Influential Factors for Value Creation within the Circular Economy: Framework For Waste Valorisation

Nadine Leder, Maneesh Kumar, Vasco Sanchez Rodrigues

Cardiff Business School, Cardiff University, United Kingdom

3 Colum Dr, Cardiff, CF10 3EH, United Kingdom

Abstract

The present trend towards greener and less-waste intensive production methods, has started to establish the idea of a Circular Economy. However, in achieving circularity, obstacles need to be overcome and new business models need to be developed. One of these business model is Waste Valorisation. Waste Valorisation focuses on the transformation of alleged waste, by-products or residue into valuable material. This paper aims to establish the current view on Waste Valorisation models and explore any influential factors within this circular business model through the lens of social capital theory. The findings are based on a focus group discussion with academics, practitioners, and policy makers. Results indicate, collaborative aspects aid to create value within this specific business model, as well as technology can act as a facilitator for collaboration between stakeholders in realizing the benefits of Waste Valorisation model. Based on the findings, a theoretical framework was developed which can be used as a guide to develop further research on waste valorization.

Keywords: Circular Business Model, Framework, Valorisation, Focus Group

1. Introduction

A functioning economy adheres to the fundamental characteristics of continuous growth and resource usage (Ghiselli et al., 2016). However, in times of growing environmental concerns, considerations about an economy, able to withstand the intensive pressure of performing at a high-quality level, at low costs, whilst equally having the lowest possible environmental impact, has further promoted the idea of circularity (EMF, 2013; Lieder and Rashid, 2016; Ghisellini et al., 2016; Despeisse et al., 2017; Urbinati et al., 2017). Consequently, governments and political institutions around the world, and specifically within Europe, have started to disembark towards a higher level of circularity (European Commission, 2015; Lacy and Rutqvist, 2015; Domenech and Bahn-Walkowiak, 2019).

Besides political institutions, the vision about a Circular Economy was informed and shaped by the Ellen MacArthur Foundation. Circular Economy is an umbrella-term, rich of ideas, contributions and solutions, in fighting excessive raw material usage and waste generation (Velenturf et al., 2019). The Foundation's butterfly model shows the ideal scenario of material circulating in two separate cycles; organic material circulating in a biological loop, whereas inorganic material circulates in a technological loop (Velenturf et al., 2019). These two cycles have tighter links than originally assumed. Firstly, because of the natural composition and technological design of products (Velenturf et al., 2019); and,

secondly, because of the nature of their waste streams (Kabongo, 2013; Vea et al., 2018; Velenturf et al., 2019).

In the development towards a zero-waste industry, these closer connections of the organic and inorganic loops need to be considered when using the approach of 'waste-to-resource innovation'. Waste-to-resource innovation can be interpreted as innovative process, emerging out of the school of Industrial Symbiosis. The process itself, is based on converting an organisation's by-products, residue, or waste, into energy (Garcia-Garcia et al., 2019; Gitelmann et al., 2019; Sehnem et al., 2019; Zeller et al., 2019), valuable material or product for another organisation, in the same or different industries (Kabongo, 2013; Sposato et al., 2017; Velenturf, 2016). Since this waste-to-resource innovation process can be applied in both the organic and inorganic loops of Circular Economy, we use the wording of Waste Valorisation model.

Literature evidencing the application of the 'waste-to-resource innovation' process, respectively Waste Valorisation models, are still limited. Existing literature shows mostly within subject-specific contributions what options are possible within Waste Valorisation models. However, those options are often restricted towards chemical and bioorganic examples, respectively food waste valorisation (Knaur et al., 2018; Sehnem et al., 2019).

When aiming to contribute towards the circular transition process, research needs to further explore the implementation of Waste Valorisation into practice and its beneficial effects on the triple bottom line (Velenturf et al., 2019). Therefore, scholars call for merging these two loops (Velenturf et al., 2019

This paper aims to further contribute towards developing Circular Economy research by

(1) establishing the current view on Waste Valorisation models; and;

(2) exploring any influential factors within this circular business model.

Our investigation is underlined by the theory of Social Capital and is structured as follows: In Section 2, we review the relevant Circular Economy and Waste Valorisation literature. Furthermore, site visits to Circular Economy events, aided in completing the bigger picture of Waste Valorisation from three perspectives (academic, industrial, and political); and; ultimately informed the next step of our research: a focus group discussion. Within Section 3, we discuss the findings of both, the literature review and the focus groups discussion. The findings contributed towards the development of a framework based on Social Capital Theory, which is introduced in Section 4. Concluding remarks, as well as further research directions, are given in Section 5.

2. Methodology

This section provides further details about the methodology applied in this research project. In the first part, authors conducted systematic literature reviews to synthesize emerging topics within circular economy rapidly whilst reducing bias (Miemczyk et al., 2012; opicfroTouboulic and Walker, 2015). Therefore, it is considered as a valuable methodology to develop and discuss research propositions and -ideas (Carter and Rogers, 2008; Touboulic and Walker, 2015). Findings from the literature review was corroborated with knowledge gained from attending over 22 industry and policy events on circular economy. This approach not only helped in development of theoretical framework, but also improved the validity of the findings presented. To bridge the gap between academia and

industry, attending practitioner and policy makers events inform researchers about the latest issues, approach, and implementation plans from different stakeholders, which could be missed by adhering to only academic journals. All attended events contained either of the following structures:

- Traditional structure of presentation and questions from the attendees;
- Industry Exhibitions with incorporated presentation sessions
- Webinars
- Presentations followed by roundtable discussion in smaller expert groups
- Presentations followed by workshops focusing on circularity

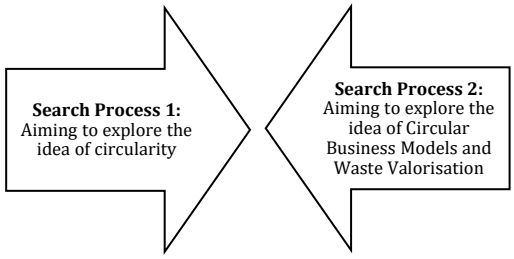
Participant numbers varied from 20 up to 80 participants. Ideas and concerns raised by participants during roundtable discussions and workshops provided the opportunity to see the current industrial application of Circular Economy and further informed our Focus Group discussion. So was one of the insights gained from attending the events, that organisations know that technology is the 'game-changer' when moving from linearity to circularity. However, the problem occurs in the 'how' – how far is technology developed and how can it be supportive in different industry sectors. This finding from industry events was further followed up in the focus group discussion. Attendance in practitioner events ensured a closer link towards practice by merging academic views with industrial concerns and viewpoints (Velenturf and Jopson, 2019). When analysing the findings, we used the lens of Social Capital Theory (SCT), which is based on the three activities of bonding, bridging and linking (Lin, 2002). More information about SCT and its application is provided in section 3. In the end, the findings of the literature review and the focus groups contributed towards the development of our framework.

2.1 Literature Review

The field of Circular Economy is still continuously developing. Having emerged out of different Schools of thoughts and political ambition to drive change towards a sustainable future, the field is widely interpreted. The enormous scope of Circular Economy becomes even more explicit when considering that up to today, over 114 definitions of circularity have been circulated (Kirchherr et al., 2017). Hence, the review does not aim to cover the literature in its entirety. It intends, to inform about the approach of Circular Economy, with a special focus on providing an informative overview of the Circular Business Model of Waste Valorisation and its connection to circularity and sustainable value creation.

When performing the literature review the approach of Tranfield et al. (2003) was used. The comprehensive literature search comprises a total number of 138 publications and was divided in two main search processes. The first search process aimed to explore the idea of circularity from a general perspective. Therefore, a wide and open search was conducted in the four main databases of ScienceDirect, Emerald, Wiley and Scopus. This search process revealed 59 publications. The second search process was more specific and looking for literature based on Circular Business Models and/or Waste Valorisation. It revealed 79 publications. A detailed research protocol and overview can be taken from the research protocol displayed in Table 1.

Table 1 Research Protocol

Research Protocol	
Search Process	
Databases	- ScienceDirect; - EmeraldInsight; - Wiley and; - Scopus - 14 journals, listed in the Scientific topic "Operations and Technology Management" of the ABS rank 2018, which maintain a high reputation in the field of Operations & SCM
Publication Type	- Peer-reviewed journals only;
Language	English only
Data range	2007 until 2018
Search fields	Search fields were applied to 'Title, Abstracts and Keywords'
Search Strings	<u>Search Process 1:</u> 'Circular Economy' AND either one of the following: SCM; Logistics; Remanufacturing; Innovation; End-consumer; End-of-life cycle; GSCM; Green; Sustainability; Change Management; Closed-loop; or reverse logistics <u>Search Process 2:</u> Circular Business Models, Waste Valorisation, Waste Management, Technology, Collaboration
Inclusion & Exclusion Criteria	- Peer-reviewed articles only; - English language only; - ABS ranked journal OR impact factor higher than 3.0 only; - Time period 2007-2019 only; - Excluding conference proceedings - Exclusion of articles failing to mention relevance to CE idea - Exclusion of articles due to semantic relevance (e.g. search string 'Economy' often refers to the wording economic) - Exclusion of articles due to relevance to research question (e.g. papers tend to address only one part of CE, such as reverse logistics, but do not mention CE at all)

2.2.Focus Groups

A focus group main purpose is to explore the respondent's feelings, belief, attitude or reaction about a certain topic. This type of method is applied when the research is in a preliminary or exploratory stage. At this stage, other research methods, for instance interviews, surveys or observations, would not achieve the same effect than a focus group discussion (Krueger, 1988). In addition, a focus group discussion draw upon respondent's experiences which are unlikely to be revealed within an interview.

Waste Management is a sensitive topic for organisations. Attending previous round-table discussion on external events, we knew, within a social gathering and the interaction of like-minded people, experiences, difficulties and approaches about Waste Management are more likely to be revealed by participants (Gibbs, 1997). A focus group discussion can be used as an individual method, but equally complement other research methods. In that regard, the conducted focus group discussion aims to complement the literature review and the field visits.

In a first step, the participants were allocated in two different groups, based on their occupational background. In doing so, a group consisted of a broad variety of executives from the manufacturing, automotive, groceries, retailer, semi-conductor and logistics service sector. Policy makers, consultants from non-profit organisations and academics were represented in each group as well. Based on this pre-allocation a critical and broad discussion atmosphere emerged during which participants were inspired by each other's comments. This unique broadness would have been difficult to achieve when conducing one-to-one interviews or surveys. To achieve a homogenous group dynamic, meaning ensuring a good-mix between academics, practitioners, policy makers and consultants, as well as a good group size, participants were carefully selected beforehand and split in two groups. Both focus groups followed the utmost classic approach of being a 'single focus group' discussion. In doing so, data was generated by an interactive discussion of all participants and a team of two facilitators (O.Nyumba et al., 2018). A detailed overview of the focus group including the questions posed can be taken from Table II. For clarity reasons, the focus group procedure is explained within the following paragraph.

The discussion was moderated in an informal and unstructured way following the attendees' flow and ideas (Carey and Asbury, 2016). Time was set up for approximately an hour. Within this hour two questions, which were of a comprehensible, broad and interesting nature, fitting both practitioners and academics alike, were proposed to create stimuli. To begin with, participants were asked to brainstorm question 1, which related to the challenges organisations might experience when applying Valorisation models, and in the follow-up to capture their ideas on post-it notes. After approximately half an hour, the facilitator proposed the second question, and deliberately shifted the focus towards technology and collaboration in Valorisation Models. The discussion itself was recorded and later transcribed for data analysis purposes. An additional note-taker summarised the main points of the discussion flow so that the focus group facilitator could focus solely on the facilitation task. Both, the transcribed recordings and the note-takers summaries, were in the following steps analysed by means of a thematic analysis. This process will be explained within Section 3.

Table II Focus Group Protocol

<table>
<tr><th colspan="2">Focus Group</th></tr>
<tr><td colspan="2"><u>Overview:</u>
Number of discussion groups: 2
Number of participants in groups: 10-12
Duration: 1hour
Number of Questions posed:2
Data collection: Recording, post-it notes, additional notetaker</td></tr>
<tr><td><u>Participants:</u>
• Executive from manufacturing, automotive, groceries, retailer, semi-conductor and logistics service sector
• Policymakers
• Consultants from profit and non-profit organisations
• Academics</td><td><u>Questions:</u>
• #1: What challenges does /or could your organisation experience when applying the business model of Waste Valorisation? (Internal & external challenges)
• #2: How can technology facilitate collaboration when realising the business model of Waste Valorisation?</td></tr>
<tr><td colspan="2"><u>Procedure:</u>
<u>Step 1.</u>
- Question #1 &2 introduced;
- Participants had 5 minutes brainstorming time to write their ideas and thoughts on post-it notes
<u>Step 2.</u>
- Start of the discussion based on questions #1
- Time: 30minutes
<u>Step 3.</u>
- Facilitators introduced second questions into the natural flow
- Discussion continued based on question #2
<u>Step.4</u>
- Closing by the facilitator

Annotation: the discussion was recorded, additionally notes were taken by notetaker.</td></tr>
</table>

3. Analysis and Findings

This section includes the analysis and the findings from systematic literature review and focus groups, as well as the industrial events. Since, qualitative data is known to be messy and unclear, a thematic analysis at a semantic level was applied. Within a thematic analysis, pattern and themes are identified. Thematic analysis at a latent level identifies the themes explicitly and does not aim to interpret the underlying conceptualisations, ideologies and assumptions of participants. Instead patterns were created to interpret the broader meanings, and where applicable set in relation to the literature (Braun and Clarke, 2006).

Findings are furthermore interpreted via the lens of SCT. SCT incorporates two elements. A social element, capturing the essence of different sociological concepts, norms and values; and a capital element, being the monetary surplus value of transformation conducted (Lin, 2002). Based on these two elements, social capital focuses on collaborative social relationships and their embedded resources. Any resources embedded in a

collaborative network can be activated when needed and in that term, contributes beneficial to the network (Glover et al., 2016).

From a network perspective, social capital is classified in three types of characteristics - bonding, bridging and linking (Claridge, 2018). Whilst bonding relates to the horizontal ties in a network, bridging relates to the vertical ties (Halpern, 2005; Claridge, 2018). Distinguishing between both characteristics allows researchers to capture both, the simultaneous openness within the network (bridging), but also the closure within a small exclusive group (Patulny and Svendsen, 2007). Linking, the third characteristic, is considered to form the links between these communities and social, political and economical institutions (Patulny and Svendsen, 2007).

3.1 Analysis and Findings of Literature Review

The review comprised 138 publications from 27 different journals. Most of these publications were published in sustainability- and environmentally-leading journals. A genuine rise in publications, indicating growing interest in the topic of circularity, is noted from 2015 onwards. Minority of papers conducted (systematic) literature reviews only. For those that did, however, there is a clear pattern from moving away from the general concept and historical viewpoints (Ghisellini et al, 2016; Winans et al., 2017; Homrich et al., 2018), towards more specified subject field and areas, such as, defining circularity (Kirchherr et al., 2017), designing for sustainability (Moreno et al., 2016), exploring drivers and barriers (Govindan and Hasanagic, 2018), as well as highlighting the eco-innovative aspects in circularity (de Jesus et al., 2018).

The application of theory in research helps to provide focus, rigor and justification for the chosen research questions and aims. Theoretical underpinnings can take however, given the practical nature of the researched field, a subordinate role. Within Circular Economy, theory is still used with hesitation. However, when applied, both, systems theory and institutional theory, are often the chosen theories to study circularity. Systems theory takes a holistic approach and investigates occurring phenomena. In that regard, interactions between groups of individuals or stakeholders in achieving results can be observed (Mele et al., 2010). In a circular environment systems theory is often used when aiming to improve the viewpoint on the bigger picture, and shifting the focus from micro towards macro level. This macro level perspective provides a better understanding for understanding the complexity of the supply chain (Sushmita et al., 2014), or even the entire product- and material life cycle (Despeisse et al., 2017). Institutional theory is often used to investigate social phenomena, comprised by institutions, rules and legislations. In the circular context, institutional theory can provide an opportunity to explore the impact which any change on the macro-level has (Khor et al., 2016; Fischer and Pascucci, 2017).

Within literature, circularity is often highlighted from a theoretical rather than practical perspective. Developing archetypes and frameworks appear to be trending (Osterwalder and Pigneur, 2010; Bocken et al., 2014; Kraaijenhagen et al., 2016; Urbinati et al., 2017) and useful, but neglecting the overarching question of how to convince industrial organisation and governmental bodies to implement circularity approaches (Velenturf and Jopson, 2019).

This has been particularly addressed as the existing gap between the development of practical sustainable solutions and the individual local actors, who are in the need to implement these solutions (Dyllick and Muff, 2016; Velenturf and Jopson, 2019). In that

regard, scholars see a growing need for best-practice business case examples, clearly indicating the benefits for business to join the circular movement (Velenturf and Jopson, 2019).

Circular Economy aims to achieve a better balance between societal, environmental and economic activities by increasing resources efficiency and waste reduction (Ghisellini et al., 2016; Sehnem et al., 2019; Velentuf and Jopson, 2019). To achieve these complementary goals new – more circular – business models need to be developed (Velenturf and Jopson, 2019). Sehnem et al. (2019), who conducted a study based on the maturity levels of sustainable business models in Brazil, listed about 12 different circular business models and approaches. Despite that most of these circular business models were classified as 'managed', organisations still need time to institutionalise and optimise their processes (Sehnem et al., 2019). This is in alignment with recent calls for a stronger support towards business models fostering the idea of resource recovery and valorisation, which shows that these models support multidimensional growth. They have the power to shift economic benefits into social and environmental values by preserving technical values from products (Velenturf and Jopson, 2019). This preservation of value is considered as an engine to create benefits based on the triple bottom line (Iacovidou et al., 2017a; Velenturf et al., 2019; Velenturf and Jopson, 2019).

Models following the innovative process of Waste Valorisation, foreground the exchange of by-product or residue converted into valuable resources or material (Kaur et al., 2018). The focus herewith, is on different waste streams. Hence the model can include, waste-to energy processes, during which bio-based or organic material is used to create energy (Rada, 2018; Rada et al., 2019; Tomic and Schneider, 2018). Furthermore, these waste streams can also be based on inorganic or organic material. Organic streams focus on the valorisation of food waste, whereas the inorganic waste streams aim to achieve value via refurbishment and remanufacturing strategies (Velenturf et al., 2019). Independent of the waste stream there is the need to stop seeing these waste streams, when starting to follow the model of Waste Valorisation (Velenturf et al., 2019).

Within valorisation, value maintains an important part. It is considered as complex and multidimensional variable, which can consist of incommensurable sets of individual values (Milward-Hopkins et al., 2018). These individual values are usually in alignment with the triple bottom line, and refer to the creation of social-, environmental-, and economic value in a research activity (Iacovidou et al., 2017b; Bernon et al., 2018 Milward-Hopkins et al., 2018).

Recently, scholars started to incorporate a fourth value towards the multidimensional value approach: the value of technology. Research claims, creating and focusing on technological value would lead towards a greater technical viability as well as investment appraisals and in the long-term, the creation of economic value. Hence, it is only a matter of considering technology in its aspects within the circle (Velenturf and Jopson, 2019).

Besides, the multidimensional value perspectives based on the triple bottom line, established frameworks and research make use of the four value perspectives of value proposition, -creation, -delivery and -capture (Bockent et al., 2014; Iacovidou et al., 2017a). The four value perspectives originally emerged from Osterwalder and Pigenuer's (2010) business model canvas and have increasingly become popular for academic research

(Urbinati et al., 2017). In industry, Ellen MacArthur Foundation makes use of said 'value canvas' by targeting industrial organisations to join the CE movement with a 'Circular design toolkit'. To be able to better differentiate between the two value characteristics, Table III displays a variety of research which takes its basis to explore value relationships either on the value canvas or the multidimensional value perspective.

Table III Value Relationships and Classifications

Authors	Value Relationship	Value part focused on	
		Value Canvas	Multidimensional Value
Reike et al., 2018	Discussing controversies in CE based amongst other things on value retention options	Value Capture	
Bernon et al., 2018	Identify a variety of Circular Economy Values which are in alignment with the retail reverse logistics sector		Economic, Environmental & Social Value
Iacovidou et al., 2017a	Developed a value framework to assess value creation, destruction and distribution in resource recovery from waste systems	Value creation, Value delivery Value capture	
Jensen et al., 2019	Discuss the impact of sustainable value creation in the context of the remanufacturing cycle		Sustainable Value
Kristensen and Remmen, 2019	Investigate value proposition in the context of product-as-a service	Value Proposition	
Di Maio et al., 2017	Measuring resource efficiency based on market value indicators		Environmental and Societal Value
Milward-Hopkins et al., 2018	Develops an integrated modelling approach for value assessment		Economic, Environmental & Social Value
Iacovidou et al., 2017b	Challenge the current multi-dimensional values of the triple bottom line within resource recovery and Waste Valorisation by conducting a critical review		Economic, Environmental & Social Value

Notably, scholars have foregrounded the idea of 'linking these value perspectives with circularity themes or supply chain related topics'. Mainly to achieve a higher sustainability outcome (Bernon et al., 2018). However, there is still a gap in defining 'value' in a unified way in the context of circularity. For instance, papers have explained the idea of Waste Valorisation. However, 'what' value emerges and 'how' this value can be assessed is mentioned in a limited way. Some papers, refer in greater depth towards value perspectives; however, interestingly, authors create their own, suitable expressions, such

as ‘circular value’ (Bernon et al., 2018) or ‘complex value’ (Iacovidou et al., 2017b; Milward-Hopkins et al., 2018). A clear definition of value, value assessment and –proposition would, however, be essential in the development of this new Circular Business Models (Lieder et al., 2018).

To achieve these targets, a radical systems change is required. The circular movement however, is far from being new and radical. Critics say, circular economy outruns the danger of simply being embedded in current institutional set-ups (Reike et al., 2018), rather than being used to unlock its true value (Despeisse et al., 2017). The circular idea faces, for instance, severe difficulties in the regard of uncertainty aspects (Lahti et al., 2018), and skepticism from stakeholder’s side, when being a first mover in this field (Aguinaga et al., 2018). Especially with regards to the ongoing discussion about the level of stakeholder involvement within circularity, shorter loop retention options are said to be put into effect faster. If stakeholder would focus on the promotion of such short loop retention options, for instance remanufacturing and refurbishing options, a change towards circularity might be accomplished quicker (Reike et al., 2018; Jensen et al., 2019).

The difficulty however is, the implementation process. Circular value can only be achieved when all stakeholders along the value chain work together (Manninen et al., 2018). Hence, a transformation of the entire supply chain is needed. Habits need to be unlearned and changes fulfilled. This would include changes in essential business departments and processes, such as economic ordering, remanufacturing, retail, and consumption. The urgency to adopt CE approaches has clearly been identified. Process and action in contrast, have been slow. The development is said to require an interplay of scientific and technological progress (Velenturf and Purnell, 2017).

Finding ourselves, in an era which is shaped by digital developments and technological progress leaves the impression that technology and innovation could be incorporated in a circular environment. Recent literature reviews indicate how interested scholars are in exploring and developing this pathway further (Baldassarre et al., 2017; Bocken et al., 2018). Linking technological aspects with the concept of Circular Economy could have a positive effect on reducing the overexploitation of virgin material (Bressanelli et al., 2018). Hence, the role of technology is said to be a positive driver for social inclusion and environmental resilience (Ghisellini et al., 2016).

Despite confidence about achieving a positive impact by making use of technological devices in a circular environment, the matter of ‘how technology could support this sustainable development further in the near future’, remains unclear. There is no doubt, that technological progress aids achieving a Circular Economy. However, the focus needs to shift towards the idea of ‘what role does technology play in this movement, and ‘how can it help create sustainable value to achieve circularity’.

Research has identified a variety of drivers of the circular movement (Govindan and Hasanagic, 2018). However, technology and collaborative ideas have been identified as inevitable contextual factors in the creation of value and the circular implication (Schenkel et al., 2015; Baldasarre et al., 2017; Hein et al., 2017; Jensen et al., 2019). In that regard, research has moved its focus towards product as-as-service options (Kristensen and Remmen, 2019), eco-innovation and circular models (Baldasarre et al., 2017), and most importantly on the development of value assessment tools and strategies when using resource recovery approaches (Iacovidou et al., 2017a; Velenturf and Purnell, 2017; Nußholz, 2018).

3.2 Analysis and Findings from Focus Group Discussion

To explore the degree of consensus with the findings from the literature review (Morgan and Kreuger, 1993; Gibbs, 1997), a focus group discussion was conducted. The collected data was analysed with the help of a thematic content analysis, during which post-it notes and the discussion protocol were coded and occurring themes clustered. In doing so, the following seven themes were identified: (1) *Awareness & Knowledge* towards Waste Valorisation Models, *(2) Implementation Process* of Waste Valorisation Models, *(3) Business Strategy* of Organisations, *(4) Stakeholders & Collaboration, (5) Communication, (6) Supply Chain,* and *(7) Product, Services & Processes*. In the following, we discuss the main points within those themes of the findings in more depth. We indicate the identified value classification in brackets.

At the beginning, participants conveyed, their organisations are either fully aware or are already involved in sustainability actions. However, general *(1) Awareness and Knowledge* about the terminology of Waste Valorisation appears to be an issue. Too often organisation work in their own bubble, and create a *"very narrow focus, which is very difficult to break out of"*.

It was mentioned that organisations do understand the sustainability movement in general. They are in the position to start tackling environmental aspects, such as CO2 emission reduction (environmental value).

The bigger challenge however, lies in the ability to identify new and emerging concepts. The model of Waste Valorisation, is, depending on the industry sector, relatively unknown. Notably, for those who were aware of it, there is still the difficulty of identifying opportunities that come with valorisation. In that regard, the smaller changes appear to be the bigger problem. This does include the ability of organisations to know their exact waste streams. Knowing waste streams and their components allows waste classification and pushes valorisation forward (value creation). However, classifying the contents of waste streams, in particular hazardous waste components, is complex and difficult. Hence, it needs laboratory technology to examine and classify these waste streams further (technological value).

Laboratory technology includes modelling techniques, for instance thermodynamic modelling or geochemical modelling. Results from these modelling techniques inform further analytical methods to help classifying the components of the waste streams (technological value). However, these technological tools are either unknown, or not affordable to organisations.

In that regard, technology brings forward the discussion about possible funding opportunities. Robotics for instances, are advantageous, particularly in the waste management sector in waste picker positions (technological & social value). The technological value created contributes towards the triple bottom line especially in terms of social benefits. Robotics can take over dangerous or even monotonous work. However, their development is costly and time consuming, since they need to learn how to deal with all sorts of different waste forms.

In times of crisis radical approaches are needed. Systems changes, which ultimately comes with valorisation activities, are needed, but difficult to realise. Technology has the potential to facilitate such systems changes and ultimately transforms industry. There are now few successful examples of managing food wastes where web

platform connects the generator of food wastes with recipients such as food banks and charities (value creation). This 'linking' activity shows the opportunities that come with technology when considering value creation. However, it is also an example which indicates the need for systems change and inter- industry collaboration to manage the organic and inorganic loops. Hence, it is necessary to start embracing technology and artificial intelligence. Going out, starting a re-thinking process, being a first mover, and in the long-term, successfully applying valorisation is considered as critical and challenging, but still not impossible.

There was common agreement, the actual *(2) Implementation process*, which requires to convert theoretical knowledge into practical actions, is challenging. On this occasions, participants considered the *'Implementation process'* as both, internally within the organisation, and externally with suppliers. Difficulties addressed appear to emerge mainly from a major lack of best practice examples and successful business cases to look upon as a role model.

Even those who claim to understand the transformation of theory into practice face severe challenges when coming to the practical execution. Following difficulties were mentioned within the discussions: (i) finding the necessary resources in terms of sufficient and well-trained staff; (ii) acquiring the necessary technological equipment, plus its readiness and reliability when going-live; (iii) tight time restrictions when aiming for a successful integration of those technologies or new model; and (iv) additional space, which might be needed for product or resource storage.

In addition, traceability was mentioned as an obstacle in the implementation process. This connects closely to the existing problem of losing the connection to products after the point of sales. However, within circularity, 'bonding' and 'bridging' activities with customers and supplier after the point of sales are essential. This is particularly important when it comes to the end-of-life and possible return-, as well as recycling schemes (value capture). Traceability, a possible solution, was specifically emphasized as an issue for industry sectors, in which cross-contamination of material or work spaces, is an apparent threat (technological value).

When looking at valorisation models from a *(3) Business Strategy* perspective, costs are instantly addressed. The focus groups identified four different kinds of costs: commencing with actual implementation costs and repair costs, plus costs in comparison to the actual value received when applying such business models. Finally, affordability, in respect of buying the necessary equipment, were mentioned.

The discussion around costs, led furthermore towards funding options and the availability of such funding pools. In this regard, policy regulations and –restrictions, as well as accreditation options, were mentioned as challenges and possibilities alike. Accreditation and legislations, which could accelerate the concept of waste valorisation, are entirely missing, or are passed through political institutions too slowly. Hence, stronger effort regarding linkages with external institutions are required. How such linking with external institutions could take place can be seen when looking at political regulations and –restrictions and EPR.

EPR is controversially discussed in connection with deposit-return-schemes for plastic bottles and aluminum cans (environmental value). It was pointed out, that some policy regulations are not willingly applied by organisations. For some, *"they are forced to do so, (…) fulfilling some of those regulations is really complicated".*

Furthermore, liability and internal rules appear to be a hurdle and to some extent a place of value destruction. In that respect, luxury goods and products could occur as a significant problem towards value destruction rather than value capture. An example was provided, where a supplier was specifically ordered to burn all spare or excess goods from a luxury brand, rather than re-supply the goods, which are still considered as a resource to the life-cycle. Hence, these bridging relationships rather destroy value instead of creating it. Fortunately, such requests are seldom and vary from organisation to organisation and sector to sector.

An additional challenge in the topic of *Business Strategy* appears to be the commitment from top management level and their support towards innovative ideas. It appears to be necessary to drive compliance to realise Waste Valorisation. This compliance is also required from the *(4) Stakeholders*, which is the fourth theme emerging from the discussion. What is currently missed is a clear commitment from stakeholders to take the risk and embark towards the joint model of Waste Valorisation.

With specific regard to the stakeholder group of customers in a B2B business environment, user behaviour and customer perception were instantly mentioned. Fear that brands might be negatively affected *'because the offered product is made of waste'* is omnipresent (value proposition). However, if stakeholders are convinced about their doing, and spread the message across, a domino effect could arise. This domino effect could lead towards economic and social value, ultimately benefiting organisations and supporting the wider public (economic & social value).

However, in a network, it is possible to change internal Operations- or Business strategies. The real challenge is to convince the public and society to support their effort in Waste Valorisation. Nowadays customer clearly state their demands, sometimes they push towards environmental improvement (value proposition), sometimes they need to be made aware of re- and upcycled or refurbished products (value capture). The current lack of clarity raises questions on how organisations can encourage the public and customers to buy and use products emerging out of this model. 'Linking' activities, such as educational events, organised in cooperation with non-profit organisations or political institutions, could be a first step.

Therefore, a change in (*5) Communication* strategies are required. This includes not only internal, but also external communication. The *'bonding'* activities between organisations need to be further expanded. Organisations need to '*be made aware that you can only recycled what is ultimately sent into the loop'.* Furthermore, ineffective cross-departmental communication needs to be eradicated.

There is also a common wish for stronger *'bridging'* activities with partners and suppliers. These activities could also take place cross-industrial wise. Different industries need to cooperate when aiming to identify how by-products can be circulated. In doing so, communication needs to start already when designing and developing the product. This leads to the theme of *(7) Product, Services & Processes.* In addition to the quality concerns of returned products, the actual design of the product and the processes appears to be the most challenging issue. Designer would need to be involved in designing products in a suitable way, which would fulfill the criteria of Waste Valorisation. Hence, the model of Waste Valorisation would even start before the physical and visible exchange of waste and resources (value proposition).

Better communication abilities would also help to tackle challenges within the *(6)*

Supply Chain. In that regard, the ability of implementing Waste Valorisation on a global supply chain level was identified. Furthermore, there is a huge fear, when it comes to the dependability of the received 'waste'. This does not only include quality concerns. In a lean and just-in time production and delivery environment, 'waste stream' predictions would need to be very precise. This endeavour is currently considered as very difficult to realise when returned waste streams come from different tiers. Intensifying these already existing 'bridging' relationships within supply chains could be of further help. Also, there is a lack of understanding of how by-products of one industry can be used as raw materials for other industries. For example, how can the steel industry work closely with automotive sector to effectively utilize the scrap at the end-of- life of cars?

In terms of the involvement of technology, participants agreed, technology is a supporting factor when it comes to circularity and valorisation. When considering the technological transition point, it appears to be beneficial to make use of the often addressed 'rise of the machines' and embrace artificial intelligence. Robotics offer a higher quality control; however, as earlier addressed, can be costly in their acquisition. Additionally, there is skepticism from an employee's side. *'Robots will take our jobs'* is a commonly heard statement. Despite skepticism towards robotics, these machines can maintain an influential role. Robots are already used to dismantle returned electronic products. Within the recycling industry, robotics are developed to be used as waste pickers. Despite being faster pickers than their human colleagues, biggest obstacle to overcome: the different sizes and shapes of the material to pick (technological value).

Mobile technology seems to be an ideal technology to facilitate circular business such as Waste Valorisation. It enables and provides live-reporting and tracking options. Tracking options could be useful when it comes to the matter of closing the gap between point of sales and end-of-life. Furthermore, technology is considered a facilitator in demand planning and forecasting. This would help the manufacturing sector, where lean and just-in-time practices are regular features (technological value).

Other technological options are 'waste exchange' platforms. These homepages provide a virtual space for organisations to either find the 'right waste', or to 'dispose' their waste in a meaningful way. In other words, waste can be exchanged via these online platforms. In doing so, these platforms are a valuable 'bonding' and 'bridging' tool. A variety of start-up organisations have started to offer this service and function as the facilitator in these waste exchange processes. Industry sectors, such as construction industry, furthermore push towards these platforms. Other industry sectors such as the logistics service provider industry, have started to make use of a common societal concept. They have started to follow an interesting approach of shared Warehouse Management, similar to the Airbnb accommodation principle (technological, environmental, social value).

It is agreed that technology can not only be used in B2B business affairs. Technology should also be considered as a 'bridging' facilitator when aiming to engage the end-consumer to stay in the loop. Technology has also evolved into a fundamentally new approach when considering the current social revolution. Originally used as a medium, aiding contact, social media has now gone beyond this point and functions as a sharing and communication platform.

Using technology to share via the medium of social media or the internet has never been easier. Such communication platforms can 'bridge' a way to consumers, and have

already taken over business-to-customer sectors, such as the food sectors. Food apps, such as 'too good to go' let users know where restaurants and bakeries offer food for a cheaper price than the original, rather than throwing it away at the end of the day. With the support of the app, customers easily find the location and availability of their preferred food and organisations save food waste and disposal costs (technological and social value). This example also shows how technology can facilitate in value creation and delivery.

Organisations in a Circular Economy rely on products (returns), rather than sales figures, to create revenue streams, technology can tip the scales. The roles of technology in circularity is clearly seen as an enabler and facilitator. However, there are certainly challenges of different scale and variety which needs to be overcome when establishing it in a solid Waste Valorisation model.

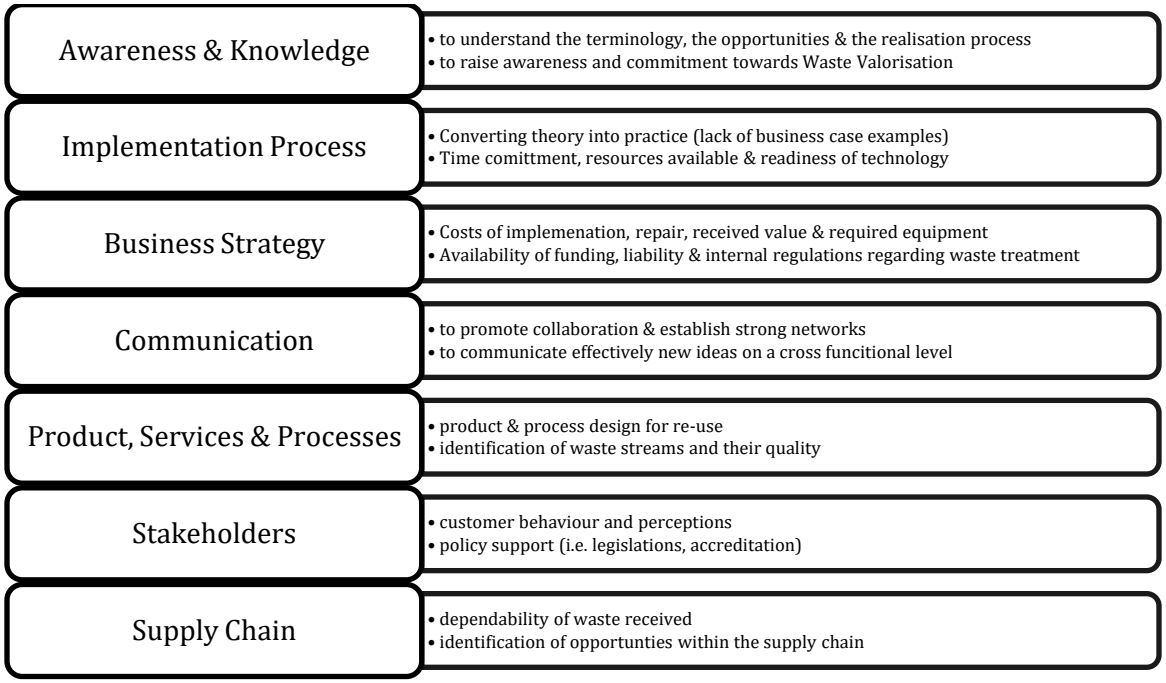


Figure I Challenges for Waste Valorisation Models (Authors, 2019)

4. Discussion on Findings

Despite that environmental sustainability approaches, are around for a considerate amount of time, the concept and research in the field of Circular Economy itself is still in its infancy (Lacy and Rutqvist, 2015; Ghisellini et al., 2016; Velenturf et al., 2019). The amount and diversity of different challenges addressed during the focus group discussion further supports this claim.

The infancy of these fields, provides space for criticism, doubts and questions. "Why should we bother about it *[Circular Economy] at all?"*, *"What are the behavioural challenges around circular economy?"* and *"What will people [annotation: the customer] accept?"*. Although several useful taxonomies, circular strategies, canvases and archetypes (Osterwalder and Pigneur, 2010; Bocken et al., 2014; Kraaijenhagen et al., 2016; Urbinati et al., 2017) have been developed recently in the literature; practical guides, best practice

business cases and approaches are still to be generated to support the transition from linearity to circularity (Velenturf and Jopson, 2019, Velenturf et al., 2019). Organisations have understood that collaboration and technology are crucial to reach a truly Circular Economy and more circular models. Collaborative partnerships include bonding or bridging with other organisations, as well as linking with external institutions, are necessary in a circular environment and will ultimately create value for organisations involved in this type of partnerships.

To support organisations in identifying circular business models and facilitating factors, we propose a framework that can be explained using the lens of social capital theory and can be applied on research focusing on the different sorts of circular business models. However, due to our focus on Waste Valorisation, we will apply it on said circular model.

Collaborative activities have been identified as an inevitable element in circular business models (Rizzi et al., 2013; Brown and Bajada 2018; Stewart and Niero., 2018; Veleva and Bodkin, 2018). Social Capital theory supports this element by capturing the elements and resources embedded in social structures and networks, rather than focusing on individuals and their developments (Lin, 2002). Collaborating within Waste Valorisation, can take place via different forms. Literature referred to all partners of the supply chain (Brown and Bajada, 2018). Furthermore, customers and other stakeholders need to be involved in the 'waste-to-resource' innovation process (Stewart and Niero, 2018). Results from the focus group showed industry encounters two difficulties. Firstly, in identifying how a successful collaboration can look alike; secondly, collaborative activities have to be considered equally, on an internal and external basis.

Based on these finding, we decided to display the triadic relationship between the organisation, the customer and the supplier. There is also an option of extending the network with external institutions, for instance political bodies or non-profit organisations. This triadic relationship does not exclude the integration of other Waste Valorisation network with stakeholder or between two business entities only.

Newest research in the field of value in circularity argues that there is a need to identify the deeper meaning of value in the business model context (Velenturf et al., 2019). This can be done by shifting the focus from the sustainability pillars of economic and environmental value towards social value, plus adding the idea of technical value (Velenturf and Jopson, 2019). As we see it, value and the idea of an environmental sustainable approach is inseparable and tied together. Hence, our framework regards the three pillars of sustainability within the benefits that might be achieved by the proposition, creation, delivery and capture of value. In doing so, we aim to bring the value discussion into the general context with the sustainability pillars of economy, environment and society.

At a time when technology determines everyday life by its omnipresence, technological development should not be neglected in the entire discussion of circularity. Within the literature, technology is identified an essential and highly important driver of circularity (Su et al., 2013; Govindan and Hasanagic, 2018). From our focus group discussions, it became apparent that technology functions as a facilitator for collaboration and, therefore, influence the ultimate achievement of Circular Business Models. Hence, we placed technology as an influential factor. It remains open where and how the effects of technology will appear. Effects could become evident within the collaborative network itself, or the external network only. So far, research has only identified technology as an

essential driver in the practical implementation towards Circular Economy. It has been silent about the 'how'. How can technology aid implementation and, in that regard, support value creation within a circular economy environment?

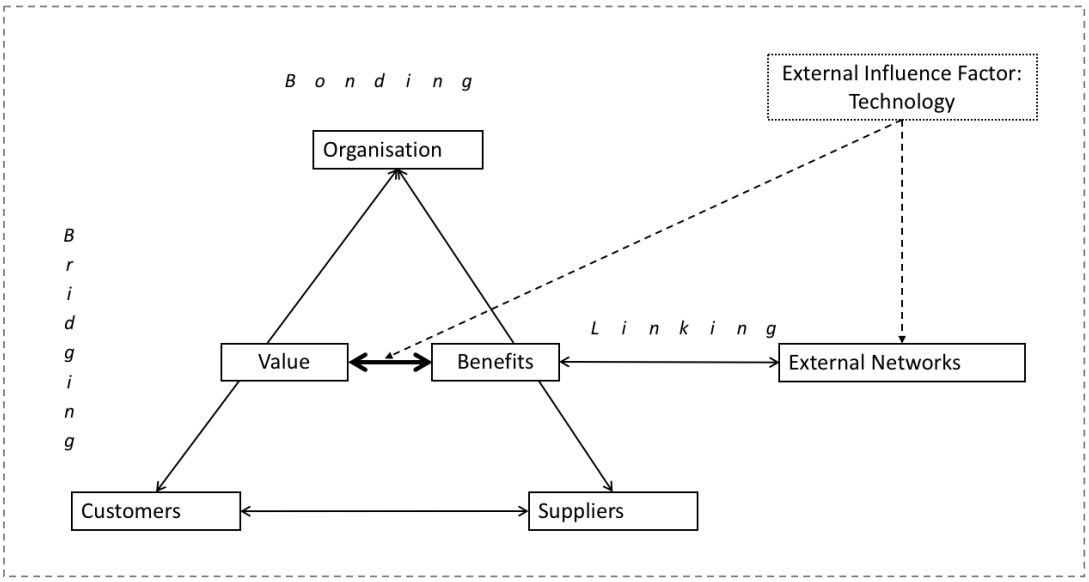


Figure II Theoretical Framework for Waste Valorisation

5. **Conclusion**

Within the last decades, the availability of resources seemed to be inexhaustible and inexpensive. Economies around the globe favoured the linear growth model. However, a growing care towards environment and the future generations has led towards a mindset change (Brundtland Report, 1978; Lacy and Rutqvist, 2015). The concept of circularity is considered as a supporting tool in realising this mindset change It is based on preventing resource exploitation, and promotes resource recover from waste (Eli et al., 2017). In doing so, new and creative, so-called business models are required. This paper investigated current views on the business model of Waste Valorisation, and discusses the influencing factor of technology within this model. Therefore, a literature review was conducted and findings of the review were used to set up a focus group discussion.

Thus, it can be highlighted that further empirical studies and business cases are required to indicate a way and guide organisations in fulfilling the transition towards circularity (Velenturf and Jopson, 2019). In the context of the circular business model of Waste Valorisation, value maintains a special role. Finding a unified definition of value and how it can be assessed in such an environment appears to be a necessary variable when moving away from a linear system. Furthermore, the two contextual factors of collaboration and technology are necessary when fulfilling the required systems change. Technology is, in the widest sense, identified as driver which can enable Waste Valorisation. The vagueness in this matter, is the 'how'. Research needs to further investigate how technology can support the creation and assessment of multidimensional value.

Research also needs to consider that circular business models, such as Waste Valorisation, find their optimal solution by connecting with different sectors or industry

branches. Hence technology needs to be adaptive and ready to bridge a naturally existing gap between diverse industry sectors.

Within the results, a theoretical framework was developed to move away from commonly applied theories in circular economy research and make use of Social capital theory. A theory which "enables participants to act together more efficiently to pursue shared objectives" (Putnam, 1995). The framework considers the three characteristics of social capital theory; bonding, bridging and linking, and can support future research in looking for new collaboration opportunities that create social-, economic- and environmental value. It also considers the contextual factor of technology and its influence on a circular model such as Waste Valorisation.

The interplay between value creation, collaboration and technology has the potential to support and drive the implementation process of closed-loop and open-loop Waste Valorisation Models. Hence, the developed framework can be a starting point for further research, focusing on the individual factors but also on the interconnectedness of value with the two contextual factors of collaboration and technology in the overall movement of shifting from linearity to circularity.

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