procurement		procurement		0	3	3	5	5	16	10	13	13				
Design for Change: development of a policy and transitional framework	Flanders (OVAM)	24 algemene ontwerprichtlijnen	http://www.ovam.be/verandering-sgerichtbouwen	assessment tool (level of building and building elements)	realise/inspire	8	5	3	8	8	32	24	21	19				

		certify the selective demolition process by issuing a "certificate of selective demolition" for demolition waste that has been selectively collected and subsequently gone through a tracing system, thereby assuring the processing company of the quality of the recycled demolition waste																
TraciMat	Flanders		http://www.tracimat.be	demolition inventory	regulate / stimulate	1	5	5	10	5	26	16	20	20				
Green Deal Circulaire Aankopen	Flanders (OVAM)	Circular procurement Vlaanderen Circulaire in 2017, samen met The Shift, VVSG en Bond Beter Leefmilieu een 'Green Deal Circulaire Aankopen' opgezet. Meer dan 100 organisaties hebben zich geëngageerd om de komende twee jaar elk twee circulaire aankoopprojecten op te zetten. Daarnaast zijn er zo'n 50 ondersteunende organisaties die hun expertise zullen inzetten om de aankopers te helpen in deze experimenten en om de inzichten te delen met andere aankopers.	http://vlaanderen-circulaire.be/nl/onze-projecten/detail/green-deal-circulaire-aankopen	procurement	realise/inspire	5	7	3	7	5	27	17	19	15				
Be.circular / PREC	Brussels			policy program		7	5	7	7	8	34	22	20	22				
Delivering the circular Economy: A toolkit for policy makers	Ellen MacArthur Foundation	Methodology for policymakers to accelerate the transition towards CE, with case study Denmark	https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_PolicymakerToolkit.pdf	assessment tool (on macro-economic and sector level) to make policy programs	realise/stimulate/inspire	1	3	3	5	5	17	11	13	13				
white paper	Slimline buildings		http://www.slimlinebuildings.nl/downloads/970/Whitepaper_Circulaire_Toekomstbestendig.pdf	industry recommendations							0	0	0	0				

UK industrial strategy	UK	focus on digital/IT, mobility, clean growth and aging society	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf	industry recommendations		2	3	3	4	5	17	11	12	12
BREEAM	International	Multicriteria and thematic sustainable building standard. BREEAM is the world's leading sustainability assessment method for masterplanning projects, infrastructure and buildings. It recognises and reflects the value in higher performing assets across the built environment lifecycle, from new construction to in-use and refurbishment.	www.breeam.com	building standard		8	7	7	7	6	35	21	20	20
London CE	London	Circular economy statement . Policy SI7 Reducing waste and supporting the circular economy. Referable applications should promote circular economy outcomes and aim to be net zero-waste. A Circular Economy Statement should be submitted.	https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/draft-new-london-plan/chapter-9-sustainable-infrastructure/policy-si7-reducing-waste-and-supporting	policy program		5	3	4	8	8	28	21	19	20
ISO working draft stand on design for disassembly and adaptability	International	ISO/CD 20887 Design for Disassembly and Adaptability of Buildings. Principles for disassembly and adaptability laid out with guidance for decision making and illustrative examples. Easy access to components and services, Durability, Exposed connections, Independence, Avoidance of unnecessary finishes, Supporting reuse	https://www.iso.org/standard/69370.html?browse=tc	standard		9	2	4	9	7	31	25	18	20



Final Best Practices Selection Based on Total Scores

category	mechanisms	Global total > or = 30	Design culture subtotal (design + innovation + circular) > or = 20	Value definition subtotal (value definition + innovation + circular) > or = 20	Collaboration subtotal (collaboration + innovation + circular) > or = 20
housing law	guidelines + financial incentives	Longer life housing law 2009 36	Longer life housing law 2009 26	Longer life housing law 2009 21	Longer life housing law 2009 21
framework programs	visionary goals (other? Concrete targets?)	Leading the cycle - finnish road map to a circular economy 2016-2025 30			Leading the cycle - finnish road map to a circular economy 2016-2025 23
	visionary goals, building passport (broad), guidelines	Circular Buildings Green Deal (one of a number of Green Deals in the construction sector) 32	Circular Buildings Green Deal (one of a number of Green Deals in the construction sector) 24	Circular Buildings Green Deal (one of a number of Green Deals in the construction sector) 21	
	visionary goals, actor based targets/milestones	Cicular Peterborough 31		Cicular Peterborough 21	Cicular Peterborough 21
	visionary goals, actor based targets/milestones, indicators	Be.circular / PREC 34	Be.circular / PREC 22	Be.circular / PREC 20	Be.circular / PREC 22
	planning requirements		London CE 21		London CE 20
	visionary goals, actor based targets/milestones			Luxembourg Circular Economy plan 19	Luxembourg Circular Economy plan 19
procurement	procurement requirements for public sector	Public Procurement rules - Rijkswaterstaat 39	Public Procurement rules - Rijkswaterstaat 21	Public Procurement rules - Rijkswaterstaat 24	Public Procurement rules - Rijkswaterstaat 22
	guidelines	The procura + manual 31		The procura + manual 20	The procura + manual 21

	illustrated procurement requirements	Procura Case studies	30			Procura Case studies	22	Procura Case studies	22
assessment tool	visionary goals, guidelines, indicators, monitoring	Level(s)	32	Level(s)	20	Level(s)	20		
	guidelines, LCA methodology/tool, inspirational demonstration	Design for Change: development of a policy and transitional framework	32	Design for Change: development of a policy and transitional framework	24	Design for Change: development of a policy and transitional framework	21		
standard	principles, requirement, guidelines, indicators	ISO working draft stand on design for disassembly and adaptability	31	ISO working draft stand on design for disassembly and adaptability	25			ISO working draft stand on design for disassembly and adaptability	20
BIM	format requirements, permit e-system							BIM - Singapore	20
demolition	planning requirements, timing/financial incentive			Demolition and Deconstruction permits	17	Demolition and Deconstruction permits	19	Demolition and Deconstruction permits	17
	Recycling/permit requirements, financial incentive (deposit), timing incentive for deconstruction, reuse incentive, salvage guidance					Green Demolition Bylaw	17		
	voluntary tracibility					TraciMat	20	TraciMat	
certification	visionary goals, guidelines, indicators, monitoring, 3rd party verification								