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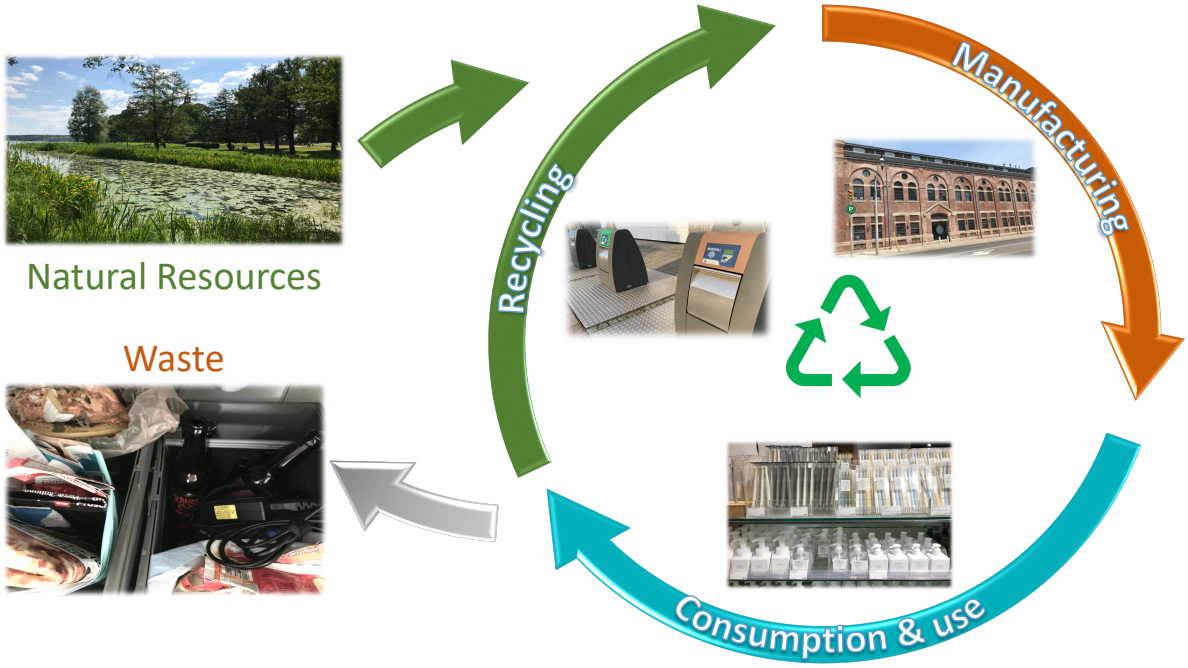
Exploring Waste Management in the Circular Economy Concept Trough a Literature Review and a Case Study.



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Summary

This thesis explores the relationship between Waste Management (WM) and Circular Economy (CE) through a literature review and case analysis. The main focus is on the role of WM in developing the CE concepts. Both concepts are linked to proper waste handling and the move of economies towards attaining a sustainable future. In addition, WM is considered an essential tool in dealing with the increasing global waste challenge. Both WM and CE have been put on the agenda in recent years as a response to the focus on sustainable development. CE especially, has gained momentum in recent years due to the attention of reaching the 17 sustainable development goals. The increasing attention for WM and CE shaped our research questions:

Q1: What role does Waste Management play in Circular Economy?

Q2: How are the two concepts of Waste Management and Circular Economy related?

The research questions have been addressed by applying a literature meta-analysis. A total of 168 abstracts of research articles were pulled through the literature meta-analysis and methodically categorised. This categorisation was then analysed to find similarities and distinctions between the two concepts. The literature meta-analysis reviled a literature gap between CE theory and CE research literature. In CE theory WM have a central role in CE, while in CE research literature was WM almost overlooked. However, the contrast was not as distinct as first anticipated. Our literature meta-analysis also revealed that even though the concept of CE was less present in WM literature, the central aspects of CE was very much present in the form of *reuse*, *reduce*, *recycle*, and *recover*.

The findings of our literature meta-analysis were then compared against operational practice of the regional renovation facility of IVAR IKS. The comparison was done through a case study of IVAR, limited to involve only the new renovated sorting facility at Forus. The case study was then finalized with interview and document analysis. This case study contradicted the findings in our literature meta-analysis, showing a more integrated practice of CE in the waste industry than first predicted. However, both studies showed less focus on the key element of reduce and more or less overlooked the consumers position in WM and CE. Due to the central role of WM within CE, we would then suggest a re-definition of the concept of WM in the context of CE.

Acknowledgements

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The information provided by IVAR IKS has been of great help in conducting the case-study. We highly appreciate our Informant, Rudolf Meissner, for providing us with such valuable information and inside knowledge of regional- and national waste management practices.

We would also like to thank each other for great communication and team work, which made this thesis more enjoyable to complete. There have been some discussions throughout the writing process, however it was all based on mutual respect and understanding of our different viewpoints and backgrounds.

Eva Marie W. Østerhus and Trine S. Brimsøe

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List of Figures, Graphs, and Tables

List of Abbreviations

CE -	Circular Economy
EE -	Environmental Economics
EU -	European Union
GHG -	Greenhouse gases
LCA -	Life Cycle Analysis
MSW -	Municipal Solid Waste
NEA -	Norwegian environment Agency
NIR -	Near Infrared light
NRE -	Natural Resource Economy
SDG -	Sustainable Development Goals
SE -	Sharing Economy
UN -	United Nations
UNWCED -	United Nations World Commission on Environment and Development
WM -	Waste Management
3 R´s -	Recycle, Reuse, and Reduce
4 R´s -	Recycle, Reuse, Reduce, and Recover

Table of Content

1. Introduction

The objective of this thesis is to study the relationship between Waste Management (WM) and Circular Economy (CE). The focus of WM lies in that our society today has evolved to be centred around consumption of goods and services. With an annual deposit of 2.01 billion tonnes of Municipal Solid Waste (MSW) we are creating a waste generation[1] we are no longer capable of handling. The problem of waste handling is only set to increase as we expect a world population growth and increased living conditions for the entire world population. With a global focus on sustainability, emissions, and 2 degree target, there will be no room for disposing all of our waste in landfills and through incineration. Recognizing these challenges, recycling has become a popular practice in WM. However, the current practice of *recycling* is not recycling the waste at all, but rather shipping our waste abroad, meaning some countries buy high and clean recycling numbers, whilst depositing their waste in *low-income* countries. It is needless to say that today´s solution is not sustainable, but on the contrary is making it worse (Kaza, Yao, Bhada-Tata, & Van Woerden, 2018; United Nations (UN), 2017a; UN, n.d-a.; UN environment, n.d.; Zhou & Reimov, 2018).

The waste problem was put on the agenda back in 1960´s, and there has been a focus on addressing WM ever since (Wilson et al., 2015). In the developed countries the goal has been to shift the fundamental thinking of waste disposal to WM, and from waste to resources. Through this process, waste becomes economical valuable for recycling and recovery. Although there is a substantial focus on the green shift, and the challenges of global warming and sustainable development, little focus is allocated towards WM within the 17 Sustainable Development Goals (SDG). While SDG 12 having some implied focus on WM, our eager to continue our consumption patterns interferes with a potential progress towards a more sustainable future (Wilson et al., 2015). It is suggested by Lenkiewicz (2016) that there needs to be a shift of priority towards WM to be able to meet all 17 SDG´s. The subject of waste is immense and will therefore affect every level of the SDG´s from greenhouse gases (GHG) to sludge and solid waste (Wilson et al., 2015).

[1] Waste generation definition: “quantity of materials or products that enter a waste stream before composting, incinerating, landfilling, or recycling” (BusinessDictionary, n.d.).

While WM has an important role in our society today, an increased interest for the concept of CE has emerged together with the fundamental thinking of waste becoming an economic recourse. A resource in which material circulation becomes a closed circle with less input, minimal output and where the materials will be recycled and reused over and over, causing minimal impact on natural resources (European Commission, 2018; Wilson et al., 2015). This global concern is pushing important *actors*, such as politicians, producers, and consumers to embrace the concept of CE, hoping that it will be the solution to our current waste problem and be the answer for a sustainable future.

The subject of WM and CE are clearly interlinked, but for some reason it is not fully comprehended by the literature. However, there is an indication in the literature that there is less focus on consumer responsibility, and lack of proper guidelines for implementation of CE across sectors. To better understand the relationship between WM and CE we formulated the following research questions to be answered in this thesis:

Q1: What role does WM play in CE?

Q2: How are the two concepts of WM and CE related?

The primary focus will be on Q1, while the second question was formulated to build a better base for conducting our analysis for Q1.

The relationship between WM and CE was studied through a qualitative literature meta-analysis of 168 scientific articles abstracts. By applying a literature meta-analysis, we were able to investigate the research gap in the literature, and explore the concepts of WM and CE, as well as the relationship between the two concepts, and WM role in CE. For the purpose of this master thesis we will primarily focus on MSW in our research. The data was collected through a meta-analysis and was selected under the criteria of being scientific publication and searchable through the selected search-engine sciencedirect.no. Recognizing that CE is a modern concept, our search range was set to year 2008-2018. With WM and CE being our main focus, our second criteria for search was either "waste management" in the title or "circular economy" in the title, with the other concept mentioned somewhere in the text. This gave us a result of 186 articles. After "cleaning" the list we ended up with a total selection of 168 articles. We decided to manually read all the abstracts, on the account that the abstracts present "a clear account of the methods, results and conclusions that accurately reflect the core components of the full research report" (Rice, Kloda, Shrier, & Thombs, 2016, p.1). Our process was recorded in a form created

in excel to document and monitor the process. The literature meta-analysis presented a literature gap between CE and WM. However, the use of the main focus of CE; recycle, reuse, reduce, and recycle (4R's), was more frequently used than the concept of CE itself. This indicates that the focus of the 4R's are present in WM, although not directly in the context of CE.

The discussion around the results in our literature meta-analysis needed to be compared against actual implementation and operation of WM. A case study of the regional renovation facility of Rogaland, IVAR IKS, was therefore conducted to give a more valid argument to our discussion. The case study was built on interview and document analysis, and was constrained to only include IVAR´s renovated sorting facility located at Forus with the focus on their new automatic recycling system for plastic. The results from the case study contradicted some of the findings from our literature meta-analysis regarding the relationship between WM and CE, illustrating that IVAR has implemented practices and measures compliant with the spirit of CE ideology.

The structure of this thesis is built around four sections. The first section concentrates on presenting the theoretical background of all the relevant aspects tied to subjects of MSW for our research and theoretical position of CE. The second section of this thesis will present our research strategy and method used for our research. The method of literature meta-analysis was selected out from the purpose of explore and analyse the two concepts of WM and CE. The third section of this thesis includes our analysis of the literature meta-analysis and the case study of IVAR. Final section provides a discussion and presents our findings. Concluding with a suggestion of a re-definition of WM through the perspective of CE, and a summary of all our findings.

2. Background

CE is a way to organize the economy with a sustainable approach where resources are not being depleted. This is not a new phenomenon, but rather an idea that has been around for centuries. The background will therefore first introduce a general understanding of WM, and why there is a pressing need for a focus within this area. Next, IVAR IKS will be presented as the focus of our case study. Then, introducing the underlying driver of the CE development; from a linear economy, to a chronological exploration of the different environmental economic thoughts, before exploring the concept of CE.

2.1 Waste Generation

McCormick (2018) states that "human waste is the most immediate form of waste, since it is produced by everyone" (p.182). We have moved on from a consumerism of *need* to *want*. In the name of production and financial growth we produce high fashion and other products in the pursuit of the latest and most fashionable trends in clothing, electronics, cars, and more. We easily discard well-functioning products as they are "yesterday's news". Production is increasing and the pile of waste is growing. The average person is currently producing 0.75 kg waste daily, with a peak of 4.54 kg amongst the biggest consumers, leaving us with an annual 2.01 billion tonnes of MSW (Kaza et al., 2018, McCormick, 2018; Pongrácz & Pohjola, 2004). "*What a Waste*" report of 2018 estimates that "when looking forward, global waste is expected to grow to 3.4 billion tonnes by 2050" (Kaza et al., 2018, p. 3). While the same report calculated South Asia region to generate a total of 334 tonnes of waste in 2016, given an average disposal of only 0.52 kg waste per inhabitant/day. This demonstrates that the South Asia waste generation is lower than that of the peak consumers, and contributes to a lower average waste generation (Kaza et al., 2018).

A prevailing issue of the increased waste generation is the shipment of waste from *high-income* countries to *lower-income* countries. In their 2018 documentary, Nick Martin and Victoria Seabrook address the problem associated with years of dumping plastic waste across the world in "good faith" of being recycled. Instead of being recycled, the plastic occupies vast open areas and the quality degrades as a result of the weather, causing the property of the plastic to not be fit for recycling. This problem created large open dumping areas which are, to this day, still polluting the environment. The same documentary (Martin & Seabrook, 2018) directs a harsh critique towards the municipality and governmental incentives for creating less work places by

going for the less attractive solutions, in order to obtain better recycling numbers. Recycling domestically would force Governments to report the actual recycling rate, while by shipping the waste out of the country they could claim a 100% recycling rate of the waste, thus making it a more attractive alternative (Martin & Seabrook, 2018). WM does not only include the easy measures and quick fixes, there are also various variables that need to be taken in to considerations such as; environmental issues, political matters, global concerns, cost, society, health, and more (Martin & Seabrook, 2018; McCormick, 2018, Kaza et al., 2018).

2.2 IVAR IKS

IVAR IKS[2] is the regional municipal facilities that operates and constructs the water, waste water and general wastes for 12 of the municipalities in Rogaland. The Stavanger region has had access to a hydro facility since 1865 which later developed into a regional operating facility. IVAR started out as a municipality water provider in 1952 under the name of "IV". In 1979 IV developed in to IVAR and became the regional facilitator of water, waste water, and municipality waste (IVAR, n.d.). For the objective of this master thesis we will concentrate our focus on IVAR´s renovation facility for sorting of MSW. Today IVAR plays a central role in the circulation, sorting, and recycling of goods in the regional area of Rogaland. IVAR is also a leading actor for implementation of improved technology towards a more sustainable waste handling (IVAR, n.d.). We therefore find IVAR to be a central source for this master-thesis.

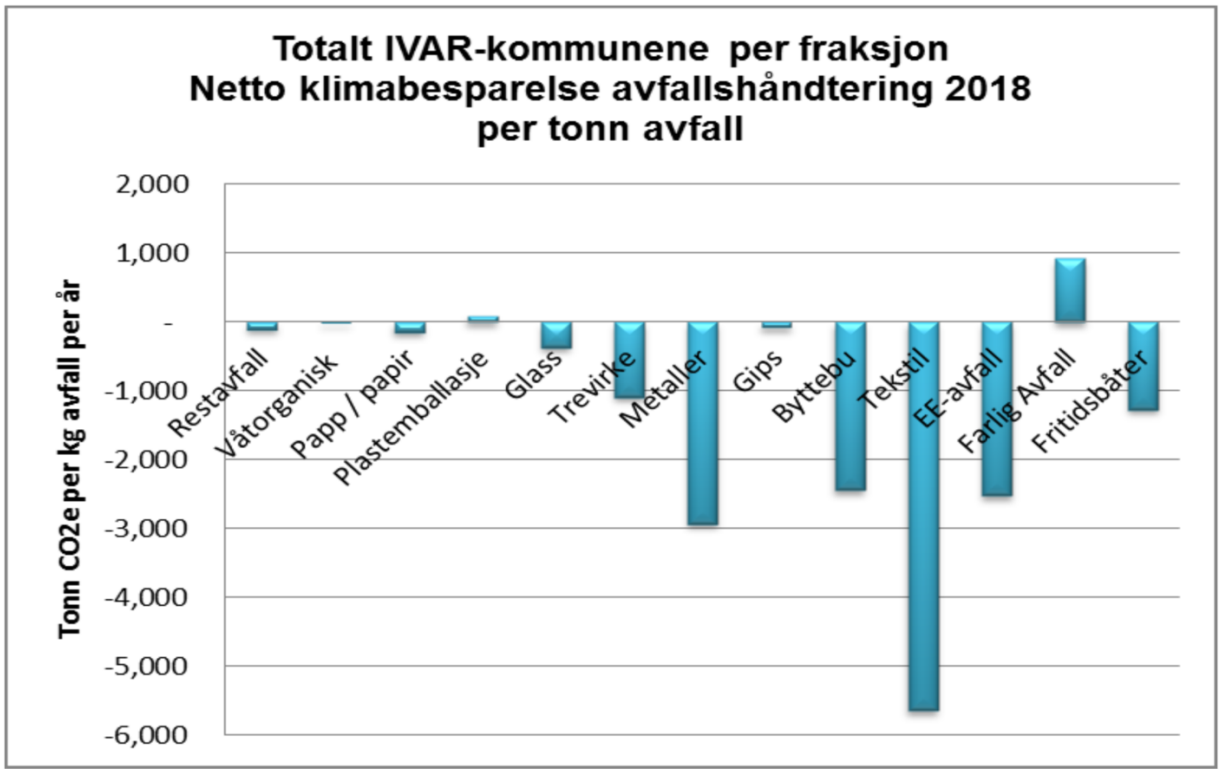
In the response to the attention towards SDGs and EU directives, IVAR MSW facility at Forus was renovated and became the first facility in the world that assembles both processes of cleaning- and production of recycled plastic into granulates within the same facility. The investment in new machinery and renovation makes it possible to do the sorting of recycle materials direct from the assembly line. This new process means, as of January 1st 2019, there is no longer need for the individual household in the regions to do the sorting of plastic and metal. All is to be processed at the facility by advanced machines with Near Infrared light (NIR) that will separate plastic and metal from the general waste to be sent for reuse or recycling. The rest of the waste is being sent to the incinerators for combustion to produce district heating. The advanced machinery is regulated to identify five different types of plastic: PET, PP, HDPE, LDPE, and PS. However, the facility only has the capacity to recycle three of the plastic types

[2] IVAR: *Interkommunalt Vann Avløp and Renovasjon* (Source: IVAR, n.d.)

so far; HDPE, PP, and LDPE. Whereas PET and PS will continue being sent to a German sorting facility (Informant, 2019; IVAR, n.d.).

IVAR´s new facility has become a stepping-stone in the shift towards a CE within its region in Norway, especially when it comes to plastic. Norway has long been a leading country for their established recycling program of plastic (PET) bottles. All disposable plastic bottles sold in Norway are included in the incentive with a prefixed recycle-tax, where the recycle-tax will be returned to the costumer when the bottle has been posted back at a recycling station. The recycling stations are strategically placed around local areas, such as in convenient stores. The incentives also impose all sellers to accept these bottles to be returned in exchange for the recycling-tax. This is also a financial incentive for producers to retrieve back bottles, and will continue separately from the new sorting facility. Historically, there have been no similar recycling incentives for the rest of the MSW. In the 1990´s, the municipalities around in Norway would implement different sorting procedures to increase the incentives for recycling materials. Although there were no financial benefits, the increased awareness for recycling and climate change were motivations enough to continue the recycling programs in individual households. Today IVAR is responsible for having accessible recycling stations around the region. IVAR also provides reuse and recover stations, such as "Byttebuå"[3] for the convenience of reuse and recover still functional goods to be picked up by other consumers (Grønt Punkt Norge, 2019; IVAR, n.d.; Kvitrud, 2019).

[3] "Byttebuå" is the recycling centre of IVAR IKS. Here people can donate well-functioning products which has served its intended purpose for the consumer, to the centre in order for others to pick it up for free or purchase at a lower price.



Graph 1: "Net climate savings for IVAR municipalities per tonne of waste 2018" (Kvitrud, 2019, p. 10).

IVAR´s "climate-account report" of 2018, states that the measures completed for recycling products have a positive outcome of reduced emissions (see graph 1). The high climate benefits for textiles and "Byttebuå" is due to the reuse of products, and the savings of emissions costs of new productions. From this, IVAR highlights the core argument of waste hierarchy that reduction of waste is the most sustainable and environmental friendly solution (Kvitrud, 2019).

2.2 Historic Development of Environmental Focus in Economics

Our society has long been practicing a linear economy which is generally considered as "converting natural resource into waste, via production" (Murray, Skene, & Haynes, 2017 p. 371). Linear economy becomes a process of use-and-dispose which deteriorates the environment from cradle-to-grave (Lacy & Rutqvist, 2016). The linear economy has long been recognized for its lack of consideration for depletion of natural recourses as well as the amount of waste generated (Murray et al., 2017). With the lack of focus of economic environmental considerations, and the increasing focus on sustainability, new ideologies and economic theories have emerged. Amongst these are the Malthusian theory, environmental economics, and CE.

Development of environmental economic thoughts begins with the Malthusian theory that emerged in the late 18th century (Kula, 1997). The Malthusian theory reflected a concern of population growth exceeding agricultural growth, through predicting an exponential population growth whilst the food supply would only increase arithmetically. Malthusian argued for a solution where population control was either controlled positively or preventative. Positive in the meaning of famine and war, while preventative would include measures such as abortion and contraception. Neither of these solutions considered the reduction of individual consumption, due to more modest consumption patterns in the 18th century (Kula, 1997). In 1850s, Henry Thoreau (Thoreau, 1854, in Kula, 1997) built on the economic thought of environmental preservation by being "highly critical of his country's preoccupation with economic growth and consumerism" (Kula, 1997, p. 47). Thoreau (Thoreau, 1854, in Kula 1997) addressed his concern for the environment in regard to the industrial revolution and the technological progress. Furthermore, the late 19th century saw the rise of the American conservation movement and their concern for permanent scarcity. Amongst the notions addressed by the doctrine was the "reckless behaviours towards natural resources such as polluting rivers, [and] excessive reliance on fossil fuel for electricity […]. Even if these deeds are dictated by the pressure of competition or cost-cutting, they cannot be condoned" (Kula, 1997, p. 48). Although this movement had a strong stance on the relationship of economic growth and the environment, it did not include any "economic analysis to study scarcity" (Kula, 1997, p. 50).

The 20th century generated a string of movements and economic thoughts concerning environmental preservation. Amongst these theories was the theory of Environmental Economics (EE). The basis behind all economic theory is the Circular Flow Model (see figure 1), which illustrates the exchange of monetary value and nonmonetary products, in an opposite circular flow. Included in the model is the position of households, firms, a factor market, and an output market, holding all else constant. By holding all these factors constant, some of the factors excluded were technological advances, population growth, and labour productivity (Callan & Thomas, 2013).

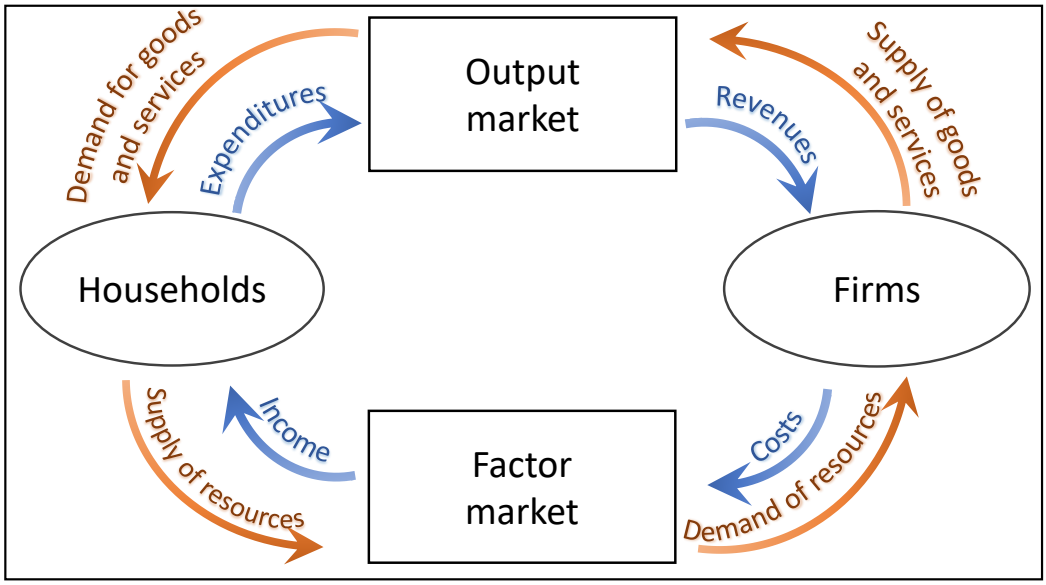


Figure 1. The Circular Flow Model (duplicated from the illustration in Callan and Thomas, 2013, p. 3).

Figure 1 illustrated the circular flow in its simplicity. However, this model excludes the essential role of nature. EE embraces the factor of nature and found it necessary to review the circular flow model. The result of this process can be seen in figure 2, the Materials Balance Model (Callan & Thomas, 2013, p. 5).

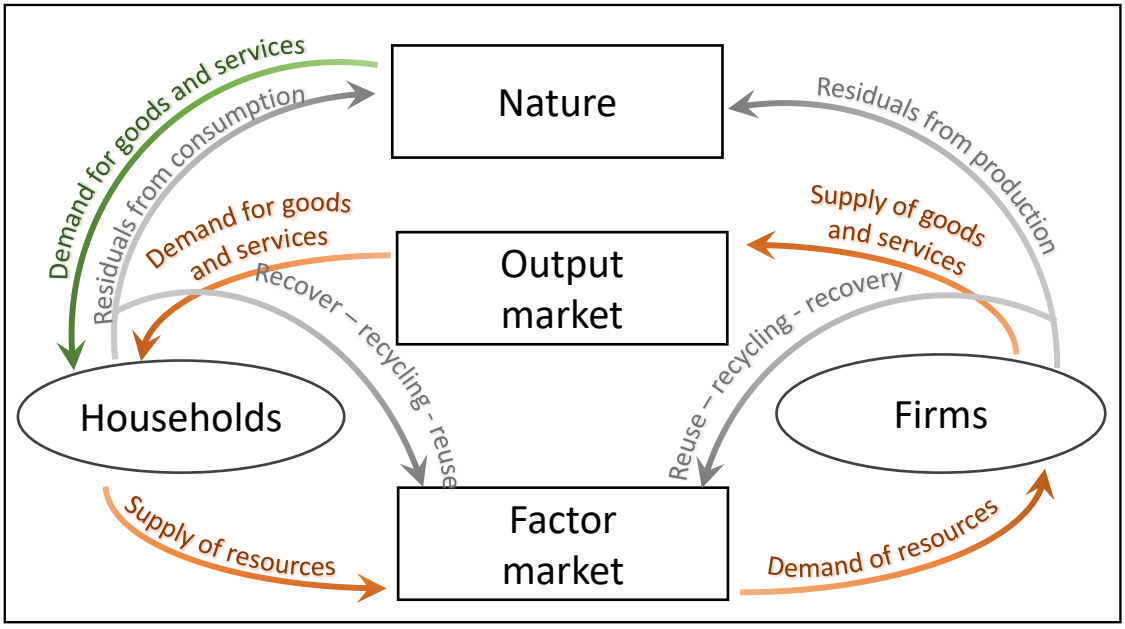


Figure 2. Materials Balance Model (duplicated from the illustration in Callan and Thomas, 2013 p. 5).

The Materials Balance Model includes the extraction of natural resources from nature, where both households and firms return residuals back to nature in the form of gasses, industrial

wastewater, or trash. Additionally, EE recognise that some of the residuals from both households and firms are being reused, recycled, and recovered back to production in the factor marked again. A further expansion and understanding of EE, is the role of the first and second law of thermodynamics. EE takes into account the theory that essentially all matter will eventually be released back into the environment in one form or another, and the energy will be converted and used for something else, although within limits (Callan & Thomas, 2013).

While CE is attentive towards the focus of resource flow, both to- and from the environment, EE is "concerned with identifying and solving the problem of environmental damage, or pollution, associated with the flow of residuals" (Callan & Thomas, 2013, p. 7). The theory classifies two different types of pollutants: either natural pollutants caused by a natural phenomenon (volcano eruption), or anthropogenic pollutants caused by humans (air pollution produced from cars). EE is predominantly concerned with the anthropogenic pollutants because these are the ones that can be accounted for and can be controlled to a certain extent (Callan & Thomas, 2013). The similarity between the two concepts exists in the focus and concern for anthropogenic consequences on nature and natural resources. However, from our understanding CE focuses more on minimizing the influx of materials and products. Environmental economics on the other hand, seems to be more concerned with the optimal utilization and efficient use- and extraction of resources and production, to find an equilibrium between the supplier and the market demand. CE takes a more holistic approach on the importance of residual handling and resource extraction, while EE grasps the anthropogenic residuals from economic growth. Thus, we chose to focus on the concept of CE, and use our understanding of the notion to further explore the role of WM in a new economic setting.

The environmental movements and different economic theories have led to the development of the concept of CE. As a step forward in the direction of a green shift, CE is a concept with partial roots in real implementation. It summarizes the previous economic thoughts regarding the concern for the environment, as well as giving the parameters of the R's as a guideline of how to attain a green shift. It is worth noting that this concept is still under construction, and the implementation is yet to be globally included.

3. Theory

The theory section of this thesis will present WM and CE, and the relationship between the two. The concepts of sustainability, sharing economy, and consumerism will then also be presented due to their relevance in discussion.

3.1 Waste Management

McCormick (2018) addressing the question for defining waste by saying; "nothing is wasted in nature, presenting the question of how best to define waste, which comes in multiple forms and can be addressed in multiple ways" (p.179). Pongrácz and Pohjola (2004) in their article "*Re-defining waste, the concept of ownership and the role of waste management"* present an interesting discussion of how to define waste. The definition of WM can, from a philosophical approach, be discussed through different characteristics. Although these definitions are relevant, we will for this master thesis use Gillespie's (Gillespie 2015, p 8-9 in McCormick, 2018) definition of waste: "any solid or liquid commodity or material that is no longer of use or value to the producer or the owner, and that is either discarded or intended to be discarded" (p.182). We find this definition to be the most applicable description of human waste in our modern society.

The waste problem has been in focus ever since the environment was put on the international agenda back in 1960´s (Wilson et al., 2015). With the consumer society we live in today it is even more important to address good practice of WM than ever before. For instance, Norway generated 11.9 million tonnes of waste in 2014, a total of a 60% increase of waste volume since 1995 (NEA, 2016). With increased waste generations, "waste collection [becomes] a critical step in managing waste, [and where] upper-middle- and high-income countries provid[es] nearly [a] universal waste collection" (Kaza et al., 2018, p.4). Pongrácz and Pohjola (2004) also highlight that "the role of waste management [is to turn] waste into non-waste [and that] regulations are necessary for effective waste management. However, the international regulation of recycling through fixed rates may be economically and environmentally detrimental" (p. 148). Keeping in mind that WM was a $285 billion industry in 2016, and is expected to grow to $435 billion by 2023 (Redling, 2018), there is a rather important global economic impact where the *high-income* countries are able to pursue recycling incentives and better WM procedures. In contrast, the *low-income* countries are only able to collect 48% of waste generated in the cities and collect only 26% of the waste outside of urban areas (Kaza et

al., 2018). The lack of proper WM in these *low-income* countries creates a huge challenge for the local environment and have a significant impacts on health, economy and the global environment. Normally such a poorly managed WM will have a higher down-stream cost than if managed properly in the first place (Hoornweg & Bhada-Tata, 2012). So, even though "financing solid waste management systems is a significant challenge, [it is] even more so for ongoing operational costs than for capital investments, and operational costs need to be taken into account upfront" (Kaza et al., 2018, p. 6).

Proper WM is imperative due to its impacts within a variety of sectors, economics being one and health being another. Lack of proper WM can cause both indirect and direct health implications, as well as environmental degradation. The surrounding population can face health challenges by "ingestion of contaminated water, soil and food" (Giusti, 2009, p. 2230). Additionally, workers in the waste industry will face a direct exposer to hazardous substances, as well as emissions from landfill and incinerators (Giusti, 2009).

Giusti (2009) highlights that the potential of GHG contribution from disposal activities could indirectly cause health effects. Amongst these are the changes in temperature due to low ozone levels[4] and climate change. This would affect those with cardiovascular problems and respiratory issues, as well as increase the chances of spreading Malaria and other diseases. As found in the research, the indirect impact of improper waste disposal can cause great harm while the direct impact is mostly felt by the workers. Furthermore, there is also the concern for inaccurate disposal of clinical waste which poses a greater threat (Giusti, 2009). Amongst the diseases mentioned by Hossain, Santhanam, Norulaini, and Omar (2011) that can be spread through clinical solid waste are Dysentery, Hepatitis, and Cholera. Further concern for environmental degradation is presented in waste leaking into waters, which can cause toxicity and bioaccumulation in animals. According to Misra and Panday (2005), improper WM can also cause birth defects in both humans and animals. These defects have carcinogenic attributes and can even cause death. The environmental impacts include everything from air-, soil-, and water pollution to the ecological impacts- which calls for a change in current consumption and disposal management (Misra & Panday, 2005).

[4] Note that Giusti article is from 2009.

The current way of handling waste and recycling is a stepping-stone towards attaining a sustainable development, although it might not actually be as sustainable as one might be led to believe. In order to keep up with the SDG's and take action, countries need to re-evaluate their current consumption and waste handling, consumers needs to take action for their production of waste, and producers need to produce products which are designed to last, which all reflects the characteristic of belonging in a CE (Kaza et al, 2018).

Some countries have taken direct incentives towards dealing with the current consumption and production of waste in households. Amongst these countries is Sweden, in which the government did an experiment of charging the households based on their waste production. This was implemented through weight-based tariff for waste collection or volume-based tariffs, depending on the municipalities (Andersson & Stage, 2018). The sorting of food waste separately proved to have a similar impact on the household waste generation as either tariffs: "separated food waste collection indirectly signals to households that recycling is important and desirable, and our research suggest that this signalling effect may be as important as direct incentive effects" (Andersson & Sage, 2018, p. 19). The same article by Andersson and Sage (2018) highlighted a survey stating that the households were motivated by separating waste as it gave them a feeling of contributing to the environment, and the public felt a sense of moral responsibility to do so. The same article also noted that individuals felt a sense of improved self-esteem by recycling their waste, as well as increased well-being (Andersson & Sage, 2018). This example from Sweden demonstrates that governmental measures for controlled WM procedures in households made the general consumer more aware of other sustainable activities.

3.2 Circular Economy

The background section highlighted the societal shift over time towards a more environmental conscious economic growth. CE is considered a school of thought which is still under construction and is a notable component for attaining a sustainable progression. Rather than approaching goods and materials in a linear process of "cradle-to-grave", the approach of CE is to manage the goods and materials in the perspective of "cradle-to-cradle". This means that goods and materials do not lose their value in the end of their life, but will continued to be utilized. The essence of CE is to close the loop by reducing inputs and add an output of resources aiming to keep existing resources in the loop for circulation. Closing the loop would avoid depletion and constraint on natural resources, as well as reduce pollutions, while allowing

us to continue our consumption and utilization of already existing products and materials (Winans, Kendall, & Deng, 2017).

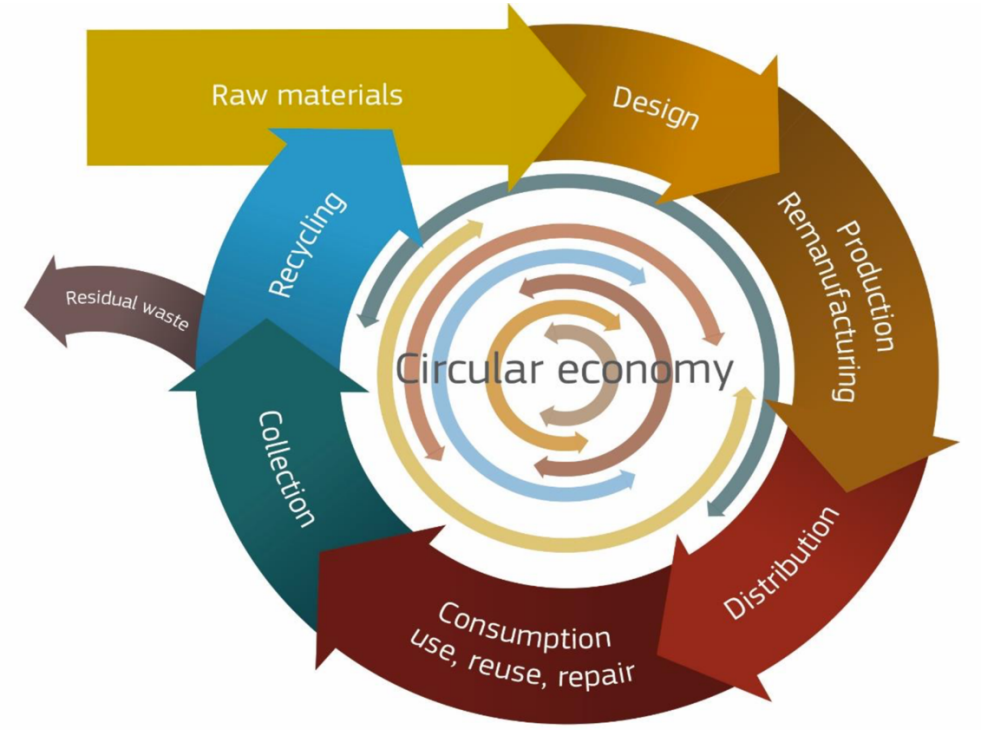


Figure 3: "Conceptual diagram illustrating the Circular Economy in a simplified way" (European Commission, 2018, p. 9).

Figure 3 illustrates the circularity of material flow, where the inputs of raw materials are entering the circulation of design, production, distribution, and consumption. The material will be used, repaired and reused within the consumption stage, before becoming *waste* to be collected. The *waste* is then collected for recycling, limiting the residual waste, and entering the loop again as raw materials. Here, the influx of raw materials will be reduced, while also reducing the residuals exiting the loop (European Commission, 2018). The theory behind closing the loop originates from a belief that there is a more efficient way to utilize already extracted natural resources, and that wasted materials has value (Cobo, Dominguez-Ramos, & Irabien, 2018). Cobo et al. (2018), explain a closed loop to be a process where recycling of a resource is reversible, and explain the concept of "close-loop recycling" with the following example:

> A case of closed-loop recycling occurs when a glass bottle is recycled into a glass jar, because the glass jar could be recycled back into a glass bottle with the same functionality as the original one, whereas recycling PET bottle into PET fibres is an example of open-loop recycling; it is an irreversible process. (Cobo et al., 2018, p. 280)

The processes of downcycling and upcycling within CE, can be compared to the open-loop- and closed-loop recycling concepts. While downcycling refers to the process of recycling a "material into a lower valued product, [will upcycling] involve a change in the fundamental properties of the material, like its physical structure or its chemical composition" (Cobo et al., 2018, p. 280).

Central to the concept of CE is the aspect of recycling, in addition to the ability to reduce and reuse resources. According to Ghisellini, Ripa, and Ulgiati, (2018), a CE is promoting recycling and reuse of "materials, goods and components in order to decrease waste generation" (p. 618). Kirchherr, Reike, & Hekkert (2017) continues by explaining that reduce can be done at manufactory level with increased production efficiency, hence reducing consumption. Reuse is a part of expanding the life of a product by transferring it to a new user that finds value in the product. At last, recycle, which is considered to be "process materials to obtain the same (high grade) or lower (low grade) quality" (Kirchherr et al., 2017, p.224). The principles of reduce, reuse and recycled are often referred to as the 3R's, although much debated, there is the presence of a 4th R[5]; *Recover* (Kirchherr et al. 2017). According to Kirchherr et al. (2017), recovery is referred to as recovering material to energy through incineration and is considered to be both a part of a linear economy as well as an aspect within CE. Recycling, reusing, and recovering of materials can all be interlinked by assuming that if a product can be recycled, it indicates that parts of the product can be reused (although perhaps into something different), and this again indicates that the materials which are being reused have also been recovered. The aspect of *reduce* can then be considered separate from the other 3R's. However, if reduce is not a possibility, the materials can be recovered from waste and recycled into a new product or into

[5] The 4th R will be included in this analysis because we found it to be a re-occurring element, as common as reuse, reduce and recycle in our literature. Thus, it is amongst the most relevant additions to the 3R's given in the literature.

new development. This leads us in to the essence of CE, which is to close the loop altogether (Kirchherr et al., 2017).

The concepts of reuse, recycle, and recover have long been in focus of EE, however the key component of reduce in CE have been left out of EE. The objective for CE is to reduce the consumption of energy input, waste, and emission output, and close the loop on production and consumption of raw materials (Callan & Thomas, 2013; Cobo et al., 2018; Kirchherr et al., 2017). Korhonen, Honkasalo, and Seppälä (2018) emphasizes the economic aspect of CE and state that there should be an economic incentive and *guideline* behind the notion. The focus should include energy, material, and emission control cost, as well as include public image and environmental taxation risk. This will further employment and efficient use of already existing material through a sharing economy encouraging cooperative use of goods and services. According to Lacy and Rutqvist (2015) it is estimated that $1 trillion in waste is lost annually. The economic impact of recycling can be highlighted by looking at plastic packaging material; it is estimated that $80-120 billion is lost to the economy annually of its value. Additionally, 32% of the packaging is estimated to escape collection, and rather drift towards urban infrastructure and the ocean. Only 14% of the collected waste goes towards recycling, where at the end of the recycling process only 5% of plastic packaging is actually recycled (Neufeld, Strassen, Sheppard, & Gilman, 2016). Another economic example illustrating what can be gained in a CE is through the measures done by Walmart. “In 2012 more than 80 percent of its waste was diverted from landfills […] returned more than $230 million to the business” (Lacy & Rutqvist, 2015 p. 58).

According to Stahel (2016), there are large benefits of implementing CE, both economic and environmental benefits. The study conducted on seven European nations found that GHG emission would reduce by up to 70 percent for each of the countries as a result of a shift toward CE. Furthermore, the articles stated that it would increase the workforce by 4 percent, and positively influence Gross Domestic Product (GDP) for a country. Not only is it environmentally and economically beneficial for a focus towards CE, it could also be debated to increase quality of life, as we decrease extraction of raw materials and then pollution as a consequence (Stahel, 2016).

An obvious limitation of looking at CE are the lack of consensus on the definition of the concept. In an attempt to grasp an overall understanding of the concept, and to get an

understanding of areas of development outside of our metanalysis, we went through a number of definitions. The variations in definitions of the term CE will, according to Kirchherr et al., (2017), eventually lead to the collapse of the concept. As we noticed from the definitions mentioned by Kirchherr et al., (2017), few of them included the aspect of consumer responsibility and their consumption of materials, service, and resources. Furthermore, few mention sustainability as a part of the CE vision, as well as disregarded recovery as one of the R's (Kirchherr et al., 2017). Recorded by Ghisellini, Cialani, and Ulgiati (2016) "the promotion of consumer responsibility is crucial for enhancing the purchase and use of more sustainable products and services" (p.19). This implies that there is a need for a prominent focus on consumer processes in the CE, along with concern regarding production and distribution of resources. It is also stated by some authors that reduce is an essential role in CE. If implementations of CE is based on definitions that excludes the part of reduce, reuse, and recycle, then the implementation will be unsustainable and considered "business-as-usual". This is because all of the R's are essential in order for CE to break ground and make a change towards a more sustainable future (Kirchherr et al., 2017).

3.3 Central Concepts

WM and CE are two concepts which both are in need of further exploration in order to assess a definition within the context of one another. The following concepts of sustainability, sharing- and service economy, and the consumer, are essential for proper implementation and relevant for our discussion.

3.3.1 Sustainability

Sustainable development was put on the agenda in 1987 by the Brundtland commission in their "*Report of the World Commission on Environment and Development: Our Common Future"* to raise global awareness of the extraction of natural resources. The Brundtland commission defined: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UNWCED, 1987, chapter 2, point 1). This definition is frequently used today and is discussed as a guideline to prevent depletion of natural resources and global warming. Furthermore, there seem to be some kind of scientific consensus across the Scientific fields that a transition into a sustainable development for the future is much needed (Bray, 2010; Grin, Rothmans, & Schot, 2010).

The approach to sustainable development in this study is based on the Brundtland commission's (UNWCED, 1987) definition, which also happens to be the basis of the UN sustainable development goals. There are 17 SDG where all of the goals are important for future development in order to preserve our natural resources. Most of the goals can, in some way, be directly or indirectly related to CE or WM, however only a couple of the goals focus within the area of impact or action of WM or CE. As we detected from an evaluation of the considered relevant goals, number 12 appears the most applicable regarding WM through a CE perspective. The SDG 12 reflects the interlinkage and co-dependency of WM and CE in the pursuit of a more sustainable economic growth and waste handling (UN, n.d-b). "Goal 12" represents a focus which is central in both WM and CE; reduction of "waste generation through prevention, reduction, recycling and reuse" (UN, n.d-b, target 12.5). Furthermore, the goal augmented for economic growth while reducing consumption of resources, involving "everyone from producer to final consumer" (UN, n.d-b, section 3), reflecting a need for an active participation of all *actors*.

3.3.2 Sharing- and Service Economy

The concept of a sharing economy (SE) is based on a somewhat similar ideology as CE and is a stepping-stone in obtaining the ambitions of a CE. It is essentially optimal utilizations of pre-existing resources, materials, and services. Rather than building a hotel, SE promotes that empty apartments shall be rented out so that others can use it while the original owner is not using the accommodation (Korhonen et al., 2018). According to Korhonen et al. (2018) Finland has an average car use of less than 10%, which poses the question of how to rationalize purchasing or producing a product that will stay unused for 90% of the time. SE represents a way to fully utilize these products potential. The function of SE works through technology allowing coordinated use of the shared product in a digital economy (Korhonen et al., 2018).

By furthering the theory of a sharing economy, one would include the aspect of selling functional services. In this scenario the product ownership is shifted where a company sells the service of a product over a period of time. In which case "the consumer is much less concerned with the performance, maintenance, upgrade or replacement of the goods." (Sauvé, Bernard, & Sloan, 2016, p.55). This is a way to ensure good quality of product and maintenance, especially if the producer is also the provider of the service. "[…] the benefits of durability or reparability can be fully internalized at the product's conception stage. In this scenario, the business model

spurs green design and encourages product reuse–clearly falling within the circular economy framework" (Sauvé et al., 2016, p.55). Examples of these services and its green function is "product lease, per-use fees, and offering a take-back service to ensure that material value is maintained when costumers dispose of products" (Heyes, Sharmina, Mendoza, Gallego-Schmid, & Azapagic, 2018, p. 629).

3.3.4 The Consumer

There is a global consensus on the pressing issue with current consumption, including depletion of natural resources. The UN has developed a focus on sustainability as a universal goal to preserve our resources for a more sustainable future. The various definitions of CE along with the implementation of CE, presents a lack of emphasis on the consumer's behaviour and their role within the theory (Ghisellini et al., 2018; UN, n.d.-a, Vergragt, 2017). According to Ghisellini et al (2018) CE is an economic development that aims "to innovate the entire chain of production, consumption, distribution and recovery of materials and energy according to a cradle to cradle vision" (p. 618).

Modern consumption patterns generate most of the waste challenges faced today, although these challenges are met at different levels and in different substance (Vergragt, 2017). To understand the objects of the MSW management challenges we also need to look further into the consumer as an active participator. Vergragt (2017) highlights the importance of addressing modern consumption patterns and the move towards a more sustainable consumption[6]. Sustainable consumption allocates some of the responsibility for waste handling to the consumer and highlights the importance of awareness for sustainable use, much in the same perception as found in CE. This willingness to adjust consumption behaviour based on awareness and environmental concern is essential for proper circulation of materials. The literature regarding consumerism presents concepts such as "green consumer behaviour" that seem to have a more economic approach where consumption and consumer behaviour are

[6] Sustainable consumption is:

> the use of goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardize the needs of future generations. (International Institute for Sustainable Development 1995, in Vergragt, 2017, p. 309)

measured in value. Such consumerism is based on the belief that the consumer reflects on individual or institutional consequence of green consumer behaviour, and presents environmental knowledge and concern within consumption (Pagiaslis & Krontalis, 2014; Zhao, Gao, Wu, Wang, & Zhu, 2014).

Other similar concepts to CE also focuses on minimalizing waste and our impact on natural resources. Amongst these is the zero-waste movement, and concept of minimalism. According to Song, Li, and Zeng (2015), a zero-waste system is concerned with reuse of materials in a circular manner, and includes the aspects of reduce, reuse, and recycling. The concept has gained momentum in some households where the goal has been to have "zero waste", encouraging the disinvestment from plastic products and packaging and rather focus on conscious consumption (Song et al, 2015).

The concept of minimalism is not new, however the increasing popularity of the movement of *minimalism* is a more modern way of living. Although there is no clear definition of the movement, it is considered as a lifestyle containing limited articles of clothing and goods. It focuses on conscious behaviour, in order to minimize consumption where you only surround yourself with things you need in life (Millburn & Nikodemus, n.d.).

4. Method

Both WM and CE have an inherent focus on waste, although the processes of doing so are different in the two perspectives. We therefore found it interesting to look at the two concepts within two different fields of study; literature and practical appliance, to best answer our research questions. By conducting a literature meta-analysis, we were able to study the relationship of WM and CE, and additionally gain a better understanding of WM role in the concept of CE.

The method section will first go over the criteria and limitations of our literature review, before presenting the case study of IVAR. The literature metal-analysis and the case study are both conducted to assess the relationship between the concepts of WM and CE.

4.1 Literature Review

We applied different qualitative methodological techniques to gain knowledge and understanding of the two subjects of WM and CE in order to better answer our research questions.

First, we made a general literature review of WM and CE to explore the two subjects and to gather relevant literature for our research. Our general literature review was prepared mainly through a web search in the search engines Google, Google Scholar, University of Stavanger library server; Oria, Science Direct, and YouTube. Following the general evaluation of these search engines, we applied a more methodological approach- through a context review. By applying this, we were able to focus our literature search towards more relevant secondary sources in the form of research reports and publications, public reports, and scholarly books and publications— mainly concentrating on the two concepts of WM and CE. The context review allowed us to investigate the link between the two concepts and study the state of WM in the context of CE. Furthermore, the process of the context review amended to set the boundaries for the literature used in our meta-analysis (Blaikie, 2010; Neuman, 2014).

Our next step was to apply a literature meta-analysis. The meta-analysis, being a qualitative methodological tool for categorizing our research, was conducted with the purpose to study the relationship between WM and CE. Gerco, Zangrillo, Biondi-Soccai, and Landoni (2013) describe a meta-analysis to be a “powerful tool to accumulating and outline summarize the

knowledge in a research field, and to identify the overall measure of a treatment´s effect by combining several conclusions" (p.219). According to Neuman (2014), a literature meta-analysis is "a special technique used to create an integrative review" (p.126), and describe an integrative review to be "a common type of review in which the author presents and summarizes the current state of knowledge on a topic, highlighting agreements and disagreements within it" (Neuman, 2014, p.127). Through applying a literature meta-analysis, we were able to explore the correlation between WM and CE by making a bibliometric cataloguing of the selected literature. This was done manually by reading through the abstracts of our selection, and then record our findings into an excel sheet (appendix 3). This cataloguing was then used to analyse and measure the text to identify patterns, common perceptions, and how the scientific community use these concepts. The literature meta-analysis made it possible for us to better observe the development of WM, CE, and the connection between the two concepts. This was used to build a more reflected background knowledge of the current status of the two concepts, while exploring the various theoretical perspectives and challenges (Geissdoerfer, Savaget, Bocken, & Hultink, 2017, Neuman, 2014).

However, there are some limitations of pulling data through a meta-analysis. Countless of meta-analysis can be performed on the same topic by various researches, with a slightly different purpose in each research, producing completely different outcomes. According to Greco et al. (2013) there are small margins for errors when conducting a meta-analysis, as "even small violation of certain rules can [result in a rather] misleading conclusion" (p. 219). In conducting a meta-analysis there will be several decision-making processes to set the design and will therefore require some personal judgments and expertise. The challenge is not to make these decisions out of personal preferences and expectations that will affect the result (Greco et al., 2013). Our advantage for this study, is that we are two Master students (with completely different backgrounds) doing this research, and are therefore able to check in on each other's work, making quality checks for personal bias errors. The entire process was documented in excel (see appendix 3), to monitor the process and to keep control- and checkpoints for clearing out errors.

The selection of literature played an important role for our meta-analysis, to ensure the validity of the study. Hence, the study was conducted based on scholarly secondary sources, through a collection of scientific articles. Scientific articles, or as Neuman (2014) call them: 'Scholarly

Journals' are "'peer-reviewed'[7] reports of research" (p.130), which are often cited by other students and in other scientific publications. Focusing on research articles would give a more scientific base to build our analysis and research on, and the preferred search engine was sciencedirect.no, as this gave us the option to restrict our search within scientific articles (Neuman, 2014). Furthermore, we chose to focus on reading the abstracts (and highlights, if enclosed) of research articles. This decision was based on the assumption that "[…] the abstract must be able to stand alone in presenting a clear account of the methods, results and conclusions that accurately reflect the core components of the full research report" (Rice et al, 2016, p.1). However, restricting the reading to the abstracts brought some limitation to our study. The challenges for reading just the abstracts and highlights of the articles in our selection has it limitation in that "the simplified summaries can give an incomplete or distorted picture of a complete study. Researchers must locate the original scholarly journal article to see what the author said and the data show" (Neuman, 2014, p. 129). This presents the challenge of capturing the essence and relevance of the articles whilst reading only their abstracts. The restraint to this is that the relevance is solely determined from the abstract and presents a risk of missing out on fundamental data for our analysis. We still, however have found the abstracts to be efficient and representative enough to conduct a literature meta-analysis for this thesis.

Our findings from our literature meta-analysis will be compared against a real operation of WM. Our next step is therefore to conduct a case study of the regional sorting facility, IVAR IKS.

4.2 Case Study

A case study is a form of social science research that stands out in which that the focus of study is to investigate the "contemporary phenomenon (the "case") in depth and within its real-world context" (Yin, 2014, p.16). Our choice fell on the regional waste facility, IVAR IKS. Due to the scoop of the study, we sat the boundaries to only include IVAR´s new waste sorting facility at Forus, with the main focus on MSW and their recycle process of plastic. While plastic is not

[7] Neuman (2014) argues that only 10% of research articles pull through the "peer-review" and get published by the most Prestigious journals. The rejection rate is higher in the social science than other academic fields and is caused by an increasing rigid review process where standards are raising and the expending of studies (Neuman, 2014, p.131).

the primary focus within our research, we see it as the most assessable example for our discussion.

We were able to secure an informant within the company- which provided us with a primary source of data to our case study of IVAR. Our Informant is the facility manager at IVAR, who has a broad expertise of the waste industry. The Informant works specifically within WM and could provide us with inside knowledge of waste industry outlook on CE, as well as the regional incentives done to implement a CE. The Informant was given the "informant for master thesis" letter and signed the "samtykkeerklæring" (see appendix 2). We conducted a semi-structured interview[8]. The form of a semi-structured interview allowed us, as researchers, to keep a direct focus on the Informant and to direct the subject of the conversation within the borders of WM and CE in guidance of our interview guide (see appendix 1). As our conversation was not bound by structured questions, we were able give our Informant the freedom to fully expand on his reflections and observations of the subjects. However, to keep within the scope of our thesis, we formulated specific questions to acquire more essential point and observations (Galletta, 2013). We were also able to collect important data of IVAR directly from our Informant, such as the GHG budget, and other unpublished reports related to IVAR. We completed our case study with a combination of interviews and document analysis.

We acknowledge that there lies a limitation in building a case study around a specific area of IVAR. A further limitation within the scope of this study is whether IVAR´s observation of the waste industry, and the role of CE, reflects the same throughout the industry. If the case study was the main purpose of research within this thesis, it would be beneficial to use a "multiple-case design[9]" to confirm our findings. However, the purpose of this case study is to compare and discuss the findings from our meta-analysis. We believe that the case study of IVAR is representative enough for our discussion, but would recommend a broader research for future exploration of the topic.

[8] "Characteristic of its unique flexibility, the semi-structured interview is sufficiently structured to address specific dimensions of your research question while also leaving space for study participants to offer new meanings to the topic of study" (Galletta, 2013, p. 1-2).

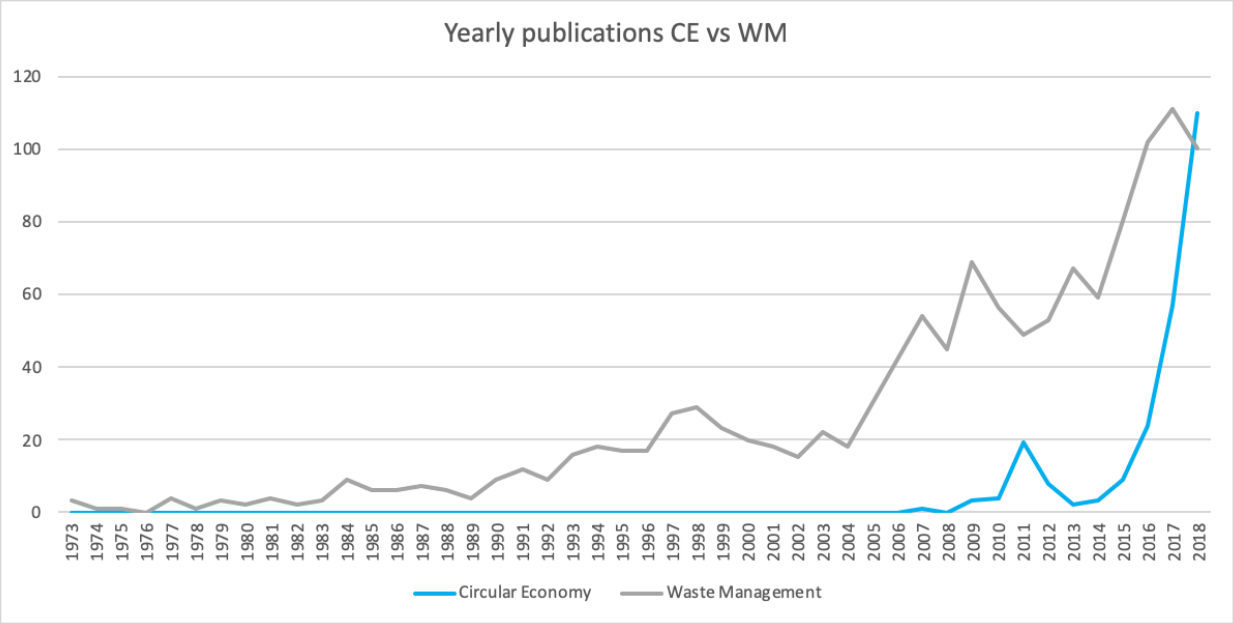
[9] "multiple-case study: a case study organized around two or more cases" (Yin, 2014, p.239).

5. Results and Discussion

The following section will first explain the results from our literature meta-analysis and highlight the commonalities between the two concepts of WM and CE. Completed though a statistical- and a frequency appearance of selected keywords, this will enable us to compare the correlations between the two concepts. The results from the literature meta-analysis is followed by the case study analysis of IVAR. The case study contradicted some of the findings in our literature meta-analysis and is discussed in the following section, including the relevance of the 4R's within both concepts. The results, analysis, and discussion from our selected methods will provide a basis for a merged discussion of the findings, which will be discussed in the last part of this chapter.

5.1 Literature Analysis

The literature analysis was conducted to explore the relationship between WM and CE. The first search in sciencedirect.no was based on articles with "waste management" in the title, including the publication year of 2018, which provided a result of 1249 research articles. The same search for "circular economy" (in the title) gave us a search result of 240 research articles. When analysing the difference of result for our first search, we recognised the subject of WM to be a practice of history, and CE to be a more recent term. We therefore made a methodological search to document the publication years of the articles to set our range for the search parameter. Graph 2 clearly illustrates that the majority of CE publication ranges from 2008-2018.



Graph 2: Yearly publication of scientific articles with CE/ WM in the title.

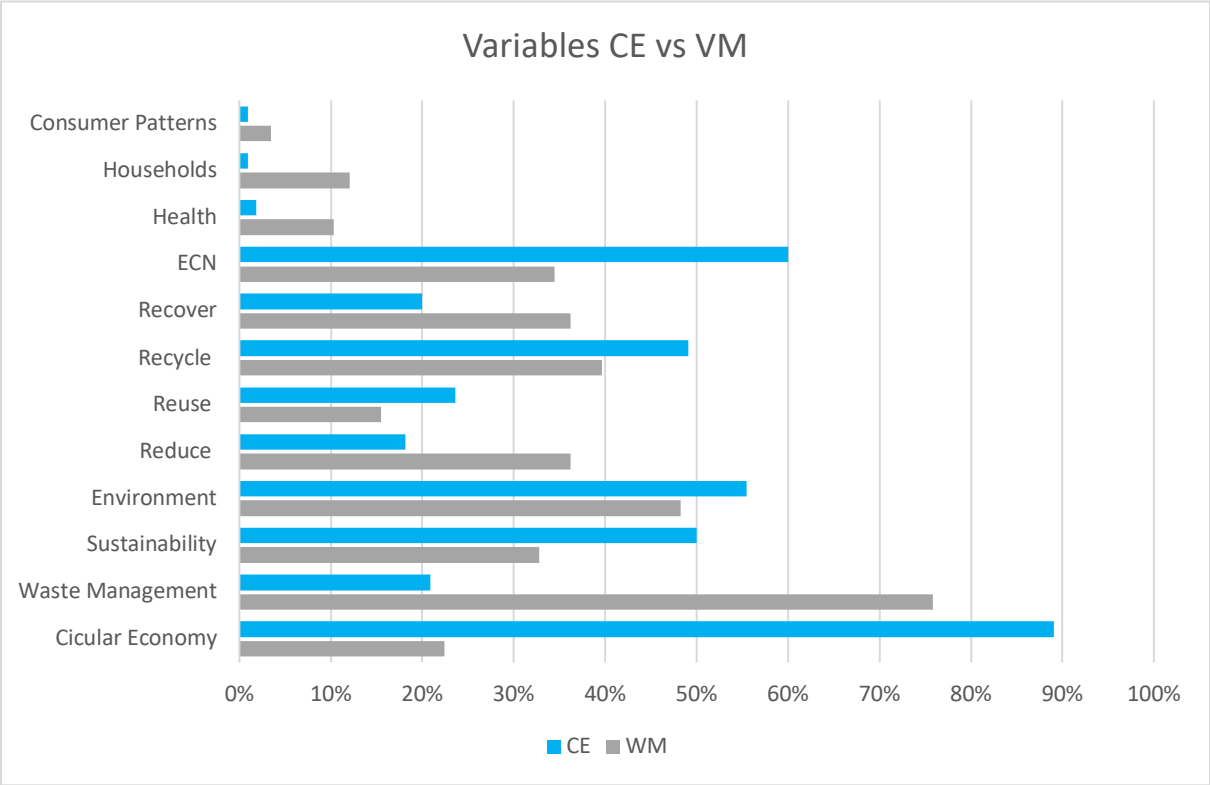
Our next step was to narrow down our search result to only include relevant literature. While both WM and CE are subjects of this thesis, we made two searches with following limiting parameters: 1st search: "waste management" in the title and "circular economy" in the text, limited to publication year 2008-2018, and got a result of only 61 articles. 2nd search; "circular economy" in the title and "waste management" in the text, limited to publication year 2008-2018, generating a result of 120 articles (see table 1 for details). The total of 181 articles established our selection for our literature meta-analysis.

Search within scientific articles	**"waste management" in title**		**"circular economy" in title**	
Publication date including end of 2018	1249		240	
Year 2008-2018	**791**	63 %	**239**	100 %
Year 2008-2018 + "circular economy"/"waste management" (respectively) in the text	61	8 %	120	50 %

Table 1: Search for scientific articles with "waste management" in the title, first selection, within the frame of publication year 2008-2018, and second with "circular economy" in the article text.

However, our selection represented some articles which only mention either WM or CE in the reference list and excluded the concepts elsewhere in the article. A total of 3 articles appeared in both WM and CE search result and were included in both results to avoid error. The cleaning of the data left us with a total selection of 168 articles (WM: 58, CE:110) for our literature meta-analysis.

Our selection was then pulled through a methodological bibliometric cataloguing of the frequent use of CE main keywords; reduce, reuse, recover, and recycle. We also wanted to catalogue different variation of sustainability, consumer roles, economics, and health, recognizing these keywords to be: sustainability, environment, consumer patterns, health, and household. The results of the frequent use of the mentioned keywords are recorded in graph 3.



Graph 3 : Result of the frequent use of key-words.

In addition, we also documented the articles mentioning the concept of WM and CE in the abstract (graph 3), to give an indication of how relevant the concepts were for the articles. Through our analysis we noticed some differences between the two searches set for our selection of data for literature meta-analysis. Even though the selection was collected through the same literature meta-analysis, we decided to keep the two search-result divided for our analysis to better understand the dynamics between the two concepts.

By analysing table 1 we can see an indication of a literature gap in our selection. The literature is less focused on CE in WM literature (8%) than WM in CE literature (50%). However, the literature meta-analysis gives us a result of 22% of the articles with WM in the title mentioning

CE in the abstract, whilst 21% of the articles with CE in the title mentions WM in the abstract. This indicates that WM does not stand as central within CE research literature as first predicted (table 1). The literature and ideology of CE highlights the importance of proper WM handling for a more sustainable development. Our literature analysis demonstrates that there is less focus on WM in the study of CE research, emphasising a literature gap between CE theory and CE research literature.

Another surprising finding was the rather low focus on health, households, and consumer patterns within both sectors. Regardless of this outcome, WM should, according to literature, have a central focus on proper handling of MSW, due to issues regarding health and hazards. This aspect has proven to be less relevant within WM or CE according to the research we have conducted. The lack of focus on health within both concepts in literature can be detrimental, as managing and recycling of goods can cause harm if not properly handled. Thus presenting a need for a larger focus on health in CE, especially considering recycling and the reusing of goods which can carry a heavy burden of toxic material or other hazards. Additionally, the lack of emphasis on consumer or household in both WM and CE shows a literature gap regarding the consumer as an active participant within either concept.

The environmental focus differentiated between the two concepts, although not significantly. This focus can be linked with the surge of environmental economics and importance of considering the environmental consequences of economic growth. The publications we looked at, presented different economic and financial concerns. Cost, revenues, financial, tax, and cost efficiency were all included when considering which of the articles mentioned economics in the abstracts, whereas “circular economy” was completely disregarded under economics as it was already accounted for in its separated category. 34% of the WM selection had an economic focus, although this was in regard to cost reduction or economic gain for implementing environmentally friendly WM incentives. Even the result of 60% for CE articles with a focus on economic concepts or any economic indication within the abstract is also relatively low. We expected a higher focus on economics amongst our selection, both due to WM being a $285 billion industry and CE for being an economic discipline and a criteria for our selection. However, WM, CE, and economics can all be considered interlinked, as our texts indicated that economic incentives have a large impact on behaviour towards waste handling, both from a consumer and business perspective.

The literature review indicated a neglect of WM in relation to CE research literature. Additionally, the analysing results of table 1 indicate a literature gap between CE focus in WM research (8%) and WM focus in CE research (50%). We therefore found it crucial to include the keywords of CE; reduce, reuse, recycle, and recover to our literature meta-analysis to compare if this negligence also applied for the keywords. The sustainable development goal 12 focuses on reduction, recycling, and reuse. It was therefore vital to include the aspect of sustainability in our analysis to assess the concern and attention in literature allocated to future generations through sustainability. The results are illustrated in table 2. The separated table is to demonstrate the correlation between the articles with WM in title and the articles with CE in the title. The frequent use of the key-words recycle, reuse, reduce, and recover present with similar importance in the two concepts.

Key-words	"Waste Management"		"Circular Economy"	
	Abstract	Search in selection	Abstract	Search in selection
Recycle	40 %	97 %	49 %	98 %
Reuse	16 %	75 %	24 %	88 %
Reduce	36 %	98 %	18 %	94 %
Recover	36 %	82 %	20 %	65 %
Sustainability	33 %	80 %	50 %	93 %

Table 2: Appearance of CE key-words. The table provides an overview of articles containing the key concept of CE. "Abstract" is the percentage of our selection containing an appearance of the key-words in the abstract. "Search in selection" is the percentage our selection containing an appearance of the key-words anywhere within the article, not restricted by the abstract.

Table 2 summarises the results of our cataloguing of the key-words for CE. Our finding in our literature meta-analysis presented a higher frequent use of the key-words than the focus of WM and CE in relationship to one another. However, we decided to make a comparison to see if the utilisation of key-words within the articles mirror the same result from our literature meta-analysis. As portrayed in table 2, there is a significant difference in appearance of the key-words through our selection, compared to those only recorded in abstracts in the same selection. This is used as a reference point in assessing the significance of the key-words within the concepts of WM and CE research literature. "Recycle" appears amongst the most popular key-word within both concepts; with an appearance of 97% (WM) and 98% (CE). This signifies a large focus on this aspect within both concepts. Closely followed by "Reduce" with 98% (WM) and 94% (CE). However, the aspect of "Reduce" presents the largest gap between amount of

abstracts mentioning the term and that of articles. This is because reduce is often mentioned in connection with energy reduction, cost reduction, and emissions, which can be excluded from the abstract as it might be considered a consequence of CE as well as in WM. The results from our analysis within WM indicates a large focus within the 4R's; reflecting a focus within the same areas as CE although the concept of CE itself might not be mentioned in the articles.

Sustainability had a 50% appearance in CE, and a 33% presence in WM. The different focus in the two concepts can be linked with the increased popularity of CE as a result of the focus points within sustainability. The sustainable development goal 12 focuses on reduction, recycling, and reuse. It was therefore important to include the aspect of sustainability in our analysis to assess the concern and attention in literature allocated to future generation through sustainability.

CE has gained popularity as a response to sustainable development and is a concept that affects all sectors. We therefore recorded which sectors the articles were referring to, in order to assess the focus areas in both WM and CE. We recognised there to be 5 categories[10]:

1- Policy, municipal responsibilities, and research
2- Energy sector
3- Construction, manufacturing, and producers
4- E-waste
5- Organic waste and chemistry

Sector	WM	CE
Policy, municipal responsibilities, and research	45 %	37 %
Energy sector	9 %	5 %
Construction / manufacturing / producers	17 %	41 %
E-waste	10 %	7 %
Organic waste / chemistry	19 %	9 %

Table 3 illustrates the allocation of articles within each sector, roughly categorized based on similarities of subject and area of research for each of the articles.

The first category contained public incentives and research of the concepts itself. The second was the least popular category- concerning energy. This can be explained by its common pairing

[10] Numbering the categories were used as a guideline for categorized sectors of the excel sheet in the appendix 3.

with sector five regarding organic waste or circulation of bio-waste to energy and was therefore difficult to adjust for. Organic waste was discussed in a circular manner in articles containing WM and CE, reflecting an interest for waste circularity within both concepts. Sector three was the most popular sector within CE, as it contained the major categories of research regarding material recovery. Private business and the production aspect were included in this category, which also incorporated the construction sector and manufacturing. Finally was the category of e-waste (sector 4), another small sector but with a very specific target. Shown in the results, both concepts of WM and CE have a similar distribution of focus; although CE presented a higher focus within industrial production sector. The categorization of the sectors can be considered a limitation within the study, as it was conducted based on similar attributes and focus in the articles, rather than including the widespread variety of sectors.

Although the relationship between the two concepts were not as central within the literature meta-analysis findings, our research showed that the concepts have a lot of commonalities within their focus. Some of the limitations within the relationship of WM and CE are rooted in the undefinable definition of CE, which presented a further challenge of assessing WM role in CE through the literature. This can be explained by the gap in CE theory and CE literature. In CE theory, the aspect of WM is central in implementation, whilst the literature only presents a 21% significance. Furthering the relationship between the two concepts is the focus on certain aspects of CE such as reuse, recover and recycle within the concept of WM. Both concepts presented a lack of consumer or household focus, which we will compare against the applied operation of IVAR, and have a closer look at what role WM plays for implementing CE into the process.

5.2 Case Study of IVAR

IVAR´s sorting facility practices multiple WM procedures for the different materials collected from our MSW. The implementations of practice appear to have adapted some of the CE ideology, particularly for the process of the mass-flow for plastic. It will therefore be beneficial to look at the plastic process of the sorting facility of IVAR to compare against a CE approach.

IVAR IKS own “flowchart of mass-flows for Forus waste recycle facility” (provided by our Informant at IVAR, 2019) gives a clear overview of how the MSW is sorted at IVAR´s waste facility (see appendix 4). We have captured the plastic flow at Forus recycling facility in table 4 below.

Plastic flow at IVAR IKS sorting facility						
Type of plastic	Sorted plastic		Washed granulate for production		Residues back to combustions	
	tonnes	% of total waste 66250	tonnes	% of total sorted type of plastic	tonnes	% of total sorted type of plastic
LDPE	4773	7,2 %	3102	65 %	1671	35 %
HDPE	826	1,2 %	636	77 %	190	23 %
PP	1445	2,2 %	1098	76 %	347	24 %
total recycled at IVAR	**7044**	**10,6 %**	**4836**	68,7 %	**2208**	**31,3 %**
PS	*288*	*0,4 %*				
PET mix	*965*	*1,5 %*				
Mixed plastic 2D	5570	8,4 %			5570	100 %
Mixed plastic 3D	2106	3,2 %			2106	100 %
Total	**15973**	**24,1 %**			**9884**	**61,9 %**

Table 4: Plastic flow for IVAR IKS sorting facility, a summary of IVAR IKS own "flowchart of mass-flows for Forus waste recycle facility", see appendix 4 (Informant, 2019).

A total of 66 250 tonnes waste goes through IVAR sorting facility on Forus. 24.1% of the total waste is sorted out and recognized as plastic, see table 4. Looking at the flow-stream for plastic, only 44% *(7044tonnes/15973tonnes)* of the sorted plastic is LDPE, HDPE and PP, leaving a total of 7044 tons plastic for the recycling process. After it is washed and cleaned, IVAR is left with a total of 4836 tons granulate to commercialize, whereas 2208 tons is sent back for combustion. This means that only 30.3% *(4836tonnes/15973tonnes)* of all the sorted plastic at IVAR is being recycled at the facility. There are different underlying reasons for this low recycling number, according to our Informant. The first challenge is the mixed plastic; both 2D (foil) and 3D (objects). These plastic products present a challenge due to the lack of a process solution and demand on the market, and are therefore sent to incineration. The second challenge is that even though PET and PS is sent to be recycled in Germany (marked with green text in table 4), the plastic manufacturers will only purchase and use clear PET in their production. An additional challenge to this, is that most of the PET that comes in contains coloured trays. Even though the facility can sort out all the PET, the machines are set to only to sort out the clear PET. Our Informant acknowledges that this challenge creates more awareness for the "upstream" of the process and encourages IVAR to look "downstream" and educate the producers to not use coloured plastic in their products. While the Informant considers the waste industry as only a small part of CE with limited influence, this case shows that the waste industry holds a bigger role in CE. Our Informant contradicted the statement regarding WM role in CE, by stating the waste industry needs to recognize their importance in a CE and learn

to look both “upstream” and “downstream” in their supply chain. The third challenge for the plastic recycling process is the use of the colour black in plastic, as well as use of paper labels on the plastic containers (e.g. yoghurt containers). The colour black and paper labels make it difficult for the machines to detect the plastic and will therefore not be sorted out but rather proceed as regular residues sent to the incinerators (Informant, 2019).

The effect of the measures for recycling plastic can be debated. The industry has allocated large resources for the construction of a proper facility for this handling, as well as the environmental impact of this construction. Additional reasoning’s for the effects to be debated, is that only 30.3% of the separated plastics actually end up as recycled plastic in the form of granulates. A total of 61.9% (containing mixed plastic 2D and 3D, and residues form the recycle process) of the separated plastic finds its way back to the incinerators, while the remaining 7.8% *(PS+PET: 288+965 /15973 tonnes, see table 4)* are shipped off to Germany for recycling.

A continuing limitation of the facility are the buyers of recycled plastics (referred to as Producers). The Producers have specific requirements for what recycled plastic they wish to include in their production. The specifications exclude large amount of eligible plastic that could have been recycled and reused if there was a market for it. For instance, Producers will only purchase granulates from clear PET; creating no marketplace for mixed plastic, the main reason why all 62% of sorted plastic is being sent to incineration. However, the Producers who set the limitations of which plastic can be recycled through their demands for only clear granulates, can increase the recycling rate by agreeing to include coloured recycled granulates in their production; accommodating for more reused and recycled plastics. Furthermore, the Producers can play a more active role in CE by adjusting their production of plastic to hold the attribute of which they are willing to purchase. This will mean producing clear plastic, of which the characteristics of plastic stays recyclable, and can be purchased for reuse.

IVAR´s process of adjusting to demand demonstrates a consumer awareness within the waste industry by only recycling and “producing” plastic granulates which will be reused. In this case, IVAR is being responsible for reducing the waste of material produced, although it still sends fully recyclable plastic to incineration. The process of Producers to adjust to this demand is essential in order for CE to be implemented, as well as it reduces waste and energy used for unnecessary recycling.

Last, but not least in the discussion about IVAR facility and plastic recycling is the representation of technology. In order to maximize recycling of plastic, technology should be developed towards sorting all plastic by both type and colour, to adjust for demand. The development of technology and information regarding waste handling can be shared through information hubs, as proper waste handling will serve to benefit all, including the aspect of cost. Our Informant highlighted that with current technology, everything is possible- but the most important factor is cost and the willingness to pay for that solution. If we were able to adjust the demand for recycled plastic towards being economically beneficial to recycle all plastic, then the plastic loop would be completed in full circulation.

According to our Informant, we are moving towards a change as the EU are working on a new directive for how to report numbers for recycled plastic. For instance today, when the companies deliver sorted plastic to the facilities for recycling, they can report 100% recycling of plastic. However, as can be seen from our analysis of the IVAR sorting facility, only 30.3% of this plastic actually ends up as recycled "raw material" for production and commercialization. If the new directive from the EU is implemented, where reports contains the actual number of recycled plastics, we will then see a large change in reported recycling numbers across all sectors. The pressure for delivering better recycling numbers might push for technological improvements and a higher willingness to pay for recycling plastic, than what is apparent today.

Although IVAR has implemented a variety of measures regarding waste handling and recycling of plastics, there is still room for improvements. The role of WM in CE, in practice, is attempted at IVAR through recycling and recovering of materials, nonetheless the firm has limited control over the aspect of reuse and reduce. However, the company identifies reduce as the best solution to our waste challenges, and has created a "Byttebuå" in an attempt at reducing waste and continuing utilization of functional artefacts (Kvitrud, 2019). Despite their efforts for maintaining "Byttebuå", IVAR have minimal control over consumer's exploitation of this opportunity. The role of IVAR in a CE contradicts the findings in our literature meta-analysis, although it builds on the CE theory. We will therefore explore this further in the next section of our discussion, where we will compare the findings from our literature meta-analysis and the case study of IVAR.

5.3 Discussion of Literature Review and Case Study

The reduction of waste and awareness towards recycling are amongst the priorities of CE theory and are important for both health and the environment. Making the consumer aware of their responsibility regarding WM is one of the steps within CE that needs to be properly addressed in order for implementation. The example of Sweden demonstrates that governmental measures for adopting consumer responsibility of WM procedures, made the general consumer more aware of other sustainable activities (Andersson & Stage, 2018. p.19). The measure was to improve WM and to "mitigate the scarcity issues of landfills capacity" and GHG emissions (Hoogmartens, Eyckmans & Van Passel, 2016, p. 345). While the governmental initiatives were not directly related to CE, the policies implemented were amongst the key concepts of CE: reduce and recycle.

The literature meta-analysis presented a gap between CE theory and CE research literature, where the theory presented WM to have a more central role within CE than reflected in the CE research literature. This mismatch between CE theory and CE research literature is present in the undefined definition of the concept of CE and the lack of direct guidelines of how to move forward. The explanation and assessments of WM's role in CE is therefore hard to grasp and varies within CE research literature. However, as can be seen throughout the literature meta-analysis WM and CE shares great deal of commonalities; from focus and concepts, to an ideology for a more sustainable development. We can therefore assess the presence of a significant relationship between WM and CE research literature, which is also reflected between CE theory and WM in practice. There is a mismatch of the case study of IVAR and the research literature. Our case study exposed that the CE research literature does not properly reflect what is actually implemented within the waste industry (at least not in Norway). Instead, our Informant echoed a desire for the WM industry to play a role in implementing CE through WM policies, although the Informant did not consider this feasible under the current conditions. However, both the literature meta-analysis (see table 2) and the case study, verified a central focus on recycling, reuse, recover, and a wish to reduce within the waste sector in order to implement a CE.

5.3.1 Recycling

The literature meta-analysis indicated a great focus within the concept of recycling (WM:40%, CE: 49%), which can be paired with IVAR's focus regarding recycling of materials at their

facility. Recycling has long been a preferable practice of WM in the work of preventing waste accumulation. However, recycling alone is not enough for circularity, as there are other actors within the system that influences the ability to recycle, as well as the financial and technological obstacles. The concept of CE has a concern for the environmental impact of economic growth and considers the circulation of products as less impactful on the environment than production and extraction of new materials. However, the recycling of products does not necessarily avoid all negative impact on the environment. Recycling of waste can acquire a significant environmental footprint for the production of machinery, construction of facilities, and emissions during the process of recycling. Although the impact might not be as significant as the production of new materials, recycling is one step closer. What is needed is the overall coalition of the R's.

5.3.2 Reuse

Sharing- and service-based action can be implemented to reuse resources and reduce the input of new products to the market. One example of this, according to our Informant (2019), is the shift towards a service-based economy in large corporations. For instance, instead of purchasing copy machines which have to be maintained, repaired, and replaced by the cost of the owner, the consumer will buy the service rather than the hardware. This shift in the economic market encourages service companies to invest in quality equipment for an extended lifecycle. These investments in higher qualities generates larger economic investments and make repairs more beneficial. Our Informant (2019) noted that such service-minded development also increased the interest in reuse of materials and parts from scrapped equipment, to repair and maintain functional ones. This circularity of equipment parts contributes to a reduced waste generation. Although the service-based economy is not a direct response to CE, its concept contributes to a CE. Furthermore, our Informant (2019) predicted a shift to a more service-based society; where the service-based economy will merge into other industry fields. The aspect of reuse can also be interlinked with IVAR´s implementation of "Byttebuå", where people can bring discarded-, but completely functional goods, to be passed on to a new appreciative consumer.

5.3.3 Reduce

Our literature meta-analysis revealed a more substantial focus on 'reduce' than first anticipated (see table 2: "abstracts"- WM 36% and CE 18% vs. "search in selection" - WM 98% and CE 94%), although its significance was mostly paired with reduction of emissions, cost, and

energy. Our results indicated that the aspect of 'reduce' in households or on consumer level was mostly disregarded. The literature was predominantly focused on the energy sector when it came to the concept of reduce. The focuses of reduce in both literature and practice can be improved upon. We believe that an increase of focus within reduce in literature, will affect the focus of reduce within production and consumption, seeing as awareness is the key when implementing new concepts and policies. Although IVAR has limited control over the production of waste within industries or households, there are still actions which can be implemented in order to educate the public and influence their behaviours. Furthermore, there are opportunities for policy makers to take preventative actions to regulate industry waste production and influence the consumption of goods.

5.3.4 Recover

The attention on recovery, in our literature meta-analysis, is mentioned in the context of construction and larger operations, or when it comes to recovery of energy. The aspect of "recover" manifests its purpose in recovery of materials for a circularity of resources. By establishing a "Recycling Station", such as IVAR has done, the large volume of MSW can be consigned against a small fee. The "Recycling Station" is open for the public and the idea behind it is to recover and reuse the obtained materials. Furthermore, agriculture was linked with energy recovery from organic waste in both analysis of WM and CE. On a similar basis, IVAR maintains this aspect of recovery by utilizing the heat from incinerators to provide district heating.

5.3.5 Re-definition of Waste Management in the Perspective of Circular Economy

The ideology of CE is pushed forward by the increasing awareness for a sustainable future, and our research establishes that the concept of CE has been adopted by industries in an attempt to decrease the input-and output of goods in the market. However, a consensus on the definition of the concept remains absent and is therefore challenging to grasp and implement into practice. This is clearly outlined through our literature analysis. The concept of WM on the other hand, which presents more than just a concept, has been implemented in different countries although at different stages and with different approaches. WM is considered a vast concept with undefined parameters, depending on social and geographical perimeters. We would therefore suggest a redefinition of the concept of WM in order to gain a consensus of its responsibility and duty within a CE. Our suggested redefinition of WM build on Gillespie's (Gillespie 2015

p. 8-9, in McCormick, 2018) definition of waste (as presented under "Waste Management" section). With this in mind we would like to present the following re-contextualized definition for WM:

The handling of any product or material which has served its intended purpose for the user, in which the used material will be returned back into the loop of circular economy through the processes of recovery, reuse, or recycle. The responsibility of waste management entails all producers of waste, with an aim at reducing the input and output of materials in circulation. The process of waste management includes the aspect of handling; from collection and transportation of material, to redistribution and providing recycled, recovered, or reusable materials to the market at all levels of the supply chain.

The definition identifies discarded goods to be collected for a recycle-, reuse-, or recover process to continue a function, either in the same shape or in a new form. WM will in this broad definition, be a key factor for material circularity. Although the concept of CE is yet to be unified defined, the general understanding of the concept is the circulation of materials which will reduce the inputs- and output of recourses. An important aspect of CE is that all *actors* partake in an operational role, from consumer habits to waste handling policies. CE considers WM to have a central role in the CE process; however, there is a further need for *actors* to contribute in their significant roles to keep the waste disposal to a minimum. If reduction of waste ever happens, then the role of WM does not decrease with the reduction. WM role, however much debated, can increase activity in the case that it would require more managing of materials to uphold the circulation rather than direct disposal. The development of IVAR's new recycling facility required an increasingly active participation from the waste industry to manage all of the recycling processes. The increased activities at IVAR generated 11 new full-time equivalents (FTE) whilst receiving the equal amount of MSW, (Informant, 2019). As can be seen from this discussion, in addition to the following section, the role of consumer plays a large part in both practice of waste handling and in literature.

5.3.6 Role of Consumer

Although a large portion of WM responsibility lies in the hands of the manufacturers, the consumer also plays a significant role. There does however, seem to be a lack in focus on the consumers which are, in an economy setting, the drivers of the market as they set the demand

for goods and services (Encyclopædia Britannica, 2019). The lack of focus on the consumer was found as a literature gap in our literature meta-analysis, as well as in the case study.

The information around IVAR´s technological challenges of their new machinery is not being shared to the public. As consumers ourselves, we are not made aware of this inability and unwillingness to recycle coloured plastic or products containing a mixture of plastic types and paper. Our suggestion is to encourage the manufacturers of plastic merchandises to change their production characteristics and design. A further suggestion is to run awareness campaigns to educate the public about good environmental choices and encourage them to become more active players in our economic society of WM. The example of Sweden clearly demonstrated that household incentives for recycling increased the feeling of responsibility of waste handling and this mindfulness transferred into other aspects of daily responsibilities. Households developed a more conscious awareness around their consumption, which lead to more sustainable purchases and a greater care for waste handling (Andersson & Stage, 2018). It is therefore interesting to follow the progression of consumers interest for sustainable consumption, as the new facility of IVAR have reduced the household's responsibility for waste sorting. How this will affect the consumers approach and attitude towards recycling and proper waste sorting is yet to be observed. However, with the example of Sweden in mind, we would like to suggest that IVAR should take more of a leading role towards educating households in pursuit of a more sustainable behaviour of consumption and WM.

Our suggestion is to increase the focus on the consumer, both in literature and in practice, to breach the gap and reach a larger sample group. In increasing consumer responsibility and awareness, the consumer has the information and control needed in order to change their consumption habits and disposal of waste. In addition to this, the main focus should, in our opinion, lie on the Producer to manufacture products that can hold the characteristics of recycling, reuse, and recover.

Even though the theory of a CE is more complex and would involve global participation, the general idea of a CE is not unique. As can be seen throughout the thesis, small movements are evolving amongst the conscious consumers. Minimalism and zero waste movements are amongst these actions which have gained momentum in recent years. Both movements have slightly different approaches for conscious- and sustainable consumerism. However, both movements encourage a reduction of consumption and, as an outcome of this, minimise the

input and reduce the output of recourses to the global market. The existence of these movements indicates that there is a willingness to change consumer patterns in order to better preserve the environment for the impact of consumption and waste. However, humans are creatures of habit and often seek the path of least resistance, the easy solution. Thus, the desire to change habits and spend time on waste handling might not be a priority amongst consumers, which would not provide the outcome one would hope for by increasing awareness and responsibility. The change in consumer behaviour could be influenced by the presence of incentives, either by rewarding good waste ethics, or by disciplining the over-consumers and those who accumulate most waste. The latter of which can be done through taxation or imposing a weight limit on waste. However, the incentive of weight limit can lead to incorrect and illegal disposal of waste in order to avoid the fee, leaving an unclear suggestion on how to move forward. Nevertheless, the example of Sweden clearly demonstrated that the incentives worked within their culture, making us hopeful for a similar WM policy effect in Norway.

The indistinct definition of CE has led to a vague suggestion for a proper implementation of the concept for policy makers and *actors* of society. Despite being optimistic of the implementation of CE in the future, we do recognise that in order for the concept to ever be properly implemented, there needs to be a consensus amongst the scientists and politicians to agree upon a finalized definition of CE. Although WM has not been fully embraced in the context of CE, it has already paved way for the different aspects of CE; reduce, recycle, recover and reuse. However, the emergence of social movements regarding sustainable consumption and green economy shows a willingness to adopt to a CE concept. This willingness to change leaves a hope for a forthcoming implementation of CE, pushed forward by the individual actors.

6. Conclusion

The literature meta-analysis revealed a literature gap between the theory of CE and CE research literature. WM is a central part of CE theory, although generally overlooked in CE research literature. The literature gap can be explained through the absence of a unified definition of CE and the uncertain path of how to implement a complete CE practice. These uncertainties makes it challenging to assess the relationship between WM and CE. The literature meta-analysis did however reveal that WM and CE research literature share a common interest for environmental measures and sustainable development. The two concepts of WM and CE are interlinked, as proper WM involves the aspects of recycle, reuse, reduce, and recover on a similar standing as CE. The relationship is also reflected in CE theory and WM practice; where the case of IVAR demonstrated a partial adapted practice of CE in their WM. We found that WM plays an important role in CE, and thus WM can be considered a stepping-stone in attaining proper implementation of CE. There were certain limitations which were met throughout our research; amongst those were the generally low focus allocated to all *actors* responsible for proper WM and guidelines for implementation of CE.

A large area that was left almost unexplored in both the research literature and by IVAR was the consumers ability to reduce consumption and reduce waste accumulation. The discussion mentioned measures of what can be done to influence consumer behaviour as well as increase awareness through weight limits or taxation of waste. The implementation of incentives and measures do not secure improved activities amongst the consumers, although the example of Sweden documented a positive effect for implementation of governmental measures of WM. Additionally, the surge of greener, more sustainable movement indicates that there is a willingness for consumers to change their behaviour, presenting a positive outlook for CE implementation. Our recommendation for future studies is therefore to direct the attention towards consumer role in WM, as well as in CE, to examine the conditions for consumers behavioural patterns for implementation of a CE through proper WM.

WM will be the essential key player within a sustainable system change towards CE, where its role will be more significant than what IVAR is considering themselves to be today. Our research supports the suggestion for a broader definition and re-contextualizing of WM in the perspective of CE, to better integrate WM central role in the implementation of a CE. We suggest the following redefinition of WM in the context of CE:

The handling of any product or material which has served its intended purpose for the user, in which the used material will be returned back into the loop of circular economy through the processes of recovery, reuse, or recycle. The responsibility of waste management entails all producers of waste, with an aim at reducing the input and output of materials in circulation. The process of waste management includes the aspect of handling; from collection and transportation of material, to redistribution and providing recycled, recovered, or reusable materials to the market in all levels of the supply chain.

The suggested redefinition of WM in the context of CE will allocate an even distribution of responsibility of WM to all *actors* of society, encouraging more reduction of waste, more reuse of materials, and improved recycling processes.

Our research demonstrates that CE have been embraced by many, both in literature and in practice. However, as our literature review has highlighted, the term CE might not be used as often as its related ideas and concepts of recover, reuse, reduce, and recycle. For the sake of adopting a full CE practice, researchers, scientists, and politicians need to agree upon a unified definition of CE and provide clear directions for how to implement a CE practice.

References

Andersson, C., & Stage, J. (2018). Direct and indirect effects of waste management policies on household waste behaviour: The case of Sweden. Waste Management, 76, 19-27.

Blaikie, N. (2010). Designing Social Research (2nd Edition ed.). UK: Polity Press.

Bray, D. (2010). The scientific consensus of climate change revisited. Environmental science & policy, 13(5), 340-350. Retrieved from: https://www.sciencedirect.com/search/advanced?tak=the%20scientific%20consensus%20of%20climate%20change%20revisited&show=25&sortBy=relevance

BusinessDictionary. (n.d.). waste generation. In BusinessDictionary online dictionary. Retrieved 04.06.2019 from: http://www.businessdictionary.com/definition/waste-generation.html.

Callan, E. J. & Thomas, J. M. (2013). Environmental economics & management theory, policy, and applications. Edition 6. Cengage Learning India Private Limited. Delhi, India. ISBN-13:978-81-315-2764-1

Cobo, S., Dominguez-Ramos, A., & Irabien, A. (2018). From linear to circular integrated waste management systems: A review of methodological approaches. Resources, Conservation and Recycling, 135, 279-295.

Encyclopædia Britannica. (2019). Supply and demand. In Retrieved from: https://www.britannica.com/topic/supply-and-demand

European Commission. (2018). Report on Critical Raw Materials and the Circular Economy. Commission staff working document. Brussels. SWD(2018) 36 final. Retrieved from: https://ec.europa.eu/commission/publications/report-critical-raw-materials-and-circular-economy_en

Galletta, A. (2013). Mastering the Semi-Structured Interview and Beyond : From Research Design to Analysis and Publication Qualitative studies in psychology

Geissdoerfer, M., Savaget, P., Bocken, N. M., & Hultink, E. J. (2017). The Circular Economy–A new sustainability paradigm?. Journal of cleaner production, 143, 757-768.

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. Journal of Cleaner production, 114, 11-32.

Ghisellini, P., Ripa, M., & Ulgiati, S. (2018). Exploring environmental and economic costs and benefits of a circular economy approach to the construction and demolition sector. A literature review. Journal of Cleaner Production, 178, 618-643.

Giusti, L. (2009). A review of waste management practices and their impact on human health. Waste management, 29(8), 2227-2239.

Greco, T., Zangrillo, A., Biondi-Zoccai, G., & Landoni, G. (2013). Meta-analysis: pitfalls and hints. Heart, lung and vessels, 5(4), 219. Retrieved from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3868184/pdf/hlv-05-219.pdf

Grin, J., Rotmans, J., & Schot, J. (2010). Transitions to Sustainable Development new directions in the Study of Long Term Transformative Change. Routledge. NY and UK. ISBN: 978-0-415-89804-1

Grønt Punkt Norge. (2019). Bakgrunn in Grønt Punkt Norge homepage. Retrieved from: https://www.grontpunkt.no/om-oss/maal-og-bakgrunn/

Heyes, G., Sharmina, M., Mendoza, J. M. F., Gallego-Schmid, A., & Azapagic, A. (2018). Developing and implementing circular economy business models in service-oriented technology companies. Journal of cleaner production, 177, 621-632.

Hoogmartens, R., Eyckmans, J., & Van Passel, S. (2016). Landfill taxes and Enhanced Waste Management: Combining valuable practices with respect to future waste streams. Waste management, 55, 345-354.

Hoornweg, D., & Bhada-Tata, P. (2012). What a waste: a global review of solid waste management (Vol. 15, p. 116). World Bank, Washington, DC. Retrieved from: https://openknowledge.worldbank.org/handle/10986/17388

Hossain, M. S., Santhanam, A., Norulaini, N. N., & Omar, A. M. (2011). Clinical solid waste management practices and its impact on human health and environment–A review. Waste management, 31(4), 754-766.

Informant. (2019). Our informant, Facility manager at IVAR IKS. Personal interview.

IVAR, (n.d). IVAR IKS homepage. CoreTrek. Retrieved 20.02.2019 from: https://www.ivar.no/Omivar/

Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). What a waste 2.0 A Global Snapshot of Solid Waste Management to 2050. World bank group. Retrieved from: https://openknowledge.worldbank.org/handle/10986/30317

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. Resources, Conservation and Recycling, 127, 221-232.

Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular economy: the concept and its limitations. Ecological economics, 143, 37-46.

Kula, E. (1997). History of environmental economic thought. London. Routledge. ISBN: 9780429231766

Kvitrud, E. K. (2019). Klimagassregnskap for IVAR´s avfallshåndtering I 2018 [Greenhouse gas budget for IVAR´s waste management in 2018]. Stavanger. NIRAS.

Lacy, P., & Rutqvist, J. (2016). Waste to wealth: The circular economy advantage. Springer.

Lenkiewicz, Z. (2016). Waste and the Sustainable Development Goals. Wasteaid.org. Retrieved from: https://wasteaid.org/waste-sustainable-development-goals/

Martin, N. & Seabrook, V. (2018). Thousands of tons of UK plastic dumped across world. Sky News. Retrieved from: https://news.sky.com/story/thousands-of-tons-of-uk-plastic-dumped-across-world-11218595

McCormick, J. (2018). Environmental Politics and Policy. Basingstoke, Hampshire.

Millburn, J. F. and Nicodemus, R. (n.d.). What Is Minimalism? The minimalists. Retrieved 16.05.2019 from: https://www.theminimalists.com/minimalism/

Misra, V., & Pandey, S. D. (2005). Hazardous waste, impact on health and environment for development of better waste management strategies in future in India. Environment international, 31(3), 417-431.

Murray, A., Skene, K., & Haynes, K. (2017). The circular economy: An interdisciplinary exploration of the concept and application in a global context. Journal of Business Ethics, 140(3), 369-380.

Neufeld, L., Stassen, F., Sheppard, R., & Gilman, T. (2016). The New Plastics Economy Rethinking the future of plastics. In World Economic Forum. Retrieved from http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf

Neuman, W. L. (2014). Social research methods : qualitative and quantitative approaches (Seventh edition, Pearson New International Edition. ed.). USA: Pearson Education Limited.

Norwegian environment Agency (NEA). (2016, 25th of May). Waste. environment.no. Retrieved from: https://www.environment.no/Topics/Waste/

Redling, A. (2018, 13th April). Rapid growth projected for global waste market in coming years. recycling today. Retrieved from: https://www.recyclingtoday.com/article/global-waste-management-market-growth/

Rice, D. B., Kloda, L. A., Shrier, I., & Thombs, B. D. (2016). Reporting quality in abstracts of meta-analyses of depression screening tool accuracy: a review of systematic reviews and meta-analyses. BMJ open, 6(11), e012867.

Pagiaslis, A., & Krontalis, A. K. (2014). Green Consumption Behavior Antecedents: Environmental Concern, Knowledge, and Beliefs. *Psychology & Marketing, 31*(5), 335-348. doi:doi:10.1002/mar.20698

Pongrácz, E. and Pohjola, V. J. (2004). Re-defining waste, the concept of ownership and the role of waste management. Resources, conservation and Recycling, 40(2), 141-153. Retrieved from: https://www.sciencedirect.com/science/article/pii/S0921344903000570

Sauvé, S., Bernard, S., & Sloan, P. (2016). Environmental sciences, sustainable development and circular economy: Alternative concepts for trans-disciplinary

research. Environmental Development, 17, 48-56. Retrieved from: https://www.sciencedirect.com/science/article/pii/S2211464515300099

Song, Q., Li, J., & Zeng, X. (2015). Minimizing the increasing solid waste through zero waste strategy. Journal of Cleaner Production, 104, 199-210.

Stahel, W. R. (2016). Circular economy. Nature, 531(7595), 435-438. Retrieved from https://search-proquest-com.ep.fjernadgang.kb.dk/docview/1776790666?accountid=13607--- change as well??

United Nations Environment (UN environment). (n.d.). Solid Waste management. Retrieved 25.03.2019 from: https://www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/cities/solid-waste-management

United Nations (UN). (2017a, 21st of June). World population prospects: The 2017 Revision. ESA/P/WP/248 New York. Retrieved 25.03.2019 from: https://www.un.org/development/desa/publications/world-population-prospects-the-2017-revision.html

United Nations (UN). (2017b, 21st of June). World population projected to reach 9.8 billion in 2050, and 11.2 billion in 2100 – says UN. Sustainable development Goals news. Retrieved 25.03.2019 from: https://www.un.org/sustainabledevelopment/blog/2017/06/world-population-projected-to-reach-9-8-billion-in-2050-and-11-2-billion-in-2100-says-un/

United Nations (UN). (n.d-a). Sustainable Development Goals. United Nations. Retrieved 25.03.2019 from: https://sustainabledevelopment.un.org/?menu=1300

United Nations (UN). (n.d-b). Goal 12: Ensure sustainable consumption and production patterns. Retrieved 25.03.2019 from: https://www.un.org/sustainabledevelopment/sustainable-consumption-production/

United Nations World Commission on Environment and Development (UNWCED). (1987). ed. Report of the World Commission on Environment and Development: Our Common Future. Oxford: Oxford University Press, 1987

Vergragt, P. J. (2017). Sustainable Cunsumption: An Important but Ambiguous Concept. In J. Meadowcroft & D. J. Fiorino (Eds.), Conceptual innovation in environmental policy (pp. 307-325). Cambridge, MA: The MIT Press.

Wilson, D. C., Rodic, L., Modak, P., Soos, R., Carpintero, A., Velis, K., ... & Simonett, O. (2015). Global waste management outlook. United Nations Environment Programme (UNEP). ISBN: 978-92-807-3479-9. Retrieved from: https://www.uncclearn.org/sites/default/files/inventory/unep23092015.pdf

Winans, K., Kendall, A., & Deng, H. (2017). The history and current applications of the circular economy concept. Renewable and Sustainable Energy Reviews, 68, 825-833.

Yin, R. (2014). Case study research : Design and methods (5th ed.). Los Angeles, Calif: SAGE. ISBN: 978-1-4522-4256-9

Zhao, H.-H., Gao, Q., Wu, Y.-P., Wang, Y., & Zhu, X.-D. (2014). What affects green consumer behavior in China? A case study from Qingdao. *Journal of Cleaner Production, 63*, 143-151. doi:10.1016/j.jclepro.2013.05.021

Zhou, X. & Reimov, A. (2018, 25th of June). Sound management of chemicals and their waste is vital for sustainable development. United Nations Development Program (UNDP). Retrieved 25.03.2019 from: https://www.undp.org/content/undp/en/home/blog/2018/Sound-management-of-chemicals-and-their-waste-is-vital-for-sustainable-development.html

Appendix

Appendix 1: Interview guide

Interview guide for Waste Management in a Circular Economy.

Areas of interest for the Case study of IVAR facility and carbon budget:

- Carbon budget for IVAR
  - Building plan
  - Waste management
  - Transport within the location
  - Equipment
- Waste management
  - Sorting facility
  - Waste handling
  - Landfill
- Process procedures of IVAR
- IVARS take on Circular Economy

Appendix 2 : Information letter and "samtykkeerklæring"

Informant for master thesis
"Exploring waste management – a case study of IVAR and a literature synthesis of waste management "?

This is a question for you to be an informant for a master thesis in Energy, Environment and Social studies at the University of Stavanger, and to provide necessary information about IVAR for our master thesis. The subject of the master thesis is "Exploring waste management – a case study of IVAR and a literature synthesis of waste management" where the data collected will be used for IVAR´s carbon budget calculations and for this thesis.

Your participation is voluntarily, and you may at any time withdraw from being an informant for this master thesis.
The data collected form you as an informant will be collected and analysed only for the purpose of this master thesis. The data will be collected and processed by the students; [redacted] and [redacted] and supervised by supervisor Gorm Kipperberg (professor at University of Stavanger).

As an Informant, we hope to be able to use (only) your name and title in the paper but will absolutely respect your choice for anonymously if wanted. All data collected will of course be handled with absolute care and in compliance with the guidelines from NSD and "personvenloven". All personal information will be deleted from our system at the completion and hand-in of this master thesis.

Your rights:
As long as you can be identified in the data-material, you have the right to:

- Assess which personal information is registered for you,
- be able to update your personal information,
- to have your personal information deleted,
- require a copy of your registered personal information (data-portability), and
- send a complaint to "personvernombudet" or "Datatilsynet" of how your personal information was treated.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:

- *innsyn i hvilke personopplysninger som er registrert om deg,*
- *å få rettet personopplysninger om deg,*
- *få slettet personopplysninger om deg,*
- *få utlevert en kopi av dine personopplysninger (dataportabilitet), og*
- *å sende klage til personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.*

What give us the right to handle your personal information?
We only register information about you if we have your consent.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

Assigned from the University of Stavanger (Institutt for medie-, kultur og samfunnsfag), NSD – Norsk senter for forskningsdata AS have decided that the treatment of personal information for this master thesis meets the requirements of "personvernregelverket".

If you have questions, or wish to apply your rights, please contact:

- Students:
  - [redacted]; e-mail: [redacted] /phone: [redacted].
  - [redacted]; e-mail: [redacted] / phone: [redacted].
- Supervisor: Gorm Kipperberg; e-mail: gorm.kipperberg@uis.no / phone: 476 74 829.
- NSD – Norsk senter for forskningsdata AS; e-mail: personverntjenester@nsd.no / phone: 5558 2117.

Kind regards,

Veileder	Master Students
Gorm Kipperberg	[redacted] and [redacted]

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om master oppgaven " Exploring waste management – a case study of IVAR and a literature synthesis of waste managment ", og har fått anledning til å stille spørsmål. Jeg samtykker til:

- ☐ å gi data til utregning av IVAR sitt karbon budsjett *og* aktuell informasjon for oppgaven og temaet
- ☐ å delta i oppfølgings spørsmål – ved behov
- ☐ at jeg blir navngitt som informant til masteroppgaven. Kun navn og tittel blir oppgitt, andre person opplysninger blir følgelig anonymisert og behandlet sådan.

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet, ca. 31 Oktober 2019.

(Signert av informant, dato)

Assigned from the University of Stavanger (Institutt for medie-, kultur og samfunnsfag), NSD – Norsk senter for forskningsdata AS have decided that the treatment of personal information for this master thesis meets the requirements of "personvernregelverket".

If you have questions, or wish to apply your rights, please contact:

- Students:
  - Eva Marie Østerhus; e-mail: evamoste@gmail.com /phone: 908 30 050.
  - Trine S. Brimsøe; e-mail: trine.brimsoe@gmail.com / phone: 995 00 998.
- Supervisor: Gorm Kipperberg; e-mail: gorm.kipperberg@uis.no / phone: 476 74 829.
- NSD – Norsk senter for forskningsdata AS; e-mail: personverntjenester@nsd.no / phone: 5558 2117.

Kind regards,

Veileder
Gorm Kipperberg

Master Students
Eva Marie Østerhus and Trine S. Brimsøe

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om master oppgaven " Exploring waste management – a case study of IVAR and a literature synthesis of waste managment ", og har fått anledning til å stille spørsmål. Jeg samtykker til:

- [x] å gi data til utregning av IVAR sitt karbon budsjett *og* aktuell informasjon for oppgaven og temaet
- [x] å delta i oppfølgings spørsmål – ved behov
- [x] at jeg blir navngitt som informant til masteroppgaven. Kun navn og tittel blir oppgitt, andre person opplysninger blir følgelig anonymisert og behandlet sådan.

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet, ca. 31 Oktober 2019.

10.05.2019

(Signert av informant, dato) Rudolf Meissner

Appendix 3 : Data form for literature meta-analysis

1st search : "waste management" in title, "circular economy" in text			
Year of publication	**Article Name**	**Author(s)**	**HTML**
2018	Prioritizing barriers to adopt circular economy in construction and demolition waste management	Mahpour, A.	https://www.sciencedirect.com/science/article/pii/S0921344918300260
2017	Municipal solid waste management and waste-to-energy in the context of a circular economy and energy recycling in Europe	Malinauskaitea, J., Jouhara, H., Czajczynska, D., Stanchev, P., Katsou, E., Rostkowski, P., ... Spencer, N.	https://www.sciencedirect.com/science/article/pii/S0360544217319862
2016	Waste Management in Germany – Development to a Sustainable Circular Economy?	Nellesab, M., Grünesa, J., & Morschecka, G.	https://www.sciencedirect.com/science/article/pii/S1878029616300901
2018	Construction and demolition waste management in China through the 3R principle	Huang, B., Wang, X., Kua, H., Geng, Y., Bleischwitz, R., & Reng, J.	https://www.sciencedirect.com/science/article/pii/S0921344917303142
2018	On the way to 'zero waste' management: Recovery potential of elements, including rare earth elements, from fine fraction of waste	Burlakovs, J., Jani, Y., Kriipsalu, M., Vincevica-Gaile, Z., Kaczala, F., Celma, G., ... Klavins, M.	https://www.sciencedirect.com/science/article/pii/S0959652618307637
2017	An environmental assessment of electricity production from slaughterhouse residues. Linking urban, industrial and waste management systems	Santagata, R., Ripa, M. & Ulgiati, S.	https://www.sciencedirect.com/science/article/pii/S0306261916310145
2017	Dynamic visualisation of municipal waste management performance in the EU using Ternary Diagram method	Pomberger, R., Sarc, R. & Lorber, K. E.	https://www.sciencedirect.com/science/article/pii/S0956053X17300181
2017	Expanding roles for the Swedish waste management sector in inter-organizational resource management	Aid, G., Eklund, M., Anderberg, S., & Baas, L.	https://www.sciencedirect.com/science/article/pii/S0921344917301064
2017	Incentivizing secondary raw material markets for sustainable waste management	Schreck, M. & Wagner, J.	https://www.sciencedirect.com/science/article/pii/S0956053X1730363X
2018	From linear to circular integrated waste management systems: A review of methodological approaches	Cobo, S., Dominguez-Ramos, A., & Irabien, A.	https://www.sciencedirect.com/science/article/pii/S0921344917302422
2017	Collaborative Robots in e-waste Management	Alvarez-de-los-Mozos, E., & Renteria, A.	https://www.sciencedirect.com/science/article/pii/S2351978917303372
2017	Greenhouse gas footprint and the carbon flow associated with different solid waste management strategy for urban metabolism in Bangladesh	Nazmul Islam, K. M.	https://www.sciencedirect.com/science/article/pii/S0048969716327103
2018	Direct and indirect effects of waste management policies on household waste behaviour: The case of Sweden	Andersson, C. & Stage, J.	https://www.sciencedirect.com/science/article/pii/S0956053X18301806
2018	Waste Management of Discarded Cell Phones and Proposal of Material Recovery Techniques	Wansi, E., D'Ans, P., Gonda, L., Segato, T., & Degrez, M.	https://www.sciencedirect.com/science/article/pii/S2212827117307783
2018	The relationship between good environmental practices and financial performance: Evidence from Italian waste management companies	Bartolacci, F., Paolini, A., Quaranta, A. G., & Soverchia, M.	https://www.sciencedirect.com/science/article/pii/S2352550918300502
2016	Landfill taxes and Enhanced Waste Management: Combining valuable practices with respect to future waste streams	Hoogmartens, R., Eyckmans, J., & Van Passel, S.	https://www.sciencedirect.com/science/article/pii/S0956053X16301362
2015	A Danish–Vietnamese partnership for business and technology development in solid waste management	Christensen, D. & Bach, L. T.	https://www.sciencedirect.com/science/article/pii/S0921344915301178
2018	Role of compostable tableware in food service and waste management. A life cycle assessment study	Fieschi, M., & Pretato, U.	https://www.sciencedirect.com/science/article/pii/S0956053X17308760

2017	Life cycle inventory and mass-balance of municipal food waste management systems: Decision support methods beyond the waste hierarchy	Edwards, J., Othman, M., Crossin, E., & Burn, S.	https://www.sciencedirect.com/science/article/pii/S0956053X17305810
2018	Indicator analysis of integrated municipal waste management system. Case study of Latvia	Kavals, E., Klavenieks, K., Gusca, J., & Blumberga, D.	https://www.sciencedirect.com/science/article/pii/S1876610218302431
2018	Environmental assessment of microwaves and the effect of European energy efficiency and waste management legislation	Gallego-Schmid, A., Mendoza, J. M. F., & Azapagic, A.	https://www.sciencedirect.com/science/article/pii/S0048969717331224
2018	Decomposition analysis of food waste management with explicit consideration of priority of alternative management options and its application to the Japanese food industry from 2008 to 2015	Fujii, H., & Kondo, Y.	https://www.sciencedirect.com/science/article/pii/S0959652618309181
2015	Destined for indecision? A critical analysis of waste management practices in England from 1996 to 2013	Farmer, T. D., Shaw, P. J., & Williams, I. D.	https://www.sciencedirect.com/science/article/pii/S0956053X15001257
2018	Decision making and software solutions with regard to waste management	Burger, C., Kalverkamp, M., & Pehlken, A.	https://www.sciencedirect.com/science/article/pii/S0959652618328130
2017	Common and Distinctive in Municipal Solid Waste Management in Baltic States	Klavenieks, K. & Blumberga, D.	https://www.sciencedirect.com/science/article/pii/S1876610217321951
2018	Assessing factors that influence waste management financial sustainability	Bartolacci, F., Paolini, A., Quaranta, A. G., & Soverchia, M.	https://www.sciencedirect.com/science/article/pii/S0956053X18304823
2018	Modelling solid waste management solutions: The case of Campania, Italy	Di Nola, M. F., Escapa, M., & Ansah, J. P.	https://www.sciencedirect.com/science/article/pii/S0956053X1830360X
2018	Modular life cycle assessment of municipal solid waste management	Haupt, M., Kägi, T., & Hellweg, S.	https://www.sciencedirect.com/science/article/pii/S0956053X18301776
2018	Environmental and sustainability evaluation of livestock waste management practices in Cyprus	Lijó, L., Frison, N., Fatone, F., González-García, S., Feijoo, G., & Moreira, M. T.	https://www.sciencedirect.com/science/article/pii/S0048969718310593
2018	Waste management performance in Italian provinces: Efficiency and spatial effects of local governments and citizen action	Agovino, M., D'Uva, M., Garofalo, A., & Marchesano, K.	https://www.sciencedirect.com/science/article/pii/S1470160X18301304
2018	Linking energy scenarios and waste storylines for prospective environmental assessment of waste management systems	Meylan, G., Haupt, M., Duygan, M., Hellweg, S., & Stauffacher, M.	https://www.sciencedirect.com/science/article/pii/S0956053X18305580
2018	Assessment of biowaste losses through unsound waste management practices in rural areas and the role of home composting	Mihai, F. C. & Ingrao, C.	https://www.sciencedirect.com/science/article/pii/S0959652616317942
2018	Where do islands put their waste? – A material flow and carbon footprint analysis of municipal waste management in the Maltese Islands	Camilleri-Fenech, M., Oliver-Solà, J., Farreny, R., & Gabarrell, X.	https://www.sciencedirect.com/science/article/pii/S0959652617314853
2017	The role of public communication in decision making for waste management infrastructure	Kirkman, R. & Voulvoulis, N.	https://www.sciencedirect.com/science/article/pii/S0301479716303413
2018	The role of environmental organisations on urban transformation: The case of waste management in Esporles (Mallorca)	Weber, G., Calaf-Forn, M., Puig-Ventosa, I., Cabras, I., & D'Alisa, G.	https://www.sciencedirect.com/science/article/pii/S0959652617319856
2018	SWIMS: A dynamic life cycle-based optimisation and decision support tool for solid waste management	Roberts, K. P., Turner, D. A., Coello, J., Stringfellow, A. M., Bello, I. A., Powrie, W., & Watson, G. V. R.	https://www.sciencedirect.com/science/article/pii/S0959652618316184
2018	Discourse coalitions in Swiss waste management: gridlock or winds of change?	Duygan, M., Stauffacher, M., & Meylan, G.	https://www.sciencedirect.com/science/article/pii/S0956053X1730805X
2016	A comprehensive study of the environmental and economic benefits of resource recovery from global waste management systems	Zaman, A. U.	https://www.sciencedirect.com/science/article/pii/S0959652616002675

2013	Combining lean and green in manufacturing: a model of waste management	Fercoq, A., Lamouri, S., Carbone, V., Lelièvre, A., & Lemieux, A. A.	https://www.sciencedirect.com/science/article/pii/S1474667016342719
2018	Sustainable approach towards extractive waste management: Two case studies from Italy	Antonell, G., Mehta, D. N., Rossetti, P., Ajmone-Marsan, F., & De Luca, D. A.	https://www.sciencedirect.com/science/article/pii/S0301420718302241
2018	Environmental Performance of Waste Management in an Italian Region: How LCI Modelling Framework could Influence the Results	Pini, M., Neri, P., & Ferrari, A. M.	https://www.sciencedirect.com/science/article/pii/S2212827117309277
2017	Sustainable waste management policy in Bangladesh for reduction of greenhouse gases	Shams, S., Sahu, J. N., Rahman, S. M. S., & Ahsan, A.	https://www.sciencedirect.com/science/article/pii/S221067071730149X
2010	An overview of municipal solid waste management in China	Chen, X., Geng, Y., & Fujita, T.	https://www.sciencedirect.com/science/article/pii/S0956053X09004590
2018	Design, implementation, and evaluation of an Internet of Things (IoT) network system for restaurant food waste management	Wen, Z., Hu, S., Clercq, D. D., Beck, M. B., Zhang, H., Zhang, H.,... Liu, J.	https://www.sciencedirect.com/science/article/pii/S0956053X17309376
2018	Waste management studies in a Brazilian microregion: GHG emissions balance and LFG energy project economic feasibility analysis	Pin, B. V. R., Barros, R. M., Lora, E. E. S., & Santos, I. F. S.	https://www.sciencedirect.com/science/article/pii/S2211467X17300688
2017	Importance of waste composition for Life Cycle Assessment of waste management solutions	Bisinella, V., Götze, R., Conradsen, K., Damgaard, A., Christensen, T. H., & Astrup, T. F.	https://www.sciencedirect.com/science/article/pii/S0959652617314348
2015	Construction and demolition waste management – a holistic evaluation of environmental performance	Dahlbo, H., Bachèr, J., Lähtinen, K., Jouttijärvi, T., Suoheimo, P., Mattila, T., ... Saramäki, K.	https://www.sciencedirect.com/science/article/pii/S0959652615001985
2018	Efficiency of packaging waste management in a European Union candidate country	Mrkajić, V., Stanisavljevic, N., Wang, X., Tomas, L., & Haro, P.	https://www.sciencedirect.com/science/article/pii/S0921344918301411
2018	Extractive waste management: A risk analysis approach	Mehta, N., Dino, G. A., Ajmone-Marsan, F., Lasagna, M., Romè, C. & De Luca, D. A.	https://www.sciencedirect.com/science/article/pii/S0048969717333181
2017	Analytical method of waste allocation in waste management systems: Concept, method and case study	Bergeron, F. C.	https://www.sciencedirect.com/science/article/pii/S0195925516300622
2015	Recovery of essential nutrients from municipal solid waste – Impact of waste management infrastructure and governance aspects	Zabaleta, I. & Rodic, L.	https://www.sciencedirect.com/science/article/pii/S0956053X15300490
2017	Economic and environmental review of Waste-to-Energy systems for municipal solid waste management in medium and small municipalities	Fernández-González, J. M., Grindlay, A. L., Serrano-Bernardo, F., Rodríguez-Rojas, M. I., & Zamorano, M.	https://www.sciencedirect.com/science/article/pii/S0956053X17303057
2017	Drivers of knowledge accumulation in electronic waste management: An analysis of publication data	Cecere, G. & Martinelli, A.	https://www.sciencedirect.com/science/article/pii/S0048733317300483
2017	Sustainable waste management: Waste to energy plant as an alternative to landfill	Cucchiella, F., D'Adamo, I., & Gastaldi, M.	https://www.sciencedirect.com/science/article/pii/S019689041631007X
2017	SIMSWASTE-AD - A modelling framework for the environmental assessment of agricultural waste management strategies: Anaerobic digestion	Pardo, G., Moral, R., & Prado, A.	https://www.sciencedirect.com/science/article/pii/S0048969716320241
2013	Collaboration between design and waste management: Can it help close the material loop?	Ordoñez, I., & Rahe, U.	https://www.sciencedirect.com/science/article/pii/S0921344913000037
2012	Evolution of the electronic waste management system in Spain	Queiruga, D., Benito, J. G., & Lannelongue, G.	https://www.sciencedirect.com/science/article/pii/S0959652611004781

2018	Areas on which to focus when seeking to reduce the greenhouse gas emissions of commercial waste management. A case study of a hypermarket, Finland	Hupponen, M., Grönman, K., & Horttanainen, M.	https://www.sciencedirect.com/science/article/pii/S0956053X18301661

Total articles: 58

2nd search: "circular economy" in title, "waste management" in text			
Year of publication	**Article Name**	**Author(s)**	**HTML**
2018	Prioritizing barriers to adopt circular economy in construction and demolition waste management	Mahpour, A.	https://www.sciencedirect.com/science/article/pii/S0921344918300260
2017	Municipal solid waste management and waste-to-energy in the context of a circular economy and energy recycling in Europe	Malinauskaitea, J., Jouhara, H., Czajczynska, D., Stanchev, P., Katsou, E., Rostkowski, P., ... Spencer, N.	https://www.sciencedirect.com/science/article/pii/S0360544217319862
2016	Waste Management in Germany – Development to a Sustainable Circular Economy?	Nellesab, M., Grünesa, J., & Morschecka, G.	https://www.sciencedirect.com/science/article/pii/S1878029616300901
2018	Moving towards a circular economy: economic impacts of higher material recycling targets	Beccarello, M. and Di Foggia, G.	https://www.sciencedirect.com/science/article/pii/S2214785317323593
2018	No zero burden assumption in a circular economy	Ilic, D. D., Eriksson, O., Ödlund, L., & Åberg, M.	https://www.sciencedirect.com/science/article/pii/S0959652618303378
2018	Circular economy of plastic packaging: Current practice and perspectives in Austria	Van Eygen, E., Laner, D., & Fellner, J.	https://www.sciencedirect.com/science/article/pii/S0956053X17308802
2018	Circular economy of composting in Sri Lanka: Opportunities and challenges for reducing waste related pollution and improving soil health	Bekchanov, M. & Mirzabaev, A.	https://www.sciencedirect.com/science/article/pii/S0959652618325290
2016	Drivers for development of circular economy – A case study of Serbia	Ilic, M. & Nicolic, M.	https://www.sciencedirect.com/science/article/pii/S019739751630128X
2018	Proposal of a dynamic model to evaluate public policies for the circular economy: Scenarios applied to the municipality of Curitiba	da Silva, C. L.	https://www.sciencedirect.com/science/article/pii/S0956053X18303611
2016	Resource recovery from post-consumer waste: important lessons for the upcoming circular economy	Singh, J. & Ordoñez, I.	https://www.sciencedirect.com/science/article/pii/S0959652615018442
2018	Rethinking packaging production and consumption *vis-à-vis* circular economy: A case study of compostable cassava starch-based material	Casarejos, F., Bastos, C. R., Rufin, C., & Frota, M. N.	https://www.sciencedirect.com/science/article/pii/S0959652618324569
2018	Ecological foraging models as inspiration for optimized recycling systems in the circular economy	Ryen, E. G., Gaustad, G., Babbitt, C.W., & Babbitt, G.	https://www.sciencedirect.com/science/article/pii/S0921344917302458
2017	Optimizing the Methodology of Characterization of Municipal Solid Waste in EU Under a Circular Economy Perspective	Rada, E.C. & Cioca, L.	https://www.sciencedirect.com/science/article/pii/S1876610217325924
2018	The role of energy from waste in circular economy and closing the loop concept – Energy analysis approach	Tomic´, T. & Schneider, D. R.	https://www.sciencedirect.com/science/article/pii/S1364032118306750
2018	Creating value in the circular economy: A structured multiple-case analysis of business models	Ranta, V., Aarikka-Stenroos, L., & Mäkinen, S. J.	https://www.sciencedirect.com/science/article/pii/S0959652618324089
2017	Best practices for the management of end-of-life gypsum in a circular economy	Jiménez-Rivero, A. & García-Navarro, J.	https://www.sciencedirect.com/science/article/pii/S095965261730999X
2016	Fouling prevention, preparing for re-use and membrane recycling. Towards circular economy in RO desalination	Landaburu-Aguirre, J., García-Pacheco, R., Molina, S., Rodríguez-Sáez, L., Rabadán, J., & García-Calvo, E.,	https://www.sciencedirect.com/science/article/pii/S0011916416301370

2018	Public awareness of circular economy in southern Poland: Case of the Malopolska region	Smol, M., Avdiushchenko, A., Kulczycka, J., & Nowaczek, A.	https://www.sciencedirect.com/science/article/pii/S0959652618317505
2016	A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems	Ghisellini, P., Cialani, C., & Ulgiati, S.	https://www.sciencedirect.com/science/article/pii/S0959652615012287
2018	Challenges and opportunities in a circular economy for a local productive arrangement of furniture in Brazil	de Oliveira, F. R., França, S. L. B., & Rangel, L. A. D.	https://www.sciencedirect.com/science/article/pii/S0921344917303658
2018	On the implementation of a circular economy: The role of institutional capacity-building through industrial symbiosis	de Abreu, M. C. S. & Ceglia, D.	https://www.sciencedirect.com/science/article/pii/S0921344918302465
2017	A pathway to circular economy: Developing a conceptual framework for complex value assessment of resources recovered from waste	Iacocidou, E., Millward-Hopkins, J., Busch, J., Purnell, P., Velis, C. A., Hahladakis, J. N., ... Brown, A.	https://www.sciencedirect.com/science/article/pii/S0959652617319893
2018	Spent coffee grounds valorization through pyrolysis for energy and materials production in the concept of circular economy	Ktori, R., Kamaterou, P., & Zabaniotou, A.	https://www.sciencedirect.com/science/article/pii/S2214785318322788
2018	Cleaner production as an antecedent for circular economy paradigm shift at the micro-level: Evidence from a home appliance manufacturer	Sousa-Zomer, T. T., Magalhães, L., Zancul, E., Campos, L. M. S., & Cauchick-Miguel, P. A.	https://www.sciencedirect.com/science/article/pii/S0959652618306553
2017	The need for better measurement and employee engagement to advance a circular economy: Lessons from Biogen's "zero waste" journey	Veleva, V. ScD, Bodkin, G., & Todorova, S. PhD	https://www.sciencedirect.com/science/article/pii/S0959652617306315
2017	Comparative assessment of circular economy development in China's four megacities: The case of Beijing, Chongqing, Shanghai and Urumqi	Guo, B., Geng, Y., Ren, J., Zhu, L., Liu, Y., & Sterr, T.	https://www.sciencedirect.com/science/article/pii/S0959652617312313
2018	Finding an economic and environmental balance in value chains based on circular economy thinking: An eco-efficiency methodology applied to the fish canning industry	Laso, J., Garcia-Herrero, I., Margallo, M., Vàzquez-Rowe, I., Fullana, P., Bala, A., ... Aldaco, R.	https://www.sciencedirect.com/science/article/pii/S0921344918300429
2018	Towards sustainable WEEE collection and transportation methods in circular economy - Comparative study for rural and urban settlements	Nowakowski, P., & Mrówczyńska, B.	https://www.sciencedirect.com/science/article/pii/S0921344917304470
2013	A review of the circular economy in China: moving from rhetoric to implementation	Su, B., Heshmati, A., Geng, Y., & Yu, X.	https://www.sciencedirect.com/science/article/pii/S0959652612006117
2018	Critical consideration of buildings' environmental impact assessment towards adoption of circular economy: An analytical review	Hossain, M. U. & Ng, S. T.	https://www.sciencedirect.com/science/article/pii/S0959652618328403
2018	Exploring institutional drivers and barriers of the circular economy: A cross-regional comparison of China, the US, and Europe	Ranta, V., Aarikka-Stenroos, L., Ritala, P., & Mäkinen, S. J.	https://www.sciencedirect.com/science/article/pii/S0921344917302653
2018	Developing an extended theory of planned behavior model to explore circular economy readiness in manufacturing MSMEs, India	Singh, M. P., Chakraborty, A., & Roy, M.	https://www.sciencedirect.com/science/article/pii/S0921344917301945
2018	The circular economy: New or Refurbished as CE 3.0? — Exploring Controversies in the Conceptualization of the Circular Economy through a Focus on History and Resource Value Retention Options	Reike, D., Vermeulen, W. J. V., & Witjes, S.	https://www.sciencedirect.com/science/article/pii/S0921344917302756
2018	The circular economy and the bio-based sector - Perspectives of European and German stakeholders	Leipold, S. & Petit-Boix, A.	https://www.sciencedirect.com/science/article/pii/S0959652618323503
2017	Experiencing Urban Mining in an Italian Municipality towards a Circular Economy vision	Ragazzi, M., Fedrizzi, S., Rada, E. C., Ionescu, G., Ciudin, R., & Cioca, L. I.	https://www.sciencedirect.com/science/article/abs/pii/S1876610217326103
2018	Towards an inclusive circular economy: Quantifying the spatial flows of e-waste through the informal sector in China	Tong, X., Wang, T., Chen, Y., & Wang, Y.	https://www.sciencedirect.com/science/article/pii/S0921344917303750

2018	Toward an integrated model of the circular economy: Dynamic waste input–output	Nakamura, S. & Kondo, Y.	https://www.sciencedirect.com/science/article/pii/S0921344918302672
2018	Corporate-entrepreneur collaborations to advance a circular economy	Veleva, V. & Bodkin, G.	https://www.sciencedirect.com/science/article/pii/S0959652618308679
2017	Closing the Loop for Packaging: Finding a Framework to Operationalize Circular Economy Strategies	Niero, M. & Hauschild, M. Z.	https://www.sciencedirect.com/science/article/pii/S2212827116313786
2018	Evaluation of Urban circular economy development: An empirical research of 40 cities in China	Wang, N., Lee, J. C. K., Zhang, J., Chen, H., & Li, H.	https://www.sciencedirect.com/science/article/pii/S0959652618301045
2017	Norwegian Waste-to-Energy: Climate change, circular economy and carbon capture and storage	Lausselet, C., Cherubini, F., Oreggioni, G. D., del Alamo Serrano, G., Becidan, M., Hu, X., ... Strømman, A. H.	https://www.sciencedirect.com/science/article/pii/S0921344917302045
2018	Circular economy – From review of theories and practices to development of implementation tools	Kalmykova, Y., Sadagopan, M., & Rosado, L.	https://www.sciencedirect.com/science/article/pii/S0921344917303701
2018	Circular Economy: Overview of Barriers	Galvão, G. D. A., de Nadae, J., Clemente, D. H., Chinen, G., & de Carvalho, M. M.	https://www.sciencedirect.com/science/article/pii/S2212827118305262
2017	Circular Economy Ownership Models: A view from South Africa Industry	Mativenga, P. T., Agwa-Ejon, J., Mbohwa, C., Sultan, A. A. M., & Shuaib, N. A.	https://www.sciencedirect.com/science/article/pii/S2351978917300422
2017	Environmental assessment of the entire pork value chain in Catalonia – A strategy to work towards Circular Economy	Noya, I., Aldea, X., Gonzàlez-Garcìa, S., Gasol, C. M., Moreira, M. T. Josè, M., ... Boschmonart-Rives, J.	https://www.sciencedirect.com/science/article/pii/S0048969717304436
2018	Exploring the Implementation of a Circular Economy Strategy: The Case of a Closed-loop Supply of Aluminum Beverage Cans	Stewart, R., Niero, M., Murdock, K., & Olsen, S. I.	https://www.sciencedirect.com/science/article/pii/S2212827117307734
2018	Lost in Transition? Drivers and Barriers in the Eco-innovation Road to the Circular Economy	Jesus, A. & Mendonça, A.	https://www.sciencedirect.com/science/article/pii/S0921800916316597
2018	A Methodological Approach to Development of Circular Economy Options in Businesses	Jørgensen, M. S. & Remmen, A.	https://www.sciencedirect.com/science/article/pii/S2212827117309332
2018	Towards a consensus on the circular economy	Prieto-Sandoval, V., Jaca, C., & Ormazabal, M.	https://www.sciencedirect.com/science/article/pii/S0959652617332146
2017	Resource recovery and remediation of highly alkaline residues: A political-industrial ecology approach to building a circular economy	Deutz, P., Baxter, H., Gibbs, D., Mayes, W. M., & Gomes, H. I.	https://www.sciencedirect.com/science/article/pii/S001671851630104X
2017	Measuring circular economy strategies through index methods: A critical analysis	Elia, V., Gnoni, M. G., & Tornese, F.	https://www.sciencedirect.com/science/article/pii/S0959652616318273
2017	The EU Circular Economy Package – Life Cycle Thinking to Life Cycle Law?	Hughes, R.	https://www.sciencedirect.com/science/article/pii/S2212827116314317
2017	Circular economy at the micro level: A dynamic view of incumbents' struggles and challenges in the textile industry	Franco, M. A.	https://www.sciencedirect.com/science/article/pii/S0959652617320450
2015	Boosting circular economy and closing the loop in agriculture: Case study of a small-scale pyrolysis–biochar based system integrated in an olive farm in symbiosis with an olive mill	Zabaniotou, A., Rovas, D., Libutti, A., & Monteleone, M.	https://www.sciencedirect.com/science/article/pii/S2211464514000888
2017	Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications	Genovese, A., Acquaye, A. A., Figueroa, A., & Koh, S. C. L.	https://www.sciencedirect.com/science/article/pii/S0305048315001322
2010	Creating integrated business and environmental value within the context of China's circular economy and ecological modernization	Park, J., Sarkis, J., & Wu, Z.	https://www.sciencedirect.com/science/article/pii/S0959652610002131

2018	Modelling the Interplay Between Institutions and Circular Economy Business Models: A Case Study of Battery Recycling in Finland and Chile	Levänen, J., Lyytinen, T., & Gatica, S.	https://www.sciencedirect.com/science/article/pii/S0921800917318621
2012	The Research on Quantitative Evaluation of Circular Economy Based on Waste Input-Output Analysis	Li, S.	https://www.sciencedirect.com/science/article/pii/S1878029612002496
2018	Eco-innovation in the transition to a circular economy: An analytical literature review	de Jesus, A., Antunes, P., Santos, R., & Mendonça, S.	https://www.sciencedirect.com/science/article/pii/S0959652617327853
2018	Circular economy as an essentially contested concept	Korhonen, J., Nuur, C., Feldmann, A., & Birkie, S. E.	https://www.sciencedirect.com/science/article/pii/S0959652617330706
2018	Analysing interplays between PSS business models and governmental policies towards a circular economy	Wasserbaur, R. & Sakao, T.	https://www.sciencedirect.com/science/article/pii/S2212827118305195
2018	The Proposal of an Environmental Break-Even Point as Assessment Method of Product-Service Systems for Circular Economy	Barletta, I., Despeisse, M., & Johansson, B.	https://www.sciencedirect.com/science/article/pii/S2212827118304281
2017	Supporting Circular Economy through Use-Based Business Models: The Washing Machines Case	Gnoni, M. G., Mossa, G., Mummolo, G., Tornese, F., & Verriello, R.	https://www.sciencedirect.com/science/article/pii/S2212827117301622
2017	Composites in a Circular Economy: A Study of United Kingdom and South Africa	Mativenga, P. T., Sultan, A. A. M., Agwa-Ejon, J., & Mbohwa, C.	https://www.sciencedirect.com/science/article/pii/S2212827117302718
2018	Heavy vehicles on the road towards the circular economy: Analysis and comparison with the automotive industry	Saidani, M., Yannou, B., Leroy, Y., & Cluzel, F.	https://www.sciencedirect.com/science/article/pii/S0921344917301714
2017	Narrating expectations for the circular economy: Towards a common and contested European transition	Lazarevic, D. & Valve, H.	https://www.sciencedirect.com/science/article/pii/S2214629617301147
2018	Exploring environmental and economic costs and benefits of a circular economy approach to the construction and demolition sector. A literature review	Ghisellini, P., Ripa, M., & Ulgiati, S.	https://www.sciencedirect.com/science/article/pii/S0959652617328809
2017	Investigating public awareness on circular economy in western China: A case of Urumqi Midong	Guo, B., Geng, Y., Sterr, T., Zhu, Q., & Liu, Y.	https://www.sciencedirect.com/science/article/pii/S0959652616319011
2017	Improving the circular economy via hydrothermal processing of high-density waste plastics	Pedersen, T. H. & Conti, F.	https://www.sciencedirect.com/science/article/pii/S0956053X17304403
2018	Critical appraisal of the circular economy standard BS 8001:2017 and a dashboard of quantitative system indicators for its implementation in organizations	Pauliuk, S.	https://www.sciencedirect.com/science/article/pii/S0921344917303531
2015	Towards a Circular Economy for End-of-Life Vehicles: A Comparative Study UK – Japan	Despeisse, M., Kishita, Y., Nakano, M., & Barwood, M.	https://www.sciencedirect.com/science/article/pii/S2212827115003522
2018	Waste valorization as an example of circular economy in extremadura (Spain)	Blázquez, F. C., González, A. G., Sánchez, C. S., Rodríguez, V. D., & Salcedo, F. C.	https://www.sciencedirect.com/science/article/pii/S0959652618302592
2018	Risk management of hazardous substances in a circular economy	Bodar, C., Spijker, J., Lijzen, J., Waaijer-van der Loop, S., Luit, R., Heugens, E.,...Traas, T.	https://www.sciencedirect.com/science/article/pii/S0301479718301154
2018	A methodological approach for assessing businness investments in renewable resources from a circular economy perspective	Donia, E., Mineo, A. M., & Sgroi, F.	https://www.sciencedirect.com/science/article/pii/S0264837718300875
2018	Is open-loop recycling the lowest preference in a circular economy? Answering through LCA of glass powder in concrete	Deschamps, J., Simon, B., Tagnit-Hamou, A., & Amor, B.	https://www.sciencedirect.com/science/article/pii/S0959652618306723
2018	Reducing environmental impacts of the ups system based on PEM fuel cell with circular economy	Stropnik, R., Sekavčnik, M., Ferriz, A. M., & Mori, M.	https://www.sciencedirect.com/science/article/pii/S0360544218319790

2018	User experience-based product design for smart production to empower industry 4.0 in the glass recycling circular economy	Lin, K. Y.	https://www.sciencedirect.com/science/article/pii/S0360835218302950X
2018	Platinized counter-electrodes for dye-sensitised solar cells from waste thermocouples: A case study for resource efficiency, industrial symbiosis and circular economy	Charles, R. G., Douglas, P., Baker, J. A., Carnie, M. J., Douglas, J. O., Penney, D. J., & Watson, T. M.	https://www.sciencedirect.com/science/article/pii/S0959652618324673
2018	Circular economy strategies for mitigating critical material supply issues	Gaustad, G., Krystofik, M., Bustamante, M., & Badami, K.	https://www.sciencedirect.com/science/article/pii/S0921344917302410
2018	Providing an economy-wide monitoring framework for the circular economy in Austria: Status quo and challenges	Jacobi, N., Haas, W., Wiedenhofer, D., & Mayer, A.	https://www.sciencedirect.com/science/article/pii/S0921344918301976
2017	Potential for circular economy in household WEEE management	Parajuly, K. & Wenzel, H.	https://www.sciencedirect.com/science/article/pii/S0959652617304808
2018	Circular Economy in Spanish SMEs: Challenges and opportunities	Ormazabal, M., Prieto-Sandoval, V., Puga-Leal, R., & Jaca, C.	https://www.sciencedirect.com/science/article/pii/S0959652618306826
2017	Synergies between agriculture and bioenergy in Latin American countries: A circular economy strategy for bioenergy production in Ecuador	Vega-Quezada, C., Blanco, M., & Romero, H.	https://www.sciencedirect.com/science/article/pii/S1871678416315102
2018	Circular economy and big data analytics: A stakeholder perspective	Gupta, S., Chen, H., Hazen, B. T., Kaur, S., & Gonzalez, E. D. R. S.	https://www.sciencedirect.com/science/article/pii/S0040162517314488
2018	Smart eco-industrial parks: A circular economy implementation based on industrial metabolism	Gómez, A. M. M., González, F. A., & Bárcena, M. M.	https://www.sciencedirect.com/science/article/pii/S092134917302460X
2018	A critical review on recycling of end-of-life carbon fibre/glass fibre reinforced composites waste using pyrolysis towards a circular economy	Naqvi, S. R., Prabhakara, H. M., Bramer, E. A., Dierkes, W., Akkerman, R., & Brem, G.	https://www.sciencedirect.com/science/article/pii/S0921344918301502
2018	Systems of practice and the Circular Economy: Transforming mobile phone product service systems	Hobson, K., Lynch, N., Lilley, D., & Smalley, G.	https://www.sciencedirect.com/science/article/pii/S2210422416301034
2018	Forest sector circular economy development in Finland: A regional study on sustainability driven competitive advantage and an assessment of the potential for cascading recovered solid wood	Husgafvel. R., Linkosalmi, L., Hughes, M., Kanerva, J., & Dahl, O.	https://www.sciencedirect.com/science/article/pii/S0959652617331475
2013	Reutilisation-extended material flows and circular economy in China	Li, N., Zhang, T., & Liang, S.	https://www.sciencedirect.com/science/article/pii/S095653X13000597
2017	Enabling Circular Economy Through Product Stewardship	Jensen, J. P. & Remmen, A.	https://www.sciencedirect.com/science/article/pii/S2351978917300549
2017	Evaluating the comprehensive benefit of eco-industrial parks by employing multi-criteria decision making approach for circular economy	Zhao, H., Zhao, H., & Guo, S.	https://www.sciencedirect.com/science/article/pii/S0959652616318807
2018	Circular Economy: The Concept and its Limitations	Korhonen, J., Honkasalo, A., & Seppälä, J.	https://www.sciencedirect.com/science/article/pii/S0921800916300325
2018	Design for circular economy: Developing an action plan for Scotland	Whicher, A., Harris, C., Beverley, K., & Swiatek, P.	https://www.sciencedirect.com/science/article/pii/S0959652617326604
2018	Recycling portable alkaline/ZnC batteries for a circular economy: An assessment of natural resource consumption from a life cycle and criticality perspective	Tran, H. P., Schaubroeck, T., Swart, P., Six, L., Coonend, P., & Dewulf, J.	https://www.sciencedirect.com/science/article/pii/S0921344917302665
2018	Circular Economy in the building sector: Three cases and a collaboration tool	Leising, E., Quist, J., & Bocken, N.	https://www.sciencedirect.com/science/article/pii/S0959652617329402

2016	Circular economy and the opportunity cost of not 'closing the loop' of water industry: the case of Jordan	Abu-Ghunmi, D., Abu-Ghunmi, L., Kayal, B., & Bino, A.	https://www.sciencedirect.com/science/article/pii/S0959652616304 98X
2018	Drivers to sustainable manufacturing practices and circular economy: A perspective of leather industries in Bangladesh	Moktadir, M. A., Rahman, T., Rahman, M. H., Ali, S. M., & Paul, S. K.	https://www.sciencedirect.com/science/article/pii/S0959652617327 21X
2018	Salvaging building materials in a circular economy: A BIM-based whole-life performance estimator	Akanbi, L. A., Oyedele, L. O., Akinade, O. O., Ajayi, A. O., Delgado, M. D., Bilal, M., & Bello, S. A.	https://www.sciencedirect.com/science/article/pii/S0921344917303609
2018	Exploring the inner loops of the circular economy: Replacement, repair, and reuse of mobile phones in Austria	Wieser, H. & Tröger, N.	https://www.sciencedirect.com/science/article/pii/S0959652617327798
2017	Product design in the circular economy: Users' perception of end-of-life scenarios for electrical and electronic appliances	Atlason, R. S., Giacalone, D., & Parajuly, K.	https://www.sciencedirect.com/science/article/pii/S0959652617320711
2017	Product biographies in servitization and the circular economy	Spring, M. & Araujo, L.	https://www.sciencedirect.com/science/article/pii/S0019850116301456
2015	Circular economy of a papermaking park in China: a case study	Li, Y. & Ma, C.	https://www.sciencedirect.com/science/article/pii/S0959652614014000
2015	Life Cycle Assessment from food to food: A case study of circular economy from cruise ships to aquaculture	Strazza, C., Magrassi, F., Gallo, M., & Borghi, A. D.	https://www.sciencedirect.com/science/article/pii/S2352550915000111
2017	Policy durability of Circular Economy in China: A process analysis of policy translation	Jiao, W. & Boons, F.	https://www.sciencedirect.com/science/article/pii/S0921344915301087
2017	Institutional pressures, sustainable supply chain management, and circular economy capability: Empirical evidence from Chinese eco-industrial park firms	Zeng, H., Chen, X., Xiao, X., & Zhou, Z.	https://www.sciencedirect.com/science/article/pii/S0959652616317139
2011	Ecological utilization of leather tannery waste with circular economy model	Hu, J., Xiao, Z., Zhou, R., Deng, W., Wang, M ., & Ma, S.	https://www.sciencedirect.com/science/article/pii/S0959652610003744
2015	A case study of a phosphorus chemical firm's application of resource efficiency and eco-efficiency in industrial metabolism under circular economy	Ma, S., Hu, S., Chen, D., and Zhu, B.	https://www.sciencedirect.com/science/article/pii/S0959652614011020
2012	Constructivism scenario evolutionary analysis of zero emission regional planning: A case of Qaidam Circular Economy Pilot Area in China	Liu, D., Li, H., Wang, W., & Dong, Y.	https://www.sciencedirect.com/science/article/pii/S0925527311001721
2018	A new holistic conceptual framework for green supply chain management performance assessment based on circular economy	Kazancoglu, Y., Kazancoglu, I., & Sagnak, M.	https://www.sciencedirect.com/science/article/pii/S0959652618316640
2014	Mode of circular economy in China's iron and steel industry: a case study in Wu'an city	Ma. S., Wen, Z., Chen, J., & Wen, Z.	https://www.sciencedirect.com/science/article/pii/S0959652613006719

Total articles: 110

1st search : "waste management" in title, "circular economy" in text																						
Year of publication	Article Name	Author(s)	HTML	Highlight	Waste Management	Sustainability	Cicular Economy	P/N Circular Economy	Addressing complecations with implementation of Circular Economy	Environment	Reduce	Reuse	Recycle	Recover	ECN	Health	Households	Consumer Patterns	Summary/relevance to study	Sector	Sector	Keywords
2018	Prioritizing barriers to adopt circular economy in construction and demolition waste management	Mahpour, A.	https://www.sciencedirect.com/science/article/pii/S0921344918300260	1	1	1	1	0	Barriers: behaviral, technical, and legal	0	0	0	1	1	0	0	0	0	Inadequate waste management hindering (access) circular economy	Construction	3	sustainability
2017	Municipal solid waste management and waste-to-energy in the context of a circular economy and energy recycling in Europe	Malinauskaitea, J., Jouhara, H., Czajczynska, D., Stanchev, P., Katsou, E., Rostkowski, P., ... Spencer, N.	https://www.sciencedirect.com/science/article/pii/S0360544217319862	1	1	1	1	P	Barriers: Lack of cooperation in multi-level governance	0	0	0	0	0	1	0	0	1	Waste-to-energy in a circular economy.	Energy	2	
2016	Waste Management in Germany – Development to a Sustainable Circular Economy?	Nellesab, M., Grünesa, J., & Morschecka, G.	https://www.sciencedirect.com/science/article/pii/S1878029616300901	0	1	0	0	0	n/a	0 (clima relevant emissions)	1	0	1	1	0	0	0	0	Turn waste into resource	Waste- Recycling technology	1	
2018	Construction and demolition waste management in China through the 3R principle	Huang, B., Wang, X., Kua, H., Geng, Y., Bleischwitz, R., & Reng, J.	https://www.sciencedirect.com/science/article/pii/S0921344917303142	0	1	0	1	P	Lack of building standard, inadequate urban planning, under developed	0	1	1	1	0	0	0	0	0	Reduce, reuse, and recycle principle	Construction	3	
2018	On the way to 'zero waste' management: Recovery potential of elements, including rare earth elements, from fine fraction of waste	Burlakovs, J., Jani, Y., Kriipsalu, M., Vincevica-Gaile, Z., Kaczala, F., Celma, G., ... Klavins, M.	https://www.sciencedirect.com/science/article/pii/S0959652618307637	1	0	0	1	P	N/A	0	1	1	1	1	0	0	0	0	CE within the conspet of "beyond Zero-waste", Landfield mining (LFM) - Waste turn to resource	Waste - Waste turn to rescource	1	Zero-waste
2017	An environmental assessment of electricity production from slaughterhouse residues. Linking urban, industrial and waste management systems	Santagata, R., Ripa, M. & Ulgiati, S.	https://www.sciencedirect.com/science/article/pii/S0306261916310145	1	0		x (H)	0	N/A	1	0	0	0	1	0	0	0	0	Turn Animal production (food) in to Energy - animal waste	energy / animal production	5	
2017	Dynamic visualisation of municipal waste management performance in the EU using Ternary Diagram method	Pomberger, R., Sarc, R. & Lorber, K. E.	https://www.sciencedirect.com/science/article/pii/S0956053X17300181	1	1	1	1	0	N/A	0	0	0	1	1	0	0	0	0	Municipal waste managment - EU performance - Ternary Diagram Method - Recoverd/Landfilling	Municipal waste	1	
2017	Expanding roles for the Swedish waste management sector in inter-organizational resource management	Aid, G., Eklund, M., Anderberg, S., & Baas, L.	https://www.sciencedirect.com/science/article/pii/S0921344917301064	1	1	1	1	0	N/A	0	1	0	0	0	0	0	0	0	Waste Managment sector - addressing barriers for transition from transport and treatment sector to a more integrated sustainable service provision and material produciton sector.	Waste Management organizations sector	1	industrial symbiosis , eco-industrial, sustainability
2017	Incentivizing secondary raw material markets for sustainable waste management	Schreck, M. & Wagner, J.	https://www.sciencedirect.com/science/article/pii/S0956053X1730363X	1	1	1	1	P	Their theoretical model support Circular Economy and landfilling mining initiatives	0	0	0	0	0	1	0	0	0	Propose a teoretical economic program and explore policy options that could motivate efficiency in secondary raw material markets.	Secondary raw materials market	3	
2018	From linear to circular integrated waste management systems: A review of methodological approaches	Cobo, S., Dominguez-Ramos, A., & Irabien, A.	https://www.sciencedirect.com/science/article/pii/S0921344917302422	1	1	0	Circular Integrated Waste Managment Sytem?	P?		0 (natural resources)	0	0	0	0	0	0	0	"our lifestyle"	Circular Integrated Waste Managment System (CIWMS) - Waste and material managment icnetivizing the circularity of resources	Waste - natural resouce	5	
2017	Collaborative Robots in e-waste Management	Alvarez-de-los-Mozos, E., & Renteria, A.	https://www.sciencedirect.com/science/article/pii/S2351978917303372	0	1	0	0 (only in keyword, but no where in the text)	0	N/A	1	1	0	1	0	0	0	0	0	e-waste - let humans and robots share the process, applying both technical and economic criteria	e-waste	4	
2017	Greenhouse gas footprint and the carbon flow associated with different solid waste management strategy for urban metabolism in Bangladesh	Nazmul Islam, K. M.	https://www.sciencedirect.com/science/article/pii/S0048969716327103	1	1	0	0	0	N/A	0	1	0	0	1	0	0	0	0	This study evaluates the GHG emissions and carbon flow of existing and proposed MSW management in Bangladesh through scenario analysis, including landfill with landfill gas (LFG) recovery, waste to energy (WtE), and material recovery facility (MRF) - reduction of GHG emissions	Waste - GHG emissions in municipal solid waste	1	energy, GHG, landfil, climate change
2018	Direct and indirect effects of waste management policies on household waste behaviour: The case of Sweden	Andersson, C. & Stage, J.	https://www.sciencedirect.com/science/article/pii/S0956053X18301806	1	1		1	P	N/A	0	1	0	1	1	0	0	1	0	Circular economy - system for separate Food waste collection increase recycling not only for food waste, but also for other waste.	Waste - food	5	
2018	Waste Management of Discarded Cell Phones and Proposal of Material Recovery Techniques	Wansi, E., D'Ans, P., Gonda, L., Segato, T., & Degrez, M.	https://www.sciencedirect.com/science/article/pii/S2212827117307783	0	0	1	x (only in abstract, nowhere else in the text)	P?	end-of-Life --> key step for progression towards a circular economy --> recycing components	0	0	0	1	0	0	0	0	0	recycling mobile phone - high metal concentrations in printed circuit assemblies (PCAs).	Electrnics - mobile phone	4	technology, sustainable, The treatment of end-of-Life products is one of the key steps for progression towards a circular economy.
2018	The relationship between good environmental practices and financial performance: Evidence from Italian waste management companies	Bartolacci, F., Paolini, A., Quaranta, A. G., & Soverchia, M.	https://www.sciencedirect.com/science/article/pii/S2352550918300502	1	1	0	1	?		1	0	1	1	1	1	0	0	0	An empirical analysis of 45 Italian companies preformance of using return assets to evaluate financial performance, and utilizing separate waste collection rates and collection per capita as proxies for good environmental practives. - improved environmeltal practices in the form of separate waste collection	Waste - return assets	1	strategy, efficient, environmental practices,
2016	Landfill taxes and Enhanced Waste Management: Combining valuable practices with respect to future waste streams	Hoogmartens, R., Eyckmans, J., & Van Passel, S.	https://www.sciencedirect.com/science/article/pii/S0956053X16301362	1	1	1	1	P	How to trigger a transistion towards a resource-efficient, circuolar economy in Europe	0	0	0	0	0	1	1	1	waste streems	Landfill taxes and Enhanced Waste Managment practices can mitigate the scarcity issue of landfill capacity. Higher Landfill taxes do not necessarly give a more effective WM. Provide of sufficient incentives for applying EWM practices in support of technological development.	Landfill taxes	1	echnological development, effect, optimal, rescource managment
2015	A Danish–Vietnamese partnership for business and technology development in solid waste management	Christensen, D. & Bach, L. T.	https://www.sciencedirect.com/science/article/pii/S0921344915301178	1	1	1	x (H)	0	Highlights: "Circular economy thinking and informal sector inclusion can improve sustainability	0	0	0	0	0	1	1	1	1	Analyzed business development process of a Danish-Vietnamese partnership in the waste sector; adapting danish technology to Vietnam though a Nort-South partnership - and issues; careful partner selection, managing different interests, cultural differences, and securing joint ownership in constructing a solution, while also showing the need for a comprehensive understanding of these issues.	Partnership business concept - Denmark /Vietnam	3	technology, sustainable solutions, environmental challanges, innovation manamgment, partnerships, social and culturally influences, solution
2018	Role of compostable tableware in food service and waste management. A life cycle assessment study	Fieschi, M., & Pretato, U.	https://www.sciencedirect.com/science/article/pii/S0956053X17308760	1	1		1	P	in line with the principle of CE	1	1	0	0	0	0	0	0	0	12% of food waste areise from food service (hospitality sector) - compares the environmental performance of using biodegradable and compostable single use tableware with orgranic recycling of food waste thrgouh composting against traditional scenario using fossil-based plastic tablewater and disposal of the waste flows through incineration and landfill.	Food service	5	organic recycling, waste flows, landfill, product environmental footprint,
2017	Life cycle inventory and mass-balance of municipal food waste management systems: Decision support methods beyond the waste hierarchy	Edwards, J., Othman, M., Crossin, E., & Burn, S.	https://www.sciencedirect.com/science/article/pii/S0956053X17305810	1	1	0	0	0	N/A	1	1	0	1	1	0	1	0	0	study a life cycle approach, of seven WM systems, was employed using a system boundary that includes the entire waste service provision from collection to safe end-use or disposal. - result describe the mass, energy and water baance of each system along with key emissions profile. confirmed that higher FW landfill diversion rates were cirtical for reducing many harmful emissions to air and water. Although, mass-balance	Food service	5	waste hierarchy, revocevered for energy, landfill, collection and sorting efficiency, valuable resource,
2018	Indicator analysis of integrated municipal waste management system. Case study of Latvia	Kavals, E., Klavenieks, K., Gusca, J., & Blumberga, D.	https://www.sciencedirect.com/science/article/pii/S1876610218302431	1	1	0	0	0	N/A	0					1	0	1	0	indicator analysis for the Latvian household waste managment sector, assessing the potential of material and energy recovery, as well as setting cost indicators related to these activities. Result: show that potential of material and energy recovery from municipal waste is in the range of 3% to 15% but avarage costs for waste collection, recycling and landfillings is 16,73 euro per tonne of municipal waste.	Household waste management sector	2	landfill, energy recovery, material recovery, municipal waste, resource recovery, efficentcy, challange,
2018	Environmental assessment of microwaves and the effect of European energy efficiency and waste management legislation	Gallego-Schmid, A., Mendoza, J. M. F., & Azapagic, A.	https://www.sciencedirect.com/science/article/pii/S0048969717331224	1	0	1	0	0	N/a	1	1	0	0	0	0	0		0	Reducing the consumption of electricity, and a more sustainable managment of end-of-life electrical and electronic waste - a life cycle assessment of Microwaves and assessing the environmental implications of the standby Regulation and the WEEE Directive at the EU level. in the efforts to reduce the environmental impacts of a future electricity mix should be comined with the development of specific eco-design regulations	electricity - Microwaves	4	end-of-life, electronic waste, life cycle assesment, environmental impact, environmetnal implications, EU regulations, electricity decarbonisation, environmental hot-spots, eco-design regulations, resource consumption, shorter lifetime, limited availability, development, product regulations
2018	Decomposition analysis of food waste management with explicit consideration of priority of alternative management options and its application to the Japanese food industry from 2008 to 2015	Fujii, H., & Kondo, Y.	https://www.sciencedirect.com/science/article/pii/S0959652618309181	1	1	0	0	P	The results show that the amount of unutilized food waste throughout the food industry decreased between 2008 and 2011, primarily due to three factors: increased food waste recycling, volume reduction, and a decrease in production scale	0	1	0	1	1	0	0	0	0	Introduction of prevention and utilization of food waste using Japanice food industry data from 2008-2015; classifiying 5 factors; Waste prevention, food recycling, heat recovery, volue reduction and production scale. - Result; decrease unutilized foods waste throught the food industry between 2008-2011. drivers for decline in unutilized food waste were recycling in the food manufacturing industry, waste prevention in the retail	Waste - Food	5	prevention, energy recovery, food industry, food waste, waste prevention, food recycling, heat recovery, volume reduction, production scale.
2015	Destined for indecision? A critical analysis of waste management practices in England from 1996 to 2013	Farmer, T. D., Shaw, P. J., & Williams, I. D.	https://www.sciencedirect.com/science/article/pii/S0956053X15001257	1	1	0	1	0	N/A	0	1	0	1	1	1	0	1	0	Local Authority Colelcted Waste for England, at national, regional and sub-reginoal level, in terms of the destination of household waste to landfill, incineration and recycling. - there is a need for clearer national strategy and co-ordination toinform and guide policy, practice, planning andinvestment in infrastructure such that waste managment can be better aligned with the principles of the circular economy and resource	Waste - household waste/landfill	1	Landfill, Household waste, Waste hierarchy, lifespan reduction, recource efficiency
2018	Decision making and software solutions with regard to waste management	Burger, C., Kalverkamp, M., & Pehlken, A.	https://www.sciencedirect.com/science/article/pii/S0959652618328130	0	1	0	0	0	N/A	0	0	1	1	0	0	0	0	0	the recycling and waste managment a direct consequence of the challange of material efficiency and lifecycles, and heavily componded by data requirements. The study investigates various software tools to critically compare the tool´s potential to improve data availability and data completeness as well as the management of the reuse or recycling business processes using Enterprise Resource Planning software	Softeware	4	
2017	Common and Distinctive in Municipal Solid Waste Management in Baltic States	Klavenieks, K. & Blumberga, D.	https://www.sciencedirect.com/science/article/pii/S1876610217321951	0	1		1	p	New policies bring strickter requirements for recovery of waste material	0	0	0	1	1	0	0	0	0	Analyses of recycling rate of biogradable waste, and various waste treatment solutions.	municipal solid waste management mswm	1	
2018	Assessing factors that influence waste management financial sustainability	Bartolacci, F., Paolini, A., Quaranta, A. G., & Soverchia, M.	https://www.sciencedirect.com/science/article/pii/S0956053X18304823	1	1	1	0	0	na	1	0	0	0	0	1	0	0	0	Financial sustainability in firms regarding waste management and the environemnt.	Firm waste management based on financial findings.	3	
2018	Modelling solid waste management solutions: The case of Campania, Italy	Di Nola, M. F., Escapa, M., & Ansah, J. P.	https://www.sciencedirect.com/science/article/pii/S0956053X1830360X	1	0 (h)	0	0	0	na	0	0	0	0	0	0	0	0	0	Waste system and its evolution of handling amount of waste over a specific time. A tool for policy making and decition processes. Alternaive waste policies.	historic analysis of waste management capacity policy.	1	
2018	Modular life cycle assessment of municipal solid waste management	Haupt, M., Kägi, T., & Hellweg, S.	https://www.sciencedirect.com/science/article/pii/S0956053X18301776	1	1		0	0	na	1	0	0	1	1	0	0	0	0	LCA, including environmental impact from emissions and extractions, treatment of waste in MSWM, energy efficiency and material substitution. In countries with advanced waste management systems such as Switzerland, there is limited improvement potential with further increases in recycling rates. In these cases, the focus of political measures should be laid on (i) the utilization of secondary materials in applications	waste management systems	1	
2018	Environmental and sustainability evaluation of livestock waste management practices in Cyprus	Lijó, L., Frison, N., Fatone, F., González-García, S., Feijoo, G., & Moreira, M. T.	https://www.sciencedirect.com/science/article/pii/S0048969718310593	1	0 (H)	1	0	0	na	1	0	1	0	1	1	1	0	0	Life cycle analysis, management otions for livcestock waste in a sustainable perspective. GHG	Waste management- livestock	5	
2018	Waste management performance in Italian provinces: Efficiency and spatial effects of local governments and citizen action	Agovino, M., D'Uva, M., Garofalo, A., & Marchesano, K.	https://www.sciencedirect.com/science/article/pii/S1470160X18301304	1	1	0	0	0	na	0	0	0	0	0	0	0	0	0	Waste management administrative and citizens. Need both in order to score well	waste management, public and adminastrative	1	
2018	Linking energy scenarios and waste storylines for prospective environmental assessment of waste management systems	Meylan, G., Haupt, M., Duygan, M., Hellweg, S., & Stauffacher, M.	https://www.sciencedirect.com/science/article/pii/S0956053X18305580	1	1	1	0	0	na	1	0	0	0	0	1	0	0	0	join energy and waste scenarios, LCA, sustainability of future waste management	Municipal waste management	1	
2018	Assessment of biowaste losses through unsound waste management practices in rural areas and the role of home composting	Mihai, F. C. & Ingrao, C.	https://www.sciencedirect.com/science/article/pii/S0959652616317942	1	1	1	0	0	na	0	0	0	0	0	1	0	0 (home composting)	0	municipal biowaste management, poor infrastrucutre, GHG emission calculations.	biowaste management	5	
2018	Where do islands put their waste? – A material flow and carbon footprint analysis of municipal waste management in the Maltese Islands	Camilleri-Fenech, M., Oliver-Solà, J., Farreny, R., & Gabarrell, X.	https://www.sciencedirect.com/science/article/pii/S0959652617314853	0	1	0	0	0	na	1	0	0	1	0	0	0	0	0	Management of municipal waste on islands, focus on GHG emissions from waste (and WM),	Municipal waste management	1	
2017	The role of public communication in decision making for waste management infrastructure	Kirkman, R. & Voulvoulis, N.	https://www.sciencedirect.com/science/article/pii/S0301479716303413	1	1	0	0	0	na	1	0	0	0	0	1	0	0	0	Importance of public engagement in waste handling and management. Need for sufficienct waste infastructure.	Waste management public perception	1	
2018	The role of environmental organisations on urban transformation: The case of waste management in Esporles (Mallorca)	Weber, G., Calaf-Forn, M., Puig-Ventosa, I., Cabras, I., & D'Alisa, G.	https://www.sciencedirect.com/science/article/pii/S0959652617319856	1	1	1	0	0	na	1	1	0	0	0	0 (H)	0	0	0	Environmental organization for reducing impact of waste production, implementations of waste maagement policies.	Waste management policies	1	
2018	SWIMS: A dynamic life cycle-based optimisation and decision support tool for solid waste management	Roberts, K. P., Turner, D. A., Coello, J., Stringfellow, A. M., Bello, I. A., Powrie, W., & Watson, G. V. R.	https://www.sciencedirect.com/science/article/pii/S0959652618316184	0	1	1	0	0	na	1	0	0	0	0	1	0	0	0	LCA, swims software for optimazing environmental and economical performance of WM, used for policy making regarding WM	Waste management policies- LCA, SWIM	1	
2018	Discourse coalitions in Swiss waste management: gridlock or winds of change?	Duygan, M., Stauffacher, M., & Meylan, G.	https://www.sciencedirect.com/science/article/pii/S0956053X1730805X	1	1	1	0	0	na (however, mentions barriers for initiating change in the swiss waste management system)	0	0	0	0	0	0	0	0	0	Material and energy flow, life cycle assessment, policy beliefs	waste management, policy level/political actions	1	
2016	A comprehensive study of the environmental and economic benefits of resource recovery from global waste management systems	Zaman, A. U.	https://www.sciencedirect.com/science/article/pii/S0959652616002675	1	1	0	0	0	na	1	0	0	1	1	1	0	0	0	GHG Emission saved by implementing municipal solid waste management. Measuring the environmental benefits of global waste management system by the Zero waste index tool. Accounts for energy savings, water and ghg saved by recovering resources from waste.	municipal solid waste management mswm	1	
2013	Combining lean and green in manufacturing: a model of waste management	Fercoq, A., Lamouri, S., Carbone, V., Lelièvre, A., & Lemieux, A. A.	https://www.sciencedirect.com/science/article/pii/S1474667016342719	0	1	0	0	0	na	1	1	1	0	1	0	0	0	0	Optimazation of a waste management program, with a focus on the environment	Waste management program	1	
2018	Sustainable approach towards extractive waste management: Two case studies from Italy	Antonell, G., Mehta, D. N., Rossetti, P., Ajmone-Marsan, F., & De Luca, D. A.	https://www.sciencedirect.com/science/article/pii/S0301420718302241	1	0	1	0	0	na	1	0	1	1	0	1	1	0	0	Found carcigenic chemicals from mining dumps from two Italian abandoned mine sites. Harmful to the environment and human health.	Waste management- mining	3	

2018	Environmental Performance of Waste Management in an Italian Region: How LCI Modelling Framework could Influence the Results	Pini, M., Neri, P., & Ferrari, A. M.	https://www.sciencedirect.com/science/article/pii/S2212827117309277	1	1	0	0	0	na	1	1	0	0	0	0	0	0	0	LCA for policies to reduce environmental impact of waste, municipal waste handling, EU	Waste management policies, LCA	1	
2017	Sustainable waste management policy in Bangladesh for reduction of greenhouse gases	Shams, S., Sahu, J. N., Rahman, S. M. S., & Ahsan, A.	https://www.sciencedirect.com/science/article/pii/S221067071730149X	1	1	1	0	0	na	0	0	1	1	0	0	0	0	(mentions improved lifestyle)	No energy recovery from landfills in Bangladesh- is needed, GHG	Waste management policies	1	
2010	An overview of municipal solid waste management in China	Chen, X., Geng, Y., & Fujita, T.	https://www.sciencedirect.com/science/article/pii/S0956053X09004590	0	1		0	0	na	0	0	0	0	0	1	0	0	0	mentions government, infrastructure, eco-efficiency, waste incineration	municipal solid waste management mswm	1	
2018	Design, implementation, and evaluation of an Internet of Things (IoT) network system for restaurant food waste management	Wen, Z., Hu, S., Clercq, D. D., Beck, M. B., Zhang, H., Zhang, H.,... Liu, J.	https://www.sciencedirect.com/science/article/pii/S0956053X17309376	0	0		0	0	na	0	0	0	0	0	0	0	0	0	sensor based network technology for resturant food waste	catering waste/waste in resturant sector	5	
2018	Waste management studies in a Brazilian microregion: GHG emissions balance and LFG energy project economic feasibility analysis	Pin, B. V. R., Barros, R. M., Lora, E. E. S., & Santos, I. F. S.	https://www.sciencedirect.com/science/article/pii/S2211467X17300688	1	x (MSWM)	0	0	0	na	0	1	0	1	0	1	0	0	0	Municpal solid waste, Economic feasible, GHG emission, generate energy from landfills	Energy from landfills	2	
2017	Importance of waste composition for Life Cycle Assessment of waste management solutions	Bisinella, V., Götze, R., Conradsen, K., Damgaard, A., Christensen, T. H., & Astrup, T. F.	https://www.sciencedirect.com/science/article/pii/S0959652617314348	1	1	0	0	0	na	1	0	0	0	0	0	0	0	0	LCA, mentions the envrionmental emissions, sensitivity analysis,	Evaluation of waste compositio data	1	
2015	Construction and demolition waste management – a holistic evaluation of environmental performance	Dahlbo, H., Bachèr, J., Lähtinen, K., Jouttijärvi, T., Suoheimo, P., Mattila, T., ... Saramäki, K.	https://www.sciencedirect.com/science/article/pii/S0959652615001985	1	1	x (H)	0	0	na	1	0	0	1	1	1	0	0	0	If recycling in construction can be envrionmental and economically beneficial, LCA, still a lack in decition making	construction recyling material	3	
2018	Efficiency of packaging waste management in a European Union candidate country	Mrkajić, V., Stanisavljevic, N., Wang, X., Tomas, L., & Haro, P.	https://www.sciencedirect.com/science/article/pii/S0921344918301411	1	1		0	0	na	1	0	0	1	1	0	0	0	0	packaging waste management, EU, extended producer responsibility,	packaging waste management	3	
2018	Extractive waste management: A risk analysis approach	Mehta, N., Dino, G. A., Ajmone-Marsan, F., Lasagna, M., Romè, C. & De Luca, D. A.	https://www.sciencedirect.com/science/article/pii/S0048969717333181	1	0	0	0	0	na	1	1	0	0	0	0	1	0	0	Envrionment and human health issue from mining waste activities. Risk analysis	Risk analysis. Mining waste	3	
2017	Analytical method of waste allocation in waste management systems: Concept, method and case study	Bergeron, F. C.	https://www.sciencedirect.com/science/article/pii/S0195925516300622	1	1		0	0	na	1	0	0	0	0	0	0	1	0	Analyis of waste managment methods and systems.	Waste management systems	1	
2015	Recovery of essential nutrients from municipal solid waste – Impact of waste management infrastructure and governance aspects	Zabaleta, I. & Rodic, L.	https://www.sciencedirect.com/science/article/pii/S0956053X15300490		1	0	0	0	na	0	0	0	0	1	0	0	0	0	Agricultural nutrient recovery (N) and (P), bio-waste, municipality legislations and actions	Agrcultural nutrient recovery	5	
2017	Economic and environmental review of Waste-to-Energy systems for municipal solid waste management in medium and small municipalities	Fernández-González, J. M., Grindlay, A. L., Serrano-Bernardo, F., Rodríguez-Rojas, M. I., & Zamorano, M.	https://www.sciencedirect.com/science/article/pii/S0956053X17303057	1	0 (H)	0	0	0	na	1	1	0	0	1	1	0	0	0	Economic and envrionmental cost of energy recovery of waste, LCA	Energy	2	
2017	Drivers of knowledge accumulation in electronic waste management: An analysis of publication data	Cecere, G. & Martinelli, A.	https://www.sciencedirect.com/science/article/pii/S0048733317300483	1	0		0	0	na	1	0	0	0	0	0	0	0	0	Electronic waste management, increased amount of e-waste + shorter life. Research for the future. Price of electronics	Electronic waste management	4	
2017	Sustainable waste management: Waste to energy plant as an alternative to landfill	Cucchiella, F., D'Adamo, I., & Gastaldi, M.	https://www.sciencedirect.com/science/article/pii/S019689041631007X	1	0	1	0	0	na	1	1	1	0	1	1	0	0	0	Energy recovery of landfill waste, Finance, SDG	Energy	2	
2017	SIMSWASTE-AD - A modelling framework for the environmental assessment of agricultural waste management strategies: Anaerobic digestion	Pardo, G., Moral, R., & Prado, A.	https://www.sciencedirect.com/science/article/pii/S0048969716320241	1	0		0	0	na	1	1	0	0	0	0	0	0	0	Emission from digestion in agriculture, LCA, GHG,	Agricultural	5	
2013	Collaboration between design and waste management: Can it help close the material loop?	Ordoñez, I., & Rahe, U.	https://www.sciencedirect.com/science/article/pii/S0921344913000037	1	1	0	0	0	na	0	0	0	0	0	0	0	0	0	Collaboraion between WM and designers to get materials into production. Material flow	Waste management + design	1	
2012	Evolution of the electronic waste management system in Spain	Queiruga, D., Benito, J. G., & Lannelongue, G.	https://www.sciencedirect.com/science/article/pii/S0959652611004781	0	1		0 (mentions it under one of the figures, but thats it)	0	na	0	0	0	0	0	0	0	0	0	Legislations for electronic waste management, gradual implementation.	Electronic waste management	4	
2018	Areas on which to focus when seeking to reduce the greenhouse gas emissions of commercial waste management. A case study of a hypermarket, Finland	Hupponen, M., Grönman, K., & Horttanainen, M.	https://www.sciencedirect.com/science/article/pii/S0956053X18301661	1	1		0	0	na	1	1	0	1	0	0	0	1	0	GHG emission reduction, LCA, envrionmental impact	Commercial waste management	3	
58				45	44	19	13	0		28	21	9	23	21	20	6	7	2				
				78 %	76 %	33 %	22 %	0 %		48 %	36 %	16 %	40 %	36 %	34 %	10 %	12 %	3 %				

1	26
2	5
3	10
4	6
5	11

* the ones with circular economy only in the abstract or as a keyword all have a scanned document. However, some of the other scanned documents still had circular

These articles was also in the search for WM in title, but CE was only listed in the citations or references, and therefor not applicable for our analysis																						
2017	Sludge from paper mill effluent treatment as raw material to produce carbon adsorbents: An alternative waste management strategy	Jaria, G., Silva, C. P., Ferreira, C. I. A., Otero, M., and Calisto, V.	https://www.sciencedirect.com/science/article/pii/S030147971630977X	x	0	0	0 (only mentions it as a keyword, but no where in the text)	0	N/A	x					0	0	0	0	Pulp and paper industry produce massive amount of sludge, consitute an enormous environmental challange. A possible managemnt option to convert Sludge into carbon-based absorrbent to applied in water remediation. -investigae if sludge is a consistent raw material - findings; precursours from different factories mitht originate final materals with distinct characteristics, being essential to take into account this source of variability when considering paper mill sludge as a raw material.	Sludge	Sludge	environmental challange, raw material,
2018	Optimizing municipal biodegradable waste management system to increase biogas output and nutrient recovery: a case study in Lithuania	Edgaras Stunzenas and Irina Kliopova	https://www.sciencedirect.com/science/article/pii/S1876610218302406	0	x	0	0	0	na	x					x		x	0	Energy from landfills, GHG, mixed municipal waste management plants. Mentions agriculture, bio-waste and biogas.	Municipal waste management plants, energy	Municipal waste management plants, energy	
2010	Evaluation of innovative municipal solid waste management through urban symbiosis: a case study of Kawasaki	Yong Geng, Fujita Tsuyoshi, and Xudong Chen	https://www.sciencedirect.com/science/article/pii/S0959652610001034	0	x	0	0	0	NA	x					0	0	0	0	Waste management symbiosis, cost, and environmental reduction. LCA	Waste management	Waste management	

2nd search: "circular economy" in title, "waste management" in text																						
Year of publication	Article Name	Author(s)	HTML	Highlight	Waste management	Sustainability	Cicular Economy	P/N Circular Economy	Addressing complecations with implementation of Circular Economy	Environment	Reduce	Reuse	Recycle	Recover	ECN	Health	Households	Consumer Patterns	Summary/relevance to study	Sector	Sector	Keywords
2018	Prioritizing barriers to adopt circular economy in construction and demolition waste management	Mahpour, A.	https://www.sciencedirect.com/science/article/pii/S0921344918300260	1	1	1	1	0	Barriers: behavioral, technical, and legal	0	0	0	1	1	0	0	0	0	Inadequate waste management hindering (access) circular economy	Construction	3	sustainability
2017	Municipal solid waste management and waste-to-energy in the context of a circular economy and energy recycling in Europe	Malinauskaitea, J., Jouhara, H., Czajczynska, D., Stanchev, P., Katsou, E., Rostkowski, P., ... Spencer, N.	https://www.sciencedirect.com/science/article/pii/S0360544217319862	1	1	1	1	P	Barriers: Lack of cooperation in multi-level governance	0	0	0	0	0	1	0	0	1	Waste-to-energy in a circular economy.	Energy	2	
2016	Waste Management in Germany – Development to a Sustainable Circular Economy?	Nellesab, M., Grünesa, J., & Morschecka, G.	https://www.sciencedirect.com/science/article/pii/S1878029616300901	0	1	0	0	0	n/a	0 (clima relevant emissions)	1	0	1	1	0	0	0	0	Turn waste into resource	Waste- Recycling technology	1	
2018	Moving towards a circular economy: economic impacts of higher material recycling targets	Beccarello, M. and Di Foggia, G.	https://www.sciencedirect.com/science/article/pii/S2214785317323593	0	1	x(K)	1	0	N/A	1	0	0	1	0	1	0	0	0	Looks in to potential socio-economic implications arising from higher recycling targets in the medium-term; what simulates the environmental contribution , according to the current recycling rate along with the reference that reflects higher goals. Result suggest that higher recycling targets are associated wiht positive effects on job creation, production and value added by virtue of both direct and indirect effects.	Socio-economic impacts/higher recycling targets	1	Packaging waste managment, extended producer responsibility, Financial mechanism, environment contribution, socio-economic, recycling rate, production, policy makers, environmental legislation, shared responsibility
2018	No zero burden assumption in a circular economy	Ilic, D. D., Eriksson, O., Ödlund, L., & Åberg, M.	https://www.sciencedirect.com/science/article/pii/S0959652618303378	1	1	1	1	P	the traditional view of separate system for production and waste managment must be changed. - life cycle assessment	1	0	0	1	0	1	0	product users	Over consumption	In order to detect connections between different problems of sustainability and to suggest measures which may contribute to their solutions, this study provides a simplified overview of the mechanisms behind waste generation and management. The results from the study show that the only way to eliminate problems of sustainability is to apply an upstream approach by dealing with the primary problems which occur in the early stages of the system	Waste treatment	1	environmental problems, waste disposal, waste treatment, sustainability, waste generation, overconsumtion of products, finite resources, toxic materials, non-recyclable materials, sustainable development, product life cycles, product developers, manufacuring companies, product user and policy makers, LCA, waste, "zero burden", Waste life cycle, responsibilityenvironmental burden
2018	Circular economy of plastic packaging: Current practice and perspectives in Austria	Van Eygen, E., Laner, D., & Fellner, J.	https://www.sciencedirect.com/science/article/pii/S0956053X17308802	1	1		1	N?	the current calculation point of the targets, i.e. on the input side of the recycling plant, is not deemed to be fully in line with the overall objective of the circular economy, namely to keep materials in the economy and prevent losses	1	0	0	1	0	1	0	0	0	quantitatively and qualitatively investigate the waste management system for plastic packaging in Austria in 2013 using material flow analysis, taking into account the used product types and the polymer composition.	Recycling plastic	1	Circularity, Increased targets, recycling rates, material flow, waste stream, recovered, technological steps, prevent losses, recyckling process, quality of the output products is maintained
2018	Circular economy of composting in Sri Lanka: Opportunities and challenges for reducing waste related pollution and improving soil health	Bekchanov, M. & Mirzabaev, A.	https://www.sciencedirect.com/science/article/pii/S0959652618325290	0	1	1	0	0	N/A	1	0	0	1	0	1	0	0	0	Crop production and use of fertilizers and how to handle organic waste to gain economic optimization by using wide-scale composting projects in Sri Lanka.	Production - organic waste/crop	5	organic waste, environmental pollution, nutrient loss, developing countires, composting, dumping, financial feasibility, waste, crop production, chemical fertilizers, environmental and economic benefits, economic optimization, finanical feasibility, compost, sustainable organic waste, environmental pollution, awareness,
2016	Drivers for development of circular economy – A case study of Serbia	Ilic, M. & Nicolic, M.	https://www.sciencedirect.com/science/article/pii/S019739751630128X	1	1	1	1	P	?	1	0	1	1	1	1	1	0	0	The objective is related to waste management drivers in the context of circular economy. This includes establishing baseline data on waste and assessment of the current waste management system, setting future goals, identification of issues, plans for integrated waste management and their implementation. The paper identifies bottlenecks that restrict Serbian's sustainable development.	Waste managment	1	developing countries, economic status, economic-social factors, environmental legistaltion, financial managment, resource from waste, innovative solutions, impact, waste, zero waste practice, sustainable,
2018	Proposal of a dynamic model to evaluate public policies for the circular economy: Scenarios applied to the municipality of Curitiba	da Silva, C. L.	https://www.sciencedirect.com/science/article/pii/S0956053X18303611	1	1	0	1	P?	CE is complex, but it tranforms problems into opportunities for municipalitites such as Curitiba	1	0	0	1	0	1	0	0	0	to develop a dynamic model that allows an analysis of different scenarios involving the tradeoff between investment in new landfills and policies to increase the recycling rate. Because it is a dynamic system, the base theory for understanding the relationship between the variables and agents was the circular economy. Show the need for further actions linked to the organization of the chain. The circular economy is complex, but it transforms problems into opportunities for municipalities such as Curitiba.	Waste - landfills vs increased recycling rates	1	Landfill, waste, investment in nyew landfills, polices to increase the recycling rate, waste value chain, environmental education, cost of disposal,
2016	Resource recovery from post-consumer waste: important lessons for the upcoming circular economy	Singh, J. & Ordoñez, I.	https://www.sciencedirect.com/science/article/pii/S0959652615018442	1	1	1	1	P?	implementing challanges; recirculate resources to make different types of products, whereas CE requires manufacturing companies to take back their own products to secure their material resources.	1	0	0	1	1	1	0	0	0	Resource recircualtion in practice - by analyse 50 ex of products developed from discarded materials, categorising them into the recovery routes described in the CE- and CE implementation challanges	Production - CE	3	Linear economic system, recirculating material resources, product development, practical challenges, implementing, manufacturing, recovery routes, society, product design, new challenges,
2018	Rethinking packaging production and consumption *vis-à-vis* circular economy: A case study of compostable cassava starch-based material	Casarejos, F., Bastos, C. R., Rufin, C., & Frota, M. N.	https://www.sciencedirect.com/science/article/pii/S0959652618324569	1	0	x(K)	1	0	N/A	1	0	0	0	0	1	0	0	Consumption	Examines packaging production and consumption vis-a-vis Circular economy. Life cycle inventory analysis of rigid cassava starch-based packaging - case of Brazil. Comparative analysis between petroleum-based and cassava starch-based packaging	packaging	3	Industrial economy, Packaging waste, negative impacts on interconected human-Earth systems, dominannt linear economy, circularity, production, consumption, raw materials, water, energy use, GHG emissions, societal and environmental outcomes, services, markets, natural capital, growth, adoption, Climate change mitigation strategy
2018	Ecological foraging models as inspiration for optimized recycling systems in the circular economy	Ryen, E. G., Gaustad, G., Babbitt, C.W., & Babbitt, G.	https://www.sciencedirect.com/science/article/pii/S0921344917302458	1	1	0	1	P	demonstrate how optimal foraging decisions can guide business, design, and end of life management toward circular economy goals in the consumer electronic system.	1	0	0	0	0	1	0	0	consumer electronic product	This article proposes that transformations in the e-waste processing system aimed at closing the material loop should look to the circular processes found in natural ecosystems, which have evolved to optimize closed loop nutrient cycling	e-waste	4	consumer electronic product system, linear system, electronic waste, extract high-value components, waste stream, ecological
2017	Optimizing the Methodology of Characterization of Municipal Solid Waste in EU Under a Circular Economy Perspective	Rada, E.C. & Cioca, L.	https://www.sciencedirect.com/science/article/pii/S1876610217325924	0	1	0	1	P	A new model of characterization is thus proposed, suitable for planning waste management in the frame of the circular economy principles.	0	0	0	0	0	0	0	0	0	paper present a few proposals in order to avoid mistakes and to deepen the reliability of the data generated during the analysis performed to classify the residual municipal solid waste in fractions.	Waste - residual municipal solid waste	1	RMSW, optimization,
2018	The role of energy from waste in circular economy and closing the loop concept – Energy analysis approach	Tomic´, T. & Schneider, D. R.	https://www.sciencedirect.com/science/article/pii/S1364032118306750	1	1	1	1	P	N/A	0	1	0	1	1	1	0	0	Primary energy consumption	Evalutaion method of the energy recovery role in the circular economy. Energy recovery influenced on the embodied energy of recycled material is analysed. sequential, time-dependent, city-based, energy are analysed. Impacts of closing the loop on the energy side of the recovery chain are identified.	Energy	2	climate change, development, EU energy systems, security of supply prolbmes, energy and material scarcity, waste generation, sustainable, resource-efficient economy, "closing the loop", material recovery, energy from waste, energy needs, sustainability assessment, primary energy consumption,
2018	Creating value in the circular economy: A structured multiple-case analysis of business models	Ranta, V., Aarikka-Stenroos, L., & Mäkinen, S. J.	https://www.sciencedirect.com/science/article/pii/S0959652618324089	1	1	1	1	P	These propositions contribute to the circular business model literature by showing how economic value is generated by CE initiatives and providing foundations for theory-testing future research.	0	1	1	1	0	1	0	0	Reductions in customers total waste management costs		economic value of circular business	3	pathway, sustainable economic growth, 3R principles, value creation/delivery, cost-efficiency, recycling is easier to implement than reducing or reusing due to a smaller impact on the business
2017	Best practices for the management of end-of-life gypsum in a circular economy	Jiménez-Rivero, A. & García-Navarro, J.	https://www.sciencedirect.com/science/article/pii/S095965261730999X	1	1	0	1	p	want CE of gypsum, thus need on-site segregation of GW, clear waste acceptance criteria and clear recycled gypsum quality criteria.	0	1	0	1	1	0	0	0	0	since prodcution of gypsum cannot be reduced, therefore the priority should be to appropriately collect and recover EoL products. (eol=end of life) this paper will focus on the best practices for the management of EoL gypsum in a circular economy	construction, focus on end of life, gypsum	3	Landfills, closed-loop supply chain, end-of-life, waste production,
2016	Fouling prevention, preparing for re-use and membrane recycling. Towards circular economy in RO desalination	Landaburu-Aguirre, J., García-Pacheco, R., Molina, S., Rodríguez-Sáez, L., Rabadán, J., & García-Calvo, E.,	https://www.sciencedirect.com/science/article/pii/S0011916416301370	1	1	x(H)	1	p	need to be more energy efficient and less costly– ce is the answer to this	0	0	1	1	1	1	0	0	0	this review aims at summarizing research efforts found in literature in order to approach a more circular economy society, covering the whole life cycle of RO membranes: from the new development of antifouling membranes to the membrane waste management	research, water desalination	1	Sustainability assessment, energy consumption, landfills,
2018	Public awareness of circular economy in southern Poland: Case of the Malopolska region	Smol, M., Avdiushchenko, A., Kulczycka, J., & Nowaczek, A.	https://www.sciencedirect.com/science/article/pii/S0959652618317505	1	0 (H)	x(H)	1	p	People's awareness of the CE concept also has a positive correlation with their educational level, such individuals believing that the CE model could, in the future, be implemented in the region. CE popular among the younger generations	1	0	0	1	0	1	0	0	0	This paper presents the results of an evaluation of public awareness and attitudes about CE in the Malopolska region of southern Poland. Increasing public awareness is one of the major driving forces	research, CE awareness	1	Air pollution, env protection, sharing ecn, educational resources,
2016	A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems	Ghisellini, P., Cialani, C., & Ulgiati, S.	https://www.sciencedirect.com/science/article/pii/S0959652615012287	0	1	x(K)	1	p	CE focus increase over the years, the purpose of grasping the main CE features and perspectives: origins, basic principles, advantages and disadvantages, modelling and implementation of CE at the different levels (micro, meso and macro) worldwide	1	0	1	1	0	1	0	0	0	Results evidence that CE origins are mainly rooted in ecological and environmental economics and industrial ecology.CE implies the adoption of cleaner production patterns at company level, an increase of producers and consumers responsibility and awareness, the use of renewable technologies and materials (wherever possible) as well as the adoption of suitable, clear and stable policies and tools. also need an economic incentive for things to work	research, CE	3	closing-the-loop, production patterns, industrial waste, ecological, industrial ecology, renewable technology,
2018	Challenges and opportunities in a circular economy for a local productive arrangement of furniture in Brazil	de Oliveira, F. R., França, S. L. B., & Rangel, L. A. D.	https://www.sciencedirect.com/science/article/pii/S0921344917303658	1	0	0	1	p	a generation of oppurtunities in production chains. Seeks to minimize negative externalities of production processes.	0 (H)	0	0	0	0	0	0	0	0	to contribute to the expansion of the circular economy in Brazil by identifying the challenges and opportunities for a furniture cluster. results indicate the extent to which companies adhere to the strategic guidelines for a circular economy in the cluster context and identify the disposal mode and final destination for the main solid residues generated by the industries	furniture industry	3	industrial symbiosis, product development,
2018	On the implementation of a circular economy: The role of institutional capacity-building through industrial symbiosis	de Abreu, M. C. S. & Ceglia, D.	https://www.sciencedirect.com/science/article/pii/S0921344918302465	0	0	0	1	p	We identified the forces that are driving the shift from the current and traditional linear material and energy flows to a circular economy.	0	0	0	0	0	0	0	0	0	Overall the study indicates that the UK government is playing a vital role in building and maintaining an industrial symbiosis coordination network, but that ultimately other actors and driving forces will be necessary if the cyclical flow of materials and energy and systemic thinking are to be achieved	policy, implementation of CE	1	Industrial symbiosis, NGO, energy flows
2017	A pathway to circular economy: Developing a conceptual framework for complex value assessment of resources recovered from waste	Iacovidou, E., Millward-Hopkins, J., Busch, J., Purnell, P., Velis, C. A., Hahladakis, J. N., ... Brown, A.	https://www.sciencedirect.com/science/article/pii/S0959652617319893	0	0	x(K)	1	na	mentions it, but does not focus on it	1	0	0	0	1	1	0	0	0	This study proposes a novel, conceptual approach that seeks to assess how complex value is created, destroyed and distributed in resource recovery from waste systems. Combines scientific and engineering methods with a socio-political narrative	research, socio-policical	1	LCA, resource recovery, socio-political, analytical framework, resource efficient,
2018	Spent coffee grounds valorization through pyrolysis for energy and materials production in the concept of circular economy	Ktori, R., Kamaterou, P., & Zabaniotou, A.	https://www.sciencedirect.com/science/article/pii/S2214785318322788	0	1	1	1	p	want to use CE to recover useful material and energy from waste	0 (but talks about the athmospheric impact)	0	0	0	1	0	0	0	0	want to use CE to recover useful material and energy from waste by studying cofee grounds	agriculture, cofee sector	5	Energy from waste, carbon and fuels, biochar, fertilizer, closing loops, sustainable food
2018	Cleaner production as an antecedent for circular economy paradigm shift at the micro-level: Evidence from a home appliance manufacturer	Sousa-Zomer, T. T., Magalhães, L., Zancul, E., Campos, L. M. S., & Cauchick-Miguel, P. A.	https://www.sciencedirect.com/science/article/pii/S0959652618306553	1	1	0	1	p	CE implementation is still unclear at the industry level, instead focus on cleaner production- a bottom up approach	0	1	0	1	0	1	0	0	0 (consumption)	CE implementation is still unclear at the industry level, instead focus on cleaner production- a bottom up approach. This research showed that cleaner production practices enable CE to be implemented at the micro-level.	Research, Industry- production of products	3	Circularity, natural resources, renewable, emission,
2017	The need for better measurement and employee engagement to advance a circular economy: Lessons from Biogen's "zero waste" journey	Veleva, V. ScD, Bodkin, G., & Todorova, S. PhD	https://www.sciencedirect.com/science/article/pii/S0959652617306315	1	1	1	1	n	bubsinesses and companies are inadequate to take on the transition towards CE, or zero waste. And there is a lack of ways to measure progress	1	1	1	1	0	0	0	0	0	business sector transition towards a more sustainable future. companies lack effective sustainability indicators to measure progress, identify opportunities, and engage employees. Focus more on waste-to-energy ways rather than environmental friendly methods.	business sector	3	Waste-to-energy, zero waste, landfill, climate change, sustainability,
2017	Comparative assessment of circular economy development in China's four megacities: The case of Beijing, Chongqing, Shanghai and Urumqi	Guo, B., Geng, Y., Ren, J., Zhu, L., Liu, Y., & Sterr, T.	https://www.sciencedirect.com/science/article/pii/S0959652617312313	0	1	1	1	p	wanted to assess the implementation of CE over the last ten years. How well different parts of china had done.	1	1	0	1	0	1	0	0	0 (resource consumption)	Assess the CE development in china during the last ten years. Assessment of balancing the development of CE's four aspects, namely, resource consumption intensity (RCI), waste emission intensity (WEI), waste recycling and utilization rate (WRUR) and waste disposal level (WDL).	research, CE implementation	1	Resource scarcity, environmental pollution, sustainable development, 3R's, resource consumption, waste emission, wastewater,
2018	Finding an economic and environmental balance in value chains based on circular economy thinking: An eco-efficiency methodology applied to the fish canning industry	Laso, J., García-Herrero, I., Margallo, M., Vàzquez-Rowe, I., Fullana, P., Bala, A., ... Aldaco, R.	https://www.sciencedirect.com/science/article/pii/S0921344918300429	1	1	0	0	na	na	1	0	0	0	0	1	0	0	0	This study demonstrates the environmental and economic benefits of applying circular economy. According to this, it is possible to introduce the cradle-to-cradle concept in the fish canned industry	food sector, fish canning industry	5	Eco-efficiency, LCA, eco-labling, landfill, incineration, env impact,
2018	Towards sustainable WEEE collection and transportation methods in circular economy - Comparative study for rural and urban settlements	Nowakowski, P., & Mrówczyńska, B.	https://www.sciencedirect.com/science/article/pii/S0921344917304470	1	1	1	1	p	wants CE, and looks at the optimal way of waste disposal handling- drop off of collection	0 (sustainable and emission)	0	0	0	0	1	0 (artificial immune system)	0	0	Looks at best method for waste collection, found that mobile collection was the most sustainable, while drop-off of waste residual was least favoured.	waste collection. E-waste	4	Resource management, sustainable, e-waste, emission,
2013	A review of the circular economy in China: moving from rhetoric to implementation	Su, B., Heshmati, A., Geng, Y., & Yu, X.	https://www.sciencedirect.com/science/article/pii/S0959652612006117	0	0	1	1	p	looks at how ce has been succesfully implemented in China	1	0	0	0	0	0	0	0	0	Holistic literature review on CE- looking at how the strategy has been developmed and implemented. And looks at the performance of CE.	Research, Policy recommendation	1	Sustainable development, energy, source scarcity,
2018	Critical consideration of buildings' environmental impact assessment towards adoption of circular economy: An analytical review	Hossain, M. U. & Ng, S. T.	https://www.sciencedirect.com/science/article/pii/S0959652618328403	1	0	1	1	na	comprehends the available information and research on LCA and CE in building industry	1	0	0	0	1	0	0	0	0	Conducted a research regarding the literature on assessment of buildings in regards to adoption of CE. LCA implication on buildings.	construction/building industry	3	LCA, energy consumption, carbon emission, sustainability performance, env assessment, env impact,
2018	Exploring institutional drivers and barriers of the circular economy: A cross-regional comparison of China, the US, and Europe	Ranta, V., Aarikka-Stenroos, L., Ritala, P., & Mäkinen, S. J.	https://www.sciencedirect.com/science/article/pii/S0921344917302653	1	0	1	1	p	the general drivers of the CE from each institutional environment support recycling as the primary CE action, while support for other CE types appears to be lacking.	1	1	1	1	0	1	0	0	0	identifying and comparing the drivers of and barriers to CE implementation, to accelerate the development path. to improve institutional support for the CE and allow it to fulfill its potential as a sustainable growth model, diversified institutional support for reducing the products produced and materials used as well as increasing reuse are needed.	research, CE implementation improvement and barrier	1	Resource efficiency, landfills, linear-economic model, sustainable development, EU, value chain,
2018	Developing an extended theory of planned behavior model to explore circular economy readiness in manufacturing MSMEs, India	Singh, M. P., Chakraborty, A., & Roy, M.	https://www.sciencedirect.com/science/article/pii/S0921344917301945	1	0	1	1	p	ce is beneficial in manifacturing small firms	1	0	0	0	0	1	0	0	0	looking at relevance of CE and designing strategic plans to encourage circular economy implementation in manufacturing small firms.	business, and small enterprices	3	sustainable, waste minimization, green economic
2018	The circular economy: New or Refurbished as CE 3.0? — Exploring Controversies in the Conceptualization of the Circular Economy through a Focus on History and Resource Value Retention Options	Reike, D., Vermeulen, W. J. V., & Witjes, S.	https://www.sciencedirect.com/science/article/pii/S0921344917302756	1	0	1	1	na	encourages businesses to focus more on the reusable aspect of CE, while scholars needs to focus on a consensus regarding the conceptualizing the concept	0	0	0	1	1	0	0	0	0	looking at the concept of CE, and found the opposite of a consensus regarding conceptualizing the concept.	research, concept of CE	1	Sustainable, energy recovery and recycling,
2018	The circular economy and the bio-based sector - Perspectives of European and German stakeholders	Leipold, S. & Petit-Boix, A.	https://www.sciencedirect.com/science/article/pii/S0959652618323503	1	0	1	1	p	but lack clear guidelines, how much it contributes to a sustainable future economy	0	0	0	0	0	1	0	0	0	strengthening the link between circular economy and bioeconomy debates may provide a crucial step towards defining the sustainability of the circular economy, thereby setting clear priorities for sustainable business practices	business/ eu- policy regarding Sustainable future	1	EU, Social-environmental effects, bioeconomy, sustainable business models, sustainability
2017	Experiencing Urban Mining in an Italian Municipality towards a Circular Economy vision	Ragazzi, M., Fedrizzi, S., Rada, E. C., Ionescu, G., Ciudin, R., & Cioca, L. I.	https://www.sciencedirect.com/science/article/abs/pii/S1876610217326103	0	0	0	0	na	na	0	0	0	1	0	0	0	0	0	mentioning textile waste and the need for seperate recycling program for this, the collection of waste through door-to-door collection, public awareness etc). This paper deals with factors associated with waste recycling, like specific criteria (waste containers selections for door-to-door collection, public awareness and tariff) and solutions (door-to-door bins, warnings, criteria for historic centers)	municipal solid waste collections	1	textile
2018	Towards an inclusive circular economy: Quantifying the spatial flows of e-waste through the informal sector in China	Tong, X., Wang, T., Chen, Y., & Wang, Y.	https://www.sciencedirect.com/science/article/pii/S0921344917303750	1	0	0	0	na	na	0	0	0	1	0	0	0	0	0	Chinas e-waste recycling program as a response to the global e-waste challenge, "discuss the policy implications for optimizing regional allocation of the e-waste recycling capacity as well as for improving the transparency of the reverse logistic system to include the informal sector in the future"	e-waste recycling	4	e-waste
2018	Toward an integrated model of the circular economy: Dynamic waste input–output	Nakamura, S. & Kondo, Y.	https://www.sciencedirect.com/science/article/pii/S0921344918302672	1	0	0	0	na	na	0	0	0	1	0	0	0	0	0 (demand patterns- in H)	a review of the waste input-output model, with a developed dynamic model which also considers the issue of quality in recycling that involves mixing, dissipation, and contamination.	waste input-output model development	1	Industrial ecology, material flow analysis (MFA), life cycle costing (LCC), contamination,
2018	Corporate-entrepreneur collaborations to advance a circular economy	Veleva, V. & Bodkin, G.	https://www.sciencedirect.com/science/article/pii/S0959652618308679	1	0	1	1	p	lack of mandates, costs, logistical hurdles and inertia is hindering CE principles into business strategy	1	1	1	0	0	1	0	0	0	The study contributes to the research on the relationship between entrepreneurial innovation and the development of CE principles within corporate supply chains, a field that is still in its infant stage.	research, business	3	Sustainability, zero waste, EU, energy, social benefits,
2017	Closing the Loop for Packaging: Finding a Framework to Operationalize Circular Economy Strategies	Niero, M. & Hauschild, M. Z.	https://www.sciencedirect.com/science/article/pii/S2212827116313786	0	0	1	1	na	evaluates framework for best implementation of CE	0 (but mentioned in one of the frameworks)	0	0	0	0	1	0	0	0	Looks at different frameworks, and evaluates which one is best for evaluating circularity strategies. Life cycle sustainability assessment framework was best at preventing burden shifting between stakeholders in the value chain.	packaging sector	3	Cradle-to-cradle, life cycle sustainability assessment, LCA, environmental life cycle costing, and social life cycle assessment, closed-loop aluminum supply
2018	Evaluation of Urban circular economy development: An empirical research of 40 cities in China	Wang, N., Lee, J. C. K., Zhang, J., Chen, H., & Li, H.	https://www.sciencedirect.com/science/article/pii/S0959652618301045	1	0	x(K)	1	p	looking at ce implementation in cities accross China	0	0	0	0	0	1	0	0	0	Focus on the city as a component of CE, and thus looks at urban circular development. This study showed that there was an increase in UCDI over the years, that it was growing faster in those cities than the national average. This all has little relationship with industrial structure.	policy, CE implementation	1	Industrial structure, urban circular development index (UCDI).
2017	Norwegian Waste-to-Energy: Climate change, circular economy and carbon capture and storage	Lausselet, C., Cherubini, F., Oreggioni, G. D., del Alamo Serrano, G., Becidan, M., Hu, X., ... Strømman, A. H.	https://www.sciencedirect.com/science/article/pii/S0921344917302045	0	0		1	p	"Circular economy may actually give the WtE (waste to energy) system the opportunity to strengthen and expand its role towards new or little developed value chains such as secondary raw materials production and valorization of new waste streams occurring in material recycling."	0	0	0	1	1	0	0	0	0	looking at which is more favourable, CCS or circular economy (waste-to-energy). As well as current situation and waste to landfill situation	energy/CCS	2	EU, climate change, decarbonization of energy sector, renewable, carbon capture and storage, LCA, ozone depletion, toxicity, value chain, raw materials
2018	Circular economy – From review of theories and practices to development of implementation tools	Kalmykova, Y., Sadagopan, M., & Rosado, L.	https://www.sciencedirect.com/science/article/pii/S0921344917303701	1	0	x(K)	1	na	does research on the literature of CE	0	0	0	1	1	1	0	0	0 (but looks at consumption)	overview of the literature on CE, looks at theoretical approaches, strategies, and implementation cases.	research	1	value chain, implementation of CE,
2018	Circular Economy: Overview of Barriers	Galvão, G. D. A., de Nadae, J., Clemente, D. H., Chinen, G., & de Carvalho, M. M.	https://www.sciencedirect.com/science/article/pii/S2212827118305262	0	0	1	1	na	looking at the main barriers for proper implementation of CE	0	0	0	0	0	0	1	0	0	Looking at the main barriers for proper implementation of CE: (i) technological, (ii)policy and regulatory, (iii) financial and economic, (iv) managerial, (v) performance indicators, (vi) customer and (vii) Social.	research	1	sustainability
2017	Circular Economy Ownership Models: A view from South Africa Industry	Mativenga, P. T., Agwa-Ejon, J., Mbohwa, C., Sultan, A. A. M., & Shuaib, N. A.	https://www.sciencedirect.com/science/article/pii/S2351978917300422	0	0	1	1	p	want ce, found that cost is the largest driver for recycling	0	0	1	1	0	1	0	0	0	Looks at the optimal drivers for circular economy, found that optimizing cost reduction is the key driver.	composite waste	3	Extended producer responsibility
2017	Environmental assessment of the entire pork value chain in Catalonia – A strategy to work towards Circular Economy	Noya, I., Aldea, X., Gonzàlez-García, S., Gasol, C. M., Moreira, M. T. Josè, M., ... Boschmonart-Rives, J.	https://www.sciencedirect.com/science/article/pii/S0048969717304436	1	0	x(K)	1	p	closed loop system and resource efficiency were favoured over final disposal option	1	0	0	0	0	1	0	0	0	environmental impact of the pork industry, how closing the loop would be more beneficial than disposing of the waste	pork industry	5	LCA, closing loop production system, resource efficiency
2018	Exploring the Implementation of a Circular Economy Strategy: The Case of a Closed-loop Supply of Aluminum Beverage Cans	Stewart, R., Niero, M., Murdock, K., & Olsen, S. I.	https://www.sciencedirect.com/science/article/pii/S2212827117307734	0	0	0	1	na	little is said about how to implement CE, and the conequences for the industry	0	0	0	0	0	0	0	0	0	Looking at closing the loop on aluminum beverage cans, in other words recycling the cans and use them in new products	Aluminum beverage cans	3	Policy makers, industries, resource scarcity, closed-loop supply, ecosystem
2018	Lost in Transition? Drivers and Barriers in the Eco-innovation Road to the Circular Economy	Jesus, A. & Mendonça, A.	https://www.sciencedirect.com/science/article/pii/S0921800916316597	1	0	1	1	na	aim is to highlight the factors "helping and hampering the development of CE"	0	0	0	0	0	1	0	0	0	Offers a framework for analysis, as well as survey of the challenges, and the helping of the development of CE.	research, policy	1	Sustainability, eco-innovation, policy guidelines and organizational strategies.
2018	A Methodological Approach to Development of Circular Economy Options in Businesses	Jørgensen, M. S. & Remmen, A.	https://www.sciencedirect.com/science/article/pii/S2212827117309332	0	0	0	1	p	adressing certain barriers for implementation of CE, because CE is considered closing resource flows in order to increase resource efficiency.	1	0	0	0	0	0	0	0	0 (Talking about costumers and users)	the article shows that CE can be beneficial to businesses,	business sector in DK	3	Re-design, value-chain, life cycle perspective,
2018	Towards a consensus on the circular economy	Prieto-Sandoval, V., Jaca, C., & Ormazabal, M.	https://www.sciencedirect.com/science/article/pii/S0959652617332146	0	0	1	1	na	Just trying to find the consensun on the concept of CE	0	0	0	0	0	0	0	0	0	this paper attempts at giving a consensun on CE, through determinants, concept and principles of the term	research	1	Sustainable development, eco-innovation
2017	Resource recovery and remediation of highly alkaline residues: A political-industrial ecology approach to building a circular economy	Deutz, P., Baxter, H., Gibbs, D., Mayes, W. M., & Gomes, H. I.	https://www.sciencedirect.com/science/article/pii/S001671851630104X	1	0		1	p	focus on resource recovery, want more circulation of raw materials	1	0	0	0	0	1	0	0	0	This paper begins to address the deficit of research into the governance of resource recovery from a novel situation where re-use involves extraction of a component from a bulk residue that itself represents a risk to the environment. Taking a political industrial ecology approach, we briefly present emerging techniques for recovery and consider their regulatory implications in the light of potential environmental impacts.	metal recovery, industry sector	3	Renewable energy and storage, political industrial ecology, EU
2017	Measuring circular economy strategies through index methods: A critical analysis	Elia, V., Gnoni, M. G., & Tornese, F.	https://www.sciencedirect.com/science/article/pii/S0959652616318273	1	0	1	1	p	because there is an increase in interest for it. But assessment of CE and implementation is still missing	1	0	1	1	0	1	0	0	0	This paper attempts at giving a strategy for proper implementation of CE, and concerning the monitoring phase of a CE strategy. And evaluates the circularity of a system.	CE impmenetation	3	Sustainability, evn assessment
2017	The EU Circular Economy Package – Life Cycle Thinking to Life Cycle Law?	Hughes, R.	https://www.sciencedirect.com/science/article/pii/S2212827116314317	0	0	0	1	na	view it as a legislation, using it here to evaluate it.	1	0	0	0	0	0	0	0	0	This paper provides an overview of this package and demonstrates why the development of standards underpins future legislation.	policy	1	EU, closing the loop of product life cycle
2017	Circular economy at the micro level: A dynamic view of incumbents' struggles and challenges in the textile industry	Franco, M. A.	https://www.sciencedirect.com/science/article/pii/S0959652617320450	0	0	1	1	na	Trying to see how the textile industry can transition into a circularity.	0	0	0	0	0	1	0	0	0 (but mentions how buyer responds and treats the product)	Looking at the textile industry and how it can transition into a more circular system. The main contribution of this paper is the dynamic understanding of how certain collaborative supplier-buyer innovation factors (i.e., supply chain position, power balance, and a shared vision) coupled with complex aspects in product design, namely in basic materials, architecture, and functionality, combine to determine the output speed and quantity of circular products to be sold, taken back, and ultimately regenerated.	textile industry in europe	3	Ecological systems, economic growth, industrial sectors. Circular production systems, sustainable product design, sustainable supply chains, reverse logistics, cradle to cradle certified
2015	Boosting circular economy and closing the loop in agriculture: Case study of a small-scale pyrolysis–biochar based system integrated in an olive farm in symbiosis with an olive mill	Zabaniotou, A., Rovas, D., Libutti, A., & Monteleone, M.	https://www.sciencedirect.com/science/article/pii/S2211464514000888	1	0	0	1	na	an objective that is aimed at reaching through agriculture into energy	0	0	0	0	0	0	0	0	0	Olive farm symbiosis, The liquid and gas fuels can fulfill the olive milling energy needs and produce an electricity surplus. pyrolysis of agri-residues targeting biochar can fulfill the aim of closing the loop in agriculture and circular economy objectives.	energy, agriculture	2	Bioenergy, closed-loop systems, agriculture, solid-waste,

2017	Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications	Genovese, A., Acquaye, A. A., Figueroa, A., & Koh, S. C. L.	https://www.sciencedirect.com/science/article/pii/S0305048315001322	1	0	1	1	p	Circular economy pushes the frontiers of environmental sustainability by emphasising the idea of transforming products in such a way that there are workable relationships between ecological systems and economic growth	1	1	0	0	0	1	0	0	0	This paper conducts two case studies and compares the performance of traditional and circular production systems across a range of indicators	prodction, supply chain management	3	LCA, circular and linear supply chain, green and sustainable supply chain management, industrial ecology, sustainability, lifecycle emissions, waste recovered, carbon maps
2010	Creating integrated business and environmental value within the context of China's circular economy and ecological modernization	Park, J., Sarkis, J., & Wu, Z.	https://www.sciencedirect.com/science/article/pii/S0959652610002131	0	0	1	1	na	China's CE- looking at challenges regarding ecn growth and env impacts	1	0	0	0	0	1	0	0	0	This paper investigates the challenges and opportunities of how firms and organizations can and will be able to strike a better balance between economic growth and environmental stewardship	business, electronic	3	Ecological modernization, sustainable supply chain management,
2018	Modelling the Interplay Between Institutions and Circular Economy Business Models: A Case Study of Battery Recycling in Finland and Chile	Levänen, J., Lyytinen, T., & Gatica, S.	https://www.sciencedirect.com/science/article/pii/S0921800917318621	0	0	0	1	na	uses it to look at interactions between circular economy business model activities and the features of diverse institutional operating environments.	0 (Operational env and institutional env)	0	0	1	0	0	0	0	0	To study the dynamics between companies' business models and the institutional features.	Business sector	3	
2012	The Research on Quantitative Evaluation of Circular Economy Based on Waste Input-Output Analysis	Li, S.	https://www.sciencedirect.com/science/article/pii/S1878029612002496	0	0	1	1	na	CE has been a steppingstone to implement SD.	0	0	0	0	0	0	0	0	0	development and principle of CE, "this paper builds an input-output analysis table and the basic evaluation model of circular economy in enterprise."	development of CE	3	Sustainable development
2018	Eco-innovation in the transition to a circular economy: An analytical literature review	de Jesus, A., Antunes, P., Santos, R., & Mendonça, S.	https://www.sciencedirect.com/science/article/pii/S0959652617327853	1	0	1	1	na	no comprehensive understanding concerning the connections between these two concepts of CE and eco-innovation	0	0	0	0	0	0	0	0	0	research on the interaction between eco-innovation and CE	literature Research of CE and EI	3	Sustainability, eco-innovation, linear to circular,
2018	Circular economy as an essentially contested concept	Korhonen, J., Nuur, C., Feldmann, A., & Birkie, S. E.	https://www.sciencedirect.com/science/article/pii/S0959652617330706	1	0	1	1	p	paradigmatic potential of CE remain unexplored but highly popular.	0	0	0	0	0	0	0	0	0	"The two intertwined objectives of the paper are; first to identify, discuss and develop the various definitions provided by the emerging literature. Secondly, to suggest an initial research approach with which research on CE can be conducted"	literature Research of CE	1	Sustainable global society
2018	Analysing interplays between PSS business models and governmental policies towards a circular economy	Wasserbaur, R. & Sakao, T.	https://www.sciencedirect.com/science/article/pii/S2212827118305195	0	0	0	1	na	tons of gaps on business models and policies by government. Focuses on product/service system business models	0	0	0	0	0	1	0	0	0	focuses on product/service system (PSS) business models, and uses a systematic literature review. Six types of policies and nine components of a PSS business model are introduced in the analysis	Policy	1	
2018	The Proposal of an Environmental Break-Even Point as Assessment Method of Product-Service Systems for Circular Economy	Barletta, I., Despeisse, M., & Johansson, B.	https://www.sciencedirect.com/science/article/pii/S2212827118304281	0	0	0	0	na	na	1	0	0	1	0	1	0	0	0	"assess technology-based product-service systems and help manufacturing companies in decision making with a new indicator" and look at environmental break-even point	electronic waste	4	ENV break-even point, product life-cycle
2017	Supporting Circular Economy through Use-Based Business Models: The Washing Machines Case	Gnoni, M. G., Mossa, G., Mummolo, G., Tornese, F., & Verriello, R.	https://www.sciencedirect.com/science/article/pii/S2212827117301622	0	0	1	1	na	introduction of new business models, based on use rather than ownership, has been identified as one of the possible enabling actions for the implementation of circular economy strategies.	1	0	0	0	0	1	0	0	0 (mentions material consumption)	a context study is performed to identify the main changes involved in the transition from a traditional to a circular supply chain in the sector, as well as the main impacts on the actors involved, through causal loop diagrams	business	3	Sustainable development, linear to circular, closed-loop supply chain, impact assessment
2017	Composites in a Circular Economy: A Study of United Kingdom and South Africa	Mativenga, P. T., Sultan, A. A. M., Agwa-Ejon, J., & Mbohwa, C.	https://www.sciencedirect.com/science/article/pii/S2212827117302718	0	0	1	1	na	just want to figure out the triggers and what is needed to sustian CE, and which aspects are aleady implemented in the country	0	1	1	1	1	1	0	0	0	Key considerations such as the drivers, sustainers, barriers, ownership models, volume of composite waste from production operations, and current recycling or disposal practices were studied. Understanding the national context and international synergies in transition to circular economy for composite materials	policy, composite waste from manifacturing	3	End of life
2018	Heavy vehicles on the road towards the circular economy: Analysis and comparison with the automotive industry	Saidani, M., Yannou, B., Leroy, Y., & Cluzel, F.	https://www.sciencedirect.com/science/article/pii/S0921344917301714	1	0	0	1	P and N	Want a CE, but it is not an implemented thing in automobile sector.	0	0	1	1	0	1	0	0	0	to what extent is CE implemented in the automotive sector? There are still remaining challenges for a more CE.	heavy veichle sector	3	EU, end of life management
2017	Narrating expectations for the circular economy: Towards a common and contested European transition	Lazarevic, D. & Valve, H.	https://www.sciencedirect.com/science/article/pii/S2214629617301147	0	0	0	1	na	just wondering what the CE can offer, what it entails and what it can do	0 (natural resources)	0	0	0	0	1	0	0	0	This paper analyses the emergence and mobilisation of expectations that are shaping the EU transition to a circular economy.	policy, EU,	1	EU, Natural resource transformation, material flow, Renewal,
2018	Exploring environmental and economic costs and benefits of a circular economy approach to the construction and demolition sector. A literature review	Ghisellini, P., Ripa, M., & Ulgiati, S.	https://www.sciencedirect.com/science/article/pii/S0959652617328809	0	0	1	1	p	It aims to innovate the entire chain of production, consumption, distribution and recovery of materials and energy according to a cradle to cradle vision. Need an economic model that improves the efficiency and effectiveness of resource use.	1	1	1	1	1	1	0	0	0	Looks at literature regarding env and ecn impacts of the construction and demolition sector, with special focus on the production and management of its waste materials. Reviews literature within the framework of the CE to explore how it applies to the management of C&D waste	construction	3	LCA, Sustainable, Cradle to cradle vision
2017	Investigating public awareness on circular economy in western China: A case of Urumqi Midong	Guo, B., Geng, Y., Sterr, T., Zhu, Q., & Liu, Y.	https://www.sciencedirect.com/science/article/pii/S0959652616319011	0	0	1	1	p	a minority administrative region, Xinjiang is facing more challenges on promoting circular economy due to economic, cultural and language barriers.	1	0	1	0	0	1	0	0 (but talks about surveys of consumers)	0 (Mentions consumers behavior and lifestyles)	Survey of CE behavior. how policy implementation of CE worked across China, with a focus on minorities, asked minorities about their understanding of sustainable development.	policy and awareness of CE	1	ENV pollution, resource scarcity, Sustainable development, public awareness and performance, water saving, energy efficiency
2017	Improving the circular economy via hydrothermal processing of high-density waste plastics	Pedersen, T. H. & Conti, F.	https://www.sciencedirect.com/science/article/pii/S0956053X17304403	1	0		1	p	wants to recycle more plastic. "supercritical hydrothermal processing of waste plastic fractions for tertiary recycling"	0	0	0	1	0	1	0	0	0 (mentions accelerated consumption of plastic)	The promising results presented demonstrate that hydrothermal processing of high-density plastics is a prospective technology for increasing the circularity of the plastic economy.	plastic waste recycling	1	PET and PBT, waste plastics, Carbon balances,
2018	Critical appraisal of the circular economy standard BS 8001:2017 and a dashboard of quantitative system indicators for its implementation in organizations	Pauliuk, S.	https://www.sciencedirect.com/science/article/pii/S0921344917303531	1	0	0	1	na	organizations had no authoritative guidance on CE. CE is far-reaching ambitions. Wants to implement CE but need more guidance.	1	0	0	0	0	1	0	0	0	Monitoring CE stategy implementation, regarding the British Standard institution (BS 8001:2017). Moreover, organizations need to monitor their contribution to in-use-stock growth, a central driver of resource depletion and hindrance to closing material cycles.	policy sector for CE	1	Legal issues with CE, LCA, Material flow cost accounting (MFCA), material cycles, Industrial ecology
2015	Towards a Circular Economy for End-of-Life Vehicles: A Comparative Study UK – Japan	Despeisse, M., Kishita, Y., Nakano, M., & Barwood, M.	https://www.sciencedirect.com/science/article/pii/S2212827115003522	0	0	0	0	na	na	0	0	1	1	1	0	0	0	0	Car manufactures need to reconsider the beginning stages of production design to make room for better end of life treatment of vehicles. Goes into policy, technical and business recommendation to improve the 3R's of vehicles in a life cycle perspective.	Car manifacturing	3	European directive, end-of-life vehicle, life cycle
2018	Waste valorization as an example of circular economy in extremadura (Spain)	Blázquez, F. C., González, A. G., Sánchez, C. S., Rodríguez, V. D., & Salcedo, F. C.	https://www.sciencedirect.com/science/article/pii/S0959652618302592	0	0	0	0	na	na	1	1	1	1	0	1	0	0	0	Gain profit from implementing clean, renewable technology that will be used on highly contaminat waste of a broiler industry. Takes into account net present value, return on investment, and internal rate of return.	industrial waste/broiler industry/agriculture	5	agriculture, NPV, IRR, ECONOMICS
2018	Risk management of hazardous substances in a circular economy	Bodar, C., Spijker, J., Lijzen, J., Waaijer-van der Loop, S., Luit, R., Heugens, E.,...Traas, T.	https://www.sciencedirect.com/science/article/pii/S0301479718301154	1	0	1	1	N	high ambitions and unambiguous. Causes re-entering of hazardous substances	1	0	1	1	0	0	0 (hazardous)	0	0	Hazardous substances that re-enter the systems through Ce, which can be harmful.	policy framework for safer entering	1	Sustainability. Policy framework.
2018	A methodological approach for assessing businness investments in renewable resources from a circular economy perspective	Donia, E., Mineo, A. M., & Sgroi, F.	https://www.sciencedirect.com/science/article/pii/S0264837718300875	0	0	1	1	p	wants to use the biogas in the CE	0	0	0	0	1	1	0	0	0	Use vineyard to produce biogas electric power in Sicily. Transfer waste into a resource in the CE.	agriculture or energy	2	Biogas production, economic feasibility, sustainable agriculture,
2018	Is open-loop recycling the lowest preference in a circular economy? Answering through LCA of glass powder in concrete	Deschamps, J., Simon, B., Tagnit-Hamou, A., & Amor, B.	https://www.sciencedirect.com/science/article/pii/S0959652618306723	1	0	0	1	p	open loop CE- use glass into concrete would be better from env perspective than producing concrete	1	0	0	1	0	0	0	0	0	Use waste glass in cementious materials (in concrete), by doing an open-loop CE. It shows that using glass would be more environmental beneficial than doing business as usual (producing concrete). Industrial symbiosis at a local scale.	cement production, industrial symbiosis	3	Landfill, LCA, emissions, GHG, industrial symbiosis,
2018	Reducing environmental impacts of the ups system based on PEM fuel cell with circular economy	Stropnik, R., Sekavčnik, M., Ferriz, A. M., & Mori, M.	https://www.sciencedirect.com/science/article/pii/S0360544218319790	1	0	0	1	p	encouraging CE, and shows what ENV reduction it can contribute with	1	0	1	1	0	0	0	0	0	Recycling and reuse of fuel cells (materials) in the end of life during manufacturing stage can reduce environmental impact	energy/manifacturing	2	Env impact, LCA, cradle-to-grave, energy, co2 emissions,
2018	User experience-based product design for smart production to empower industry 4.0 in the glass recycling circular economy	Lin, K. Y.	https://www.sciencedirect.com/science/article/pii/S036083521830295X	1	0	0	1	na	just wanting to get a better understanding of consumer preference from a glass producer point of view	1	1	0	1	0	0	0	0	0	Glass recycling can contribute to less waste, energy use, as well as air and water pollution. This study focused on user preference of glass products, and service design in order for smart production.	glass production/manifacturing	3	energy, CE
2018	Platinized counter-electrodes for dye-sensitised solar cells from waste thermocouples: A case study for resource efficiency, industrial symbiosis and circular economy	Charles, R. G., Douglas, P., Baker, J. A., Carnie, M. J., Douglas, J. O., Penney, D. J., & Watson, T. M.	https://www.sciencedirect.com/science/article/pii/S0959652618324673	0	0	0	0	na	na	1	0	1	1	1	1	0	0	0	recovery of platinum from waste thermocouples, a industrial symbiosis would contribute to less landfil, less co2 emission and more jobs, while also save on material cost	industrial symbiosis, CE, and solar cells	3	Cost-benefit analysis, Industrial symbiosis, Co2 emissions associated with primary production, Clean energy
2018	Circular economy strategies for mitigating critical material supply issues	Gaustad, G., Krystofik, M., Bustamante, M., & Badami, K.	https://www.sciencedirect.com/science/article/pii/S0921344917302410	1	0	0	1	p	Results indicate the potential for risk reduction that could be gained from implementation of these strategies; specifically recycling, for example, can provide an in-house source	0	0	0	1	0	1	0 (healthcare)	0	0	CE in manifacturing at different levels of the supplychain, "examine how certain firms assess and monitor their vulnerability to critical material supply chain issues and provides specific business examples for integrating circularity strategies"	manifacturing,	3	Energy consumption, waste, pollution (Cost), electronics, supply chain, End-of-life
2018	Providing an economy-wide monitoring framework for the circular economy in Austria: Status quo and challenges	Jacobi, N., Haas, W., Wiedenhofer, D., & Mayer, A.	https://www.sciencedirect.com/science/article/pii/S0921344918301976	1	0	x(K)	1	p	focusing on implementatin on a national leve, the	1	0	0	1	0	1	0	0	0	focusing on national implementation of CE, rather than looking at production and firm level.	policy implementation, nationally	1	climate change mitigation, energy, linear (production cycle), emission,
2017	Potential for circular economy in household WEEE management	Parajuly, K. & Wenzel, H.	https://www.sciencedirect.com/science/article/pii/S0959652617304808	1	0	1	1	p	encouraging CE, but there is a lack of understanding and the true potential of CE.	0	0	1	1	1	1	0	1	0	How much of electronic waste can be recycled or reused, from production to houeholds waste	Household electronic waste	4	Sustainable, linear business model, end-of-life products,
2018	Circular Economy in Spanish SMEs: Challenges and opportunities	Ormazabal, M., Prieto-Sandoval, V., Puga-Leal, R., & Jaca, C.	https://www.sciencedirect.com/science/article/pii/S0959652618306826	0	0	0	1	p	businesses are more concerned with the law and their image rather than preserving the environment bc env wont increase their profit and competitivnes	1	0	0	0	0	1	0	0	0	What drives the business sector towards CE, what human barrieres are there and what are the "hard-barriers"	Business, industries	3	industrial symbiosis, closing the matrial loop
2017	Synergies between agriculture and bioenergy in Latin American countries: A circular economy strategy for bioenergy production in Ecuador	Vega-Quezada, C., Blanco, M., & Romero, H.	https://www.sciencedirect.com/science/article/pii/S1871678416315102	1	0	0	1	na	Just measures taken to implement a bioenergy sector. Scenarios evaluated through CE	0	0	0	0	0	1	0	0	0	implemetation of bioenergy sector in Ecuador, taking into account CE initatives. Looking at four different scenarios (energy sources)	agriculture/ bioenergy	5	Energy, agriculture, carbon balance
2018	Circular economy and big data analytics: A stakeholder perspective	Gupta, S., Chen, H., Hazen, B. T., Kaur, S., & Gonzalez, E. D. R. S.	https://www.sciencedirect.com/science/article/pii/S0040162517314488	1	0	1	1	p	implementation of CE remains a challenge. Need a "collaborative association among all supply chain members can positively affect CE implementation."	1	0	0	0	0	1	0	0	0	implementation of CE in business sector, needs all level of the supply chain to be collaborating	business	3	social benefits, sustainability, policy sector, supply chain, cooperation,
2018	Smart eco-industrial parks: A circular economy implementation based on industrial metabolism	Gómez, A. M. M., González, F. A., & Bárcena, M. M.	https://www.sciencedirect.com/science/article/pii/S092134491730246X	1	0	1	1	p	Circular Economy (CE) is considered as a suitable way to carry out the transition from current economic models to models of a more sustainable nature. From the biological perspective however, industrial systems are generally inefficient	1	1	0	0	0	1	0	0	(based on social criterias)	Smart eco-industrial parks, "an ontological framework for CE, based on industrial metabolism, is developed as the technology for information and knowledge models to share the circularity of resources through industrial ecosystems, based on ecological, economic, and social criteria."	Eco-industrial parks	3	Sustainable, eco- industrial parks, industrial metabolism, product life cycle,
2018	A critical review on recycling of end-of-life carbon fibre/glass fibre reinforced composites waste using pyrolysis towards a circular economy	Naqvi, S. R., Prabhakara, H. M., Bramer, E. A., Dierkes, W., Akkerman, R., & Brem, G.	https://www.sciencedirect.com/science/article/pii/S0921344918301502	1	0	0	1	p	Using the recycling and re-use of fibres (carbon/glass) to explain Ce and cradle-to-cradle approach	1	0	1	1	0	0	0	0	0	First comprehensive and systematic review on recycling of carbon/glass fibre reinforced composite using pyrolysismethod.	Carbon/glass fibre recycling	3	end of life handling, resource conservation,
2018	Systems of practice and the Circular Economy: Transforming mobile phone product service systems	Hobson, K., Lynch, N., Lilley, D., & Smalley, G.	https://www.sciencedirect.com/science/article/pii/S2210422416301034	1	0	1	1	p	Trying to implement sustainable production service systems, but need consumer change in phone purchase and use	1	0	0	0	0	0	0	0	mentions consumer reaction and actions	Consumer awareness for a phones life cycle. It outlines barriers to alterations in practices, underscoring the centrality that connectivity and data storage now have in many peoples' daily lives, which have for some become clustered around the capabilities and accessibility of the mobile phone.	Phone- electronics	4	Phone life cycle, sustainability
2018	Forest sector circular economy development in Finland: A regional study on sustainability driven competitive advantage and an assessment of the potential for cascading recovered solid wood	Husgafvel. R., Linkosalmi, L., Hughes, M., Kanerva, J., & Dahl, O.	https://www.sciencedirect.com/science/article/pii/S0959652617331475	1	0	1	1	P	need more focus on life cycle thinking in the future	1	0	1	1	1	0 (bioeconomy)	0	0	0	CE in forest sector. Wood recovery and reuse of furniture	Wood sector	5	Energy efficiency, sustainability, life cycle
2013	Reutilisation-extended material flows and circular economy in China	Li, N., Zhang, T., & Liang, S.	https://www.sciencedirect.com/science/article/pii/S0956053X13000597	0 (under abstract)	0		1	na	na, focus on one aspect of CE- the comprehensive reutilasation (CR)	0	1	1	1	0	1	0	0	0	Looking at one aspect of the CE- the CR, policy implementations of CE	policy, material flow analysis	1	solid waste,
2017	Enabling Circular Economy Through Product Stewardship	Jensen, J. P. & Remmen, A.	https://www.sciencedirect.com/science/article/pii/S2351978917300549	0	0	1	1	na	na	1	0	0	0	0	0	0	0	0	Manifacturing gets competetive advantage by being sustainable, this looks at high quality end of life management, challenges and benefits with a circular economy	manifacturing- CE	3	sustainability
2017	Evaluating the comprehensive benefit of eco-industrial parks by employing multi-criteria decision making approach for circular economy	Zhao, H., Zhao, H., & Guo, S.	https://www.sciencedirect.com/science/article/pii/S0959652616318807	1	0	1	1	p	na	1	0	0	1	0	1	0	0	0	Focus on sustainable development and eco-industrial parks.	eco-industrial parks, policy formulation	1	Sustainable development, eco-industrial parks, recycling economy
2018	Circular Economy: The Concept and its Limitations	Korhonen, J., Honkasalo, A., & Seppälä, J.	https://www.sciencedirect.com/science/article/pii/S0921800916300325	0	0	1	1	n	say that CE is superficial and unorganized.	1	0	0	0	0	0	0	0	0	CE as a concept does not work, need further things to be organized befroe CE can contribute to gloabal net sustainability	Policy, CE	1	Sustainabledevelopment, envrionmental sustainability,
2018	Design for circular economy: Developing an action plan for Scotland	Whicher, A., Harris, C., Beverley, K., & Swiatek, P.	https://www.sciencedirect.com/science/article/pii/S0959652617326604	0	0	0	1	p	Came up with twelve actions to improve CE implementations, divided into four themes: support and finance, skills and educations, promotion and awareness, and policy and regulations	1	0	0	0	0	1	0	0	0	Wanted more realitic goals/policy in order to implement CE	Policy sector, action plan	1	Ecosystems, linear economy,
2018	Recycling portable alkaline/ZnC batteries for a circular economy: An assessment of natural resource consumption from a life cycle and criticality perspective	Tran, H. P., Schaubroeck, T., Swart, P., Six, L., Coonend, P., & Dewulf, J.	https://www.sciencedirect.com/science/article/pii/S0921344917302665	1	0	1	0	na	na	1	1	0	1	0	0 (socioeconomic)	0	0	0	not efficient in terms of energy and land use. Recycling of certain minerals did not contribute to less emission and consumption of resources than incineration. It had a higher emission and higher energy required than with incineration, however it saved on other resources such as fossil fuels.	Mineral industry	3	Incineration, recycling, life cycle impact assessment, sustainable management strategies,
2018	Circular Economy in the building sector: Three cases and a collaboration tool	Leising, E., Quist, J., & Bocken, N.	https://www.sciencedirect.com/science/article/pii/S0959652617329402	1	0	x(K)	1	p	It was found that developing circular buildings requires (i) a new process design where a variety of disciplines in the supply chain is integrated upfront, (ii) the co-creation of an ambitious vision, (iii) extension of responsibilities to actors along the entire building supply chain, and (iv) new business and ownership models.	0	0	0	0	0	0	0	0	0	CE requires circular buildings	Construction/building	3	energy efficiency, circular buildings, supply chain collaboration,
2016	Circular economy and the opportunity cost of not 'closing the loop' of water industry: the case of Jordan	Abu-Ghunmi, D., Abu-Ghunmi, L., Kayal, B., & Bino, A.	https://www.sciencedirect.com/science/article/pii/S095965261630498X	0	0	0	1	p	economically cheaper to "close the loop" of water usage. Circulate water	1	0	0	0	0	1	0	0	0	Testing economically if it is cheaper to treat wastewater and use it again, "keep water in the loop" or rather just use new water.	water, wastewater circularity	1	
2018	Drivers to sustainable manufacturing practices and circular economy: A perspective of leather industries in Bangladesh	Moktadir, M. A., Rahman, T., Rahman, M. H., Ali, S. M., & Paul, S. K.	https://www.sciencedirect.com/science/article/pii/S095965261732721X	0	0	1	1	p	na	1	1	0	0	0	1	0	0	0	this study is to assess, prioritize and rank the drivers of sustainable manufacturing practices in the leather industries of Bangladesh. Knowledge of CE is essential for changes	leather industry	3	Sustainable manifacturing, green supply chain, government rules and regulations, energy and material usage
2018	Salvaging building materials in a circular economy: A BIM-based whole-life performance estimator	Akanbi, L. A., Oyedele, L. O., Akinade, O. O., Ajayi, A. O., Delgado, M. D., Bilal, M., & Bello, S. A.	https://www.sciencedirect.com/science/article/pii/S0921344917303609	0	0	0	0	na	na	1	0	1	1	1	0	0	0	0	A review of literature to identify factors that influence salvage performance of structural components of buildings during their useful life.	Construction	3	
2018	Exploring the inner loops of the circular economy: Replacement, repair, and reuse of mobile phones in Austria	Wieser, H. & Tröger, N.	https://www.sciencedirect.com/science/article/pii/S0959652617327798	1	0	0	1	na	na, looks at consumers of mobile phones willingness to upgrade/replace their phones	0	0	1	0	0	0	0	x (interviews)	0	Consumer motivations underpinning phone replacement, repair, and reuse.	electronic, mobile phone	4	
2017	Product design in the circular economy: Users' perception of end-of-life scenarios for electrical and electronic appliances	Atlason, R. S., Giacalone, D., & Parajuly, K.	https://www.sciencedirect.com/science/article/pii/S0959652617320711	1	0	0	1	p	women are more likely to care for CE, and willing to pay a higher price accordin to this study	1	0	1	1	0	0	0	x (household electrical survey)	0	Research how keen/observant users are to a products end of life for electronics	electronic, waste management	4	end of life product management
2017	Product biographies in servitization and the circular economy	Spring, M. & Araujo, L.	https://www.sciencedirect.com/science/article/pii/S0019850116301456	1	0	0	1	p	Using circular ecnomy to see products as being more than just a product of producers	0	0	0	0	0	0	0	0	0	The wider and multiple product biographies occasioned by the circular economy also lead to reconfiguration of networks, as new potential valuations give rise to new entrepreneurial spaces	product, marketing	3	
2015	Circular economy of a papermaking park in China: a case study	Li, Y. & Ma, C.	https://www.sciencedirect.com/science/article/pii/S0959652614014000	0	0	1	1	p	Evaluation of paper making industry, not really CE in other aspects than -->	1	0	0	1	0	1	0	0	0	Resource consumption and usage of materials in the papermaking industry in China has been going on for 10 years and is a great example.	Paper industry	5	Energy, pollution, sustainable development, Resource conservation,
2015	Life Cycle Assessment from food to food: A case study of circular economy from cruise ships to aquaculture	Strazza, C., Magrassi, F., Gallo, M., & Borghi, A. D.	https://www.sciencedirect.com/science/article/pii/S2352550915000111	1	0	1	1	p	NA, just recycle food to feedstock vs conventional feeding footprint	1	0	0	1	0	0	0	0	0	Looks at recycling food form cruise to agriculture sector.	food sector	5	Industrial ecology, LCA, Global warming potential, energy demand, and water scarcity, carbon footprint, supply chain
2017	Policy durability of Circular Economy in China: A process analysis of policy translation	Jiao, W. & Boons, F.	https://www.sciencedirect.com/science/article/pii/S0921344915301087	1	0	1	1	na	viewing CE from a policy perspective, not really giving any indication of what they thing	0	0	0	0	0	0	0	0	0	Policy durability, sustainable industrial cluster. case of the Chinese Circular Economy (CE) policy is presented here for the first time as a translation process that evolves from being dominated by a single agency engaged in experimental implementation to centralized cooperation implementation with a mixture of experimental and administrative features.	Policy sector in regards to sustainable industrial cluster	1	SIC, sustainability, policy
2017	Institutional pressures, sustainable supply chain management, and circular economy capability: Empirical evidence from Chinese eco-industrial park firms	Zeng, H., Chen, X., Xiao, X., & Zhou, Z.	https://www.sciencedirect.com/science/article/pii/S0959652616317139	1	0	1	1	p	NA, but sustainable supply chain management is important for CE to work, while the systems reacts negativly to external pressure for CE	1	0	0	0	0	1	0	0	0	variables affecting sustainable supply chain management and also provides theoretical guidance for successful green production practices of eco-industrial park firms	Eco-industrial parks sustainability	1	Sustainable supply chain management, green production
2011	Ecological utilization of leather tannery waste with circular economy model	Hu, J., Xiao, Z., Zhou, R., Deng, W., Wang, M ., & Ma, S.	https://www.sciencedirect.com/science/article/pii/S0959652610003744	0	0	1	1	p	na	1	1	1	1	1	1	0	0	0	The CE model has been implemented as a new way of raw materials, water and energy consumption reduction in the leather industry.	leather industry	3	Water and energy consumption, renewable, wastewater, sustianable development
2015	A case study of a phosphorus chemical firm's application of resource efficiency and eco-efficiency in industrial metabolism under circular economy	Ma, S., Hu, S., Chen, D., and Zhu, B.	https://www.sciencedirect.com/science/article/pii/S0959652614011020	1	0	1	1	p	NA, just needed more in the mining and chemical sector	1	0	0	1	0	1	0	0	0	Implementation of CE in phosphor sector and mineral	chemical industries	5	Eco-efficiency, sustainable development,
2012	Constructivism scenario evolutionary analysis of zero emission regional planning: A case of Qaidam Circular Economy Pilot Area in China	Liu, D., Li, H., Wang, W., & Dong, Y.	https://www.sciencedirect.com/science/article/pii/S0925527311001721	0	0	1	1	na	Just an indicator of how to optimize profit without degradation of the ENV- policy	1	0	0	0	0	1	0	0	0	the model provides solutions to the optimal expected output levels of main chemical products and minimal quantity of pollution treatment facilities according to the optimal scenario evolutionary path which embodies the self-purification emission with moderate resource exploitation. The results of the paper will have important policy implications to the regional development planning in China.	Political, profit and conserving the ENV	1	sustainable development, zero emission, environmental pollution minimalization is a constriction
2018	A new holistic conceptual framework for green supply chain management performance assessment based on circular economy	Kazancoglu, Y., Kazancoglu, I., & Sagnak, M.	https://www.sciencedirect.com/science/article/pii/S0959652618316640	1	0	0	1	p	NA, but mentions the need for optimal balance in regards to env, ecn, logistic, organizational and marketing performance indicatros	1	0	0	0	0	1	0	0	Consumption patterns	Making a performance indicator for CE, a new framework for CE	GSCM-	1	Green supply chain management,
2014	Mode of circular economy in China's iron and steel industry: a case study in Wu'an city	Ma. S., Wen, Z., Chen, J., & Wen, Z.	https://www.sciencedirect.com/science/article/pii/S0959652613006719	0	0	1	1	p	Still need improvement in utalization rates of coke over oven, gas converter, slag converter, reducing sulfur dioxide emissions	0	1	0	0	0	0	0	0	0	CE has contributed to pollution reduction and energy consumption recution. Still need improvement	Steel and iron industry	3	Reduction in energy consumption and pollution emission, Sustianable development
110				64	23	55	98			61	20	26	54	22	66	2	1	1				
				58 %	21 %	50 %	89 %			55 %	18 %	24 %	49 %	20 %	60 %	2 %	1 %	1 %				

1	41
2	6
3	45
4	8
5	10

fallback: WM might not be mentioned in the article, but is just the heading of one of the sources used under references.

2018	The ratio of EPR compliance fees on sales revenues of electrical and electronic equipment in Italy. A circular economy perspective	Marinella Favot, Raphael Veit, and Antonio Massarutto	https://www.sciencedirect.com/science/article/pii/S0921344917301660	x	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

No abstract. Have to stay consistent with the rest of our research

These articles was also in the search for CE in title, but WM was only listed in the citations or references, and therefor not applicable for our analysis

2017	A circular economy solid waste supply chain management based approach under uncertainty	Yousef Saif, Muhammad Rizwan, Ali Almansoori, and Ali Elkamel	https://www.sciencedirect.com/science/article/pii/S1876610217360587	0	0	1	0	na	na	x	0	0	0	0	x	0	0	0	This study looks at the MSW supply chain network to find an optimal model solution regarding decomposition.	MSW (municipal solid waste)	MSW (municipal solid waste)	MSW (municipality solid waste), sustainability, supply chain,
2017	Towards a Circular Economy: Exploring Routes to Reuse for Discarded Electrical and Electronic Equipment	Christine Cole, Alex Gnanapragasam, and Tim Cooper	https://www.sciencedirect.com/science/article/pii/S2212827116314032	0	0	0	x	p	want ce, but need more implementation of it. Want to increase reuse	0	0	0	0	0	0	0	x	0	The paper illustrates how different business approaches can make a significant contribution to tackling waste and implementing the circular economy.	electronic waste	electronic waste	Waste reduction, EU, waste streams,

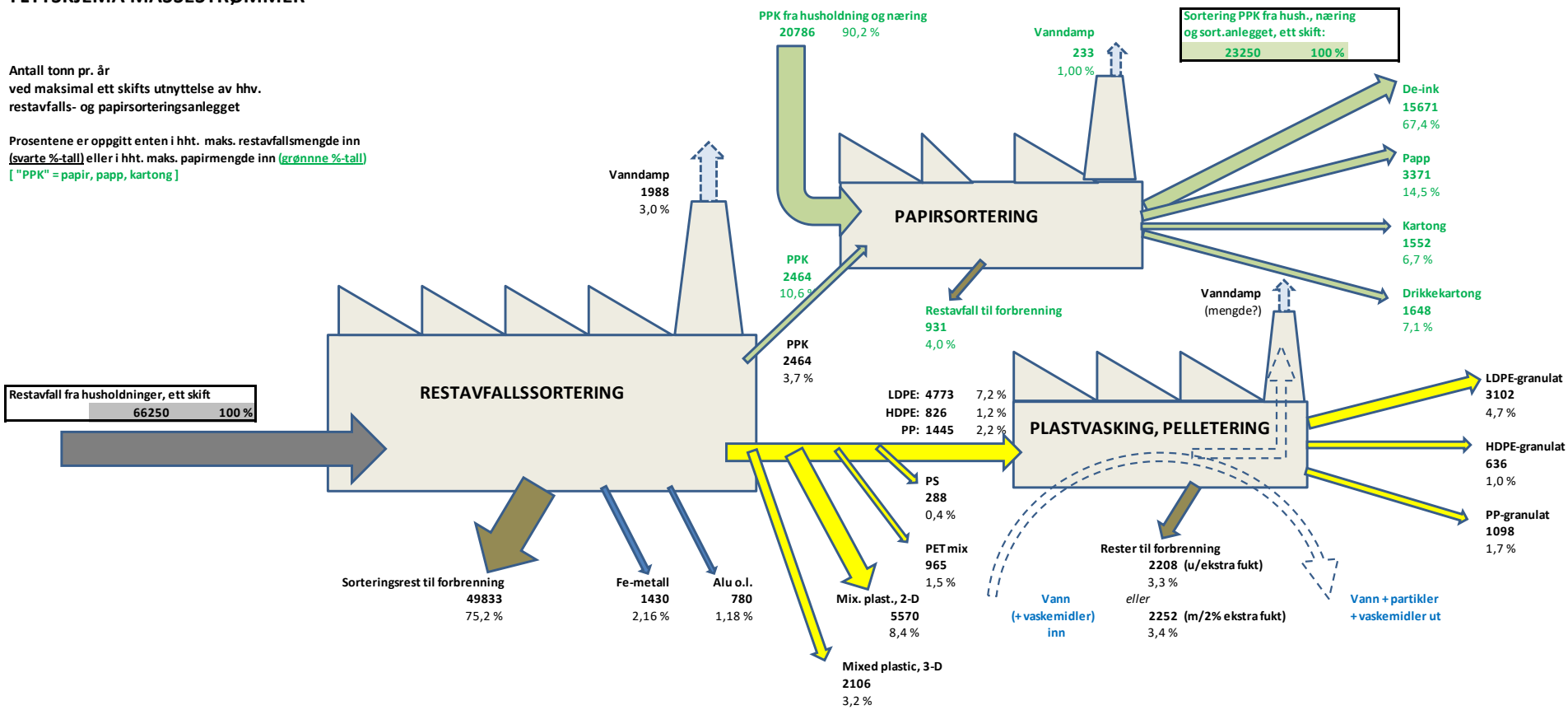
2017	Leather wastes in the Portuguese footwear industry: new framework according design principles and circular economy	Fabiana Marques, Sónia Duarte, and Fernando Almeida	https://www.sciencedirect.com/science/article/pii/S1877705817326760	0	0	1	0	0	0	x	0	0	0	0	0	0	0	0 (more concious consumers)	If the footwear companies will perceive the competitive advantages of being "green", then they will incorporate the design principles and they will make the sustainability be an essential part of their strategies		shoe industry	sustainable, "green" industry,
2018	Intermediate Bulk Containers Re-use in the Circular Economy: An LCA Evaluation	Laura Rigamonti, Lucia Tognetti, and Mario Grosso	https://www.sciencedirect.com/science/article/pii/S2212827117307771	0	0	1	x	na	CE is a goal, but this is not focusing on implementing of CE, but re-use of packaging as a goal to one day attain CE	x (impact and performance)	0	0	0	0	0	1	0	0	0	Uses LCA to assess the env impact of bulk containers as a stepping stone to one day reach CE	packaging waste	production/manifacturing	Sustainable economy, LCA, Env impact
2017	AgroCycle – developing a circular economy in agriculture	Trisha A. Toop, Shane Ward, Thomas Oldfield, Maria Hull, Marie E. Kirby, and Michael V. Theodorou	https://www.sciencedirect.com/science/article/pii/S1876610117324636	0	0	1	x	p	circular economy in agricultural waste apsect	0	0	0	0	0	0	x	0	0	0	Waste in agricultural sector, economically optimizing this waste	agricultural sector (waste)	agricultural sector (waste)	
2014	An exploration of firms' awareness and behavior of developing circular economy: An empirical research in China	Ying Liu and Yin Bai	https://www.sciencedirect.com/science/article/pii/S0921344914000683	x	0	0	x	na	GAP between firms awareness of CE and actions	x	0	0	0	0	0	0	0	0	Gap between knowledge and actions of CE in firms and their willingness to act on their words	manufacturing firms	manifacturing firms	
2009	Negative entropy mechanism of the circular economy development countermeasures in mining area	Jing-Ru Lin, and Zhong Miao-ling	https://www.sciencedirect.com/science/article/pii/S1876612009602598	0	0	1	x	p	no, but mentions that CE can help with sustainability and balance of ecosystems	x	0	0	0	0	x	0	0	0	Coal industry, introduce the related industries which consume the entropy flow and realize entropy reduction in the mining area.	mining industry	mining industry	ecosystems, sustainable development
2018	Predictive model for the Dutch post-consumer plastic packaging recycling system and implications for the circular economy	Mariëlle T. Brouwer, Eggo Th. Thoden van Velzen, Antje Augustinus, Han Soethoudt, Steven De Meester, and Kim Ragaert	https://www.sciencedirect.com/science/article/pii/S0956053X17307808	x	0		0	0	0	0					0	0	x	0	Post-consumer plastic packaging recycling network. Focus on the recycling chain of post-consumer plastic waste.	post-consumer plastic packaging recycling network waste	Waste management- dealing with consumer waste	
2009	Implementing China's circular economy concept at the regional level: A review of progress in Dalian, China	Ying Geng, Qinghua Zhu, Brent Doberstein, and Tsuyoshi Fujita	https://www.sciencedirect.com/science/article/pii/S0956053X08002432	0	0	0	x	P	Still some parts missing until completely implementing CE; lack of incentives for older industry to become more green, lack of financial support, need for public awareness and parctripitation in CE	x					x	0	0	0	Challenges for implementing CE and the municipal/government response to these challenges- such as tax and financial support as incentive, CE training programes. Each Chinese city must tailor their own approach to CE.		CE- Municipality level, implementation	Green, water, energy

Appendix 4 : IVAR IKS “Flowchart of mass-flows for Forus waste recycle facility”

IVAR IKS
FORUS AVFALLSSORTERINGSANLEGG
FLYTSKJEMA MASSESTRØMMER

Antall tonn pr. år
ved maksimal ett skifts utnyttelse av hhv.
restavfalls- og papirsorteringsanlegget

Prosentene er oppgitt enten i hht. maks. restavfallsmengde inn
(svarte %-tall) eller i hht. maks. papirmengde inn (grønnne %-tall)
["PPK" = papir, papp, kartong]



Status: pr. 21.02.2018