Inventory of literature on Barriers and Enablers of SME's for Upcycling

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This report is drafted by Phil Churchman for the project Upcycle your Waste. The aim of the Upcycle Your Waste project is to accelerate circular business cases among SMEs, in which local business waste flows are converted into high value secondary resources, thus reducing waste costs for SME's and increasing resource efficiency in cities. This report provides a general insight in the "mindset" of entrepreneurs about circularity and waste re-use. This insight will be completed with an inventory on barriers & drivers amongst SME's in the six pilot areas. This will help with learning with barriers in the project needs to be overcome and which drivers can be used to accelerate the application of circular waste business cases in the pilot area's

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Contents

1 Introduction

1.1 Project Introduction

This report is part of the Upcycle your Waste project. The city of The Hague together with 7 partners (Roubaix, Ostend, Kent, Norwich, IJmond, Vives and TU-Delft) developed the Upcycle your Waste project idea and applied for a subsidy of the EU Interreg 2 Seas-program, which has been rewarded December 2019.

The project will be executed in 6 business areas in Roubaix, Ostend, Kent, Norwich, IJmond and The Hague with various companies and waste flows. The aim of the Upcycle Your Waste project is to accelerate circular business cases among SMEs, in which local business waste flows are converted into high value secondary resources, thus reducing waste costs for SME's and increasing resource efficiency in cities. The project focusses specifically on creating local circular systems. This level is the most sustainable form of circularity, given the combination of resource efficiency and local economic development and avoidance of waste transport. The overall result of the project is an increased adoption of circular business cases by SMEs in the partner areas, quantified as:

- 360 SMEs adopting circular business cases
- 20% of the pre-existing waste stream being upcycled on a structural basis.

Additionally, the project will lead to an improved capacity of local authorities, business district managers and SMEs to introduce circular business practices, through our capacity building and dissemination and transfer activities.

The project has different phases in order to realize a lasting upcycling framework that is also able to be sustained by the local authorities and business park managers and SME's after the project has ended.

One of the first phases of the project is to collecting and analyse key information on the context and conditions for business waste upcycling in the partners business areas. This report is the result of a scientific process to identify relevant research on barriers and enablers for upcycling at SME's and provides a database for use by project partners and SMEs. It focuses on case examples, frameworks and analyses that provide insight into upcycling barriers and enablers and is an important knowledge base for our activities and outputs. It covers:

a) Regulatory context. Desk research of the EU and national rules and regulations governing SME waste management.;

b) Barriers and drivers for upcycling that SMEs experience or perceive, like awareness, knowledge, capacity, resources, operational barriers. The objective of this is:

1) to get an overview of the barriers & enablers that are already know in scientific research, based on existing sources;

2) to get the actual barriers & enablers that SME's are experiencing in their day by day working experience. For this, interviews with the SMEs in the 6 targeted business areas will be conducted to collect their input.

The present report is the result of b1; being a scientific approach to map existing literature on barriers & enablers in SMEs. This inventory will be based on existing sources and incorporated into the overall report on the barriers & enablers and the inventory of the specific barrier, being the current legislation.

The literature searches was conducted during May and June 2020. If the searches (search expressions included in Appendix A) are repeated, further papers will be identified that were published later.

1.2 Introduction to upcycling

Upcycling is defined as transforming waste(d) products, parts or materials into secondary resources as products, parts or materials of at least equal and preferably better technical, economical and societal quality, without burdening people and the environment with hazardous and harmful substances add value and reduce the use of virgin materials in the process.

Upcycling is one strategy as part of the development of a circular economy. The circular economy is contrasted with a linear economy in which spent materials are simply dumped in landfill (or other "sinks") at the end of their life. An effective circular economy is sometimes presented as comprising two distinct "cycles:" a biological cycle and a technical cycle (see figure 1).
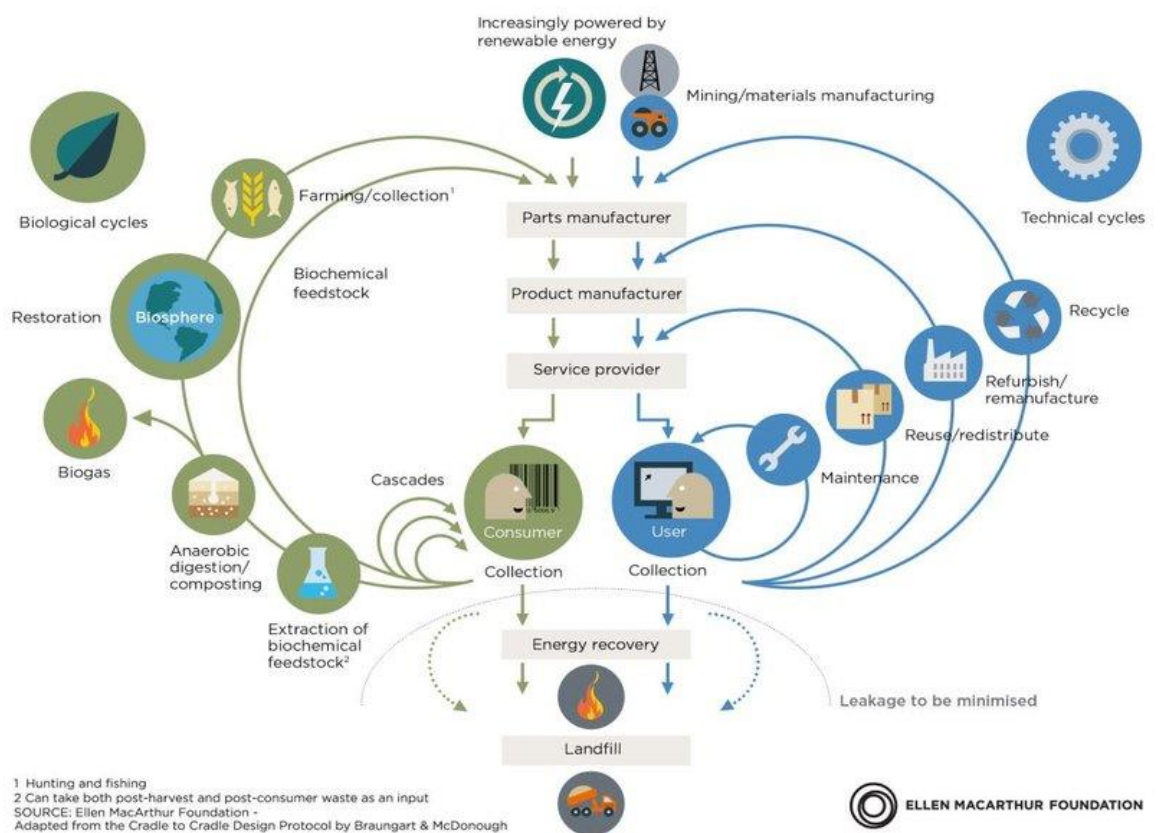
Figure 1: The Circular Economy; Source: Ellen MacArthur Foundation

The Ellen MacArthur Foundation[1] identifies three principles underpinning the Circular Economy:

- Regenerate natural systems
- Design out waste and pollution
- Keep products and materials in use

Upcycling relates primarily to the first and, especially, the last of these principles. Upcycling can occur in both the biological and technical cycles. There is an implicit "value" hierarchy in each cycle. At the bottom of the hierarchy is landfill. Then, in the technical cycle, we might identify, in ascending order of value:

- Re-use

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[1] https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy

- Maintenance/Repair
- Refurbishment
- Remanufacture
- Repurpose

In the Biological cycle the hierarchy is simpler because the sole aim is to return all biological materials back to nature in order to maintain the quality of the biosphere.

Value in the hierarchy may be economic, societal or environmental (the so called "triple bottom line").

Upcycling can be defined as moving up the value hierarchy, thus, it may involve redirecting waste from landfill to any other cycle. It may also involve moving waste from a lower value cycle, such as traditional recycling, to a higher value cycle, such as remanufacture or reuse. In this context, value may be economic, social or environmental and may be private or public.

An important aspect of this shift would be the use of the economic potential of waste materials as a valuable secondary resource for new products. The basic principles of the 'value hill' is that it not only wants to create value out of "waste", but make resources more valuable because of their "multi functionality".
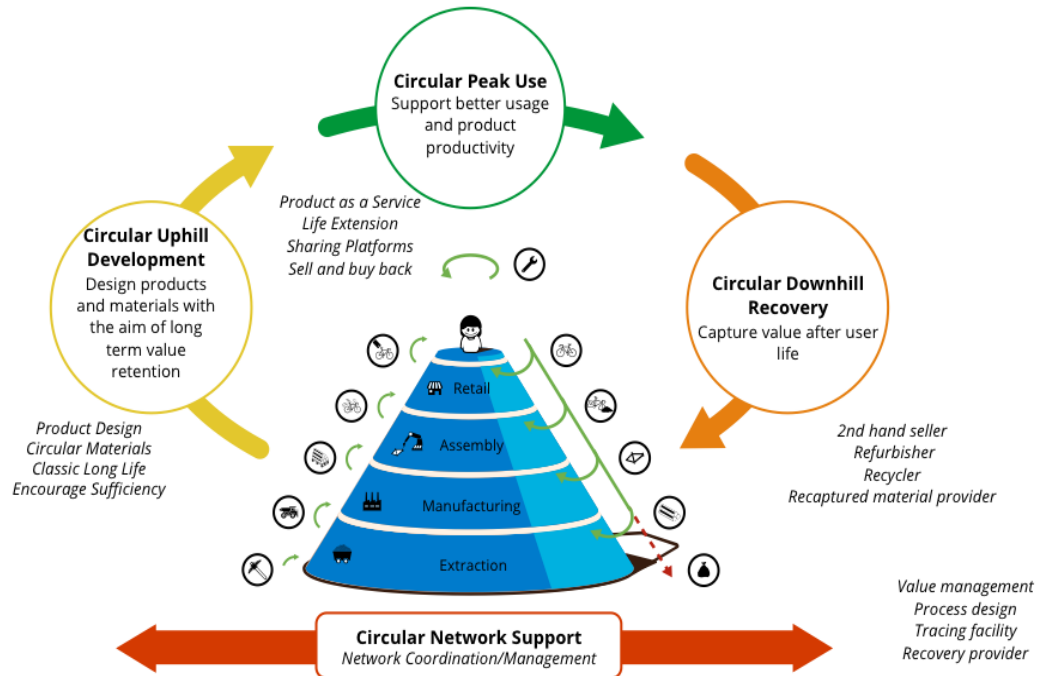

Figure 2: The 'value hill' of circular economics; Source: Achterberg, E; Hinfelaar, J; Bocken, N.: "The Value Hill Business Model Tool: Identifying gaps and opportunities in a circular network"

The Value Hill is a circular business strategy tool that provides companies with a tool to position their business in a circular context and to develop future strategies for a circular economy. Additionally, the value hill provides oversight in essential circular partners and collaborations in a circular value network. Therefore, the value hill can also be used to identify circular opportunities for stakeholders in a city perspective.

In the value hill, different stages of materials and products flowing through the economy are shown. Through different processes materials gain value as they go up hill, they have the highest value when they are in use at the top of the hill, and slowly lose value when they go downhill. In a circular economy the aim is to feed a material, product or part back into a phase with a higher value in order to retain value.

2 Inventory Protocol

2.1 Inventory of existing barriers and enablers

This inventory of barriers and enablers with the Upcycle your Waste project is to establish an overview of the main barriers and enablers for upcycling of business waste streams by SME's which have been mapped in previous scientific research. To systematically construct an inventory of upcycling processes, products and solutions requires three prior elements:

- A clearly defined search protocol (a replicable sequence of activities)
- A set of searchable resources (databases, etc.)
- A set of search and inclusion criteria (keywords to search for and criteria for including or excluding particular cases)

To extract value from the inventory, requires subsequent thematic analysis and the provision of effective search tools.

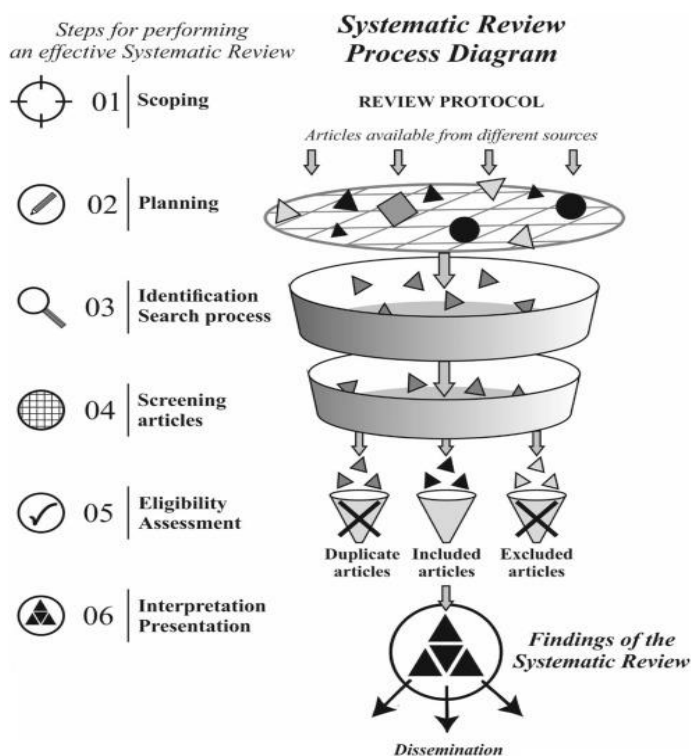Figure 2 shows a generic systematic review as a set of stages arranged as a funnel.

Figure 2 Systematic Review; Source: Koutsos, T. M., Menexes, G.C. and Dordas, C. A. (2019) An efficient framework for conducting systematic literature reviews in agricultural sciences, Science of The Total Environment, 682: 106-117. https://doi.org/10.1016/ j.scitotenv.2019.04.354

For this inventory we translated this approach into a 6 step approach as summarised below. After each step, the findings and approach for the subsequent step were discussed and agreed with the workstream steering group. There was a review with partners to confirm the scope and approach after step 1.

Step 1: Exploratory literature search to identify search terms and filters

Step 2: First literature search with audit trail

Step 3: Second literature search with audit trail

Step 4: Identification of barrier and enabler themes and keywords

Step 5: Consolidated searchable database in Excel spreadsheet

Step 6: Report and database instructions

3 Objectives and scope

3.1 Objectives

1. Identify the sources to conduct the inventory on and get better idea on scope, establish scope;
2. Identify relevant case studies, frameworks, practices and analyses from peer reviewed literature;
3. Identify themes and keywords for barriers and enablers and establish the "importance";
4. Consolidate the above into a searchable inventory for the project team and partners;

3.2 Scope

The following aspects have been taken into account in the inventory

- Included:
    - Use of SME waste streams for any economically valuable purpose, including new product manufacture, construction materials, energy production and agriculture
    - SME remanufacturing, refurbishment, re-use and/or repurposing of products
    - SME waste separation enabling the above

- Excluded:
    - Medicine and medical applications
    - Materials, chemical and biological science
    - Product design
    - Product lifespan improvement within linear models
    - Manufacturing technology, efficiency and waste reduction within linear models
    - Waste recycling
    - Waste management practices and processes
    - Theoretical modelling
    - Sustainable building design and refurbishment
    - Water and energy efficiency
    - Sustainable consumer practices including degrowth, using products for longer, waste reduction, recycling and domestic reuse / upcycling

The objectives and scope together define the research questions for the workstream.

4 Workstream Products

4.1 Observations

The following are some high-level observations from a first review based on the term Upcycling:

- Upcycling as a term is used most commonly in fashion, textiles and furniture manufacturing. Alternative terms such as remanufacturing, repurposing and reuse are used more frequently in other sectors;
- Financial considerations and regulation are important in companies' decisions whether or not to develop upcycling or other circulation economy opportunities. Many companies will pursue opportunities that have significant financial benefit, and few will do so if there is a large cost unless this is necessary to comply with regulation;
- Companies are more likely to implement successful upcycling initiatives if:
    - Sustainability is core to the company's ethos;
    - Circular economy principles are embedded in the company's business model;
    - Business models are developed collaboratively with companies supplying or receiving waste streams for upcycling;
- Supply chain considerations including supply security, complexity and risk are significant factors, as are concerns regarding materials quality.

4.2 Sources

Searches were conducted using Scopus and Web of Science. See appendix A for search expressions.

Journal titles with the terms medicine, chemistry, biology, computing, transport and materials, and their synonyms and derivatives, were excluded from searches.

With these exclusions, papers from over 300 journals were returned, of which 234 papers in 51 journals were found to meet the scope and filter criteria. Of these, 79% were in the following 13 journals:

- Journal of Cleaner Production
- Sustainability (Switzerland)
- Resources, Conservation and Recycling
- Journal of Remanufacturing
- Sustainability
- Resources Conservation and Recycling
- Business Strategy and the Environment
- International Journal of Production Research
- Procedia CIRP
- Journal of Industrial Ecology
- Environmental Footprints and Eco-Design of Products and Processes
- Waste Management
- Ecological Economics

References were additionally included from:

- Waste separation review – 24 papers
- Circular process and products workstream – 9 papers + 20 case examples
- NGOs – 6 reports

Excluded sources:

- NGOs (except the above reports and case examples)
- Local / national / EU government sources
- Waste management service providers
- Industry sector reports
- Local / national / industry media

The primary sources (also included in the database) are papers published in academic journals, as these provide rich insights and are less readily accessible to those without academic institution access.

NGOs such as the Ellen MacArthur Foundation (https://www.ellenmacarthurfoundation.org/) and the Community Research and Development Information Service (CORDIS) of the European Commission (https://cordis.europa.eu/) are additional valuable open access sources of upcycling research and case studies.

4.3 Terms

The search has been conducted in an iterative way. Based on initial results some of the terms were adapted in order to improve the search.

- After an initial exploratory search, upcycling turned out to be an unknown search topic, which mainly yielded hits in the textile sector, but not elsewhere. The team decided to also include the various R strategies as search topics;
- the team changed drivers by enablers as search term because this generate more adequate hits, after comparison;
- the geographical search was limited to markets of the team thought it would resemble the marketed situation in the Interreg 2 seas area;

The terms mention in the table below were used for selection of the found literature.

Language	Topic	Sub-topic	Geography	Sector
English	• Circular economy • Upcycling • Re-use • Refurbishment • Remanufacturing • Repurpose • (Waste separation*)	• Practices • Business case • Regulation • Policy • Barriers • Enablers • Challenges AND opportunities	• Europe / EU • Netherlands • France • Belgium • UK • Other comparable economies	• Business • Commercial • SME / Small and medium-sized enterprises

*: Incorporated from previous work of TU-Delft on waste separation

4.4 Filters

- In scope per section 3
- Relevance to project:
    - Applicable to SME upcycling, per project definition
    - Connects to practices and policies
    - Relevant practical insights
- Apparent authority of writer / source
- Does not require deep technical or scientific knowledge to understand
- Selected on date of 2012 or later

4.5 Themes and keywords

The following themes and keywords were identified by reviewing papers that contain the words "barrier*" or "enable*" in the title or abstract:

4.5.1 Enablers

Themes	Keywords
• Integrated strategy	Integrated / Strateg
• Stakeholder engagement	Stakeholder / Engagement
• Shared values	Share / Value
• Trust	Trust
• Environment engagement	Engagement
• Shared vision	Vision
• Enthusiasm	Enthusiasm
• Credible:	Credible
o Value proposition	Proposition
o Supply chain and reverse logistics	Supply chain Logistics
o Business / revenue model	Business model / Revenue model
• Information sharing platform	Platform
• Integrated design processes	Design/ Process
• Customer communication	Customer / Communication

4.5.2 Barriers

Themes	Keywords
• Cost / investment	Cost / Investment
• Lack of financial / economic / human resources	Resources
• Lack of time	Time
• Lack of knowledge / expertise	Knowledge / Expertise
• Risks associated with implementing a new sustainable practice	Risk / Regulat
• Current policies and regulation	Polic
• Existing organisational / institutional / corporate culture / capability	Cultur / Capabilit / Organisation / Institution
• Existing performance metrics / measures	Metric / Measure
• Inconsistent standards	Inconsistent / Standard
• Lack of customer / consumer / retailer acceptance / demand	Customer / Consumer / Retailer / Acceptance / Demand
• Social barriers	Social Societ
• Complexity	Complexit
• Lack of win-win, risk, reward and benefits sharing	Win-win / Reward / Benefit / Shar
• Unstable / insecure supply	Stable / Secur / Suppl
• Business model changes required:	Business model
○ Material flows	Flow
○ Long term partnerships	Partnership
○ Technology requirements	Technology
• Product obsolescence	Obsolescence
• Material traceability, quality, consistency, contamination	Consistency / Traceability / Contamination / Quality
• Supply chain gaps / lack of integration	Supply Chain Integration
• Regulatory / legal / administrative requirements	Legal / Administrat
• Unclear / inconsistent / misaligned standards / policy frameworks	Misaligned / Unclear
• Intellectual property uncertainty	Intellectual property

4.6 Database of barriers and enablers.

All the papers, reports and case examples that have been identified are consolidated into the Excel spreadsheet: "Inventory of Barriers and Enablers v7.xls"

The spreadsheet includes:

- Authors
- Year of publication
- Title
- Journal / organisation
- Abstract
- URL link

Only open access reports are identified. These can be accessed and downloaded freely. Other papers require academic institution access or can be purchased. Purchase cost is typically around €35 per paper.

The spreadsheet catalogues the papers according to whether the title or abstract contain:

- A defined search term
- "Barrier*" + barrier keyword (see below)
- "Enable*" + enabler keyword (see below)

A selection of 56 papers of particularly high relevance to the project are identified. These are a good starting point for someone wanting to review the literature for the first time.

The spreadsheet also includes a search facility with AND / OR / AND NOT functionality so users can use their own search terms to select papers.

5 Analysis

5.1 Process results

An overview of the results of the inventory process have been listed below:

Step 1: Exploratory literature search to identify search terms and filters

- It was found that "upcycling" was only used in literature to describe a subset of in-scope opportunities
- Based on this it was agreed that the following were also in scope:
    - Remanufacturing
    - Reuse
    - Refurbishment
    - Repurposing
    - Waste separation
- A proposed filtering approach was defined based the observed features of relevant and less relevant papers

Step 2: First literature search with audit trail

- Using agreed search terms and filters:
  - Conducted Scopus and Web of Science searches
  - Selected papers with 6 or more citations
  - Filtered out papers from non-relevant journals
  - Filtered out remaining non-relevant papers based on title and abstract
  - Compared results from Scopus and Web of Science
- Based on these searches, proposed refinements to search terms and filters

Step 3: Second literature search with audit trail

- As step 2 with:
  - Refined search terms and filters
  - Reviewing all papers, irrespective of number of citations

Step 4: Identification of barrier and enabler themes and keywords

- Reviewed c. 100 papers with "barrier*" and/or "enable*" in the title or abstract
- Identified barrier and enabler themes
- Defined barrier and enabler keywords based on themes

Step 5: Consolidated searchable database in Excel spreadsheet

- Relevant papers consolidated from step 1, 2 and 3 searches
- All c. 280 papers reviewed to confirm relevance, c. 30 removed
- Open access papers identified
- Highly relevant papers identified
- 6 NGO papers provided by the city of the Hague included
- Papers included from waste separation work conducted by the TU-Delft
- Papers and case examples included from Circular Process and Products workstream
- Cross referenced papers to:
  - Search terms
  - Barrier and enabler keywords
- Added search facility for users to define custom searches

Step 6: Report and database instructions

- Added database instructions and protection against unintended data deletion
- Tidied and made more user-friendly
- Prepared report for sharing with partners

The found theme and keywords can be divided into a number of categories. The tables below show how often a theme and keyword has been found in the literature found and in which category they can be classified.

5.2 Enablers

Themes	Keywords	Papers with "Enable*" + Keyword	Category
• Integrated strategy	Integrated Strateg	5 9	Policy / Vision
• Stakeholder engagement	Stakeholder Engagement	2 2	Business case
• Shared values	Share Value	1 7	Policy / Vision
• Environment engagement	Engagement	2	Policy / Vision / Awareness
• Shared vision	Vision	1	Policy / Vision
• Credible:			
o Value proposition	Proposition	1	Business case
o Supply chain and reverse logistics	Supply chain Logistics	3 2	Business case
o Business / revenue model	Business model Revenue model	11 1	Business case
• Information sharing platform	Platform	2	Knowledge
• Integrated design processes	Design Process	11 5	Business case
• Customer communication	Customer Communication	5 1	Awareness / Knowledge

5.3 Barriers

Themes	Keywords	Papers with "Barrier*" + Keyword	Category
• Cost / investment	Cost Investment	17 6	Business case
• Lack of financial / economic / human resources	Resources	20	Business case / Awareness / Social
• Lack of time	Time	13	Awareness
• Lack of knowledge / expertise	Knowledge Expertise	11 2	Knowledge
• Risks associated with implementing a new sustainable practice	Risk Regulat	9 11	Business case
• Current policies and regulation	Polic	26	Policy / Vision
• Existing organisational / institutional / corporate culture / capability	Cultur Capabilit Organisation Institution	14 5 11 8	Policy / Vision / Social

• Existing performance metrics / measures	Metric Measure	2 9	Business case
• Inconsistent standards	Inconsistent Standard	1 9	legislation
• Lack of customer / consumer / retailer acceptance / demand	Customer Consumer Retailer Acceptance Demand	12 9 2 3 12	Awareness/ Business case
• Social barriers	Social Societ	12 6	Social
• Complexity	Complexit	6	Social
• Lack of win-win, risk, reward and benefits sharing	Win-win Reward Benefit Shar	2 1 17 10	Social
• Unstable / insecure supply	Stable Secur Suppl	2 1 25	Business case
• Business model changes required:	Business model	20	Business case
○ Material flows	Flow	10	Business case
○ Long term partnerships	Partnership	2	Business case
○ Technology requirements	Technology	6	Business case
• Product obsolescence	Obsolescence	1	Business case
• Material traceability, quality, consistency, contamination	Traceability Contamination Quality	1 1 5	Business case
• Supply chain gaps / lack of integration	Supply Chain Integration	15 7	Business case
• Regulatory / legal / administrative requirements	Legal Administrat	3 4	Legislation
• Intellectual property uncertainty	Intellectual property	1	Legislation

Based on the number of "hits" per category we can draw conclusions on how important (in general) which Barriers & Enablers are for SME's.

6 Conclusions

In table below the result of the analysis is summarised.

	Enablers	Barriers
• Policy / Vision	25 (+2)	28
• Social		54 (+29)
• Knowledge	2 (+6)	12
• Awareness	6 (+2)	38
• Legislation		18
• Business case	38	89 (+38)
total	72	239

The number of times that barriers are listed is almost 4 time the number of times enablers are listed. In general, this could mean that the barriers are perceived as bigger and more important than the enablers.

The fact that "social" is only seen as barrier subscribes to the idea that the majority of society has not yet or only partially embraced upcycling and re-use of resource. These same applies for "awareness". This is mentioned as a barrier more often than as an enabler.

It is striking that Policy (government)/Vision (companies) has an equal score. This could mean that having a policy or vision in place to back-up or support upcycling and re-use of resources is precondition to support this development. This outcome is backed up by the observation under 4.1 that companies are more likely to implement successful upcycling initiatives if sustainability is core to the company's ethos.

"Business case" is mentioned 38 times as an enabler and at least 89 times as a barrier. From this could be derived that it is still very difficult to realise a business case when upcycling waste into a secondary resource and/or product. This is not surprising if we consider that society is still largely organized in a linear way. Circular business models are therefore often difficult to realize. However due to lacking awareness, companies could be lacking information about successful circular business cases and thus not being aware of the opportunities for themselves.

Themes and keywords categorized under "Legislation" are only mentioned as barrier. Given the fact that the values of today's society are protected by legislation, it is not illogical that legislation is being regarded as a barrier. After all, the waste legislation is aimed at removing waste safely and quickly as possible and without harming humans. The recovery of waste is "contrary to" this.

Appendix: Search expressions

7 Scopus

7.1 Search 1

A range of exploratory searches, identifying 28 relevant papers

7.2 Search 2

(TITLE-ABS-KEY ("Circular Economy") AND NOT TITLE-ABS-KEY (china)) AND (TITLE-ABS-KEY ("Barrie") OR (TITLE-ABS-KEY ("Challeng*") AND TITLE-ABS-KEY ("Opportunit*"))) AND PUBYEAR > 2014*

Total 501 results

7.3 Search 3

SUBJAREA (envi) AND TITLE-ABS-KEY (("circular econom" AND "SME*") OR "upcycling" OR "re-use" OR "refurbish*" OR "remanufact*" OR "repurpos*") AND TITLE-ABS-KEY ("barrie*" OR ("challeng*" AND "opportunit*") OR "enabler*" OR "business case*" OR "regulation*" OR "polic*" OR "practice*") AND PUBYEAR > 2011 AND NOT TITLE-ABS-KEY ("China" OR "Japan" OR "Korea" OR "Russia" OR "Brazil" OR "India" OR "Mexico" OR "africa") AND TITLE-ABS-KEY ("SME*" OR "enterprise*" OR "commercial" OR "business*") AND NOT INDEX (medline) AND NOT SRCTITLE (veterinary) AND NOT SRCTITLE (cell) AND NOT SRCTITLE (medicine) AND NOT SRCTITLE (biology) AND NOT SRCTITLE (chemistry) AND NOT SRCTITLE (material) AND NOT SRCTITLE (neuroscience) AND NOT SRCTITLE (biotechnology) AND NOT SRCTITLE (transport) AND NOT SRCTITLE (medical) AND NOT SRCTITLE (computer) AND NOT SRCTITLE (bmj) AND NOT SRCTITLE (disease) AND NOT SRCTITLE (health) AND NOT SRCTITLE (engineering) AND NOT SRCTITLE (water) AND NOT SRCTITLE (communications) AND NOT SRCTITLE (heart) AND NOT SRCTITLE (chemical) AND NOT SRCTITLE (petroleum) AND NOT SRCTITLE (gastroenterology) AND NOT SRCTITLE (pharmacy) AND NOT SRCTITLE (tobacco) AND NOT SRCTITLE (injury) AND NOT SRCTITLE (soil) AND NOT SRCTITLE (data) AND NOT SRCTITLE (trauma) AND NOT SRCTITLE (rmd) AND NOT SRCTITLE (esmo) AND NOT SRCTITLE (ageing) AND NOT SRCTITLE (information) AND NOT SRCTITLE (acm) AND NOT SRCTITLE (horticul) AND NOT SRCTITLE (ajil) AND NOT SRCTITLE (earth) AND NOT SRCTITLE (ecology) AND NOT SRCTITLE (building) AND NOT SRCTITLE (land) AND NOT SRCTITLE (urban) AND NOT SRCTITLE (energy) AND NOT SRCTITLE (law) AND NOT SRCTITLE (electron*) AND NOT SRCTITLE (marine) AND NOT SRCTITLE (sae AND technical AND papers) AND NOT SRCTITLE (informes AND de AND la AND construccion) AND NOT SRCTITLE (desalination) AND NOT SRCTITLE (development) AND NOT AFFILCOUNTRY (china) AND NOT AFFILCOUNTRY (japan) AND NOT AFFILCOUNTRY (india) AND NOT AFFILCOUNTRY (iran) AND NOT AFFILCOUNTRY (malaysia) AND NOT AFFILCOUNTRY (brazil) AND NOT AFFILCOUNTRY (south AND korea)*

Total 330 results

8 Web of Science

8.1 Search 1

TS=("Circular Economy" NOT "China") AND TS=("Barrie" OR ("Challeng*" AND "Opportunit*"))*

Filtered 2015 and later

Total 441 results

8.2 Search 2

TS=("circular econom" OR "upcycling" OR "re-use" OR "refurbish*" OR "remanufact*" OR "repurpos*") AND TS=("barrie*" OR ("challeng*" AND "opportunit*") OR "enabler*" OR "business case*" OR "regulation*" OR "polic*" OR "practice*") AND PY=("2012" OR "2013" OR "2014" OR "2015" OR "2016" OR "2017" OR "2018" OR "2019" OR "2020") NOT TS=("China" OR "Japan" OR "Korea" OR "Russia" OR "Brazil" OR "India" OR "Mexico" OR "africa") NOT SO=("cell*" OR "medicine*" OR "biology*" OR "chemistry*" OR "material*" OR "neuroscience*" OR "nature biotechnology" OR "transport*") AND TS=("SME*" OR "enterprise*" OR "commercial" OR "business*")*

Total 749 results