Social acceptance of novel, (quasi-)circular funeral technologies: framework development and recommendations to the Dutch funeral industry

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by

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Acknowledgements

Summary

As mankind's awareness of environmental problems increases, and products and services in all industries are looking for ways to become more sustainable, so too does the funeral industry need to innovate to reduce their environmental impacts. However, due to cultural norms and ethical principles tied to death care, such innovation is not easy to introduce to the public. As a result, sustainable developments in the funeral industry, and literature based thereon, are still scarce.
This study aims to address this research gap through an exploratory, quantitative research approach. Although these problems play at a global scale, this study focuses on the Dutch scenario, taking recent changes and current developments into account.

Based on an analysis of the resource flows in current mainstream funeral alternatives, a comparison between the funeral and waste management industries is made. Whereas both fields of work have a lot in common on technical and logistical levels, their social aspects differ significantly.
The waste management sector is not bound to nearly as many social factors, and is significantly further in the development and integration of sustainable systems that people use on a daily basis. Real-life examples of these new developments are analysed, to identify which factors played a prominent role in the social acceptance by its users, the public. In order to do so, a custom social acceptance framework for (quasi-)circular funeral technologies, based on pre-existing frameworks from different theoretical backgrounds for social acceptance in other contexts, is developed.
The seven values of community, connectedness, family, cleanliness, trust, procedural fairness and attitude are identified as most influential in the contexts of composting municipal organic waste and the collection and sorting of MSW (Municipal Solid Waste). These values are then analysed in the context of death care literature, which allows for a comparison between both industries. With such varying cultural backgrounds to these technologies, social values in an acceptance framework are also bound to show plenty of differences. Interesting to note are the numerous similarities, reinforcing the initial assumption that the two industries are comparable.

Based on the identified differences, ideas are conceptualised that implement aspects that should positively influence the introduction of sustainable waste management systems in the death care industry. These ideas, and other relevant developments in the industry, are discussed with various funeral experts. Different perspectives of these topics can be analysed through their unique backgrounds. With their feedback, the ideas are updated with experience and knowledge from within the field, which is used to develop two sets of recommendations. A key differentiation is made between sustainable funeral alternatives and (quasi-)circular funeral technologies.
The recommendations provide a wide variety of approaches to increase the social acceptance of either two categories. Although there's room for both developments at the same time, it is recommended that the overall social support for sustainability in the funeral industry is increased through the improvement of currently available alternatives, before novel (quasi-)circular technologies are ultimately introduced onto the market.
The proposed suggestions represent a range of different approaches: from technological aspects, to digitalisation of services, and much more. In the end, it is important to realise that the selected funeral method is only responsible for a part of the total emissions related to the whole funeral ceremony. On a larger scale, one's funeral is only a fraction of the emissions one creates in a lifetime. However, sustainable funerals can be a tool to provide a meaningful end to a personal quest of living more sustainably.

Keywords: Funerals Industry, Death Care, Municipal Waste Management, Social Acceptance, Theoretical Frameworks, Circular Innovations

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1. Introduction

Death has been part of human cultures and traditions from the beginning. After all, death is the only certainty in life. There have been, and still are, many different ideologies about what happens to people after the moment of passing away. These thoughts are often shared amongst communities. The characteristics of these communities have changed a lot throughout history, but for the last century, the most prominent communities are those based on the political environment within a nation's borders and religion. Regardless of time and location, there is one shared characteristic between these communities (and individuals alike): respect for the dead. This respect most notably translates to an honourable disposal of the body and condolences to the mourning family.
The way in which the body is disposed of and the ceremony surrounding this activity is known as death care. As death care is heavily affected by cultural norms and values, there are many different funeral alternatives present around the globe. Ideologies within certain cultures about death care have been shaped for centuries, and have grown into important cultural traditions, with prominent roles for honour and respect.

The funeral industry in urban areas in the Western world has seen continuous growth over the last few centuries. This can be attributed to standardised techniques, densely concentrated populations and a professional approach to the management of the dead. As technologies improve and people strive for modernisation, the funeral industry does not stagnate either. That being said, many of the technologies' core principles can be traced back to traditions of the far past. As these techniques have gradually evolved from old traditions, they are accepted by their respective communities. However, different (often religious) communities rarely perceive another community's approach to death care as acceptable. Especially novel funeral technologies have severe difficulty finding acceptance among communities with established traditions.

The aim of this research is to find factors that increase the social acceptance of new, sustainability driven funeral alternatives. After having previously worked on a project commissioned by the Urban Death Project (UDP), where the environmental impact of a new funeral technology (dubbed "recomposition") was compared to both matured and other novel technologies, it became very clear that novel funeral alternatives face many problems at a social level. These factors were briefly looked into, but the focus of that study was on the environmental performance of these technologies (Van der Burgh et al., 2017). In this study, the focus is no longer on the performance of a single technology, but rather on the social acceptance of novel funeral technologies in general. It is clear that more sustainable alternatives are required in the future in order to keep the death care system feasible. Regardless of the theoretical performance of these technologies, they first need to be accepted by the general public in order to find their place on the market. Only a few studies have looked into this, which is why this study could provide meaningful information to the funeral industry and indirectly to society as a whole. In order to get a better grasp of the fundamentals of funerals, find more meaningful literature and approach the industry from a new perspective, funerals are considered as a special type of waste management system.

1.1 Choosing the topic

Prior to the writing of the research proposal, the only set parameter was the topic of sustainable funerals. Although limited research has been conducted in this field, the topic is too broad to analyse in a single study serviceable as thesis. An exploratory literature study was conducted to determine the exact topic of the study. Terminologies such as 'circularising the linear life process', 'strategic waste planning', 'funeral policies and legislation', 'sustainable funeral business models', 'public

participation', 'risks to the environment and public health from death care', 'combined treatment of necro- and regular waste', 'social compatibility' and 'social acceptance' were explored in the Google Scholar search engine. Eventually, based on the availability and quality of literature, shared interests of both student and supervisor and an interesting research gap, the choice was made to focus on the social acceptance of sustainable funeral technologies. Due to experience with and interest in Circular Economy, "sustainable" funeral technologies is further specified as (quasi-)circular funeral technologies. A considerable amount of research was already conducted for a previous project, including literature studies and interviews. This theoretical backbone is utilised throughout this study and serves as a valuable tool for contacting experts.

Once the social acceptance of sustainable funeral technologies had been chosen as research topic, a more in-depth literature study was performed, starting with an analysis of the definition of social acceptance. The effects of social acceptance in other sustainable technologies were researched, among which were many examples of waste management systems. Based on this research, the connection between funerals and waste management systems was created and implemented in this study. Furthermore, it was discovered that there are valuable frameworks available to study social acceptance. Analysing, structuring and repurposing these frameworks would become an important aspect of this study.

1.2 Death and death care in society

Humans have attached many ideas to the principles of death and death care. Things are ought to be done certain ways, either because that's how it was done over the past generations, or because they align with what is deemed as respectful treatment of the dead. A proper farewell is of utmost importance for people to create a state of peace of mind after the passing of a loved one. When looking at the socially accepted funeral technologies of the present, it can be noted that no part of the disposed body is used for anything other than memorialising the deceased after the funeral. After a burial, the corpse slowly decomposes according to natural processes. In some cultures, this natural process is even attempted to be slowed down as much as possible, by utilising embalming techniques and metal caskets to prevent the soil from reaching the corpse. But ultimately, the body will decompose.

During the cremation process, the body is destroyed. The remains, a mixture between bones and ash, is collected in an urn. These are then buried, stored elsewhere where they can serve as remembrance or spread out in a meaningful place. In both scenarios, no output of the funeral process is used for anything other than remembrance, certainly no processes that utilise (part of) the remains as input flow. This is the situation the Dutch have grown accustomed to. It is accepted in their society, and rules and regulations are bound to these ideologies. Currently applicable death care policies are made to regulate the alternatives described above (burial and cremation). These regulations are a severe limitation to the introduction of new, more sustainable funeral technologies.

However, it is becoming increasingly more popular to apply personal touches to the ceremony befitting the deceased individual. Funeral homes have picked up on the demand for this personalisation of funerals, and can now provide solutions for the most diverse scenarios. These personal touches are in most cases still connected to well-known funeral technologies, such as burial and cremation (Yarden, 2017). It does show that the industry is opening up to new innovations and alternatives, and people are willing to make use of it. Albeit one step at a time.
If sustainable funeral technologies are to become a viable and popular alternative, people should learn about and familiarise themselves with these technologies while their minds are still clear, preferably well before the moment that they themself or a loved one passes away. The problem is that people do not (want to) think or talk about funerals until it is too late.

1.3 Importance of social acceptance

The goal of this study is to increase the social acceptance of novel, (quasi-)circular funeral technologies. This chapter highlights why social acceptance is of such great importance in the funeral industry, starting with a theoretical explanation of the terminology and key differences with seemingly similar expressions. Then, social acceptance is analysed in the context of this study.

1.3.1 Defining social acceptance

The term 'social acceptance' should not be confused with similar (and related) terms such as 'social sustainability', 'social indicators', 'social aspects' and 'social impacts'. The latter three terminologies are used to explain social acceptance, whereas social acceptance itself is merely a part of the total picture that is described by social sustainability (Assefa & Frostell, 2007).
The term 'social acceptance' is commonly used in the literature, but the definition is not always identical between authors. Confusion is commonly found between the meaning of the words 'acceptance' and 'support'. In their study, Batel et al. (2013) clarify the definitions of these two terms and quote the following:
"Acceptance is "the act of accepting" (Collins, 2000) and, in turn, accept is "to take or receive something offered", "to give an affirmative reply to", "to tolerate or accommodate oneself to", and also "to receive with approval or admit, as into a community or group" (Collins, 2000). "To endure something without protest", and "regard as proper, normal, or inevitable" (Penguin, 2000) also underlie the word 'acceptance'.
On the other hand, support means "to give approval to (a cause, principle, …); subscribe to" (Collins, 2000) or "to approve of something, to encourage it; to uphold or defend something as valid or right, to advocate" (Penguin, 2000)." (Batel et al., 2013).
Thus, to clarify: acceptance suggests a much milder opinion towards a technology than support does, almost nigh to indifference. A different view is provided in the work of Cohen et al. (2014) who describe social acceptance as: "A set of outcomes and aspects that leave locals at least as well off as they were before the project." (Cohen et al., 2014). These outcomes and aspects relate to (perceived) welfare increasing or decreasing effects by local residents as a result of the placement of new infrastructure.
In this study, social acceptance will oftentimes be analysed through integration in a framework. As the selection and development of frameworks is a key aspect of this study, the meaning of the word framework within the context of this study is also specified:
"A framework provides a set of assumptions, concepts, values and practices that constitute the way of viewing the specific reality." (Binder et al., 2013)

Social acceptance can be analysed through the eyes of many different groups of people. Creating shared solutions through the acknowledgement of the stakeholders' different (moral) viewpoints leads to products and services which generally gain a larger public acceptance (Correljé et al., 2015). To name the most important ones in the context of funeral technologies: scientists that develop new technologies, policy makers that legalise them, funeral organisations that bring them onto the market and consumers who ultimately choose and purchase that specific technology.
This study aims to increase the social acceptance of this last group, which can be further divided into two categories: people who select a funeral technology for themselves in advance, and next of kin who choose a funeral technology for a deceased family member. The focus is on this group, because they ultimately decide which funeral alternative is purchased. Without their support, new alternatives will not find a place in the funeral market. Before the final consumer will even consider purchasing a new technology, they must first accept it. Once the technology has a solid foothold in the market, acceptance will gradually grow as people become exposed to, and more familiar with it.

1.3.2 Relevance of studying social acceptance

Implementing social acceptance into waste management models is something that Morrissey & Browne (2004) also deem necessary in order to create waste management plans that are feasible and sustainable in the long term. In the past, many waste management plans only looked at economic features, ignoring the social factors. Among the first implementation of these factors in the planning phase was the acknowledgement of social factors due to the siting of the facility (Fuertes et al., 1974). Much later, Motameni & Falcone (1990) shifted the focus towards the people's attitudes towards waste, in an attempt to increase the involvement of local communities before plans were executed. Nowadays, with the complexity of waste management systems increasing, it is becoming ever more important to involve the public at an early stage in development of new systems. After all, "it is becoming increasingly evident that a waste management programme and especially a waste treatment technique, which ignores the social aspects, is doomed to fail." (Joos et al., 1999). Following the reasoning above, social acceptance is important for this study because it analyses funerals as a form of waste treatment. Additionally, death care is inherently closely tied to norms and culture, which places an even bigger emphasis on the social aspects of this waste management system. Increasing a system's sustainability can come at a cost of economic or social benefits, as those three factors are inherently connected (Morelli et al., 2011). Therefore, the goal for new technologies is to find a balance between these factors. It must be economically viable, sustainably desirable and socially acceptable.

1.3.3 Social acceptance in the funeral industry

Death care related products and services operate with a strong social bias towards traditions and norms. Introducing new, sustainable approaches to death care may be perceived as 'unethical' by the public at a first glance, because they operate in a different way than current, mainstream options. These new technologies must be perceived as ethical by the consumers in order to become successful and remain feasible in the future, while also aiming to reduce its environmental footprint. There are two dominant scenarios which describe under what circumstances the choice for the desired funeral technology is made. These also reflect the social groups discussed in subsection 1.2.1, namely those who choose their own funeral, and those for whom it needs to be decided shortly before or right after their moment of passing.

During the time of mourning, next of kin, other close family members and friends have many things on their mind and go through relatively unstable days leading up to the ceremony. This is especially true if the death has come unexpectedly and the deceased had not shared his or her wishes. Due to the state of mourning the next of kin find themselves in, they are not or hardly approachable for new methods that strongly deviate from the norm. The process of choosing the right funeral is a difficult one and has to happen on short notice.

People have a strong tendency to choose for something they are familiar with, if only to get quickly through the decision-making process. This familiarity can, for example, come from previously experienced funerals. As funerals are often the third most expensive purchase in a person's life, falling only short to a car and house, the decision is also not to be taken lightly from an economical perspective. Furthermore, all preparations lead up to a single event, in which everything has to go right. This takes the incentive for trying something new further away.

1.4 Sustainability in the funeral industry

Over the course of their lifetimes, humans produce, consume and dispose of many products and services. This results in a significant environmental footprint. By now, the effects this behaviour has on climate change, biodiversity, human health and the general well-being of the planet are well known. These anthropogenic impacts on the environment do not stop at the moment of passing away. Traditional funeral technologies are well adapted to complete the life from a social point of view, but have severe limitations from an ecological perspective. Unnecessarily many resources are wasted and end up as emissions in soil, water and air. Valuable land is occupied for a long, in some situations even eternal, timespan. All of this results in continuous negative effects on the local environment, potentially ongoing for years to come. Although other countries have considerably more polluting traditions when it comes to funerals than the Netherlands, the Dutch situation can also be improved upon.

One aspect all funerals have in common are environmental impacts associated with the ceremony. People travel (often by car) back and forth to sometimes multiple locations, food and drinks are served and flowers are left behind. Production, growth and shipment of these goods have their own associated impacts. Another problem which characterises some funeral technologies is their required land use. Especially in urban areas, cemeteries face many challenges related to spatial planning. Considering the expected scenario of land shortages to grow food in the future, preserving land now may prove to be valuable later (Godfray et al., 2010).

In a study for Yarden, Keijzer (2011) performed an LCA (Life Cycle Assessment) study regarding three funeral technologies: burial, cremation and resomation. The latter is a relatively new process where the body is dissolved in an alkaline substance. The technology is currently not legal in the Netherlands, but steps towards its potential legalisation are being made. This study was later expanded upon (Keijzer & Kok, 2014) and yielded updated results. The study shows how poorly burial and cremation score on almost all impact categories, and the potential that a new technology such as resomation could have. Although resomation does not provide a circular solution by itself, it does allow for the separation of the nutrient elements in the body. This nutrient-rich content can then be directly used elsewhere. The alkaline remains can be brought back to neutral pH levels and safely removed, potentially through the sewer network. A study by TNO (2018) confirms this theory.

If the goal of the future is improvement of the ecological footprint of funerals through implementation of circularisation methods, it is almost certain something will have to happen with the remains of the body. This is in contrast with the current mindset in which the remains only have symbolic value as a way of remembrance. New methods will have to be developed to positively change the social acceptance of the principle in which resources are recovered from the body. Studies such as those by Keijzer & Kok (2014) and Van der Burgh et al. (2017) shows what potential mass-utilisation of technologies such as resomation could have, if it were to be legalised and widely accepted. In order to achieve this, a different mindset from all involved parties is required.

1.5 Circularity

This study strongly emphasises the aspect of sustainability through circularity. This is particularly important, because people (i.e. consumers, policy makers and manufacturers) strive towards lower environmental impacts of the products and services they consume, manage and produce. With sustainability and climate change being such hot topics, more environmentally friendly solutions make an appearance in countless markets and industries. The funeral industry is no exception, as more sustainable alternatives have recently become available. Examples of such alternatives are the introduction of woven willow caskets, or even forgoing them completely through the use of a burial shroud. One effective way in which products or services can become more sustainable is through the principles of circularity. In the old, linear production pattern of 'production, use and disposal', the demand for new resources (input) and waste (output) were high. Circular production patterns strive to use waste as input material. By doing so, both input and output flows are greatly decreased. Although the funeral industry is looking into the potential of applying circular aspects into (new) funeral technologies, they have mostly only been developed on a conceptual level in the Netherlands.

1.5.1 Circular economy

An economy driven on the principles of circular production is called a circular economy. It is considered to be a utopian concept, as the efficiency of the production and waste treatment processes currently applied are nowhere near high enough to accommodate a fully circular economy. Furthermore, complete cooperation and a change of mindset from all involved actors are required in order to successfully introduce and sustain such a system. Policy makers have started to realise that the traditional linear production model will not remain feasible forever. It becomes increasingly more costly to secure new resources as well as lose resources through waste streams, while also irreversibly damaging the environment (Mathews et al., 2011).

Although the funeral industry could theoretically apply principles of circular production, an ethical problem arises once the waste stream needs to be circulated into the same, or another system. As ethics and cultural influence weigh heavily upon this industry, it is critical to contemplate to what extent human remains theoretically can, and practically should be used for any purpose other than remembrance. This question cannot be unanimously answered, as different cultures hold different values towards (respect of) the dead.

1.5.2 Quasi-circularity

A potential answer to the problem mentioned in the previous paragraph is the concept of quasi-circularity. A quasi-circular economy is the middle ground between traditional linear production and a fully circular economy, although it leans more to the latter. Because the system is not fully circular, minor waste streams are acceptable. Other output flows must be recycled. Recycling rates generally vary between 60% and 80% (Grosse, 2011). This provides a scenario in which the novel funeral technology should operate. The 20% to 40% waste stream leaves room for the human remains to be disposed respectfully, in a meaningful way that is ethically supported and provide the bereaved with a satisfying remembrance that connects on a personal level. Meanwhile, the remaining resources are returned to different aspects of the death care system, or a different system altogether.

By analysing how other industries introduced (quasi-)circular programs and how people reacted to them, ideas can be generated to implement sustainable, novel funeral technologies that are accepted by the general public.

1.6 Research questions

Based on the key characteristics of the research context and knowledge gap that have been described in the previous sections, the research questions that will provide insight into possibilities to increase the social acceptance of (quasi-)circular funeral technologies are formulated. To create a structured research process, the main question is subdivided into five sub questions, each seeking to isolate and answer a specific part of the problem. It is important to note that due to the lack of pre-existing approaches to researching a topic like this, the research is exploratory by nature. Many of the applied methods have not been used in this context before and the research methodology described further ahead can therefore be considered as non-standard. This study is somewhat experimental by analysing a relatively unexplored field through an altogether new approach. The extent to which this is a viable academic strategy is discussed at length in chapter 10.

1.6.1 Main research question

The primary goal of this study is described in the following research question:

What type of factors are essential for the improvement of the social acceptance of novel, (quasi-)circular funeral technologies, and how can they be integrated in recommendations to achieve this goal?

1.6.2 Sub questions

In chapter four of this report, the methodologies and general course of action required to research each sub question are provided. Each sub question has a dedicated research chapter in this report, concluding with the answer of the question.

1) *With which waste management technology or system can the funeral industry be best compared?*
2) *Which pre-existing frameworks describing social acceptance are available in the literature, and to what extent can they be adapted and combined to better reflect the funeral industry?*
3) *What type of factors in the successful introduction of circularisation methods in the chosen waste management systems influenced the social acceptance according to this specialised framework?*
4) *How do the identified factors that improve the social acceptance in the chosen waste management sectors compare to the funeral industry?*
   What are their differences and similarities?
5) *What recommendations can be made to the Dutch funeral industry to increase the social acceptance of (quasi-)circular funeral technologies?*

1.6.3 Research structure

Table 1.1 below presents an overview of the research questions, in which chapters they are answered and what methods are used to achieve this. Chapter 3 will provide more insight into how these research questions were formed and what their relevance is within the study.

#	Research questions	Chapter	Research method
1	With which waste management technology or system can the funeral industry be best compared?	5	LCA flowchart, literature study
2	Which pre-existing frameworks describing social acceptance are available in the literature, and to what extent can they be adapted and combined to better reflect the funeral industry?	6	Literature study, Binder's framework
3	What type of factors in the successful introduction of circularisation methods in the chosen waste management systems influenced the social acceptance according to this specialised framework?	7	Literature study, sustainable case-studies, custom framework
4	How do the identified factors that improve the social acceptance in the chosen waste management sectors compare to the funeral industry? What are their differences and similarities?	8	Literature study, data comparison
5	What recommendations can be made to the Dutch funeral industry to increase the social acceptance of (quasi-)circular funeral technologies?	9	Idea generation, expert interviews

Table 1.1: Overview of the five sub questions and their respective research methods.

1.7 Project scope

The primary spatial scope of this study is on the Netherlands, in particular on urban areas, as these places have a higher population density and therefore having a stronger incentive to solve the proposed challenges that traditional funeral alternatives face. An advantage of focusing on the Dutch funeral scene is that contact with several local experts within the industry has already been established. Furthermore, information is generally more readily available as there is some ongoing research and plans for implementation of new technologies.
This information can then be adapted and utilised to align with the goals of this study more easily. Considering the high population density in urban areas (and with that, the relatively high percentage of all deaths occurring in urban landscapes), it makes sense to have a stronger focus on these areas. However, besides statistical differences, there are also cultural differences between urban and rural areas. An approach that may be meaningful for urban areas may not be for rural areas, and vice versa. By targeting urban areas, more people can be reached through the development of a meaningful innovation than would be the case for rural areas.
Some countries are further ahead when it comes to conceptual (and in some cases already legalised and available) funeral technologies, which may contain aspects worth taking into consideration, but these will not have the main focus of this research.

This study aims to increase the social acceptance of (quasi-)circular funeral technologies by 'funeral consumers'. In other words: the people who will ultimately choose a funeral alternative either for themselves or (soon to be) deceased loved ones. Increasing the acceptance by funeral homes or other stakeholders is not the main goal of this study, but would be an added benefit.
The temporal scope is set between now and the near future. As novel technologies are discussed, a timespan of several years will be required to theoretically develop the technologies, run pilot projects and ultimately fully implement them.

1.8 Relevance to the field of Industrial Ecology

This topic is undeniably relevant for the field of Industrial Ecology, as it represents all three pillars of sustainability, also known as the triple bottom line. The term triple bottom line was invented and popularised by the British business author John Elkington. It stresses the importance of the balance between social, economic and environmental factors to create value with a product or service. In a consumer driven society, most focus goes out to social and economic factors, coming at the cost of the environment. A strong focus point of this study is on the social acceptance (of novel technologies), which ties in naturally with the social pillar. Secondly, the environmental pillar is addressed through the circularisation of existing technologies. This study aims to provide solutions for a more environmentally friendly future. The least attention is given to the economic factors, but the technologies under study are currently feasible alternatives. It must be verified that any recommendations made to decrease the environmental impact of the technologies do not result in an unacceptable decrease of economic feasibility.
The topic of sustainable funerals has received more publicity recently in the Netherlands. Multiple newspapers have devoted large articles to the matter, stating the problems with some of the current funeral methods, as well as highlighting more sustainable alternatives currently available (AD, 2017), (AD, 2018), (Het Hele Westland, 2017). The articles do not, however, provide insight in the need for circularity in the funeral industry and neither do they offer solutions to develop new, more sustainable, alternatives.

2. Background information

Dealing with the dead is as old as mankind itself. Many factors surrounding death care regarding why, where and how have changed significantly. This chapter explains where alternatives which are nowadays commonly practiced originate from, both on global and national scale.

2.1 History of death care

This section briefly describes how the current standards of the industry were established. It covers the origin of the technologies themselves, as well as the development of the customs surrounding the ceremony.

2.1.1 Burial

The first signs of purposeful death care can be traced back to the Neanderthals, who buried the deceased to avoid the attention of predators, but also as an act of remembrance. This can be concluded from the presence of animal bones and flowers on top of the graves. As all this happened roughly 50.000 BCE, burial is the oldest form of death care (McCorkle, 2010) (Than, 2013). Many years later, in Mesopotamia around 5.000 BCE, burial received another purpose, namely a spiritual one. As people believed the afterlife took place under the earth's crust, burying the deceased would bring them one step closer to the afterlife (Kramer, 1963).
For the first civilisations, being buried in nature was completely normal. As people started to conglomerate in larger groups and settle down, the burial grounds became more densely concentrated as well. This led to manmade environments built to cater to the special needs of these occasions. Modern cemeteries still reflect those ideas.

2.1.2 Tools and preparation

The Egyptians were believed to be the first ones to bury tools with the deceased that would help them in the afterlife, around 3.500 BCE. Furthermore, the mummification processes in the Egyptian culture was the first resemblance of the embalming technology that is utilised nowadays (Ikram, 2015). It was also around this time that the first containers for the corpses were used, often made from cloth, paper or wood. It was not until much later, around 700 CE, when the Celts started making stone caskets. The Egyptians are the most notable example of a culture that buried valuable resources with the dead, for both the poor and the rich. In some cultures, it is still a common practice to place money or other items with the body in the coffin.

2.1.3 Cremation

The oldest appearance of cremation known to man can be traced back to the Ice Age, where remains were found around Lake Mungo, Australia (Bowler et al., 1970). Much later, around 7.000 BCE, the use of urns to contain the cremation remains was popularised. Cremation remained popular in the Roman culture, up to 2 CE. The cremation symbolised the journey to the necropolis. After the fires had expired, bones, teeth and other remains would be collected and stored in urns (Fife, 2012). This is a tradition that is still common to this day, but it was not until much later that the urns were also buried. When Christianity became the dominant religion in Europe, burial soon became the only permitted method of death care. Through colonisation, this ideology spread to other parts of the world (Rafael, 1993). Over time, this resulted in a variety of distinctive cultural habits regarding death care. Many religions advocate for a specific type of funeral. Even between sub-religions, different beliefs about how particular funerals ought to be performed exist.

2.2 Dutch context

Because the scope of the project is focused on the Netherlands and culture has such a prominent role in death care, it is important to gain insight into the national context. This section provides information about the historic events that shaped the Dutch funeral industry as it is known now and deducts likely scenarios for the near future based on the current situation and recent changes.
The information below is deducted from a series of interviews with experts from the Dutch funeral industry in 2017 (Museum Tot Zover, Yarden and Natuurbegraven Nederland).

2.2.1 The past

Due to the church's influence, burial was the dominant funeral method. The church was responsible for the funerals and kept the deceased in the centre of society, as the churchyard was placed around the church. Churches were one of the most important buildings in a town or city. However, as hygiene standards were far from optimal at the time, keeping the dead close to crowded places often proved problematic. Under the rule of Napoleon and the modernisation that came with it, cemeteries were untied from churches and moved to more isolated locations.
The influence of the church was so strong, that under the rule of Karel de Grote, cremation was officially banned around the year 800 as it was perceived as a heretical practice.
Much later, when the church started losing its political influence, the ban was lifted in the early 1900s. The first 'official' cremation took place in the dunes at Driehuis in 1914. Until then, people had to go to Germany to have remains cremated. Since 1998, people are allowed to take the ash-filled urn to their home.

Cremation has seen a steady increase in popularity since its relegalisation, especially in urban areas, where there is a stronger sense of individualism. Fewer choices are made on basis of what another person, in particular family members, would do in such an instance.
One reason why traditional burial lost much footing in the death care industry was rising costs as a result of limited available space in cemeteries. Population growth, and therefore the number of deaths, outpace the grave renewal policies that are active in the Netherlands, which allow people to rent a spot on a cemetery for a limited time, after which the contract either has to be resigned or the remains are moved to a mass grave. As a result of the expensive ground in urban areas, plot prices have gone up, which makes cremation more attractive from an economic perspective
(Yarden, 2017).

The latest funeral alternative that has gained popularity is natural burial. Although its market share is significantly smaller, it has been recognised as a viable alternative. Over the last few decades, natural parks and forests have been adjusted to facilitate these burials (Museum Tot Zover, 2017).

2.2.2 The present

Due to its steady climb in popularity, cremation has acquired a market share of approximately 70% in urban areas. Religious people are likely to stick to their respected traditions, but many have become milder in this final decision. The desire for one's final resting place to be in the country of origin can be limited by problems with shipment of the body. This has to be arranged on short notice, and can be very costly. Furthermore, economics is also a significant factor for funerals in the same region, as not all death care alternatives are priced equally. The desired method may not be financially feasible and a cheaper alternative has to be used. Although prices vary throughout the country, the cheapest funeral technology is cremation. As more people with a religious or foreign background choose for cremation, it becomes more accepted within those communities.

It is important to note that the aforementioned scenarios do not align with orthodox practitioners of a religion. They do not deviate from the traditions they were taught to such extents.
Most cemetery grounds and crematoria are owned by the respective municipality. Land in urban areas is becoming increasingly more expensive, which becomes problematic for traditional burial. In the Dutch system, cemetery plots are hired for a set amount of years, after which the contract can either be elongated or terminated. The average time for such a contract is 10 years, with a maximum of 50 (which can be repeated infinitely). The physical remains associated to a terminated contract are dug up and moved to a mass grave. The remains stay in the mass grave until they have been fully decomposed. The plot is cleaned and prepared for a new funeral. By cycling through existing cemetery plots, the need for continuous expansion of the cemetery ground is negated. The same principles apply for the burial of urns.

To adjust to different cultural or religious demands, cemeteries often have selected areas for all major religions. Deceased with no family or friends to pay for a funeral are buried in a common grave at the cost of the municipality, for the shortest duration possible: 10 years (Museum Tot Zover, 2017). A relative short time ago, a new movement promoting natural burial started. These burials only allow for natural resources to descend into the earth. Elaborately decorated coffins and headstones are forbidden, to name some examples. Everything needs to be biodegradable, as the natural burial grounds are given back to nature once they have reached their capacity (Natuurbegraven, 2017). The death care industry is currently looking to expand the available options in funeral methods, but this is a relative slow process. New technologies are often technologically advanced, thus requiring longer development times. Because of their novelty and complexity, it is usually difficult to legalise them (Yarden, 2017).

2.2.3 The foreseeable future

The increasing population in urban areas leads to foreseeable problems for funeral homes. It is uncertain for how much longer current practices regarding traditional burial will remain viable. Many cemeteries in urban areas are limited in available land for expansion, and will thus be ultimately limited in the amount of burials that can be performed. The Dutch system of renting a cemetery plot rather than buying it for eternal use will keep the system manageable for a while, but ultimately, a new solution has to be found (Yarden, 2017).

A potential solution for burial can be relocation to less crowded areas, where land for expansion is comparatively plentiful and cheap. Lines between 'greener traditional burial' and 'natural burial' could become blurred. The burial of urns could also result in spatial challenges, although less land is required for the burial of an urn. It will most likely remain the most economically attractive alternative in the market (Van der Burgh et al., 2017). Furthermore, cremation is becoming more accepted by religious groups who would originally not use this method, thus it can be expected that cremation will continue to increase its market share in the funeral industry (Yarden, 2017). However, there is a growing concern about emissions as a result of funeral processes.

The exhaust fumes of cremation ovens are a prime example of such emissions. This challenge can be 'solved' through end-of-pipe solutions, as have already been implemented in some cases. Alternatively, new techniques could be designed that would not only reduce the emissions but also the input of gas and output of waste heat through industrial symbiosis. As regulations regarding emissions will become stricter, technically more advanced cremation ovens will be built that can help reduce or potentially completely negate these environmental problems. However, these technical solutions are in some instances already considered unethical by the public, which slows their implementation in current crematories down considerably.

The environmental impacts of traditional burial are also analysed, as potentially harmful substances can leach into the soil. This is an inherent problem of burial, as over the course of a lifetime, the human body takes up many substances, some of which are potentially hazardous (Van der Burgh et al., 2017).

In an attempt to mitigate the emissions in funerals, new methods have been developed. Considering the effort of the death care industry to introduce new options to the market, it can be expected that some of these will soon become available. The environmental performance of these new alternatives is expected to be better than current popular alternatives, and even the price looks to be competitive. Examples of such technologies are cryomation and resomation (Yarden, 2017).

2.3 Background information conclusions

The funeral industry is, as other industries, expected to become more sustainable and reduce their environmental footprint. As with all industries, increasing environmental efficiency indirectly impacts the social factors associated with that technology or service.
This is particularly challenging as funerals and death care have been shaped by millennia of social norms and cultures. In their implementation in the Netherlands it is nowadays nearly impossible to consider death care without these social aspects and the ethical views of the general public based thereon. The environmental footprint of funerals needs to be reduced without interfering with the social aspects of death care.

When considering the anthropogenic effects on the environment of death care and their associated impacts on resource management, it is important to make a distinction between environmental and social factors. On the one hand, the social factors can be expected to change as a result of adapting the technologies the industry implements to reduce the environmental footprint. On the other hand, the social factors cannot be changed too much, otherwise they may begin to conflict with the cultural norms surrounding death care. If these norms are broken, a public backlash can be expected that would prevent a successful introduction of these new, sustainable technologies.

Chapter 3: Research design and chapter 4: Methodologies will discuss how this study aims to overcome this challenge.

3. Research design

Generally speaking, social acceptance studies are performed on a quantitative basis. A lot of data is gathered through surveys, which is used as input for frameworks. However, this study takes a unique approach to researching social acceptance in the funeral industry by including case studies from waste management industries. As a result of this exploratory method, it is deemed unviable to take a quantitative approach to this study. There are too many uncertainties to reach out to a large audience in a meaningful way. Rather than providing facts that can be verified in a closed format, this study will provide guidelines which require a more open, personal approach to verify. Therefore, this study is of qualitative nature. The sections below describe the five research questions, the reasoning behind their formulation and their place within the study. The methodologies which are applied to answer the research questions are described in chapter 4: Methodologies. Throughout this study, a distinction is made between the technical and social aspects of both the funeral and waste management industry. A visualisation of this four-way division is provided in figure 3.1 below. The content of all quadrants is discussed in the analysis of the first four research question. The fifth research question combines all data previously obtained in a final comparison between the waste management and death care industry. This answers the main research question:
What type of factors are essential for the improvement of the social acceptance of novel, (quasi-) circular funeral technologies, and how can they be integrated in recommendations to achieve this goal?
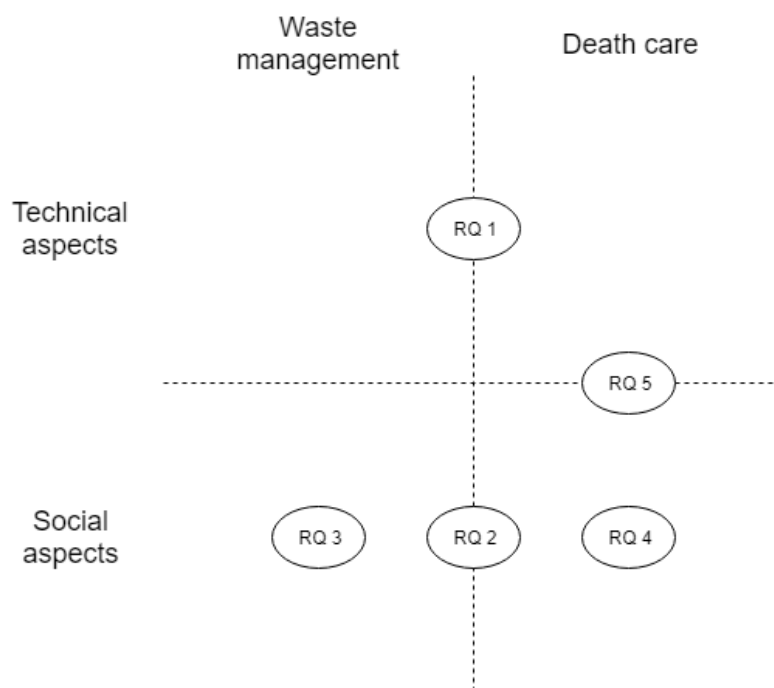
Figure 3.1: Visualisation of the technical and social aspects of the waste management and death care industries.

The visualisation in figure 3.2 is added to the introduction of each new research question. It provides an overview of where the current research question fits into the overall study and what connections between social and technical aspects are made with the funeral and waste management industries.

Figure 3.2: Overview of the order in which social and technical aspects are researched.

3.1 RQ 1: Funerals as waste management system

In the field of waste management, a strong focus on circularity has arisen. The demand of virgin materials in order to prepare funerals, combined with excessive amounts of waste and emissions during and after a funeral, makes the current system ill aligned with the sustainability goals of modern society. This study aims to compare the social acceptance of the funeral industry to that of waste management systems. The first step is the identification of a waste management method, system or technology that is comparable with funerals, which results in the first research question:
1) *With which waste management technology or system can the funeral industry be best compared?*

This section introduces the comparison between funerals and waste management technologies from a research perspective. By separating funerals from cultural and ethical factors, they can be considered as a waste management system. The selected material flows from the funeral industry are categorised in such a manner that they are comparable to the input flows of other waste management systems. These categories are based on the characteristics of the materials in the flows present in the three main Dutch funeral alternatives: traditional burial, cremation and natural burial. By comparing the material flows at such an abstract level, a waste management system that deals with similar resource flows can be found that represents the core material flows present in funerals. Because multiple funeral technologies are analysed, more than one representative material flow may be found. As each material flow leads to a representative waste management technology, it is possible that the answer to this research question can consist of more than one comparable waste management system. These systems are further specified to distinct technologies utilised in everyday waste management.
This research question studies the technical aspects of funerals through a comparison between its current material flows and characteristics found in other waste management technologies. The comparable system(s) has likely already undergone sustainable innovations which have impacted its social acceptance. These changes are analysed in the third research question.

3.2 RQ 2: Developing a framework for social acceptance in the funeral industry

Whereas the first research question focused on the technical aspects of waste management, the second one analyses the factors that are relevant for the social acceptance of death care. To get a better grasp on these social aspects, a literature research is conducted to find social acceptance frameworks relevant in this field of study. Most importantly, a theoretical framework needs to be found that allows for a structural research of the aforementioned social acceptance. The funeral industry is a very specific research topic that may not align with pre-existing frameworks. With a numerous selection of diverse frameworks available, a combination of elements from different frameworks can be hand-picked. This results in a customised framework that offers a methodological approach catered to the goals of this study. It is common for social acceptance frameworks to rely heavily on quantitative data input, mainly obtained through means of surveys.

The goal is to adapt the framework to enable the use of qualitative data, which is a more reliable source of information in this relatively unexplored field of research. In chapter 6, a selection of social acceptance frameworks found in the literature is analysed. It is explained how and where they were found, which of their aspects are useful for this study and how they are finally combined.

It is assumed that a customised social acceptance framework is suitable for a study which is explorative by nature. The implications and validity of this assumption are further discussed in chapter 10. To structure the framework analysis in the context of death care, the following research question is formulated:

2) *Which pre-existing frameworks describing social acceptance are available in the literature, and to what extent can they be adapted and combined to better reflect the funeral industry?*

3.3 RQ 3: Social acceptance of waste management systems

At this point, the technical aspects of funerals have been studied through comparable waste management technologies, and a social acceptance framework has been developed that allows the research of the social aspects of funerals and waste management. In chapter 7, the specialised framework is used to discover which factors have the largest impact on the social acceptance in the chosen waste management sector(s). Suitable cases of real-life circularisation processes in the applicable waste management technologies are found through a literature study. Another possibility to obtain information about useful cases is interviewing experts from the relevant fields.

These cases describe (preferably recent) endeavours of waste management organisations to improve the sustainability of one or more of their core waste management processes, by means of applying circularisation methods. Similar to this study, a completely circular system is not required (and also likely not yet available). While analysing these cases, the information is formatted to serve as input for the framework. For each waste management system, the framework is applied twice: once for the situation before the change, and once after. By comparing the change in social acceptance before and after the circularisation methods have been applied, factors with both positive and negative impact can be identified. The following research question is formulated to study and implement these cases:

3) *What type of factors in the successful introduction of circularisation methods in the chosen waste management systems influenced the social acceptance according to this specialised framework?*

The main goal of this chapter is to create an overview of factors that positively impact the social acceptance of the waste treatment technologies that share similarities with the funeral industry. The identification of barriers, factors that result in a negative change in social acceptance, is also considered as an important outcome. Furthermore, through its application in real-life scenarios, the framework is tested and it can be discovered whether it functions as intended.

Ultimately, the goal of this study is not to determine the type of factors that impact the social acceptance of waste management systems. These factors will, however, act as a stepping stone to find the relevant factors in the funeral industry.

3.4 RQ 4: Social acceptance in the funeral industry

With the factors increasing the social acceptance in the waste management system now known, the next objective is to convert these factors to be applicable to the context of death care. Each factor is analysed independently, but it is likely that through the research overlap or similarities can be identified. As the factors are based on waste management case studies, it is likely not every single one will yield valuable results. It is expected that not all relevant factors in waste management can be copied directly into the funeral system, thus each unique aspect needs to be looked at individually and adjusted where necessary.

Once the factors have been analysed in the context of death care, a final comparison can be made between the funeral and waste management industries. Each industry has had an analysis of the same selection of factors. Each of those factors in one industry can then be compared to the corresponding factor from the other industry. By doing so, similarities and differences between both industries can be found. Doing so will allow the following research question to be answered:

4) *How do the identified factors that improve the social acceptance in the chosen waste management sectors compare to the funeral industry? What are their differences and similarities?*

As the factors describe the aspects that were impactful in the social acceptance of circularisation processes in the waste management industry, their implementation in the funeral industry could theoretically lead to an improved social acceptance of (quasi-) circular funeral technologies.

The preparatory work in the previous chapters studies the technical aspects of funerals and the social aspects of waste management. The results from this research chapter are the first time that social aspects from the funeral industry are directly analysed. This research question is pivotal in this study as it identifies the factors that influence the social acceptance of sustainable funeral technologies.

3.5 RQ 5: Recommendations to improve the social acceptance of (quasi-)circular funeral technologies

Once the analysis with the theoretical framework is completed and the impactful factors are identified and analysed through a comparison between the waste management and death care contexts, all data required to develop a meaningful scenario that should lead to the improvement of the social acceptance of (quasi-)circular funeral technologies is available.
Given the Dutch context of this study, it would be interesting to analyse how the factors found through the application of the framework could potentially be implemented into the local funeral industry. By turning theory into strategies for the real world, the funeral industry may get one step closer to reaching more people with sustainable funeral alternatives and thereby reducing its environmental footprint.

These strategies can result in the identification of opportunities and barriers, but also the proposition of changes to the current system, in order to help prepare (future) customers with the right mindset to approach the challenge of choosing a suitable funeral alternative. The ideas and scenarios that are generated this way are presented to a group of experts, to improve them with their knowledge and expertise. The use of expert feedback through a set of interviews is also in line with the demand of qualitative over quantitative data.

Through the integration of the previously acquired data, idea generation, scenario building and expert feedback, the strategies can be adjusted to create a valuable guideline for the industry.
This final part of the research is concluded in the following research question:
5) *What recommendations can be made to the Dutch funeral industry to increase the social acceptance of (quasi-)circular funeral technologies?*

Some experts in the funeral industry have already been contacted and interviewed for a previous study (Van der Burgh et al., 2017). It would be interesting to contact these experts again for feedback on the new insights obtained from this study.

The report ends with a discussion about the applied research processes, assumptions made during the study and recommendations for further research, as well as a conclusion.

4. Methodologies

Throughout this study, many different research methods have been applied to find the answers to the research questions presented in section 1.6. Some of these methodologies are generic techniques used in almost any research paper, the application of others are more specific and lend themselves only to certain research goals. This study also introduces a new methodologies, namely a custom framework created from other literature pieces. A brief overview of all applied methodologies can be found in table 1.1. This chapter will categorise and describe each applied methodology per research chapter. Elaborate descriptions are given here, and the corresponding chapter in which they are applied refer back to the descriptions presented in the sections below.

Generally speaking, all data collected for, and used in, the chosen methods is qualitative. Considering the theoretical nature of this study, multiple literature studies are conducted to obtain information. However, as was discovered in a previous study (Van der Burgh et al., 2017), many experts in the funeral industry are open to discussion, making interviews an appealing option. The literature research and interviews are described per case, as the goals of these studies are not identical for each case. Although numerous literature studies are performed throughout this study, each one is described in its dedicated section. Similarly to the structure of chapter 3, sections 4.1 to 4.5 each describe the methodologies used in their respective research question.

All literature studies performed throughout this thesis were executed similarly. Two search engines were utilised for each individual literature study: Google Scholar and Scopus. The keywords used in the search queries, which are visualised by tables such as the example in table 4.1, are interchangeable to create different, but comparable results. Each search query consists of a set of complementary terminologies. Each of such a terminology describes a specific aspect of the study's goal. Each terminology can be described by different keywords. These different keywords are represented in the tables by the alternatives. More important terminologies in a search query usually have more alternatives, in order to find more related articles in the literature.
Once the first alternative of each terminology has been used, the alternatives per terminology are interchanged to acquire new results. Additionally, prepositions (of direction, place and time) were added where necessary to construct grammatically correct search queries.
From the listed search hits, the articles and papers which appeared to suit the research' needs were read superficially to scan for more potential amongst the abstract, keywords and table of content. The chapters that aligned with the research goal were read thoroughly, and the reference list was studied in a similar way to find new, related articles (also known as the snowball effect). Once an input of data ran dry of useful results, the alternatives for their respective terminologies were interchanged to generate new results. Afterwards, the other search engine was utilised to potentially find new material. Through this method, a large part of the available literature was analysed.

Terminology 1	Terminology 2	Terminology 3	Terminology 4
Alternative 1	Alternative 1	Alternative 1	Alternative 1
Alternative 2	Alternative 2	Alternative 2	Alternative 2
Alternative 3		Alternative 3	
Alternative 4			

Table 4.1: Example of the presentation of the research query.

4.1 Funerals as waste management system

Section 4.1 describes the methodologies applied to answer the first research question. The first method that is utilised is an LCA flowchart. Secondly, a literature study is conducted to further analyse what information is available about the chosen waste streams and their respective waste management technologies.

4.1.1 LCA flowcharts

In a previous study (Van der Burgh et al., 2017), the environmental impacts of five funeral technologies were analysed by means of an LCA study. One component of such an LCA study is the flowchart, which visualises all involved material flows and the ways in which they are connected to each other through system and production processes. This method is particularly useful in this study, because it helps to create an abstract view of funerals. By separating the social and ethical values from the technical components, a clear view can be created of how funerals function as a waste management system. The flowcharts made for the study in 2017 are based on the American funeral scenario, which must first be adapted to the Dutch situation. The American and Dutch funeral scenarios differ mostly in the use of embalming fluids. There are also smaller, underlying values that are different, but those are not important for the goal of this study. The data sources of the original study can be found in the research report (Van der Burgh et al., 2017). The adapted flowcharts will highlight what resources are required for the currently applied death care technologies in the Netherlands: traditional burial, cremation and natural burial. The data from the flowcharts is used to create an abstract vision of what funerals are, and which materials they contain.

4.1.2 Literature study on waste management

The literature study for this section can be split into two aspects: research into aerobic decomposition of organic matter and research into mixed non-organic waste treatment.

4.1.2.1 Literature study of aerobic decomposition

Although the first waste flow was specified and a suitable waste management system was found in aerobic decomposition, no specific technology had yet been identified which is suitable for a case study. In order to find such a technology, subsection 5.3.3 describes the result of this literature study. The search queries that were used in this study can be found in table 4.2 below.

Technology specification	Primary technology description	Resource flow specification	Generic flow condition	Broad technology
Aerobic	decomposition	organic	waste	technology
Open	composting	green	produce	system
	degradation	bio	matter	processes
	digestion	food	sludge	treatment
	treatment	soil		

Table 4.2: Search query for the literature study of aerobic decomposition.

Notably, no terminologies were entered at this stage to find a specific location, such as 'The Netherlands' or 'Dutch', because only the actual technology matters at this stage. Finding a suitable case study will have its own literature study later, and is described in subsection 4.3.1.
Once a list of potential technologies was found, a refined search was made for each of the technologies. The new search queries were respectively 'aerated static pile composting', 'windrow composting', 'in-vessel composting', 'tunnel composting', 'high fibre composting', 'vermicomposting' and 'mechanical biological treatment'. Based on the results of these searches in the literature, table 5.4 was compiled which lists each of the technologies' advantages and disadvantages.

4.1.2.2 Literature study of non-organic solid waste management

Subsection 5.3.4 looks into the second identified material flow, namely non-organic solid waste. This category is relatively diverse and can contain a lot of different shapes, weights and material types. Another common waste stream which shares these characteristics is MSW, which was therefore used as core search term in the literature study to define potential waste management technologies for this flow. For starters, a study was performed to identify which waste types are commonly found in MSW. The following terminologies and alternatives were used in this literature search:

Resource flow specification	Generic flow condition	Demographic specification	Geographic boundary
MSW	composition	Urban areas	The Netherlands
Municipal Solid Waste	mix	cities	Dutch
Urban waste			European

Table 4.3: Search query for the literature study of non-organic solid waste management.

Based on this study, an overview was made with the most common waste types within Dutch (or comparable) MSW flows. The next study sought to further understand the MSW treatment processes. The search queries applied in this literature study were developed on the basis of alternative combinations of following terminologies, as seen in table 4.4.

Resource flow specification	Demographic specification	Primary technology description	Broad technology
MSW	municipality	management	system
Municipal Solid Waste	urban area	treatment	technology
Non-organic solid waste	city	recycling	techniques
Mixed waste	urban agglomeration	recovery	
		disposal	

Table 4.4: Search query for the MSW treatment process specification.

This literature study provided the insight that the biggest challenges of MSW management are the collection and separation of this waste flow. A more refined search was conducted based on the results of the previous study to find suitable sorting and recycling techniques. The search queries for this new study can be found in table 4.5.

Primary technology description	Resource flow specification
Collecting	MSW
Collection methods	Municipal Solid Waste
Resource recovery	mixed waste
Separation	non-organic solid waste
Sorting	urban waste
Value recovery	
Recycling	

Table 4.5: Search query for the MSW collection and separation specification.

4.2 Frameworks for social acceptance

In this chapter, a custom framework is developed that helps to study the social acceptance of circular funeral technologies. In order to create this framework, knowledge about currently available social acceptance frameworks needs to be collected and structured, which requires two methodologies.

4.2.1 Literature study on social acceptance frameworks

This subsection describes the search query that was used to find the frameworks (and their related papers/articles). The fields of study from which the frameworks were sought deviated between several alternatives, as can be seen in table 4.6.

Primary goal	Target audience	Goal specification	Industry specification	Target industry
Framework	social	acceptance	green	renewable (energy) technology
Theoretical framework	societal	acceptation	renewable	waste management
	public	perception	sustainable	funeral technology
		compatibility	sustainability	funeral
				burial
				cremation

Table 4.6: Search query for the literature study on social acceptance frameworks.

Potentially useful titles were selected and read superficially, in order to create a list of articles worth further inspection. These were read thoroughly, while taking notes on the most applicable sections. Once finished, the reference list would serve as a source for new potentially interesting articles. This process could be repeated numerous times. The problem, however, is that references only go back in time, which sometimes result in finding mostly outdated information. Once that point was reached, a new search was started with different keywords. This process was repeated until a sufficient number of frameworks had been found, covering many angles of approach and views from various industries. The analysed frameworks from this literature review have been compiled and are briefly described in Section 6.1 and Appendix B.1.

4.2.2 Binder's framework

A framework based on the work of Binder et al. (2013) was applied to bring structure to the social acceptance frameworks found through the previously described literature study. The work of Binder et al. provides numerous questions that aim to find criteria by which the main characteristics of the frameworks can be compared. These criteria are contextual and mostly focused towards socio-ecological systems. The original paper differentiated between questions related to the social, ecological and social-ecological system. A combination of these questions was made, together with a few miscellaneous questions that are relevant to the specific context of this study. An overview of these questions can be found below. Although developed by a team of researchers, it is referred to as 'Binder's framework' in this study. The leading keyword describes the criteria. The adaptation of the frameworks identified in the literature study to Binder's framework can be found in appendix B.2.

Purpose: With what purpose in mind is the framework developed?
Target: What is the target group whose social acceptance needs to be improved?
- Does it apply to individuals or a group of people?
Process: What does the process of changing acceptation look like?
Problem: Who is the problem owner?
Levels: Are different levels of the social system considered
- If so, how are those interactions and dynamics explained?
Binder et al. (2013) propose the following possibilities:
"Macro: depicts the social system only at the macro level, i.e. society, not including the level of the individual.
Micro: considers only the micro level, e.g., individual decision making, without considering the upper levels.
Macro → Micro: provides concepts in which the macro level, i.e., societal or governance system, influences the micro level, e.g., individual users, consumers, etc.
Micro → Macro: sets the focus on the micro level, i.e., individual decision making and learning, and how this impacts the macro level, e.g., group, society.
Macro ↔ Micro: considers the duality between the macro level, i.e., social structure, and the micro level, agency, that is, social structure influences individual behaviour, and individual behaviour perpetuates or changes the social structure. Whereas the first is synchronic, the second is diachronic, that is, delayed, in time (see also methodological individualism / individual collectivism)."
(Binder et al., 2013)
Downside: Which potential downsides of using the framework are mentioned in the literature?
(Not always applicable.)

4.3 Social acceptance in waste management

The third research chapter aims to implement the newly developed framework through a series of case studies. The first step in doing so is performing a literature study in which suitable case studies are chosen. Once suitable local cases had been found, more information was obtained through a semi-structured interview. The framework for social acceptance of circular funeral technologies was used as a guideline for obtaining the right data during these interviews. Finally, all information about the case studies was gathered and implemented into the framework.

4.3.1 Literature studies

As two main waste management technologies have been identified at this point, the goal is to find a suitable case study for each technology. Both case studies are preferably situated locally.

4.3.1.1 Literature study of in-vessel composting case study

The search terms used in the literature study to obtain a suitable case study of aerobic decomposition can be found in table 4.7.

Goal description	Target audience	Goal specification	Resource flow specification	Primary technology specification	Primary technology description	Broad technology	Geographic boundary
Pilot	social	acceptance	organic	in-vessel	(de)composting	installation	urban
Case study	societal	acceptation	green	aerobic	(de)composter	technology	Dutch
Project	public	perception	Food waste				The Netherlands

Table 4.7: Search query for the literature study on selecting the in-vessel composting case study.

Unfortunately, most studies focused on the technical aspects of composting, whereas this study seeks for its social components. Due to a lack of useful results, the specification of the aerobic nature of the decomposition process was removed. Any composting technique that was comparable to the originally desired technology on a basic level was accepted as case study. Additionally, the regular Google search engine was used to find non-academic examples of composting in society. This particular search was done with the Dutch equivalents of the terms mentioned above to get a better view of local projects.

4.3.1.2 Literature study of mixed MSW sorting and recycling case study

The goal of the second literature study for this chapter is to find a case study of sorting and recycling MSW of which the social acceptance can be researched through the new framework. Combinations of the keywords described in table 4.8 were used to find desirable cases. These keywords provided a considerable list of both examples of cases as well as research into their performance, development or functioning. Contrary to the composting literature study, a lot more social aspects were described in the research articles.

Resource flow description	Broad technology	Primary technology description	Target audience	Goal specification	Geographic boundary
MSW	treatment	sorting	social	acceptance	The Netherlands
Municipal Solid Waste	management	recycling	societal	acceptation	Dutch
Consumer waste		Value recovery	public	perception	
Non-organic waste					

Table 4.8: Search query for the literature study on selecting the MSW sorting and recycling case study.

4.3.2 Waste management expert interviews

As this study utilises qualitative and empirical data, expert interviews are an excellent method to obtain specific information about the social acceptance of waste management technologies, particularly considering the required information for the custom framework. Due to the highly specific data that is required, the interviews will have a structured format. The legitimacy of expert interviews as an academic research methodology has been under discussion among social scientists (Bogner & Menz, 2009) (Pfadenhauer, 2009), because these interviews are too dependent on the relational concept, susceptibility to interference, and non-exclusive objectivity of the expert. However, considering the exploratory nature of this study and the lack of other literature in this field, expert interviews are deemed acceptable as a method for data collection. Dorussen et al. (2005) provide additional reasons as to why expert interviews can be a beneficial data collection method. For example, expert interviews give control over research dimensions and allow the gap between generic, publicly available data and case studies to be bridged. Both aspects of waste management, composting of organic waste and sorting and recycling of non-organic MSW were analysed through interviews with the same expert.

4.3.2.1 Waste management expert: Hemmo Hagedooren

When ROVA was contacted for the possibility of being used as case study, Hemmo Hagedooren replied as available expert in the field of the reverse collection systems that ROVA applies. Within the ROVA organisation, Hemmo Hagedooren's job position is client relationship manager. Through this function, he is well aware of introduction strategies of new, sustainable waste management systems. Additionally, he is well-informed about the public's opinion about the introduction and daily use of these systems. As a result, Hemmo Hagedooren and the ROVA case study are a valuable asset for the research of waste management systems in this study.

4.3.3 Framework for social acceptance of circular funeral technologies

The information obtained through the expert interviews is formatted to serve as input data for the framework for the social acceptance of circular funeral technologies. More specifically, the focus is on the selection cycle (the outsider's, 'right' side of the framework), but it is likely that information is gathered to help fill in other aspects of the framework as well.

The selection cycle features four categorised areas, along with some miscellaneous aspects that are not grouped in any particular way. The four main categories: concrete, social, identity-driving and idealistic values, include the social values as presented in the FAF (Bergen & Van den Hoven, 2018). These values were originally established to research the extent to which alternative funeral technologies cause harm, or potentially offend people, and whether the technology should be prohibited as a result of that. In this study, through the connection between waste management and funerals, these same values are used to analyse the social acceptance of the two previously determined waste management technologies.

By applying information from two specific case studies representing the waste management systems, this chapter aims to identify factors which have an impact on the system's social acceptance.

In the next chapter, these factors of identified relevance are used to make the switch back from the waste management industry to the funeral industry.

4.4 Social acceptance in the funeral industry

The preliminary results from the third research question describe the most impactful factors for the social acceptance in the waste management industry. Although this study makes a comparison between the funeral and waste management industries, they are certainly not one and the same. This chapter seeks to find out how the chosen values can be applied in the death care scenario.

4.4.1 Literature study to analyse impactful values in the death care scenario

A new literature study is performed that searches for articles describing the specific values previously discovered in the context of death care. As numerous sources have already been implemented in earlier stages of the research, they will also be reanalysed to find parts that describe the effects of the seven values in the funeral industry. In similar vein, previously conducted interviews are used to find information related to the chosen values.

Primary goal specification	Primary goal description	Technology specification
Community	death care	burial
Connectedness	death rites	cremation
Family	death rituals	green burial
Cleanliness	funerals	cryomation
Trust	funeral industry	resomation
Procedural fairness	funeral homes	composting
Attitude	mortuary	

Table 4.9: Search query for the literature study on impactful values in the death care scenario.

While looking for content for a specific value, it is not unlikely to find information suitable for another one. All available information is collected, regardless of the search query it originated from.

4.4.2 Scenario comparison between waste management and funeral industry

The information obtained from the literature study described above is combined to provide a complete view of the factors that influence the social acceptance of sustainable funeral technologies. Afterwards, an accurate comparison between the funeral and waste management industries can be made. The comparison is made based on the seven values derived from the custom framework. Similarities and differences are discussed separately.

4.5 Funeral industry transition proposals

Two noteworthy methodologies were applied to answer the final research question. First of all, the data found throughout this study has to be converted into creative ideas that form the basis of the recommendations to the funeral industry. Secondly, these recommendations are presented to experts from the funeral industry through a series of interviews.

4.5.1 Idea generation

In order to generate valuable ideas based on the theory previously discovered, idea generation strategies from the field of industrial design engineering were applied. The creative idea generation was done alone, but the viability of the ideas was later discussed with experts (see subsection 4.5.2). Although a combination of different creative strategies was utilised to develop the ideas to improve the social acceptance of circular funeral technologies, the mindmap was the main method. Despite the proven use of images during these creative processes, a word-based format (on paper) was applied to stay closer to the original data. Seven individual mind maps were created, one for each chosen value. The key differences between both industries for each value were centralised, which was expanded upon by linking important factors that are related to each described difference. Arrows connect all related items to highlight the flow of the thought process. Then, solutions are sought that implement as many of these connected aspects as possible. By developing ideas that include many different aspects of a problem, the solution is realistically more likely to be viable as it has considered more potential problems.

4.5.2 Expert interviews for recommendation development

Whereas the expert interviews described in subsection 4.3.2 are with a single waste management expert, the interviews that are conducted as part of the fifth research question will feature various experts active in the funeral industry. The experts were selected with the goal of representing a wide spectrum of different daily occupations within the field of death care. The other statements presented in subsection 4.3.2 are still true for these interviews.

One noteworthy difference is the goals between both sets of interviews. Whereas the first set was conducted with the goal of data collection, the second set is focused on providing feedback on already created content. First of all, there are some interesting conclusions from the literature study that are worth to discuss with the experts to see if the literature accurately describes the modern, Dutch funeral industry. On the other, a wide selection of ideas was generated, which can be improved with the expert's feedback.

Because these experts are asked for their insight and advice about this content, rather than a description of the work they do or projects they are involved with, the interview may be somewhat more subjective in nature. However, because a larger range of experts from within the field is interviewed, different perspectives can be analysed to end up with a well grounded result regardless. It is likely that through a discussion with one expert, an idea is changed that is presented to the next expert in its updated state. As a result, the topic of conversation and level of detail of the discussion will gradually change as more experts are consulted. Due to this flexible approach, the format of these interviews can be considered as semi-structured.

4.5.2.1 Funeral expert: Peter van der Aa

Peter van der Aa is co-founder of funeral home Lupine, active in the western part of the province South-Holland. Besides the many years worth of experience in his role as funeral director, he also supervises thesis projects of students of the funeral director education program. Through these occupations, Peter van der Aa is actively involved in multiple aspects of the funeral industry and therefore a valuable expert to interview for this study. The interview notes are in appendix D.1.

4.5.2.2 Funeral expert: Guus Sluiter

Guus Sluiter has been active in the industry of art and exhibitions before he became the director of funeral Museum Tot Zover, located in Amsterdam, in 2004. Through his role as director there, he has experienced many different cultural aspects of death and dying. He has curated several exhibitions on death and culture and has also published on this theme. Through these endeavours, he has experienced the way people react to different cultural views and new rituals related to death care at close hand. Additionally, Museum Tot Zover is located directly besides a cemetery, with which the museum has close contact. Through his involvement in bringing new views on death care to the people and experiencing their reactions, Guus Sluiter is a valuable expert to interview for this study. See appendix D.2 for the interview notes.

4.5.2.3 Waste management expert: Guus Rang

Although Mark Spruijt (co-author of the TNO report on research about the safety of resomation (TNO, 2018)) was initially contacted for additional information about the resomation technology, he was unable to provide further information about specific aspects for this study. He did, however, forward the questions to Guus Rang, who is the managing director of WastePoint, the company who cooperated in TNO's research by analysing the resomation-effluent (TNO, 2018. Appendix E). Because Guus Rang is affiliated with the waste management industry, and not the funeral industry, it was instead opted to go with a series of questions through email. Regardless, his expertise in the waste management industry provided helpful information regarding some of the technical possibilities with the resomation technology. Appendix D.3 provides a summary of this email.

4.5.2.4 Waste management and funeral expert: Marinus Heldoorn

The final expert who was consulted to provide feedback on the preliminary ideas is Marinus Heldoorn, who is a ROVA employee dedicated to managing the waste produced in and around the cemetery in Zwolle. Not only was he responsible for the management of green waste, but it was also his job to relocate bodies on public cemeteries to mass graves at the closure of the permit. He is experienced in the way the funeral industry, in particular the traditional burial sector, operates. As a result, his opinion and experience were a valuable input for the idea optimisation process.

4.6 Expectations based on the applied methodologies

Multiple literature studies and interviews form the basis of the quantitative data acquisition required for this study. These methodologies are common in quantitative research approaches. The data acquired through them is required for the framework that is developed in this study. In particular the development process of this customised framework leans heavily towards the exploratory side of research. The approach of combining frameworks originally developed to be utilised in different contexts works well within the boundaries of this study, as it allows to analyse the topic from multiple perspectives. As this study analyses both social and technical aspects of death care, a research approach that includes many factors is valuable to gain new insights. Utilising this custom framework in other research settings can also prove to yield interesting results, but its academic viability may be questioned. Chapter 10 discusses the viability and feasibility of this approach.

5. Funerals as waste management system

In this study, the assumption is made that funeral technologies can be seen as an alternative waste management program. The primary reasons for this are that in the field of waste management, literature about social acceptance and frameworks, as well as circularisation development case studies, are available. Through the comparison, the frameworks can be applied to the funeral industry. However, it should be considered whether this comparison is valid or not. This chapter discusses the validity of this comparison and provides the waste management system that has the most similarities with funerals through analysis of LCA flowcharts, by asking the following question:
1) *With which waste management technology or system can the funeral industry be best compared?*

In perspective to the whole study, finding comparable technologies from the waste management industry is the first step towards increasing the social acceptance of circular funeral technologies.

Figure 5.1: Research goal of this chapter in relation to the complete study.

5.1 Legitimacy of the comparison between funerals and waste management

In essence, regardless of the chosen alternative, death care technologies are the disposal service of dead bodies. People are hesitant to use words such as 'disposal' and 'waste' in the context of deceased humans, since deceased humans are treated with respect. Respectful treatment is not the norm for almost everything else we dispose of. However, from a theoretical point of view, which analyses systems through flows and processes, the similarities between the disposal of human bodies and other, regular waste flows are striking.

5.1.1 System comparison

When analysing the funeral industry as a system, the bodies of the deceased are brought to centralised institutions that treat these 'disposals'. In other words, the dead bodies are a waste flow of society, and the input flow of the funeral system. The funeral industry has access to several processes to treat the input flow of bodies, each with their advantages, disadvantages and associated costs. They operate under strict rules and regulations. The output of the funeral processes also resembles regular waste management in many ways. In the early stages of municipal solid waste (MSW) management, landfill was very common. When people became aware of the environmental damage caused by landfilling, alternatives were found in incineration. Awareness of the need to become more sustainable urged the waste management industry to develop sustainable alternatives. Now, as the importance of a transition to a circular economy becomes clear, the waste management industry needs to adapt again.

To some extent, these first steps also happened in the funeral industry. Looking back in history (see chapter 2), the first funeral method was burial. The placement of the 'waste flow', the human body, into the ground has many similarities to landfilled MSW. The next widely available funeral technology is cremation, which has similarities to the incineration process of MSW. The newest advancement in the technology of cremation is the capture of heat from the cremation process, which is used elsewhere in the crematory or other local buildings.

One transition the funeral industry still needs to make is the development of a viable option towards a circular economy. Regular waste management is further ahead than the funeral industry in the refining of their technologies. The volumes they process are significantly larger. By applying principles of the economy of scale, it becomes a lot more attractive to improve efficiencies of those processes and reduce harmful side effects. A key difference between most waste management systems and the funeral industry is a lack of involvement of ethics and morals at the processing level. Waste management systems are geared towards resource and energy efficiency and economics. On the contrary, resources and energy efficiency play only a limited role in the funeral industry. Here, social factors, such as providing the best possible ceremonial experience, are perceived to be of much higher importance. Ideally, resource efficiency will increase in the future, as the industry incorporates principles of a circular economy. This may affect its social factors in one or more ways, resulting in a shift of social acceptance.

Although regular waste management systems can increase the efficiency of their waste treatment processes more effectively due to a lack of social factors, these factors do play a role in other stages of waste treatment systems. The collection of waste, use of output products (and harm as a result of emissions) and general presence of the facility and its required infrastructure all have social impacts. In return, these influence the social acceptance of the waste treatment installation by the general public. Low social acceptance may lead to disadvantageous actions ranging from indifference towards cooperation to outright protests against (new) waste treatment facilities.

5.1.2 Functions of the waste management and funeral industries

Whereas funeral ceremonies are filled with personal touches, the complete opposite is true for other waste management systems. Little to no thought is spent on who the waste belonged to, for how long the products or materials had served their purpose, or what memories people attached to them. Waste managers are interested in recoverable materials or energy and the associated costs. This strictly functional approach to waste management allows for much shorter cycle times, and therefore economic benefits.

It can be argued that the main function of the funeral industry is not the disposal of human bodies, but providing a service to the next of kin. A service where people can regain a state of peace of mind, as the deceased person's life has now 'officially' come to an end. A service that brings family, friends, (ex-)colleagues and other acquaintances together to share memories. At that moment, people don't want to think about the state the world would be in if the body of the deceased was not disposed of, while that is certainly an undeniable function of the funeral system. This last function has had changing recognition throughout mankind's history. If a circular economy is the objective, focusing on the disposal aspect of a funeral's function will have to become more prominent.

It is as if funerals have two functions, for two different groups of people. Creating an idea of closure, completeness and remembrance for a select few people who were close to the deceased person, while the main function for everyone else is safe disposal of the remains to keep society inhabitable. This duality is what makes the funeral industry such a challenge to circularise, as each change needs to be thoroughly considered from an ethical perspective as well.

5.2 Material flows of funerals

In order to analyse which waste management technology has the most in common with funerals, all resource flows of a typical Dutch funeral must be known. A funeral has many more resource flows than the body that is processed. As described in chapter 2, the most common funeral techniques in the Netherlands are (traditional) burial and cremation, with a very small market segment reserved for natural burial. In a previous study, flowcharts of five funeral alternatives were made for an American scenario (Van der Burgh et al., 2017), which are based on the work of Keijzer et al. (2014). The flowcharts of the three relevant funeral alternatives, presented in subsections 5.2.1 to 5.2.3, are adjusted to better reflect the Dutch scenario. Although a short description of these technologies has been added in the appendices A.1 - A.3, more detailed information about these funeral alternatives can be found in Keijzer, et al. (2014), Van der Burgh, et al. (2017) and Bergen & Van den Hoven (2018). A subdivision between these flows is made based on several characteristics: whether the material is natural and degradable, whether the material contains value and what its function is within the system. An overview of these categories, along with a representative example from the flowcharts presented in appendix A.1, A.2 and A.3, can be found in table 5.1.

Cate-gory	Material type	Degradability	Contained value	System function	Resource flow example
1	natural	low	little to no nutrient value	system output	memorial stone
2	natural	high	little to no nutrient value	system output	n/a
3	natural	low	high nutrient value	system output	n/a
4	natural	high	high nutrient value	system output	the human body
5	artificial	minimal	valuable material components	system output	recycling of metal coffin decorations
6	artificial	minimal	heterogeneous or otherwise unusable parts	system output	landfilling non-organic, non-human materials
7	artificial	minimal	valuables usable within system	main processing unit	cremation oven
8	artificial	minimal	valuables usable outside system	other processing unit	burial site maintenance
9	energy	n/a	contained energy	energy for processing	digging and closing of the grave

Table 5.1: Material flow characteristics.

The selection of representative material flow categories is the first of many decisions, both in context of the funeral and waste management industries, that will ultimately lead to the development of recommendations for the improvement of social acceptance of (quasi-)circular funeral technologies in chapter 9. The selection of the material flow categories described in table 5.1 indirectly determines the values associated with the introduction of sustainable developments in the management of the chosen waste flows. This is fundamental to answering the research question.

For each funeral technology, the impactful material flows are paired with one of the characteristics described above. Two main category groups can be distinguished.

First, there are the flows that leave the system. They are products from the funeral technology, and most of these flows end up 'in the possession of' the customers.

Secondly, the flows that are inherently part of the system. These are the flows of materials or products that remain within the processing facility or enable the continuation of the system. They are mostly used throughout many repetitions of the process and customers do not 'own' the product or material after the funeral has been paid. Important to note is that not all flows in the flowcharts are categorised this way. There are some, mostly emission-based, flows that are important for the LCA, but are hard to quantify on a physical level. As the resource inputs these flows are based on have already been accounted for in earlier flows, they can be safely left out. These flows have no representative number in the flowchart.

5.2.1 Traditional burial funeral alternative

The flowchart of traditional burial upon which the following description is based can be found in appendix A.1. The first clearly identifiable flow in all funeral types is the human body. Due to the complexity of the body and the variety of elements it is constructed of, the system as a whole is difficult to categorise. Skin, flesh, organs, etc. decompose relatively quickly, whereas bones and nails decompose very slowly. Some body parts contain more nutrients than others and are therefore potentially valuable. Besides the natural parts, it is important to realise the body may take up non-organic elements during its lifetime. Dental operations or other surgeries may leave such elements behind. Especially metal parts remain valuable and should ideally be retrieved. Other sources of non-organic elements can be included in the clothing or other miscellaneous items that are buried along with the body. One aspect that is met with uncertainty within the industry is the (potential) effects on the local environment of viruses or other diseases present in the body at the moment of dying. Another controversial topic is the effect of medicine on the local environment. The extent to which these can be harmful is mostly unexplored.

Other notable flows related to traditional burial are the (often large) monuments placed at the grave and decorated coffins containing the body. Because the coffin is the centrepiece in the ceremony, a lot of attention goes into its presentation. Expensive, commonly treated wood is used and metal ornaments are added as decorations, although they also provide functionality when used as handlebars. Both these materials can be considered to be valuable, due to potential applications (in a second life). As important as the coffin is during the ceremony, the monument at the grave takes on that role afterwards. In some cases, it reflects the personality of the deceased, in other cases it is also seen as a status symbol. Where some people are content with a message carved in a simple natural stone, others strive to create unique pieces of art. Material use is reflected in the variety of available options and can potentially result in the use of valuable components.

An additional required funeral item is the shroud, which is usually made from cotton or linen. In some cases, decorations are sewn into the fabric. Naturally sourced fibres are biodegradable, whereas synthetic fibres are not (Frey et al., 2010). However, the speed at which they degrade is lower in anaerobic scenarios and also dependent on the density (and quality) of the material. Some religions prescribe burial shrouds to be of natural origin, but most people simply deem the perceived higher quality of natural fabric worthy of the situation.

Furthermore, there are some flows inherently part of the burial ceremony, such as the use of the elevator and the preservation of the body prior to the ceremony through cooling. The actual grave needs to be dug, maintained and reopened after the burial contract has expired, which would require energy in the form of fuel for excavators and manpower.

5.2.2 Cremation funeral alternative

The flowchart of cremation upon which the following description is based can be found in appendix A.2. As the body going into the system is identical to that of the burial alternative, it is categorised equally. However, it is important to note that due to the difference in processing methods, the output is different. Cremation remains are a mixture of grounded bones and ash. The ash, coming from organic matter, has some potential uses, for example to increase the fertility properties of soil (Sajwan, 2003). The bones are categorised equally.

Although both burial and cremation utilise coffins, there are some distinctive differences. Similarly to the burial scenario, cremation also uses high-end, decorated coffins but only to put the body on display during the (viewing) ceremony. The actual incineration of the body happens in a much more modest coffin made from cardboard. Although cardboard is generally recyclable, the remains of the incineration get mixed with those of the body. The ceremonial coffin will be used many times over, as it is owned by the crematory. However, in the end, it eventually has to be replaced. This flow will also be categorised equally to the burial scenario. Another identical flow required for this funeral process is the shroud, as well as the cooling of the body prior to the ceremony.
To operate and maintain the incinerator, several more resources are required. The oven itself consists of more technical components (compared to both burial alternatives), which have inherent material value. The same is true for the cremulator.

Most cremation ovens operate on natural gas, whereas the grid is utilised to power miscellaneous processes. Another necessary product to keep the system running smoothly is the activated charcoal, which is used to purify the air in the incinerator. Depending on the level of saturation of contamination in the pores, it may be used again. Another option is reactivation of the activated charcoal, however, depending on the level of adsorption, this is not always possible.
The last physical material flow is that of the urn (also known as ash bus). Its function is somewhat comparable to that of a monument or gravestone at a burial site. Generally speaking, urns consist of the same variety of materials (ranging from 'natural options' such as clay and ceramic to high-end artificial options such as metal). Similar to the burial alternative, non-organic remains could have been taken up by the body. Before the ashes are put into the urns, a last attempt is made to filter out any non-organic materials (most specifically metals). Finally, there are some post-ceremonial processes that require energy to perform. The most notable in the cremation scenario is the travelling which is required to spread the ashes.

5.2.3 Natural burial funeral alternative

The flowchart of natural burial upon which the follow description is based can be found in appendix A.3. As green burial is subjected to stricter regulations regarding the use of non-organic resources and utilises no facility in which the ceremony takes place, considerably fewer resource flows are present for this funeral alternative. Compared to traditional burial grounds, natural burial grounds are often located significantly further away, which as a result require more energy, to reach.

Both burial alternatives use similar elevators to descend the body into the grave and require energy for the digging and maintenance of the graves. Although green burial does not allow any non-organic materials to be taken into the grave, they could be present in the body as a result of a surgery or other operation. Green burial has no method to recover these materials. Although most materials used for shrouds in traditional burial are already from organic nature, green burial leaves no question regarding the origin of the materials. One final difference is the material use for the coffin. Coffins used for green burial are a lot more simplistic, as the use of treated wood or metal is banned.

5.3 Comparing the funeral and waste management industries

In section 5.1, arguments have been provided to justify the comparison between funerals and waste management systems. However, a wide variety of waste management technologies exist, each specialised to process different kinds of input flows by different means. This chapter will analyse which characteristics these systems share with the funeral industry.

5.3.1 Distribution of categorised flows

The resource flows that have been identified and categorised in subsections 5.2.1 to 5.2.3 cannot be directly added up. First of all, not all three alternatives are equally represented in the funeral market. Looking specifically at urban areas, cremation has a market share of 70% (Yarden, 2017). Green burial is estimated at 1%, leaving 29% for traditional burial as no other alternatives are currently legal and donations to science are rare. Another important aspect is that the flows have no allocated weight or volume. When taking the ideals of a circular economy into consideration, not only the large material flows should be recovered, but preferably any flow with value. It becomes more a matter of 'which value-containing flows exist', rather than 'what are the most impactful flows'. An overview of the presence of every categorised flow is provided in table 5.2 below. It is noteworthy that flows 2 and 3 are absent in any of the alternatives. Additionally, certain alternatives have fewer resource flows.

Category	Traditional burial	Cremation	Green burial
1	3	3	2
2	-	-	-
3	-	-	-
4	2	2	2
5	3	4	1
6	1	2	1
7	2	3	1
8	1	-	1
9	4	5	3

Table 5.2: Number of occurrences of each categorised material flows in the three funeral technology alternative flow charts.

The most important distinction between categories is whether they contain value or not. Flows with limited to no value are generally transformed into energy through incineration, which is not a desirable solution in terms of circularisation. In the funeral industry, flows that have no significant value can hold onto their value as means of remembrance of the deceased person.
By doing so, flows will always maintain at least some degree of value, albeit sentimental. Interesting flows to analyse further are those that do contain material value, namely categories 4, 5, 6, 7 and 8. Category 9 (energy) is not further analysed because it is an input flow to power the processes within the system, rather than an output flow. The two main differences which distinguishes these flows is whether they are organic or not. As only organic matter can naturally decompose, it needs to be separated from artificial resources. The latter flow must be treated by other man-made processes.

Based on the characteristics of the resource in the flow, a suitable value recovery system can be chosen. Figure 5.1 is used to select the appropriate recovery systems for flows present in the funeral industry. It will most likely not be useful outside this industry, as only materials from the funeral-based flowcharts are accounted for. From table 5.2 can be concluded that category 4 and 5 should be prioritised, as the described flows are often found in funerals and contain value that can be recovered. Examples of the contained value are the human remains (the organic content as well as any non-organic substances that have found their way into the body), as well as valuable additives from the funeral service. Category 4 and 5 are treated in subsections 5.3.3 and 5.3.4 respectively.

5.3.2 The chosen waste management technologies

In the waste management sector, specific technologies are used to recover value from a large variety of waste streams. Having identified the most relevant categories that are suitable for value recovery in table 5.2, the next step is an analysis of which waste recovery system is most applicable. The checklist presented below in figure 5.1 is used to find the technologies that match the waste flows that were found in table 5.1.
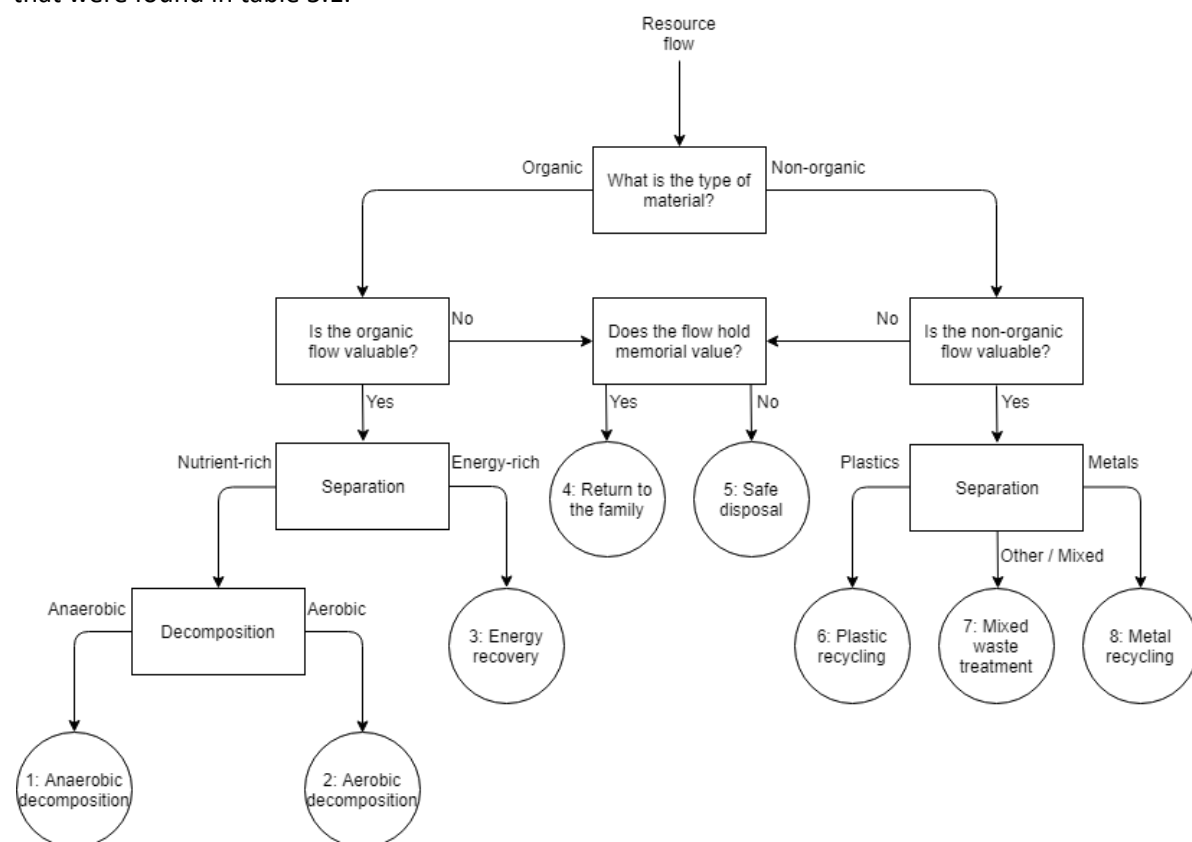
Figure 5.1: Resource recovery checklist for material flows present in the funeral industry.

As can be seen in figure 5.1, eight ways of value recovery have been identified. Several material characterisation factors are checked, starting with the general waste type and ending with the potential value involved and means to recover that value.

In the funeral industry's processing facilities, large machines (category 7) may be present, which have a high concentration of metals and other valuable technologically advanced materials that can be easily reused or recovered. However, when looking at the metal that is found in very small concentrations after the funeral process has been applied, it is significantly more challenging to utilise the value of those pieces as they are found. As a result, recycling is the most realistic solution. Because of this, the artificial materials part in figure 5.1 focuses on material recycling rather than reuse or remanufacturing, which would otherwise be the more ideal situation.

5.3.3 Waste management of organic matter

In table 5.1, the characteristics of the material flows present in funerals were listed and separated into nine categories. The interest of category 4 and 5 in terms of potential value recovery was established in table 5.2. The potential means for value recovery of category 4 is discussed in subsections 5.3.3. The value recovery of category 5 is discussed in subsection 5.3.4. For clarification, the relevant rows of table 5.1 are copied in the respective subsection of each category.

Category	Material type	Degradability	Contained value	System function	Resource flow example
4	natural	high	high nutrient value	system output	the human body

Table 5.3: A section of table 5.1 highlighting category 4.

Following material category 4 through the checklist presented in figure 5.1, the first major distinction is made during the separation between nutrient-rich and energy-rich flows. Looking specifically at the human body, the biggest potential lies within the nutrients present in the fleshy parts and organs. Although there is value to be had in energy recovery (by means of incineration), it should be considered as a last-ditch effort as it contradicts with the principles of circularity.

Decomposing nutrient-rich organic resources can be done in multiple ways. Although the decomposition processes can be artificially enhanced (i.e. with the implementation of heat and/or chemicals), the natural processes are aerobic and anaerobic decomposition. Decomposition as it occurs during a burial falls under the anaerobic category, as no oxygen can reach the body in the buried coffin. Anaerobic digestion is relatively slow and does not generate nearly as much heat as its aerobic counterpart. Because of this, pathogens and bacteria are not killed off. Due to the oxygen-free nature of the process, methane is produced (Khalid et al., 2011) (Erses et al., 2008). Technologies exist that aim to produce methane through anaerobic digestion (Li et al., 2011).

The speed at which organic matter decomposes is generally increased with the addition of oxygen. The required oxygen for the aerobic decomposition of organic matter can be provided by moving the process outdoors, or by creating a controlled environment with an integrated oxygen supply system. Alternatively, oxygen can be provided manually by displacing and stirring the compost pile. However, a steady supply of oxygen must be provided, as it is continuously consumed during the process. The heat that this process releases is useful as both a potential source of energy, as well as a method to kill harmful pathogens and weeds, but it also stimulates the growth of bacteria with positive effects for the process. Aerobic digestion produces carbon dioxide as notable emissions, which can be tapped off and collected when operating a closed system (Erses et al., 2008). Another benefit of aerobic decomposition is the reduced amount of bad odours that are released during the process.

The decomposition rate can be further optimised through the alteration of several parameters, such as: the pH level, addition of organic or non-organic nutrients, the Carbon : Nitrogen ratio and the supplementation of bulk material (Bernard et al., 2000).
With the advantages of aerobic decomposition described above, this collective term for organic waste treatment is further analysed to find a waste management technology which is comparable to funerals. As aerobic decomposition is a rather broad terminology, more specific technologies are listed below. Professional (industrial) composting installations are subdivided into seven technologies.

Windrow composting places the compost outdoors, exposed to the air, on a hard surface in long rows. Large machinery is used to place these rows and turn them through every once in a while to ensure sufficient aeration throughout the entire windrow. As no further technology is implemented, checks on temperature, oxygen levels, etc. need to be done manually.

In the category of Aerated Static Pile (ASP) composting, the process by which the compost is placed in a single pile without turning, two main technologies can be identified, namely in-vessel and tunnel composting. Piles of organic matter being processed by in-vessel composting are part of a closed system that is (semi-)automatically operated (Pandey et al., 2016). Tunnel composting is open to oxygen from the top, while being held in place from all other sides. These technologies are the most dominant ones. The remaining three technologies are high fibre composting (adding cardboard to the compost to increase its balance), vermicomposting (utilising earthworms to break down organic matter, resulting in the nutritious matter vermicast) and mechanical biological treatment (includes pre-treatment sorting of non-organic waste) (EPA, 2016). The advantages and disadvantages of these technologies are further analysed in table 5.4.

Technology	Advantages	Disadvantages
Aerated static pile composting	Standardised technique that can be combined with others for specific scenarios.	Unoptimised technology by itself. Not suitable to process all organic matter.
Windrow composting	Produces large volumes of compost in rows, outdoor on a hard surface.	Large machinery (truck/tractor) required, manual checks and turning required. Relatively lower compost stacks require more land.
In-vessel composting	Controlled setting in a closed tank with controlled airflow, moisture and temperature conditions. Easiest system to optimise, therefore versatile.	Capital intensive, limited scalability per unit. Compost not directly usable when leaving the system.
Tunnel composting	It is cheaper to install and easier to maintain than in-vessel composting	Lacks the controllability of in-vessel composting.
High fibre composting	Requires another waste flow (cardboard and paper).	Tougher to control the system, as the Carbon : Nitrogen balance is dependent on system input. Does take away from generic paper recycling.
Vermi-composting	Biological method utilising methods that nature offers, applicable at small scale.	High 'disgust factor', limited to the availability and characteristics of the earth worms. Worms need replacing.
Mechanical biological treatment	Reliable all-round, catch-all system, sorts and processes all kinds of materials.	Capital intensive, the additional sorting is not necessary for homogenous flows.

Table 5.4: Advantages and disadvantages of aerobic decomposition technologies in the funeral context.

In conclusion, in-vessel composting is the most suitable aerobic composting technology. Its ability to be adjusted to any organic waste flow makes it efficient to deal with the rather unusual diverse, organic product that is the human body. Although the bodies are relatively large, the rate at which they enter the processing facility is rather restricted. The need for indoor placement should not be problematic, as funeral homes already have similar demands for cremation ovens, which are also technically advanced machines (Mu et al., 2017).

5.3.4 Waste management of non-organic matter

The other selected category from table 5.1 is analysed identically to the approach of subsection 5.3.3. As is determined in table 5.2, category 5 is the second material category which is analysed in this subsection.

Category	Material type	Degradability	Contained value	System function	Resource flow example
5	artificial	minimal	valuable material components	system output	recycling of metal coffin decorations

Table 5.5: A section of table 5.1 highlighting category 5.

Following material category 5 through the checklist presented in figure 5.1, the first problematic point is the identification and separation of different materials. When analysing the non-organic flows that are present in funerals, a distinction can be made between those present in the human body (taken up during the lifespan of a person) and those added by the application of the funeral technology.

Non-organic flows in the human body are generally present in very small quantities (large quantities would be problematic to live with). These small bits and pieces may have ended up in the body by accident, or purposefully placed there as part of a surgery. Either way, they can consist of a vast range of different metals and plastics. This diversity can only be expected to further increase in the future as more (advanced) materials are utilised in the medical industry. As the average life expectancy continues to rise, the funeral industry will encounter a large diversity of materials used to solve medical problems. A good example of this would be (dental) fillings, which throughout the years have varied between amalgam (which consists of many different metals), composites, gold, porcelain and resin (Colgate, 2018). Due to their large variety, sparse (and unpredictable) use, these non-organic material flows are relatively hard to identify, sort and process accordingly.
Secondly, there are the larger, homogeneous material output flows from the funeral ceremony, such as a metal monument, or ornaments on the coffin. These flows are significantly easier to identify in the total waste stream and are much more likely to be fully recovered. In turn, this results in an easier separation and recovery process, which leads to much higher potential recovery rates at a lower cost.

Whereas with organic matter the diversity of the waste stream is not really a problem (after all, everything is composted sooner or later), diverse waste streams are problematic for non-organic waste treatment technologies. Complex sorting facilities have been developed to deal with these heterogeneous flows. After the sorting process, different value recovery technologies can be applied according to demands of circularity (Cimpan et al., 2015).
Alternatively, the sorting procedure is not as rigorous, and a larger selection of materials is incinerated to retrieve energetic value. This is not ideal, as the base material and energy put into the production of these components are lost, not to mention the emissions that result from the incineration process. With options that have a higher value recovery available, incineration is preferably avoided.

Due to its diverse nature, municipal solid waste (MSW) is a logical comparison with non-organic funeral waste. Although the exact composition MSW varies from one place to another, the following waste streams are generally present to some degree:
- Biodegradable waste (including paper), which is discussed in subsection 5.3.3
- Recyclable materials, such as paper products, glass/ceramics, plastics and metals
- WEEE, consisting of both small and large electronic devices
- Composite waste, which describes the more simplistic material combinations such as Tetra Packs
- Hazardous waste, including but not limited to paints and batteries
- Toxic waste such as household pesticides and fungicides
- Biomedical waste such as pharmaceuticals

Given the description of non-organic funeral waste flows previously provided, the best matching waste stream of this list are the recyclable materials. It is worth mentioning that there are ongoing discussions about the potential hazards that biomedical waste present in human bodies may provide to the local environment. However, the focus will remain on the recyclable flows.

As of 2009, the Netherlands treated its municipal waste according to the following percentages: Landfill: 1%, Incineration: 38%, Recycling: 32%, Composting: 29% (Eurostat, 2011).

Although the largest material category of the recycled materials was paper and cardboard (62%), metals amassed to 4% whereas plastics took up 5% of the total recycled material flow of approximately 1.7 million tonnes (EEA, 2013). Compared to other EU countries, the percentage of recycled MSW is relatively high. This can be mainly attributed to early involvement of the government, for example through the introduction of a landfill tax.

MSW material recovery can be achieved in two ways: recycling homogeneous flows that were separated at the source, or recycling from a mixed flow. Most MSW treatment systems combine both methods, and they supplement each other well (WUR, 2013).

Sorting a mixed flow is done by utilising sensors to distinguish several material properties, such as density, visual aspects like colour, opacity and reflectiveness, magneticity, moisture content, but also the size of the components. Despite all these technologies that are applied to do the sorting for us, manual sorting is still common practice in many places around the world. As sensors are quicker, more precise and capable of distinguishing more characteristics, they are usually applied in developed countries such as the Netherlands on a large scale. When it comes to separating metals, eddy current separators are particularly useful. This can potentially be followed up with induction sorting to divide the metal content more accurately (WMW, 2008).

Once all flows have been sufficiently separated, the materials are gathered and shipped to production facilities that prepare the waste flow for their second (or third, fourth, etc.) life.

The recycled material can either be mixed with virgin material, or remain separated to create a different product altogether.

Between the material properties described previously, all identified non-organic funeral flows can be sorted. Therefore, the technology of sorting and recycling MSW is considered to be a suitable comparison for the processing of non-organic funeral output flows. Although the focus is on the sorting and treatment of mixed flows, the potential of sorting at the source should not be discarded.

5.3.5 Waste management technologies literature overview

Table 5.6 below presents the results of the two literature studies that were conducted to find the waste management technologies that are comparable with the resource flows in the funeral industry. The articles are listed in order of appearance in their respective chapters. A total of 13 unique sources were analysed before the final two comparable waste management technologies were selected.

Chapter	Topic	Author(s)
5.3.3	Anaerobic digestion	Khalid et al., 2011 Erses et al., 2008 Li et al., 2011
5.3.3	Aerobic digestion	Erses et al., 2008
5.3.3	Optimising decomposition rates	Bernard et al., 2000
5.3.3	Aerated static pile, in-vessel and tunnel composting	Pandey et al., 2016
5.3.3	Various other niche composting technologies	EPA, 2016
5.3.3	Decisive in-vessel composting data	Mu et al., 2017
5.3.4	Non-organic pollution in human bodies	Colgate, 2018
5.3.4	Value recovery technologies	Cimpan et al., 2015
5.3.4	MSW management	Eurostat, 2011
5.3.4	MSW composition	EEA, 2013
5.3.4	MSW treatment systems	WUR, 2013
5.3.4	MSW separation technologies	WMW, 2008

Table 5.6: Results of the literature study applied in chapters 5.3.3 and 5.3.4.

5.4 Conclusions

In this chapter, an answer was sought to the following research question:

With which waste management technology or system can the funeral industry be best compared?

As the formulation of the question already suggests, the assumption is made that the funeral industry functions on a similar level as waste management systems. Although arguments can be provided why this would, or would not be the case, it makes for an interesting research proposal that analyses the problem from a different perspective and can potentially find innovative solutions.

In order to find the waste management systems that share the most similarities with funerals, the flowcharts of the three most popular funeral technologies were analysed. Flows containing valuable materials that appeared frequently were highlighted due to their value recovery potential. These flows were further analysed by means of a checklist, which identified what suitable waste management technologies allow for value recovery of each specific material flow. After its application, two important waste management categories were identified in aerobic decomposition of organic matter and mixed non-organic waste treatment.

Through literature research, both technologies were further specified to find two waste treatment technologies that have most in common with the organic and non-organic flows of funerals respectively. In-vessel composting offers highly customisable composting conditions that are suitable for almost any organic flow, while operating quickly without many negative side effects such as bad odour. It fits in well with the professional, industrialised technologies currently utilised by funeral homes. The process of sorting and recycling mixed MSW flows has many similarities with the non-organic flows present in funerals. These materials are highly diverse and exist in small quantities. A technologically advanced system, utilising sensors that can identify many material characteristics, is required to adequately separate these flows.

Initially, the goal was to find the single most comparable waste management technology, but further analysis proved that the organic and non-organic flows are too diverse to capture effectively with a single technology. It can be argued that the organic matter is of higher importance and should therefore be focused on, but the non-organic content may provide additional valuable insights. Considering the exploratory nature of the project, it seemed wrong to limit the options this early. Concludingly, both waste management technologies are chosen to represent the funeral industry and will continue to be used throughout the study.

6. Developing a framework for social acceptance in the funeral industry

The next step in this study is research on theoretical frameworks that describe social acceptance. Social acceptance is of major importance for the introduction of new technologies to the market. Even more so for funerals, which are, as previously discussed, heavily influenced by culture.

Figure 6.1: Research goal of this chapter in relation to the complete study.

The social acceptance framework that is used to analyse the waste management systems that were selected in chapter 5 is developed in this chapter. Ultimately, this framework must allow for a social acceptance study on the basis of a comparison between waste management and death care. Frameworks that study social acceptance have been created for many different scenarios in the past. Through a literature study, these predefined frameworks are analysed and collected. It is key to gather a large sample of frameworks originating from diverse fields of study, to get a solid grasp of different perspectives. From among the collected frameworks, a selection of those elements which are desirable to include in the custom framework is made. Once this selection has been made, the individual elements need to be adjusted to reflect the funeral industry more accurately. Considering the uniqueness of the industry, this step will most likely need to be applied for most chosen framework elements. Once all elements have been adjusted, they are combined into the complete, custom framework that this study will utilise to research the social acceptance of circular funeral technologies. This goal is formulated into the following research question:
2) *Which pre-existing frameworks describing social acceptance are available in the literature, and to what extent can they be adapted and combined to better reflect the funeral industry?*

6.1 The theory of frameworks for social acceptance

The first section of this section shows the results of an extensive study to find and structure a large variety of social acceptance frameworks from the literature.

6.1.1 Literature study for social acceptance frameworks

For decades, frameworks have been used as a theoretical backbone of research that allows for a well-structured, repeatable approach to both qualitative and quantitative studies, with a wide range of research goals in mind. A great variety of styles of frameworks have been established, each with different characteristics, focused at serving these different research goals. In order to be a credible academic study, a suitable framework needs to be found that aligns with the goals of this study. The selection of search terms described in subsection 4.2.1 aided in finding both social acceptance frameworks that are not context specific, as well as some very context specific frameworks. The resulting list of 15 frameworks has a great variety of styles. Many frameworks have different characteristics serving different purposes and research goals. The results of this literature study, which included visualisations and other miscellaneous information that did not particularly match with the structure desired from Binder's framework can be found in appendix B.1.

In the end, the frameworks still need to be comparable. To achieve this, the description of each framework is formatted to answer several defining questions. A study by Binder et al. (2013) states several of such questions, which are used in this study. Especially the structural analysis criteria which they describe is valuable. Some of the questions presented below have been formulated to analyse the core functionalities of the frameworks which allow for a comparison on a functional basis. On the other hand, there are also questions (based on the work of Binder et al. (2013)) that analyse the societal levels at which the framework operates that provide a more in-depth view. By combining both aspects, a complete picture is generated that facilitates a meaningful overview of the frameworks and a well-grounded basis for comparison. The defined questions are identified with a leading keyword. In the framework analysis depicted in table 6.1, only the keywords are used. The overview in subsection 4.2.2 provides a detailed explanation of the questions and corresponding keywords.

Appendix B.2 displays the same 15 frameworks in identical order, but this time structured by the criteria of Binder's framework. An overview of this appendix can be found in table 6.1 below, which repeats the highlighted key points of all criteria in the appendix. The full names of the frameworks can also be found there, while the table below uses their respective acronyms. The frameworks are presented in alphabetical order.

Framework	Purpose	Target	Process	Problem owner	Levels
AHP	Facilitate shared decision making	Experts of various fields	Evaluation and discussion of a structured problem statement	Experts in the related fields	Micro
CTA	Shape the development phase of new technologies	All relevant stakeholders	Excels in interaction between inside and outside experts, relative to the technology that is being developed	Technology developer	Macro ↔ Micro
DSA	Adequately represent all three aspects in technology development	Consumers of renewable energy / local affected communities	Implementing the public's interest into the development of new renewable energy technologies	Project manager	Macro
ESTEEM	Prevent social opposition to technological projects	People living nearby planned projects	Preemptively informing affected people and utilising their feedback	Project manager	Micro → Macro
FAF	Offer areas of improvements that increases a funeral technology's acceptability	The general public	Personal values related to death and funerals are analysed and integrated into the framework	Funeral houses	Macro → Micro

FEH	Improve the end-of-life-care provided to patients	People who have reached the final stage of their life	Discussing life closure with medical experts	Medical experts and patients	Micro
HEP-NEP	Make people environmentally aware	The general public	A Likert-scale test of 15 environmental related items	Executing scientists	Macro → Micro
ISWM (1)	Develop an optimal waste system	Influence people's perception	looking closely at the demands of all stakeholders	Waste management group	Macro → Micro
ISWM (2)	Balance the three pillars of sustainability in the context of SWM	Local community	Represent the interests of the local community by integrating them in the development phase	Municipality or waste management group	Macro
MA	Public involvement in waste management	People who will be affected by new waste management	Involving affected people in the development phase	Development department	Macro
SIA	Empowering local communities	those who will be indirectly affected by the new technology	Changing acceptation of local communities by direct involvement in R&D	Project manager	Macro ↔ Micro
SSM	Addressing the socio-political aspects of interventions	Human interactions based on interventions	Analysing idealistic views and comparing these to realistic scenarios	Project manager	Micro → Macro
TAF	Research the acceptance of sustainable technologies	Future consu-mers and/or affected groups or individuals	Research of the likelihood of social acceptance of a sustainable technology	Project manager	Macro ↔ Micro
TPB	Determine the level of a technology's acceptance	Those who will be directly involved with the technology	Studying the three core social factors that influence acceptance	Development department	Macro ↔ Micro
VSD	Account for human values	Direct and indirect stakeholders	Consider which factors do and do not align with the stakeholder values	Product development companies	Micro → Macro

Table 6.1: Overview of the 15 frameworks structured by Binder's criteria.

6.1.2 Social acceptance framework literature overview

Table 6.2 below presents an overview of the identified social acceptance frameworks and the author(s) of their respective articles in the literature. The frameworks are listed in the same order as they are presented in table 6.1. A total of 28 articles were found in the literature from which 15 unique frameworks were selected, along with a methodology to structure these frameworks to allow for a fair comparison.

Chapter	Topic	Author(s)
6.1.1	Structural analysis criteria for frameworks	Binder et al., 2013
B.1.1	Analytic Hierarchy Process - AHP	Hummel et al., 2014 Morrissey et al., 2004
B.1.2	Constructive Technology Assessment - CTA	Garud & Ahlstrom, 1997 Van den Ende et al., 1998
B.1.3	Dimensions of Social Acceptance - DSA	Wüstenhagen et al., 2006
(B.1.3)	(Advocacy Coalition Framework - ACF)	(Wolsink, 2010)
B.1.4	ESTEEM	Cohen et al., 2014
B.1.5	Framework for Alternative Funerals - FAF	Bergen & Van den Hoven, 2018
B.1.6	Family Evaluation of Hospice - FEH	Caserett et al., 2008 Teno, 2005
B.1.7	HEP-NEP	Bechtel et al., 2002 Castro, 2006 Dunlap et al., 2002
B.1.8	Integrated Sustainable Waste Management - ISWM 1	Anschütz et al., 2004 Guerrero et al., 2013
B.1.9	Integrated Solid Waste Management - ISWM 2	Marshall et al., 2013
B.1.10	Methodological Approach - MA	Garnett et al., 2017
B.1.11	Social Impact Assessment - SIA	Gallegher et al., 2005 Joseph, 1999 Price et al., 2000
B.1.12	Soft System Methodology - SSM	Checkland, 1999 Lane et al., 1998
B.1.13	Technology Acceptance Framework - TAF	Huijts et al., 2012
B.1.14	Theory of Planned Behaviour - TPB	Ajzen, 1991
B.1.15	Value Sensitive Design - VSD	Friedman et al., 2002 Taebi et al., 2014

Table 6.2: Results of the literature study applied in chapter 6.1.1.

6.2 Framework selection

In the literature review of section 6.1, fifteen different social acceptance frameworks have been listed. In this chapter, the most interesting elements of these frameworks are collected. These elements do not yet have to form a cohesive framework, as the adjustment and combination of these elements will happen in sections 6.3 and 6.4 respectively.

6.2.1 Selection criteria

The criteria by which the frameworks in section 6.1 are selected should reflect the goal of this study to develop a framework suitable for researching the social acceptance of circular funeral technologies. In order for a framework to be suitable for the funeral industry, it must comply to certain characteristics, which are formatted identically to the description in subsection 4.2.2.

Purpose: As many (quasi-)circular funeral technologies have not yet been fully developed for societal application, there are still many aspects that can be changed before they are eventually legalised and put onto the market. Therefore, a framework that analyses the values and norms of society and translates that data to design criteria would be preferred.
Target: The target of the social acceptance framework should be the general public. It is the public who will be confronted with the technology once it has been implemented, but they are also the potential future customers who have to choose a funeral technology.
Process: The integration of values that are representative of the public into the development of a new technology is a crucial part of the new framework. Adapting the technology to the demands of its users limits their need to adapt, which increases the likelihood of the success of the technology.
Problem: The problem owner is preferably an organisation (or representative thereof) which is experienced in involving the public in sustainability schemes.
Levels: Because of the difficulty of developing for something as personal as death care, presence of aspects of the societal micro level is a necessity. On the other hand, many values are based on culture and are shared amongst larger communities, which is strongly tied to the macro levels. An interaction between both levels would be preferential.

6.2.2 Literature input for framework development

Based on the criteria defined above, a list of frameworks suitable for application in the funeral industry has been selected. Some of these frameworks had already built onto the work of other researchers, which are also listed. Therefore, a few frameworks are used indirectly because they are integrated into those that have been selected. Frameworks that are used indirectly this way will not be further analysed, but will to a varying degree be present in the final framework. The complete list of frameworks that are included both directly (primary frameworks) and indirectly (secondary frameworks) can be found in table 6.3. Only the frameworks with the highest potential for successful use in the funeral industry have been listed and are further analysed in this chapter.

Primary framework	Chapter	Secondary framework	Chapter
Constructive Technology Assessment	B.2.2		
Technology Acceptance Framework	B.2.13	Theory of Planned Behaviour	B.2.14
Framework for Alternative Funerals	B.2.5	Value Sensitive Design	B.2.15

Table 6.3: Overview of theories and frameworks incorporated in this study.

6.2.3 Elaborating the Constructive Technology Assessment (CTA)

The CTA framework seems particularly useful for this study, as it focuses on socio-technical problems that operate on a multi-level dynamic landscape (Rip & te Kulve, 2007). Furthermore, the method is applicable to a technology that undergoes a change in the function, form and use (Schot, 1992). All these characteristics are applicable to the funeral industry. Furthermore, a wide range of actors is involved in the industry, and the decision-making process of these actors needs to be socially robust (Genus, 2006). This is achieved through the inclusion of relevant societal actors. The aim is to create an optimal balance between societal and technological developments. Through CTA, actors are aligned to develop joint strategies to find solutions for a shared problem.

By broadening the scope and including more actors, the decision-making process of technological developments is shaped towards more socially desired directions. The extended range of actors is subdivided into two categories: inside and outside actors (Van den Ende et al., 1998). Insiders are researches already dedicated to the development of technologies closely related to the innovation. Outsiders, on the other hand, are professionals who help to progress the technological innovation through other means than direct involvement in the development. They can for example finance, promote, or manage the required legislation for the specific technology. Both groups of perspectives result in the creation of cycles, which strongly vary in dynamics. Insiders create so-called enactment cycles, which result in a surge of new trajectories. On the other hand, outsiders create selection cycles which result in a diminishing rate of trajectories (Van den Ende et al., 1998). Although insiders and outsiders usually interact amongst themselves, there are moments in the development phase of new technologies in which they interact with each other. It is then, that insiders get to influence the pool of knowledge that outsiders utilise as basis for their selection cycle. Additionally, during meetings between insiders and outsiders, outsiders make decisions that (re)define their assessment approaches which are used to direct the development of technological changes (Garud & Ahlstrom, 1997). The framework is visualised in figure 6.2.

6.2.4 Elaborating the Technology Acceptance Framework (TAF)

As established previously, the framework by Huijts et al. (2012) is designed with sustainable energy technologies in mind, but can also be utilised for other new technologies. As a framework for social acceptance, it aims to gain insight into the likeliness of people to act against or in favour of new technologies. This decision is influenced by both social and personal norms, perceived behavioural control and the person's attitude towards new technologies in general. The attitude is further influenced by the person's perception of involved costs, risks and benefits. Furthermore, the person may have (either positive or negative) feelings about the technology, (dis)trust in the developers, and a view of (un)fairness of procedural and distributive aspects. A person's norm is influenced by outside factors such as the perceived risks and benefits, associated costs and general (estimated) effectiveness of the project. Another influential aspect is the person's awareness of potential negative consequences of *not* accepting the technology.

All these factors are taken into account in the framework as presented in figure 6.3, but their individual relevance will need to be considered for the custom framework. It is possible that some of these aspects play a more significant role in the funeral industry than others. Once it is known which physiological factors are most important to the funeral industry, the development, communication and implementation of circular funeral technologies can be developed accordingly.

The presented framework, as based on its corresponding literature, limited itself to only include psychological factors. It is conceivable that other aspects, such as individual traits and situational factors, also influence the acceptance of new technologies. It is assumed that these factors are indirectly applied through the variables already included in the framework. Simultaneously, the model can be utilised to analyse which of the described factors have the most influence on the acceptance and acceptability of new technologies.

6.2.5 Elaborating the Framework for Alternative Funerals (FAF)

The FAF by Bergen & Van den Hoven (2018) is developed to assist in the decision-making procedure of legalising new funeral alternatives, as is visualised in figure 6.2. In order to determine whether a new funeral alternative is ethically acceptable, numerous values associated with death care are analysed from the perspective of both direct and indirect stakeholders.
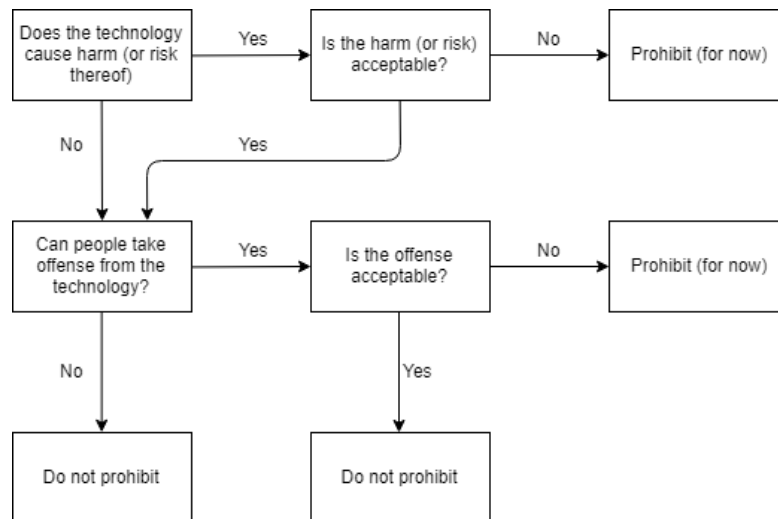
Figure 6.2: Decision hierarchy for the legislation of alternative funeral technologies (Bergen & Van den Hoven, 2018).

Based on the list of direct stakeholders from Bergen & Van den Hoven (2018), a new list of stakeholders has been developed for this study that focuses less on the professional and development aspects of funeral technologies and more on societal aspects. See table 6.4.

Stakeholder	Important interests
The deceased	Continuation of the person's interests during life.
People planning their own funeral	Freedom of choice. Finding a funeral technology that is in line with personal values.
Next of kin	Respectful farewell, befitting for the deceased. Possibilities for mourning. (economic) Costs.
Family and friends	Respectful farewell, befitting for the deceased. Possibilities for mourning.
Religious and philosophical organisations	Respect for religious prescriptions. Post-mortem wellbeing of followers.
Unaffiliated citizens	No conflicts with actor-neutral values (see table 6.4) that can be perceived as offensive.

Table 6.4: Stakeholders and their interests when choosing a funeral. Based on Bergen & Van den Hoven (2018).

The study utilises a list of values that concern the funeral industry which was already established by Thynes, et al. (2015). Thynes, et al. utilised the Value Sensitive Design method (see appendix B.1.15) to develop this list. Bergen and van den Hoven reformatted it into a table, dividing each value into either the actor-neutral or actor-relative category. They implemented another categorisation step which distinguishes between concrete, social, identity-driving and idealistic values. See table 6.5.

Actor-neutral values	Actor-relative values
Concrete values	**Identity-driving values**
Sustainability	Environmentally friendly
Health	Spirituality
Cost effectiveness	Cycle of life
Social values	**Idealistic values**
Autonomy	Reverence
Dignity	Ritual
Respect	Peacefulness
Community	Cleanliness
Connectedness	Beauty
Family	Nature
Religious freedom	Authenticity
Accessibility	
Inclusivity	

Table 6.5: actor-neutral and actor-relevant values in the funeral industry. Based on Bergen & Van den Hoven (2018).

Each person has a different value hierarchy and interprets a given scenario differently. What some may consider to be a 'respectful' method because it acknowledges the 'cycle of life', may be considered as 'disrespectful' because there is no 'dignity' for the corpse by others. Each funeral technology will always have its positive and negative aspects, perceived by different groups of people. No alternative will ever be satisfactory to everyone. As this project aims to increase the social acceptance of novel funeral technologies by the general public, with the idea to familiarise them with circular funeral methods before they must make a decision for themselves or a loved one, the actor-neutral values (left column of table 6.3) are most important. These values should be (partially) reflected in the final framework, but no specific value is more important that another.

6.3 Evolving the frameworks to reflect the funeral industry

In this section, the three chosen frameworks are adjusted to better reflect the funeral industry. As the goal of this study is based on qualitative research, the new framework is to support this approach. Although the selected frameworks are mostly already supporting qualitative research, some quantitative aspects may still need to be replaced. General terms that may be used in the original frameworks are specified to be more in line with this study and to better reflect the funeral industry. Binder's framework will act as a guideline for these adaptations. When considering the criteria provided by Binder's framework, the 'purpose' and 'process' criteria are particularly interesting to apply to the development of the new framework.

6.3.1 Evolving the Constructive Technology Assessment (CTA)

A visualisation of the framework, as presented by Garud and Ahlstrom (1997), is provided below in figure 6.3. The insider category of the CTA is originally described as the researches directly involved in the development of a new technology. Outsiders in the CTA are other professionals who are somehow related to the project, be it for financial, legal or other reasons.
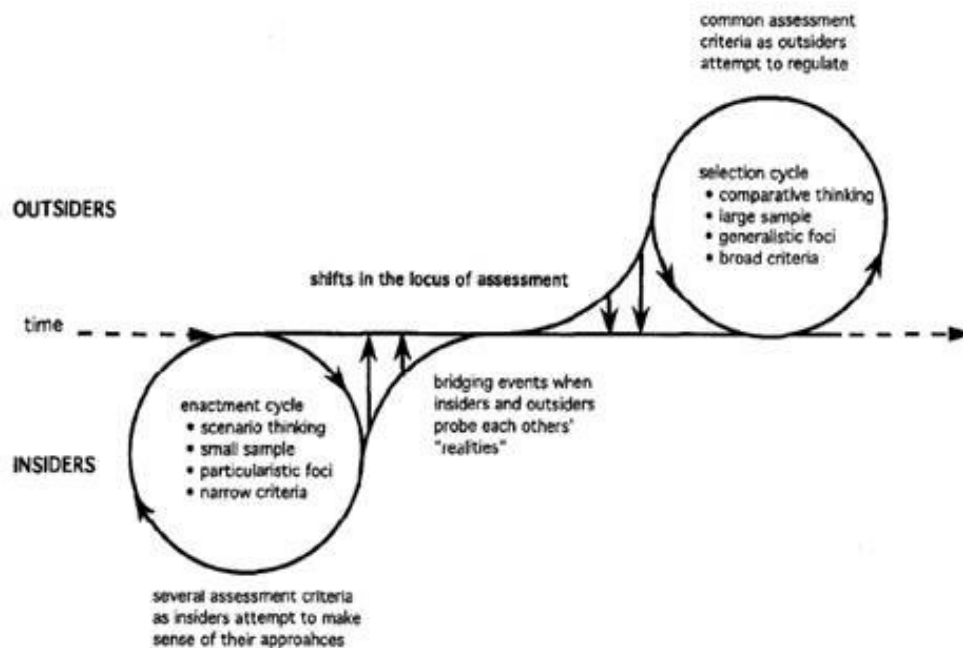
Figure 6.3: Framework of the Constructive Technology Assessment method (Garud & Ahlstrom, 1997).

In the case of circular funerals, the technologies are mostly already developed. It is the integration of these technologies in society that proves to be challenging. To accommodate this new purpose, the following shift in the role of insiders and outsiders of the framework is proposed:
Insiders are everyone involved at the professional side of the funeral and its organisation. The public, or in other words, those who look for (advice about) available funeral technologies will take the place of the outsiders group.

As a result of this adaptation, the enactment- and selection cycles will also change to some extent. The role of the insiders, who are responsible for the enactment cycle, is expanded with occupations previously related to professional 'outsiders'. Aspects that characterise consumers of funerals are added to the new outsiders' selection cycle.
The enactment and selection cycles describe the views and available methods insiders and outsiders respectively have towards the development of new technologies. As the represented groups of people functioning as in- and outsiders is adapted for this study, so are their views on technology development. The changes to both cycles are further analysed in tables 6.6 and 6.7.
A distinction is made between elements present in the old CTA that have been removed, elements that are present in both versions of the framework and elements that have specifically been added for the adapted version.

The bridging events will remain relevant, as the new insiders and outsiders continue to meet, discuss and exchange feedback. Recommendations as to how the bridging events can be organised in the new scenario can only be made once the funeral industry and its respective values have been thoroughly analysed. See chapter 9 for further information regarding the bridging events.

The new enactment cycle - assessment criteria for insiders: now includes all experts related to all (including but not limited to development, financing and legal) aspects of new funeral technologies.

Removed elements of the enactment cycle	Copied elements of the enactment cycle	New elements of the enactment cycle
Overly positive attitude towards the new technology	Small scale: fill a niche role in the funeral industry	Realistic view of costs, benefits and risks
Holistic view of the technology	Integration of feedback from outsiders	Developing the technology with society in mind
Narrow criteria	Enthusiasm to convince others	

Table 6.6: Changes made to the enactment cycle.

The new selection cycle - assessment criteria for outsiders: is now represented by the non-expert stakeholders, most notably the general public.

Removed elements of the selection cycle	Copied elements of the selection cycle	New elements of the selection cycle
Comparative thinking	Realistic approach, society driven	Uncertainty about new alternatives
Generalistic foci	Broad criteria	Large diversity of interests and preferences
		Large diversity in knowledge and experience

Table 6.7: Changes made to the selection cycle.

The process criteria of the CTA framework remain mostly unchanged, in which two groups of actors interact through bridging events. In these events, insiders share their knowledge with outsiders, while outsiders provide useful feedback about their experiences to insiders (Garud, Ahlstrom, 1997). Communication between both groups remains important, but the composition and tasks of both respective cycles has changed. Rather than being moments in which professionals discuss amongst themselves, funeral experts now communicate their knowledge with customers who are most likely inexperienced in the funeral industry. Therefore, clear communication during these bridging events is even more important. In the original CTA, communication between insiders and outsiders was mostly on direct, verbal basis. In the new scenario, insiders will only directly meet outsiders when a funeral is being arranged (or information therefore is requested). Because funeral homes have direct contact with potential customers in these moments, feedback about the technology can be collected. Indirect communication will take place when customers (outsiders) read or hear about alternative funeral technologies (developed by insiders). The specific content and frequency of this one-way communication is in control of the insiders group and needs to be managed carefully to achieve a desired effect. Indirect communication with the customers is more meaningful as a means to provide them with information, which stimulates communication with the insiders which eventually happens when a funeral choice needs to be made.

6.3.2 Evolving the Technology Acceptance Framework (TAF)

Just like the CTA, the TAF also requires some adaptations to adjust it to the funeral industry. Whereas the CTA focused on two groups of people, the TAF is directly aimed at analysing the social acceptance by the public. The original framework (Huijts et al., 2012) is presented below in figure 6.4.
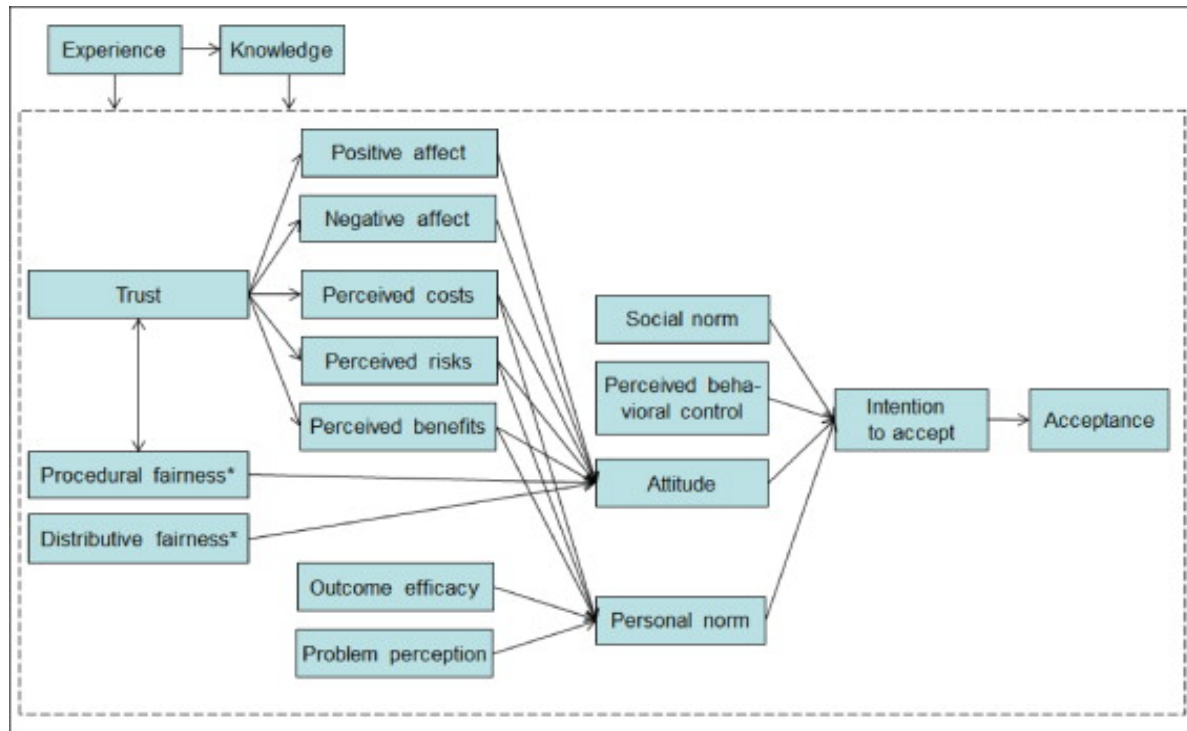
Figure 6.4: Complete schematic representation of the technology acceptance framework (Huijts et al., 2012).

Generally speaking, the TAF describes the acceptance of people to the development and construction of technologies which are potentially harmful to nearby citizens. The effect of location is not necessarily an issue for the acceptance of sustainable funeral technologies. Location is indirectly measured in the framework through other elements. The perception of costs, risks and benefits, for example, are greatly affected by distance. The potential harm that a funeral technology can cause is unlike that of a power plant not in a medical or physical way. One can, however, be psychologically harmed because the new funeral technology conflicts with one's values.

Considering Binder's purpose criteria, nothing should change in the TAF. The goal of analysing the social acceptance of new technologies should remain, although the studied technology is different. The process criteria will see a lot more change. The original TAF features some elements that are not particularly relevant for the death care scenario, whereas others are integrated with aspects from the remaining two frameworks.

As the elements in the framework are to some extent already grouped, it makes sense to analyse these groups one by one. Experience and knowledge are relevant factors regardless of the technology the framework is applied to. In the case of this study, the experience and knowledge is naturally related to funeral technologies, their characteristics and the process of choosing one. Because the TAF covers a lot of relevant parameters that influence social acceptance, it serves as an excellent basis to develop the custom framework around. The elements are clearly grouped, which makes it easier to change and rearrange the clusters or add a new one. This is appealing when considering the goal of integrating multiple frameworks into one. The elements that are discussed below and presented in bold are included in the TAF.

Experience and knowledge are part of the TAF as external forces on the social acceptance. Although this will still be the case in the new framework, they are integrated elsewhere to put more emphasis on the origin of these factors.

The procedural and **distributive fairness** boxes can, in the context of funerals, be explained as the process of analysing the available options all the way to making a final decision. The fairness of this process could be the degree to which each alternative has received equal attention. However, funerals are a very personal subject, heavily influenced by culture. Therefore, not all people may have equal interest in all available options. The degree to which funerals are 'fair' is hard to judge.

Trust in the executing party is still a relevant aspect, although it should be safe to presume a funeral home is the right organisation to choose a funeral. However, prices of different funeral technologies can vary greatly among different funeral homes. Although risks are not necessarily something to worry about when choosing a funeral alternative, there are enough other distinctive factors that push or pull people to certain alternatives. The previously identified factors from the FAF will come in use to model this in the new framework.

The positive and **negative affect** are of less importance in the funeral scenario, as every funeral technology ultimately affects a person equally: controlled disposal of the body. The precise method with which this happens is described through other factors within the framework.

The elements that make up the Theory of Planned Behaviour (**social norm, perceived behavioural control** and **attitude**) will remain in the framework. After all, this study aims to find out how the (introduction and presentation of the) technology can be changed to be more in line with the (expected) behaviour of people. If the alternative funeral technology is changed or adapted to align with the behaviour of the general public, they are more inclined to accept the technology.

The **outcome efficacy** and **problem perception** that influence the **personal norm** can, in the context of funeral technologies, strongly relate to the time it takes to 'process' the body, the potential to recover resources and social (ethical) problems surrounding the technology. Where circular funeral technologies suffer from a 'cultural shock', linear technologies suffer from a higher environmental footprint (Keijzer, 2012) (van der Burgh et al., 2017). The extent to which people include this in their choice for a specific funeral technology has more to do with their perception of these factors than the actual effectiveness of the technology. Therefore, the outcome efficacy is removed from the custom framework.

6.3.3 Evolving the Framework for Alternative Funerals (FAF)

As the FAF is already designed for use in the context of funerals (Bergen & Van den Hoven, 2018), no further adjustments are needed. It is worth to consider where the identified factors of table 6.4 can be integrated into the TAF, which is used as a basis for the new framework. As previously described, four main categories (concrete, social, identity-driving and idealistic values) are identified, which all need to be placed into the framework. As the TAF consists for the most part of element-clusters, the approach to integrate the elements of FAF is adding to, or replacing FAF value categories with, the clusters in the TAF.

6.4 Combining the adjusted framework elements

Each of the three chosen frameworks has its unique characteristics which need to be represented in the custom framework. The CTA offers a unique view on the interaction between insiders and outsiders which explains how knowledge and experience is shared between both groups. The TAF shows what information is used by people to form an image about a certain technology. The FAF binds all these elements together into the funeral scenario. Ideally, all these aspects are inter-connected and combined into a single framework.

6.4.1 Integration of the frameworks

The experience and knowledge factors, that externally influence the social acceptance in the TAF, have a similar role to the bridging events from the CTA. As insiders pass information onto outsiders, they begin to influence their views and ultimately their decisions. As the TAF previously made no distinction between 'insiders' and 'outsiders', it can be assumed that the TAF in its entirety takes place in the domain of the outsiders.

The domain of the insiders remains largely unexplored, as they have no direct impact (other than providing information, which is already incorporated through the bridging events) on the decision-making, and therefore on the social acceptance, of the outsiders. Instead, the insider's domain showcases a brief overview of their key tasks that lead to both a demand for and availability of information. The descriptions in the bridging events include some (but are not limited to) of these exchanges of information. Bridging events on the left (coming from the insiders) describe the information that insiders have to offer and is sought after by outsiders, whereas bridging events on the right (coming from the outsiders) describe information that outsiders have to offer or is sought after by insiders.

As the domains of the in- and outsiders are visualised circular patterns, information can travel through these cycles to the other party, where it can be utilised and returned through new bridging events. New information can be processed by its respective cycle to create valuable content for future bridging events, thus continuing the loop. This principle works in both directions.

6.4.2 Element replacements

The first of the four values determined by the FAF are the concrete values, which include sustainability, health and cost effectiveness. These values align well with the original factors of perceived costs, risks and benefits and have replaced them in the new framework.

The second set of values are the identity-driving values, which have also replaced an element from the TAF, namely problem perception. Problem perception is a broad term, which involves many different aspects. How one perceives something is not only a matter of what you look for, but also how you interpret it. For this reason, the identity-driving values as presented in the FAF will replace the problem perception in the new framework.

The third value category of the FAF is the social values. These are a perfect replacement for the social norms, which was a category in the old TAF, as they describe the same thing.

The last set of values described in the FAF are the idealistic values. As these, similarly to the social values, describe actor-relative values, they serve a similar role to the personal norm as presented in the TAF. See table 6.8 for a compact overview. By replacing individual factors from the TAF with value clusters from the FAF, the structure and connections between the elements is maintained. This is important, as it helps to visualise that the described values do not influence the social acceptance independently. Many values have shared connections and are influenced by each other. This is also supported by the ideology of the CTA framework, which describes the complexity of social values in technical system when many actors are involved. Ultimately, values from frameworks designed for different contexts are interchanged. Chapter 11, discussion, offers more insight into this choice.

6.4.3 The custom framework for social acceptance in the funeral industry

When combining all aspects that were discussed in sections 6.4.1 and 6.4.2, the new framework can be constructed. This section will describe the three parts of the new framework. The visual approach of the original CTA framework is maintained. The enactment- and selection cycles are still connected by bridging events, but the content within the loops has changed considerably.

The selections of the outsider-, and insider cycles as well as the framework in its entirety will also be presented in appendices B.3, B.4 and B.5 respectively. It must be noted that these visualisations serve as support to understand the underlying interactions. The visualised framework is by no means a definitive solution. This framework merely aims to provide a guideline when researching the social acceptance of circular funeral technologies, something that was non-existent in the literature before. The most important aspect of the new framework is the adapted selection cycle. Additionally, it displays the outsider's half of the bridging events, which provides user feedback for the insiders upon which they can base the development of future technologies. Both elements are previewed in figure 6.5, whereas a full-size image is included in appendix B.3. The interactions and flows within the selection cycle are strongly based on the TAF, but four new value groups can be identified. These groups represent the four types of values (concrete, social, identity-driving and idealistic) as presented in the FAF. Each cluster of values has substituted a part of the original TAF framework. The colours in the second column correspond with the colours applied in the framework visualisation. An overview of the applied replacements can be found in table 6.8 below.

Original TAF element(s)	Substituting FAF values
Perceived costs, risks and benefits	Concrete values
Social norm	Social values
Outcome efficacy, problem perception	Identity-driving values
Personal norm	Idealistic values

Table 6.8: Overview of applied TAF element(s) replacements with FAF values.
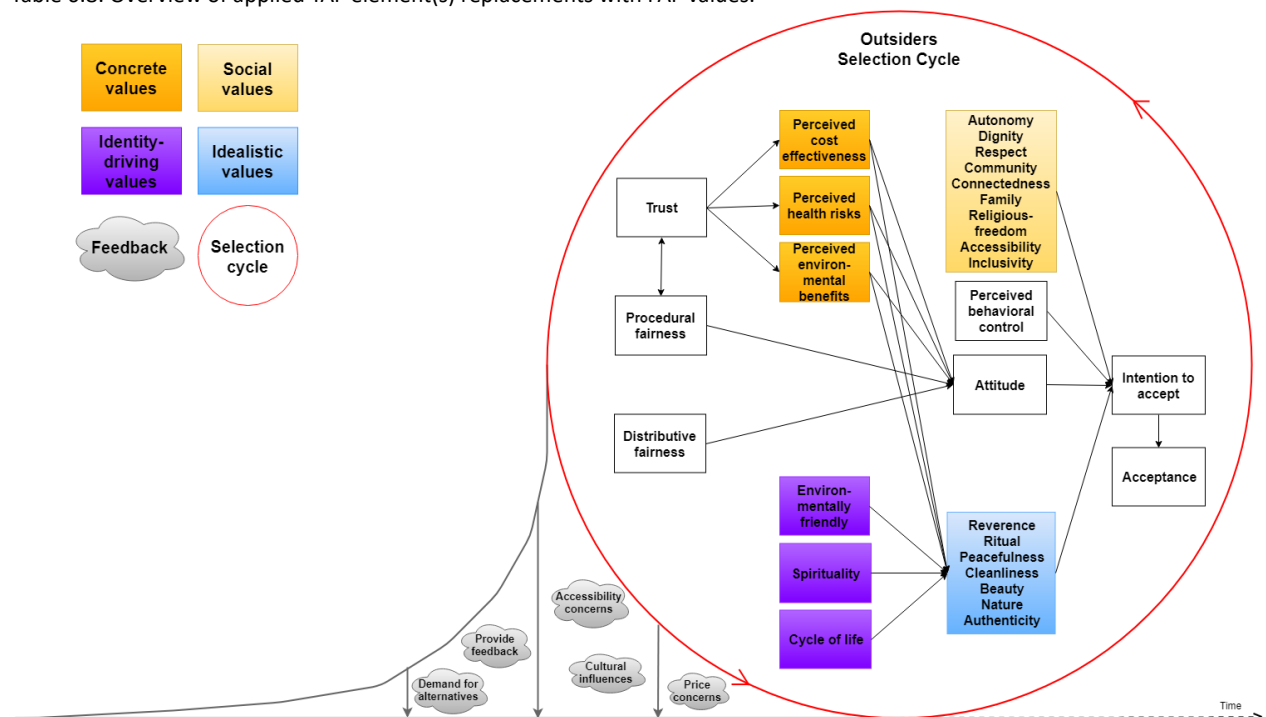
Figure 6.5: Preview of the selection cycle of the new, custom framework for social acceptance in the funeral industry.

The extent to which the exchange of values from frameworks which were developed to operate in different contexts is academically justifiable, is further elaborated in chapter 10: discussion.

Within this study, the enactment cycle is of lesser importance as it focuses on the experts of the funeral industry. The goal of the study is to research the social acceptance of the general public, which lends itself to the selection cycle. Nevertheless, the enactment cycle is further detailed to create a more accurate image of the complete custom framework.

The new enactment cycle is previewed below in figure 6.6. A larger version can be found in appendix B.4. Inside the loop is an overview of the tasks of, and interactions between, the combined expert groups. Not only is the shared pool of experts responsible for the development of new technologies (visualised by the yellow boxes), but also for executing funerals with the current alternatives and resource management to do so effectively. Some of these tasks, such as financial management of current alternatives and marketing analyses for future technologies, have a shared pool of knowledge.

Ultimately, the two main branches of tasks lead on the one hand to a demand for information from, and on the other hand a source of information for the users. Possibilities for exchange of information are provided through bridging events. This framework has been updated to give some examples of what information is offered by the insiders, and during what occasions this happens.
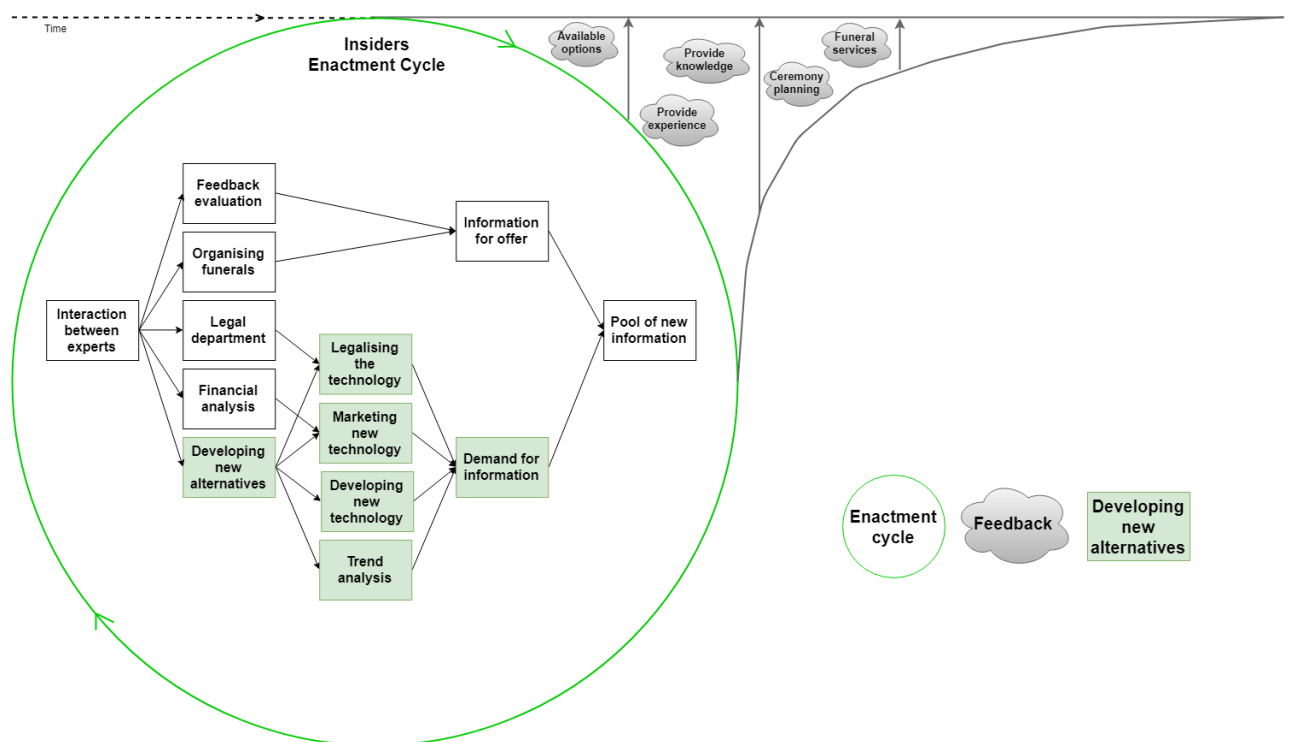
Figure 6.6: The enactment cycle of the new, custom framework for social acceptance in the funeral industry.

When the insider and outsider cycles are combined and their respective bridging events connected, the complete framework is created. Figure 6.7 provides a preview of the custom framework for the social acceptance of (quasi-)circular funeral technologies. A larger version of the framework can be found in appendix B.5.
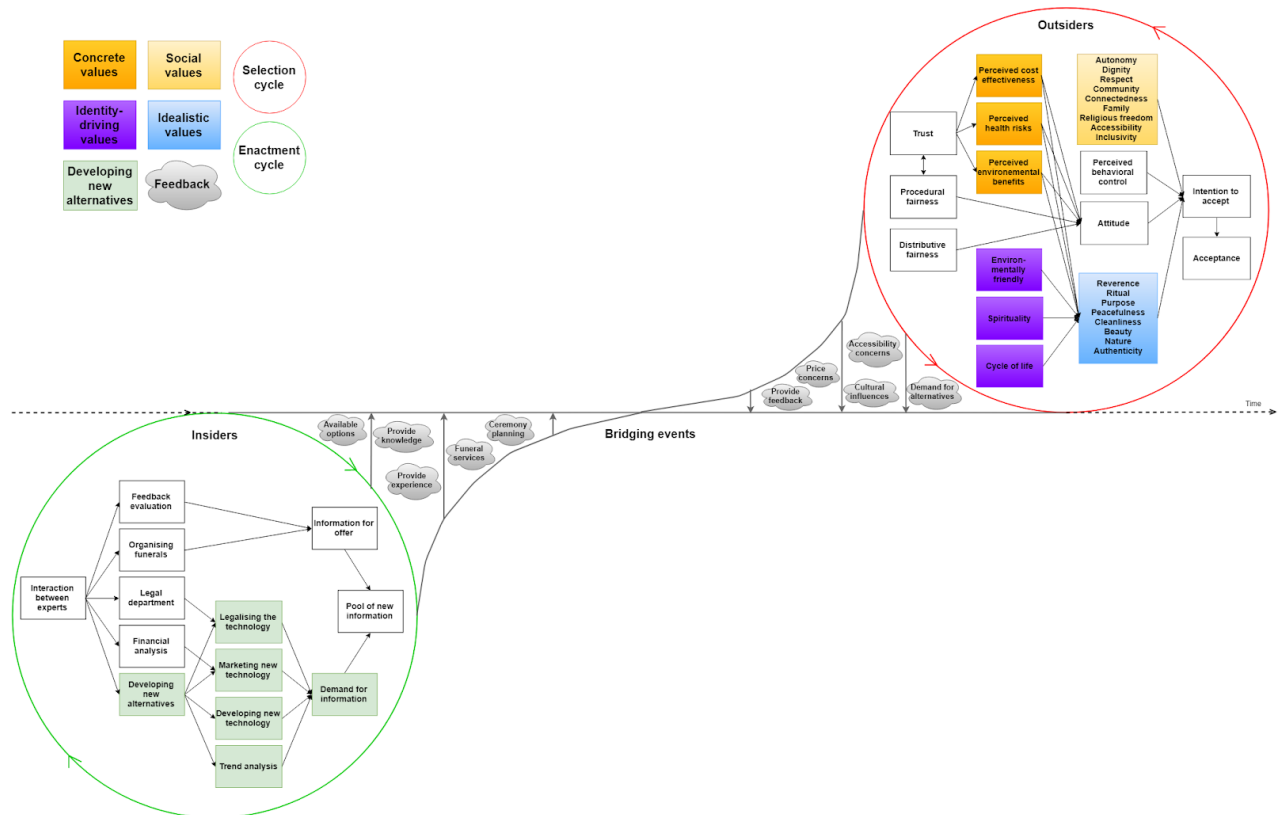
Figure 6.7: The new, custom framework for social acceptance in the funeral industry in its entirety.

As can be seen in figure 6.7, the original structure of the CTA framework has remained. The content inside, however, has changed significantly. The individual aspects of all three frameworks are still recognisable, albeit occasionally interchanged by elements from other frameworks. Despite the change of content within the cycles, the principles of the original CTA framework still remain important for the new scenario. Especially the context of a technology that undergoes changes in form, function and use (Schot, 1992) relates well to the changes the funeral industry needs to make in order to become (quasi-)circular. Furthermore, the decision-making process of the actors involved in both waste management as well as death care needs to be socially robust (Genus, 2006).

Each of the original frameworks contribute partially to the goal of researching a new scenario in their own respective context. Although the values described in these different contexts are not directly interchangeable, it was decided that it would provide an interesting approach to this study which could yield fascinating result, as insights from different theoretical perspectives could be combined to create new research opportunities. Furthermore, the combination of aspects from multiple fields of study and their respective theoretical starting points does work well for a complex topic such as death care, as it already touches ground with many aspects within society. The figures in which the custom framework is depicted serve as a visualisation tool to provide an overview of the involved values and are by no means a definitive solution that justifies the integration of the theories.

The custom framework, specifically the selection cycle highlighted in figure 6.5, was used during the case study interviews in chapter 7. During these interviews, the framework served as a checklist to ensure all involved values were discussed. The data that was acquired through these discussions, could then be used as input for the framework. This process was repeated for each of the waste management case studies. The impactfulness of each of the values can be found in tables 7.1-7.5. Although no direct suggestions were made for the organisation of new bridging events, enough data was found which could be used for this purpose. This would, however, require a new CTA study, which was beyond the scope of this study. It would make for an interesting future research topic.

6.5 Conclusions

This chapter presents the process of developing the custom framework that is used in the next chapters to study the social acceptance of (quasi-)circular funeral technologies. The first step towards the development of the framework was a literature study on currently available frameworks for social acceptance. From these already existing frameworks, the elements which are deemed to be most applicable to the funeral industry are selected and used to develop a new, custom, framework. This framework is specifically made to research the social acceptance of (quasi-)circular funeral technologies. Through this method, the following research question is answered:
Which pre-existing frameworks describing social acceptance are available in the literature, and to what extent can they be adapted and combined to better reflect the funeral industry?

Through an elaborate literature study, a list of fifteen potentially useful frameworks was established. A framework based on the work of Binder et al. (2013) was applied to provide structure to the collected frameworks which were formatted differently. After compiling a list of fifteen comparable frameworks, Binder's criteria were applied to extract the three most applicable frameworks. These criteria consist of the purpose, target, process, problem and level at which the frameworks operate. The following three social acceptance frameworks were chosen (in order of appearance):
the Constructive Technology Assessment (CTA), the Technology Acceptance Framework (TAF), and the Framework for Alternative Funerals (FAF).

After a brief explanation about the desired elements of each of these three frameworks, these elements were adjusted to better represent the unique demands of the funeral industry. Some parts of the frameworks were taken out entirely, or replaced with elements more befitting the funeral industry. Two of Binder's criteria (purpose and process) were used to make these adaptations. Finally, the three individually adapted frameworks were combined into the final, custom framework for the social acceptance of circular funeral technologies.

Ultimately the new framework will act as a guideline when studying this research field. It lists many factors from various social study origins, providing a diverse and well-grounded checklist of factors that influence the social acceptance of the general public. The visualisation of the framework provided in figure 6.7 (and appendix B.5) is only a tool to visually structure the framework. It is by no means the 'definitive' order in which the values affect each other. The relative position of the values does not make one more important than another. They should all be considered when applying the framework in the context of sustainable funeral technologies, similarly to the idea that none of the originally applied frameworks is more important than the other. Specific elements of each framework have been chosen for their contribution to the field of social acceptance studies. Through the combination of the three frameworks, a complete overview is created with values that affect each other and ultimately the social acceptance of a new technology. CTA provides insight in how to affect decision-making processes by actors in technologies that are heavily affected by social factors, TAF represents a general model of the aspects that impact the social acceptance of a new system by the public, and the FAF specifies which values are most relevant in the field of death care.

This framework is further explained in subsection 6.4.3. At this point, the framework has not yet been applied. It will be tested through a set of case studies which is further elaborated in chapter 7.

7. Social acceptance of waste management systems

By utilising the custom framework that has been developed in chapter 6, examples of applied circularisation methods in the waste management technologies chosen in chapter 5 are analysed. These circularisation methods are cases that have been previously applied and are well documented. The cases should give insight into both the state prior to and after the application of the circularisation methods. Ideally, details about the applied technology which help with input of the framework are also documented.

Figure 7.1: Research goal of this chapter in relation to the complete study.

It is important to realise that the goal of this chapter is not to find the case that described the highest advancement in circularity, but rather a case that provides insight into changes of the social perception the technology went through. This chapter answers the following research question:
3) *What type of factors in the successful introduction of circularisation methods in the chosen waste management systems influenced the social acceptance according to this specialised framework?*

In order to answer this question, the research is divided into smaller segments. As was established in chapter 5, in-vessel composting and the sorting and recycling of mixed MSW flows are the waste management systems that share the most similarities with funerals. A representative case study is selected for each of these systems to further analyse the social acceptance of the applied circularisation methods in these industries. Through these cases, data is gathered which can be used in the new social acceptance framework for circular funeral technologies. Through a comparison between old and new scenarios in the chosen waste management sectors, the factors that contribute most to the social acceptance can be identified through the framework.

7.1 Waste management case studies

Through a literature study, suitable cases needed to be found that represent the composting and MSW sorting and recycling waste management technologies. This section provides more insight into the literature study that was performed to find them and why the selected cases are deemed viable.

7.1.1 Composting case study selection

In-vessel composting is the first of two waste types whose circularisation activities and their effects on its social acceptance are analysed. A literature study has been performed to find a suitable case where in-vessel composting was applied. Unfortunately, most literature was specified towards the technological and economical aspects of composting. Examples of such studies were the determination of an appropriate bulking agent, achieving the correct Carbon : Nitrogen levels, the amount of required airflow and the general recommended duration of the composting process. The economic studies analysed the initial investments, running costs and potential profits by selling the finished compost. Some of the studies also looked into potential markets to sell the final product to, which does touch grounds with social aspects as well. A more specified literature study was conducted, the details of which can be found in methodology sub-subsection 4.3.1.1. Case studies of in-vessel composting get a lot less public exposure than cases of MSW management, which resulted in finding considerably less suitable cases from this literature study.

As a result, the search queries were broadened to include more composting technologies than just in-vessel composting. This resulted in some acceptable case studies, but the organisations behind the cases of composting (NVRD, 2018) (Van Vliet, 2018) were unavailable to help with this study or offer further insights into the social acceptance of their respective processes. A new approach was needed to get into contact with a composter who was willing to invest time into this study.

As research on the MSW case study was running parallel to that of the composting case, the chosen MSW case study of ROVA was willing and able to also provide insights into their composting facility (see subsection 7.1.2). This installation, which manages the municipal organic waste of the area around Zwolle functions as both a composting as well as a fermentation installation. The applied composting technology in this facility is comparable, but not identical to that of in-vessel composting. Considering the similar technologies and the additional sustainable benefit of the fermentation process, the case is deemed viable to use as case study.

7.1.2 MSW sorting and recycling case study selection

The literature study, which was conducted to find a suitable MSW collection case study, focuses on the general characteristics of the material flow property of MSW, not so much on the fact that the waste is collected and treated by the municipality. Municipalities do, however, have a good record of documenting changes made to their waste management systems. They can use the documentation of a successful waste treatment program as a marketing tool to attract new companies and residents to move to that municipality. Successful endeavours in municipal waste management often attract the interest of researchers, who will document these systems in research papers.

To find a suitable case for this waste management system, a literature study (see sub-subsection 4.3.1.2 for details) was performed. Relevant articles found through this literature study were analysed for information about suitable case studies of sorting and recycling of MSW in the Netherlands. Some articles (Cimpan et al., 2015), (Dahlén & Lagerkvist, 2010), (Goorhuis et al., 2012) featured a collection of case studies, whereas others (Van Velzen & Jansen, 2011), (Barr & Gilg, 2005) focused on a single case study. There are also studies (Feil et al., 2013), (Van Velzen et al., 2013), (Bing et al., 2013), (Reichenbach, 2008) that only analyse waste data from specific municipalities, but do not discuss the treatment systems in place, nor describe its social acceptance. Finally, there are more general studies (Wilson, 2007) that don't focus on any specific case or dataset, but rather provide an overview of existing methods. Most articles from the literature study provide insight into the mass flows, system specifications and processing efficiencies, which is not the required information for the framework for social acceptance. One aspect which is strongly related to social acceptance and that frequently appears is the participation rate of citizens. Besides that, the mentioned organisations and companies responsible for the collection and processing of municipal waste are important. Considering the spatial scope of this study, Dutch cases and their related organisations are particularly interesting.

The most promising of the organisations and their case studies found through the study were contacted for further information. One of these companies is ROVA (ROVA, 2018) (Goorhuis et al., 2012). ROVA specialises in municipal solutions for waste management and sustainable living. With their experience in urban areas such as Zwolle and Amersfoort, ROVA makes for an excellent case study.
It is important to note that the collection system of both waste management technologies are combined in a single service for the respective households in that area, as both cases are closely tied and managed by the same organisation. However, the information that was obtained through the two interviews (one for each case) proved that both situations were different enough and featured enough unique aspects to justify acknowledging them as separate cases.

7.2 Case study data acquisition

Data from both case studies was acquired through two means: a set of interviews with a ROVA representative, as well as the report of an independent study of the social acceptance of the reverse collection system which was commissioned by the municipality.

7.2.1 Expert interview composting

As previously mentioned, at the time of analysing the composting case study, the MSW case study had already been completed, including its respective interview with ROVA's client relationship manager Hemmo Hagedooren. Thankfully, he was generous enough to spend more time on a second interview. The structure of the interview was comparable to that of the first interview about MSW, although there was less focus on generic background information of the process as much of that was already discussed. Appendix C.1 shows the the full set of notes which were taken during the interview about the composting case study.

Because Hemmo Hagedooren was more familiar with the goals of this study, the structure of the interview was more closely bound to the framework (which was provided prior to the interview). The old and new organic waste management systems were explained and more details were provided about the development process of the new composting facility and its functioning. The main section of the interview was a discussion about the values of the four clusters in context of the old and new organic waste management system. Similarly to the other interview, more information was available about the relatively concrete values, whereas not all of the more abstract values could be discussed in detail. The interview was successful as new insights were gained into the functioning and undergone changes of the composting process, and the overall data collection for the framework.

7.2.2 Expert interview MSW

A structured format was chosen for the interview about the sorting and recycling of MSW case study, which was conducted with Hemmo Hagedooren. This format was chosen as distinct information had to be collected to serve as input for the framework. Information regarding the surrounding activities of ROVA and the general approach to waste management was acquired through a semi-structured approach. The interview notes can be found in appendix C.5.

During a brief introduction, the general goal of the interview is explained, and the setting is clarified to make sure both parties are on the same page. The first questions serve to ease into the topic, in which Hemmo Hagedooren is asked to describe the MSW management systems from before and after the adaptations made by ROVA. Additionally, some questions are asked about how the involved public reacted to the new system and what their expectations of, and involvement in the development of the redesigned system were.

The next part of the interview is used to gather data for the framework. The four value clusters (as determined in chapter 6) are explained and detailed questions about each of their sub-values are asked. Ultimately, the goal is to find out to what extent the demands and the ideals of the public are met for each category, in both the old and the new MSW management scenarios. Some of the value clusters (such as the concrete and social values) are rather concrete, whereas others (such as the identity-driving and idealistic values) are a lot more abstract. It is expected to be more difficult to obtain data on the abstract values, as they do not always directly relate to MSW management. Generally speaking, the interview was successful, as many questions regarding factors from the framework were discussed and answered, and data for the framework was acquired.

7.2.3 Pilot study survey of reverse collection in Amersfoort

The user survey of the city of Amersfoort is based on the pilot project involving 1000 citizens in the Nieuwland area. Pilots in two other areas are scheduled, but still in their infancy. Therefore, no additional data is available yet. However, Amersfoort wants to completely transition to a reverse collection-based system by 2020. The pilot ran from October 2015 to May 2016. The conclusions from this survey are listed in appendix C.6. Unfortunately, similar research was neither conducted for the waste management system that was used prior to the transition towards the reverse collection system, nor the composting facility.

7.3 Data application in social acceptance framework for circular funeral technologies

The framework, which was developed in section 6.4 and is visualised in figure 6.4, 6.5 and 6.6, provides a list of values that formed the basis for the interviews which were conducted as described in section 7.2. The data that was obtained through these interviews is allocated to the values in the framework. As each waste management system is described by both an 'old' and 'new, sustainable' scenario, the framework is used a total of four times. The four variations are compared to create a complete overview.

7.3.1 Applying the framework for composting

In this chapter, the framework for social acceptance of circular funeral technologies is applied to the composting case study. The four value-clusters, as well as some miscellaneous values, are analysed for both the old and new compost scenario from the case study. The old scenario is characterised by small groups of people with home-composters, whereas the majority dispose of their organic waste through biweekly kerbside collection. The collected waste is either composted or incinerated, depending on the quality. In the new scenario, home-composting has been made redundant through more efficient, centralised treatment methods. In the new facility, organic waste is fermented to produce biogas, while also producing compost.
Appendix C.2 provides an overview of the established values in relation to the two composting scenarios. The data from this table is integrated into the visualisation of the framework for social acceptance of circular funeral technologies. The old and new system can be found in appendices C.3 and C.4 respectively.

7.3.2 Applying the framework for MSW management

With the information gathered from the interview and survey analysis, the social acceptance framework for circular funeral technologies was applied twice to the MSW sorting and recycling case study. The former situation being an old two-bin kerbside collection system, the latter a new reverse collection system introduced by ROVA. The frameworks constructed with these contexts in mind can be found in appendix C.8 and C.9 respectively.

Putting the frameworks of both scenarios next to each other provides some valuable insights into the way people respond to waste management systems. The most noteworthy aspect is that despite an increase of expected commitment and effort, the acceptance of the new system is higher than the old one. Each of the value clusters that influence this outcome are discussed in appendix C.7.

At this point, it can be concluded that the type of factors which the research question refers to are the values present in this framework. Section 7.3.3 will identify which of the values are the most impactful, and therefore, which values are selected as the factors from the research question.

7.3.3 Comparing the waste management systems

Whereas subsection 7.3.1 and 7.3.2 analysed the composting and MSW management systems, further detailed in appendices C.2 and C.7 respectively, the goal of this chapter is to compare both systems. This comparison will identify which values have a high, neutral, or low impact on the social acceptance of these systems. The values, listed in the first column of the tables presented below, are directly taken from the custom framework presented in section 6.4.
This comparative study can be found in table 7.1 to 7.5 below.

All described values have a positive impact on the social acceptance of a system to some extent. However, when looking at these two systems in particular, some were found to be more influential than others. If a value has a high impact on one system, but a low impact on the other, the overall impact is rated as neutral. This impact can be found in the second column of the tables below. All values in these tables that are found to have a high impact in both scenarios are worth looking further into, and are described more in depth below their respective tables.

Finally, the third column in these tables shows the results of the comparative analysis between both waste management systems. A more detailed description of this comparison can be found in appendix C.10. The tables presented below offer a focussed insight, as the four value categories and the miscellaneous values are analysed separately.

Value	Impact	Waste management system comparison
Concrete values		
Perceived costs	Neutral	Communicate the system clearly. Make investments visible to public. Users with intrinsic value towards environmentally conscious behaviour appreciate the reward, those who don't feel like they should be rewarded more.
Perceived health risks	Neutral	More bins results in less waste per bin, which is perceived as cleaner. Better separation results in better management, which is especially helpful for organic waste. Personal disposal schedule of mixed waste stops the need to 'top off' other bins.
Perceived environmental benefits	Neutral	Environmental benefits of waste management take place away from the separation source, which reduces the perceived effectiveness by the public. Environmental benefits need to be communicated by the waste manager or local government.

Table 7.1: Results of the concrete values in the case studies of the chosen waste management sectors.

None of the values from the concrete values cluster were identified to have a high impact on the social acceptance of the sustainable composting and MSW management systems.

Value	Impact	Waste management system comparison
Social values		
Autonomy	Neutral	System complexity leads to more conscious decision-making. Managing organic waste flows has historically been close with humankind. Urbanisation has put a barrier between our connection with nature. New efforts required to relearn waste management.
Dignity	Neutral	Waste is perceived as problem. People will see the value of waste through communication and education. Valuable objects are managed much better. The rate of change of view is not equal for all.
Respect	Neutral	People have respect for systems which are perceived to be successful in relation to the required effort to use it. Communicating results clearly is therefore important to improve this respect.
Community	High	Environmentally conscious users are the first to embrace a new sustainable system. Their effort and enthusiasm radiate slowly to other groups in society. Feedback opportunities and a local spokesperson are important to maintain loyalty. Once a majority is convinced about the system's value, social control is created.
Connectedness	High	Organised events spread awareness of environmental problems and teach people how they can improve the situation. Giving devoted people a medium through which they can help and inspire others is key. Success of the program increases as experiences are shared.
Family	High	Increased system complexity requires more effort and takes up a bigger part of the user's lives. This results in being more likely to be a topic of discussion in private spheres. Experience, skills, but also frustrations are shared. Passionate family members are likely to help others with improving their experience, or do their tasks during absence.
Religious freedom	Low	Religious freedom was not found to be a relevant value.
Accessibility	Neutral	Waste management infrastructure should be placed to provide everyone comfortable access, both in terms of location as well as day-to-day use. User feedback should be integrated during the development to satisfy as many user groups as possible.
Inclusivity	Neutral	Some user groups may be alienated through the complexity of a system. Such complex systems need to be tested extensively and user feedback needs to be integrated to make sure the system can be used by (almost) everyone at launch. If anything, solutions need to be implemented for those who are excluded by the system's design.

Table 7.2: Results of the social values in the case studies of the chosen waste management sectors.

From the social values cluster, the following three values were identified to have a high impact on the social acceptance of the sustainable composting and MSW management systems: Community, Connectedness, and Family. It makes sense that these three values are selected together, as they are closely tied to each other.

As a system that includes all residents of a municipality, the interactions between different (user) groups is highly important. First of all, they can help each other to understand the system and improve the efficiency and quality of their daily interactions with the system. Secondly, over time, each municipality will create its own social norm towards its local waste management system. A municipality, or a confined area within, will perceive their waste management system either as 'satisfactory' or 'unsatisfactory'. Getting the community to the right side of this spectrum is key for the executive organisation.

Connectedness mainly describes the ways through which the executive organisation communicates and interacts with the system's user base. Not only is the content of the information they provide relevant, but also the frequency and method of the communication. Furthermore, it is important to note that the interaction goes both ways. The public wants to know their opinion is heard and their feedback used to improve the system.

The family value can be considered as a special aspect of the community value. One key difference is the frequency and difference in authority that these conversations can have. One is generally more likely to accept the opinion of an (older) family member. When systems become more complex, require more active decision-making and take up a larger part of one's daily routine, the system is more likely to become a topic of discussion during family meetings. Additionally, family members are generally the first people one asks for help, either if the functioning of the system is unclear, or when a task cannot be performed due to illness or absence for work or holiday.

Value	Impact	Waste management system comparison
Identity-driving values		
Environmentally friendly	Neutral	External factors such as news reports and documentaries help to shape a general picture of the environmental challenges we face. Internal factors such as education by the waste management organisation teaches the public about their waste and consumption patterns, the available waste management systems and the value of recovering resources. Although skeptic at first, the public can be motivated to change their behaviour to be more sustainable.
Spirituality	Low	Spirituality was not found to be a relevant value.
Cycle of life	Neutral	As people become aware of the potential value of their waste, they become more open to increasing their effort to recover this value through better sorting practices. The difference between organic and artificial processes has fade due to the industrialisation of the industry. Life cycles of resources are rarely considering from an idealistic perspective. Waste is sorted and managed because of its contained value, not for intrinsic values of a waste-free society.

Table 7.3: Results of the identity-driving values in the case studies of the chosen waste management sectors.

None of the values from the identity-driving values cluster were identified to have a high impact on the social acceptance of the sustainable composting and MSW management systems.

Value	Impact	Waste management system comparison
Idealistic values		
Reverence	Neutral	Active participation in a system helps people to adapt faster. Their efforts are continued if they are rewarded adequately. If the system also contributes to a cleaner / better world, people will care about it even more. People show reverence for what they care about.
Ritual	Neutral	Waste management systems are perceived as a means to an end. The goal of most people is to get rid of their waste, not to recover the value within. If a more effective, easier or cheaper system would be introduced, most people would have no problem switching. The journey of the waste and its rituals are less important.
Peacefulness	Neutral	Peacefulness can relate to the real and tangible aspects of waste management, as well as more idealistic aspects that cannot be literally perceived such as peace-of-mind. The majority of the public primarily considers physical aspects and desires to experience as little discomfort from the smell of waste and noise of collection trucks as possible. Considerably fewer people actively consider idealistic aspects.
Cleanliness	High	For the user's comforts, the extent to which waste is seen, smelled or even starts to rot or attract flies must be minimised. Once these conditions are met, people look beyond their own homes to the local environment. A system that reduces waste in both contexts is best.
Beauty	Neutral	Waste management generally applies to people on a technical level only. However, as their awareness of environmental challenges increases, so does their perception of local problems. These local issues are prioritised on the agenda of people and politicians alike. Through a good waste management system, people are more inclined to contribute to a greener, cleaner (residential) area.
Nature	Neutral	As even composting processes take place indoors, the difference between natural and artificial waste management processes is too abstract for most people. People are more interested in the results of a system, and not in the way a system functions.
Authenticity	Neutral	Waste streams produced by humans consisted historically only of organic matter. Even back then, these flows were not disregarded as waste, but instead value was recovered from them. Current society has deviated far from this waste-free ideology that used to be so common. To some degree, a focus on circularity and waste-free consumerism only returns us to what once was our default procedure.

Table 7.4: Results of the idealistic values in the case studies of the chosen waste management sectors.

From the idealistic values cluster, the following value was identified to have a high impact on the social acceptance of the sustainable composting and MSW management systems: Cleanliness.
As waste is still mostly perceived as a problem that needs to be solved, people do not want to come in contact with waste or experience any of its associated images or smells. A clean system is perceived as a good system. After their homes, people also want their local areas to be clean.

Value	Impact	Waste management system comparison
Miscellaneous values		
Trust	High	The supposed effectiveness of a new system is always met with skepticism by the public. Downsides of a new system generally weigh more heavily to them, potentially blinding them from upsides. Through communication and educating the people during informative sessions, a stronger bond is created between the executive organisation and the intended users of the system. Users can provide feedback, while the organisation can clearly explain the benefits and functioning of the new system, as well as expectations of the users. If this exchange of information is appealing to both groups, trust is built.
Procedural fairness	High	Established rules need to be perceived as fair to the majority of people, although they will always continue to compare their situation to that of others. Even with equal rules, some people may find themselves to be restricted more than others. It is important to clarify to these people why the system is as is, why this should be considered to be fair and what they can do to better adapt to the rules.
Distributive fairness	Neutral	The baseline of the waste management system must be affordable, but people should still feel incentivised to perform better through financial rewards and fines. Whereas some people separate their waste for intrinsic reasons, others will only do so for financial benefits. The financial model should be communicated clearly to ensure people know beforehand what their costs will be.
Perceived behavioural control	Neutral	Increasing the public's awareness of environmental problems and the importance of a good waste management system is crucial to motivate people to separate their waste better. A group of environmentally conscious people will likely be the first to adapt to a new, sustainable system. Through their enthusiasm and passion, others will follow. Over time, the majority of the people will use the system as intended, albeit for different reasons. The last remaining people will adapt either through social control or legal repercussions.
Attitude	High	Two main attitudes towards waste management can be identified: those who intrinsically value the environment and are willing to put in more effort to do what is socially desired, and those who act predominantly for their own convenience. The perceived effectiveness of a system may attract or deter people from putting in more effort. Financial (or other) benefits are another drive. Clear communication of the system's functioning and expected results, along with the expectations from the user can convince people whether a system is worth their best effort, thereby shaping the user's attitude.

Table 7.5: Results of the miscellaneous values in the case studies of the chosen waste management sectors.

From the miscellaneous values, the following three values were identified to have a high impact on the social acceptance of the sustainable composting and MSW management systems: Trust, Procedural fairness, and Attitude.

Although the public image of an organisation prior to the development of a new system is important, people will generally be skeptical from the beginning. As people generally don't like change, it can be difficult to convince them a new system will be better than what they previously used.
This is closely tied with procedural fairness, as people will always keep looking around them to see how their situation compares to that of their (figurative) neighbours. The original level of skepticism grows If they feel their system has certain disadvantages compared to another system which they are familiar with. It is important for the executive organisation to communicate clearly why decisions have been made as they are, and why the current system offers the best service to the largest amount of people possible (or explain why this is not the case).
To some degree, the level of skepticism that people have towards a system can be regarded as their attitude towards that system. The public's attitude starts low, but should gradually increase if the executive organisation does its work well. Through community events and the appointment of local spokespersons, the trust people have in both the system and the organisation will grow. Through this increased trust, and further experience with the system through practical use on a day-to-day basis, their attitude towards the system and organisation also changes. Economic (dis)incentives further affect the public's attitude. Attitude and trust are fluctuant, in the sense that a certain level of trust is not permanent and can easily drop as a result of poor communication, a change in the financial model, or a poor execution of promised services. Additionally, the attitude that people have towards a system also reflects the enthusiasm with which they put effort into its use. People with a positive attitude are willing to put in more time and effort into the system, and are more likely to speak positively about their interaction with it.

The research question of this chapter looks to identify factors that influence the social acceptance of systems in the waste management industry. These factors could change the influence either positively or negatively. This consideration was made to keep the research open, but with the values from the framework applied, it turned out that all have a positive influence on the social acceptance. Therefore, the seven values mentioned above qualify as factors that influence the social acceptance of the two analysed waste management systems.

As can be concluded from tables 7.1 to 7.5, the following seven values are identified to have a high impact on the waste management sector:
Community, Connectedness, Family, Cleanliness, Trust, Procedural fairness, and Attitude.
As these have been found to be the most impactful in the waste management case studies, they are further analysed in the context of the funeral industry in the next research chapter. Appendix C.11 helps to visualise where the chosen values make their appearance in the social acceptance framework for circular funeral technologies.

7.4 Conclusions

This third research chapter describes the application of the framework for social acceptance of sustainable funeral technologies in the context of two waste management case studies. These case studies were chosen to help answer the following research question:
What type of factors in the successful introduction of circularisation methods in the chosen waste management systems influenced the social acceptance according to this specialised framework?

The two particular case studies that are selected are both waste management systems introduced by ROVA (ROVA, 2018). The composting case describes the history, development and changes for the community as a result of the opening of the composting and fermentation facility in Zwolle around 2008. The second case study focuses on the reverse collection of MSW in Amersfoort, which was introduced around 2016. Although the collection of the organic waste for the composting facility in Zwolle is gathered through the same (reverse collection) system as that of other waste streams, organic waste is still perceived and treated differently by the users of the waste management system. Therefore these two cases are deemed viable as independent systems for this study.

Through a series of interviews, data was collected that was used to apply the framework to both cases. The values of the framework were listed in a series of tables which describe how each of these values impacted the social acceptance of the old and new scenario of both respective waste management technologies. Furthermore, the visualisation tool of the framework was updated with the results, which produced four frameworks that provide an overview of the values in the old and new composting scenario, and the old and new mixed MSW scenario respectively.

The analysis of both cases show people perceive waste management systems as technical processes and don't put much thought into the idealistic side of waste and the management thereof. Despite this, a selection of values was selected that were impactful on the acceptance of these new waste management processes. The type of factors which influence the social acceptance of the chosen waste management systems, which the research question refers to, are identified as the following seven values from the selection cycle in the custom framework:
Community, Connectedness, Family, Cleanliness, Trust, Procedural fairness, and Attitude.

Although the factors described in the research question are now identified as social values, they will continue to be referred to as factors in the upcoming research question to provide a cohesive story. During the analysis and research of these research questions, they are referred to as values, as that is their proper terminology according to the framework. Essentially, both names are used interchangeably.

8. Social acceptance in the funeral industry

Now that the analysis of the waste management industry has been concluded and the seven most influential values have been identified, this chapter focuses on the implementation of those values in the death care scenario. The place of this chapter and respective research question in relation to the other chapters in this study can be found in figure 8.1 below.

Figure 8.1: Research goal of this chapter in relation to the complete study.

Each individual value is analysed through a literature study, but also other, previously used pieces of information are included in the search. Through this final, extensive literature search specifically aimed at the chosen values, a comparison can be made of the similarities and differences between both industries. This will allow the following research question to be answered:

4) *How do the identified factors that improve the social acceptance in the chosen waste management sectors compare to the funeral industry? What are their differences and similarities?*

When this research question has been answered, the study will have come full circle. It will show the differences between both industries, with a strong emphasis on the different ethical associations and cultural impact within both fields. The results of this chapter will ultimately be used for the construction of a set of recommendations, which serve as discussion material with industry experts in the next chapter.

8.1 Waste management values implemented in the funeral industry

The seven values found in the previous chapter are used in the search query of a new literature study. The process is described in methodology subsection 4.4.1. The influence of the individual values: community, connectedness, family, cleanliness, trust, procedural fairness, and attitude on the funeral industry is described in the subsections 8.1.1 to 8.1.7 below. Subsection 8.1.8 provides an overview of the results of this literature study. In this part of the study, only information and events applicable to the current state of funerals is applied. A historic overview can be found in chapter 2. Whenever possible, the Dutch funeral scenario is followed. However, some research may find their origin elsewhere, yet still be applicable to the Dutch scene. Pieces of literature that specifically apply to sustainable funeral technologies are particularly interesting. Similar to the waste management scenario, the seven values in the context of the funeral industry will also have some overlap as many are interlinked.

8.1.1 Community in the funeral industry

It is becoming increasingly popular for funeral homes to use (online) services to promote their products and services, in order to connect with local politicians as well as the community at large. Funeral services have also been technically enhanced which can potentially be shared through this network. Other examples of online funeral home activities are digital memorial pages and guest books (Beard & Burger, 2017). Another element that can connect to specific communities is the emergent ideology of 'providing any service desired by the family they are willing to pay for' (Yarden, 2017) (Beard & Burger, 2017). Nobody has to feel excluded with the knowledge that even the most uncommon requests can be integrated into the final service.

Many people are inspired by a specific funeral technology, ceremony style, activity, etc. on basis of first-hand experience at another funeral. This is especially true for elderly, as they visit relatively many funerals and think about their own funeral more than younger people would (Davies & Rumble, 2012). The attendance of friends, acquaintances and family during times of grief and at the funeral service itself helps those who are directly impacted by the death of someone close to them. Through their presence and support, social ties between them and the bereaved are strengthened (Smith, 2017). Death of a society member can shake the ties between all its other members. The bereaved within such a society need help to cope with this loss and to strengthen the bonds between the members of that society (Corr, 2015). Cooperation with a funeral home and the planning of a suitable funeral service can help the bereaved in this scenario to consolidate these social ties.

As a large percentage of people die in the care of a nursing home or hospice, the carers and medical staff of these institutions also contribute to the process of preparing a family for the inevitable loss (Holdsworth, 2015). Through their active participation and care, they do not only prepare the dying for their eventual moment of passing, but also the family.
During a funeral ceremony, an individual's perception, processing and response to death are heavily influenced by the social groups that person is framed by (Davies, 2017).
Holloway (2006) argues that the generality of our death rituals proves that there is a need to develop symbols and rites that find common ground with a larger publicity to establish a shared meaning of death. However, in this day and age, there is a growing demand to combine these social rituals with a personal touch befitting of the deceased, which goes unsupported by the current system. The challenge lies in finding a way to give "shared social meaning to personal experience" (Holloway, 2006). In other words, a transcultural state of spirituality of dying and death is not achieved by creating a death care model to which we can all relate. Instead, one way to achieve this goal may be by discovering the means through which the shared humanity in each of our traditions is accessed (Holloway, 2006).

8.1.2 Connectedness in the funeral industry

Customers of a funeral find it important that the chosen technology matches the image of what used to define the deceased person in life. When an individual sets up a will, they may have looked for a funeral technology and ceremony that match their personality. When the next of kin choose a technology, they may make the decision based on what reflected the deceased's personality. Either way, it is likely they end up with a funeral technology they feel personally connected to (Beard & Burger, 2017). This value connects well with the availability of personal requests to customise the funeral ceremony. The ability to find a product that matches your desires in an otherwise unwelcome and unpleasant situation is of great importance for customer satisfaction. The funeral home that caters best to the specific needs of the customer is likely to create a stronger connection with them. Additionally, the bereaved family as a whole is more likely to process the loss through personal and adequate interaction with the funeral directive. A shared intense emotional moment, such as the death of a loved one, is generally more likely to bring people together.

Those who perceive the attended funeral rites as helpful and comforting were able to cope better with the loss of the deceased friend, family or acquaintance. Therefore, both the living and the dead benefit from taking part in the funeral. Individuals participating in the ritual have an emotional outlet, which lets them act out the deep feelings associated with grief. Furthermore, they can find meaning in the loss of the deceased through the symbols used in the ritual. Participating in a meaningful ritual also helps to memorialise the dead and cope with the loss (Smith, 2017).

Funerals can be considered as unwanted services, as consumers do not want to be attracted to them or show a strong sense of reluctance to commit to them. Due to feelings of disgust, clash of morality or even fear by the consumers, it can be difficult for funeral homes to engage in a relationship with their (future) customers (Korai & Souiden, 2017).

8.1.3 Family in the funeral industry

Funeral-related desires one describes in their will are hardly ever met with opposition by the family post-mortem. Familial bonds are strengthened when the bereaved are guided through the funeral preparations by the wishes described by the deceased, but can be tested when no personal desires are available and the mourners are time-pressured to make a decision (Davies & Rumble, 2012).

Smith (2017) found that reports of participants of meaningful rituals experienced an increased level of family cohesion. The overall quality of family life was found to be tied to the cohesion experienced after the ritual. In conclusion: a meaningful ritual increases family cohesion in dealing with the death of a beloved. In its own right, family cohesion strengthens quality of life, as the members have a stronger feeling of belonging.
During a funeral, many friends and family come together, who may or may not have seen each other for a long time, functioning as a reunion. This get-together naturally creates the possibility for individuals to emotionally support each other, but also to seek counsel and advice (Smith, 2017).

It should be noted that a potential for intrafamilial conflicts to arise as a result of a family member's death, the planning of their funeral service, the executing of it, or other post-funeral aspects exists. Some of these struggles may have already taken place prior to the death, others started soon after or were reinforced through the difficult emotional conditions the family members found themselves in (Gamino, 2000).

Quality family time spent as a unit in the days leading up to the inevitable event of final parting contributes to a higher acceptance of that person's death. These family meetings could either take place in their own homes, or at the location of a hospice or nursing home, in which the care for the dying could be left in hands of professionals. When this pre-death family time is used to discuss matters related to the acceptance of death and decisions surrounding the funeral, the bereaved are more likely to accept the chosen funeral technology once the service is held. Especially when the final days of a person's life are spent in the comforts of their own home, the bereaved are generally more appreciative of the healthcare assistant's role and overall quality of the time spent there. (Holdsworth, 2015).

8.1.4 Cleanliness in the funeral industry

Cleanliness is part of the overall service quality picture of the funeral service by all attendees, but especially by the next of kin that made deliberate choices regarding the final service. The psychological part of dealing with loss is one part of the funeral's home tasks to manage, but cleanliness falls into another, more physical, category.
Cleanliness of the physical processes relates to many stages of the funeral planning and execution. The preparation of the body for the viewing ceremony, the appearance of the mortuary vehicle, the smell of the ceremony chapel or gathering hall, etc. are examples of elements where cleanliness and general appearance of the physical elements greatly contribute to the overall quality perception of the funeral (Korai & Souiden, 2017).

It is not uncommon for funeral industry services to be perceived as 'dirty' work. Although it must be stated that it is not the work itself that is inherently dirty. Instead, it is the association people have with such work that decreases their esteem and prestige for occupational members of that line of work. The status of 'dirty' is based on a social construction of subjective standards. Work that does not align with these standards (such as work related to the field of death care) can to a certain extent evoke a feeling of rejection and repulsion. It is work that we do not want to consciously think about or acknowledge its presence in society. It is preferably shunned as to prevent contact with the people active in this line of work. The duality of this problem lies in the evoked feelings of disgust and rejection, mixed with the knowledge of the necessity of the work (Ward & McMurray, 2018). Funeral directors are associated with all four forms of dirty work: emotional, moral, physical and social (Ward & McMurray, 2018).

When looking at cremation specifically, an odd contradiction arises. (Death by) Fire has for centuries been perceived as a purifying process. This is true on both spiritual as well as medical levels. Medical experts back in the 19th century already vowed for the purity of fire and ashes that cremation provides in order to create hygienic cemeteries (Sørensen, 2009).

8.1.5 Trust in the funeral industry

In the past, it has been suggested that some funeral homes abuse the position of the consumers, which is characterised by making a purchase with a lack of prior information, under significant time pressure and in poor emotional state. However (partly through new legislation), the extent to which funeral homes can theoretically financially extort their consumers is greatly reduced. As a result, people in their role as consumers have gained more trust in the funeral industry (Schwartz et al., 1986). Recently, funeral directors have shown an increased level of open-mindedness in an industry that was mostly operated in a traditional, conservative manner. By showing willingness to adapt to the consumer's needs (but also to create an unexplored market for higher revenues), people's perspective of the industry changes positively (Beard & Burger, 2017). Furthermore, increasing technological implementations allows customers to casually learn about the funeral home in a no-pressure environment which will ultimately help them once a decision needs to be made (Beard & Burger, 2017).

Trust in the funeral industry is indirectly increased through trust in the carers and medical personnel leading up to the moment of a person's death. The trust in these experts is increased if the same (few) nurses and healthcare assistants treat the dying client. By becoming familiar and trusted by the family, their input in decisions surrounding the funeral selection procedure is better respected, which ultimately results in a higher level of acceptance of the funeral service (Holdsworth, 2015).

Trust plays an important role for consumers in their role as business relationship, but also in the extent to which they are satisfied with their purchase (Theron, 2013).

Through active participation in the planning and ceremony of a funeral, bereaved who view themselves to generally be in positive mental health have more trust in the funeral industry and perceive their services as more valuable. The positive mentality and open-mindedness is related to the life experiences and educational level of the bereaved (Hayslip et al., 2006).

8.1.6 Procedural fairness in the funeral industry

In the case of British green burial sites, occasional problems arise with the conception of certain rules. Some wish to plant trees, shrubbery or flowers that are non-native to that specific area. Others don't agree with what is considered to be a non-organic grave marker. Another common debate is the use of microchip trackers to locate the graves. Through all these examples, it shows that people can have a different perception of the procedures present in the green burial market, and the consumer's interests don't always align with the conditions set by the owner of the burial grounds (Yardwood, 2014).

In another UK study, about a third of the surveyed green burial sites have run into objections from the local community during the development of the site. Most of these objections were based on the fear of the new purpose for the ground attracting more traffic - a rather general complaint when repurposing land (Yardwood, 2014). More serious complaints, such as fears of ground and water contamination from the bodies were solved through discussion with the local community.

Due to the psychological conditions of the consumers of funeral technologies and their desire to finish the process as quickly as possible, hardly any comparative research is done to see what alternatives are out there. As a result, they are more likely to accept the few alternatives their chosen funeral home has to offer. The grief affecting consumers makes them vulnerable, which has caused considerable problems in other countries in the past. Due to time constraints and emotional instability, the decision-making and consumption pattern of the bereaved are not always rational (Kopp & Kemp, 2007). To simplify the funeral arrangement, many funeral homes offer their products and services in bundles. From the consumer perspective, a downside to this marketing strategy is that they do likely end up with (at least some) products and services they did not originally need or want. Post-purchase concerns regarding the price-quality ratio of the delivered service are often neglected. The bereaved do not want to mentally go through the experiences again, out of fear for the return of unpleasant memories (Kopp & Kemp, 2007).

8.1.7 Attitude in the funeral industry

As the environmental awareness of people increases, they also start looking for more sustainable alternatives to burial and cremation. *"It appears that going green is no longer just a way of life, but it is also a way of death"* (Beard & Burger, 2017, p. 62). Additionally, the idea that a funeral needs to be expensive to 'honour the dead' is no longer a given fact. People are looking for different alternatives, and expect the funeral industry to deliver.

The social acceptance of death as a natural process can be increased when cultural landscapes, urban open land, preservation of rural land and new funeral rituals are all integrated (Harker, 2012). The integration - or conservation - of green burial in urban green planning also increases its visibility to the public, giving them a realistic picture of their own possibilities after passing away. People are more likely to be motivated to care for a piece of (urban) land when they start to see it as *"embodiments of personal and cultural identity and history"* (Hester, 2006, p. 364). It can bring communities together for a common cause of restoring, maintaining and improving their shared part of an ecosystem (Harker, 2012).

Within the American society in particular, there are two main attitudes towards death and death care: acceptance and avoidance. A society may try to avoid death through denial of the occurrence of such an event. This is reflected both in terms of used language in context of death, as well as death from a medical perspective. Rather than an individual 'dying', he or she 'passes on'. Furthermore, death is not perceived as a natural occurrence, but rather as a problem for which a solution needs to be found. If a (new) death care ritual is to be successful in allowing an individual, or group of individuals to cope with their loss, the ritual must minimise their life disruption (Smith, 2017).

To some extent, the level of acceptance of circular funeral technologies also lies in the meaning of 'nature' among society at large. If humans were to be included in our perception of nature, it would be a much more logical approach to return the resources entailed in human bodies back to nature (Kelly, 2012).

On the other hand, the attitude of funeral homes towards their customers has also changed. What started as a traditional industry has shifted to organisations with flexible business models that sell their products and services in a variety of packages and bundles. On top of that, they have adapted to individual desires and are now willing to provide anything the customer asks for.
The overall range of products and services has been greatly increased (Beard & Burger, 2017).

Societies have a much stronger focus on the individual nowadays, whereas the group was more important in the past. Back then, death was felt as a disturbance to the social network. In modern times, death is a much more considered to be a threat to the individual, and their individual potentials rather than a loss to the societal potential. The funeral industry has transformed to become an outlet for the memorialisation of a unique life (Crabtree, 2010).

Davies (2017) looks at people within society as a collection of various roles, each reflecting a symbol. When an individual dies, who was regarded as a spouse to someone, and a friend to others, the ideals of marriage and friendship within society at large are attacked by that single death. People who share the same connection in their own lives can relate more to the loss of this individual's life as the deceased reflects part of them. This perspective sees the human body as vehicle for, and bearer of social beliefs, values and connections within society.

Throughout the western world in the twentieth century, the topic of death has been met with controversy and is publicly discussed with reluctance. Although not all studies agree it is a taboo (Walter, 1991), it is often regarded as it shares enough similarities. Although research into more technical and environmental aspects of death was found to be scarce (Van der Burgh et al., 2017), literature about social aspects of death is much more commonly available. This does not change the fact that *"death remains an improper topic of conversation in many places"* (Lee, 2008, p. 746). Whether the taboo is challenged on a global scale is left undecided for now, but it should be noted that the Dutch scene has been comparably progressive. Professional funeral organisations such as Yarden actively advertise their services on natural radio and television (Yarden, 2017). Although the responses from the public are still mixed, Yarden's effort in opening the discussion is remarkable. Despite a strive for individualism, death is still widely considered to be a strictly serious topic. Laughing about things associated with death is considered tasteless, which results to humor and death finding themselves generally on the opposite sides of the spectrum (Gadberry, 2000).

8.1.8 Social acceptance in the funeral industry literature study overview

Table 8.1 below presents the results of an extensive literature study that was conducted to find the respective meaning in the funeral industry of the values which were identified in chapter 7. As becomes apparent from the multiple appearances of certain authors, some articles provided input for more than one topic. On a similar note, some topics are more actively discussed in the literature than others. Particularly the community and attitude values are well represented. A total of 22 unique articles were found. The articles are listed in order of appearance in their respective chapters.

Chapter	Topic	Author(s)
8.1.1	Community in the funeral industry	Beard & Burger, 2017 Corr, 2015 Davies, 2017 Davies & Rumble, 2012 Holdsworth, 2015 Holloway, 2006 Smith, 2017
8.1.2	Connectedness in the funeral industry	Beard & Burger, 2017 Korai & Souiden, 2017 Smith, 2017
8.1.3	Family in the funeral industry	Davies & Rumble, 2012 Gamino, 2000 Holdsworth, 2015 Smith, 2017
8.1.4	Cleanliness in the funeral industry	Korai & Souiden, 2017 Sørensen, 2009 Ward & McMurray, 2018
8.1.5	Trust in the funeral industry	Beard & Burger, 2017 Hayslip et al., 2006 Holdsworth, 2015 Schwartz et al., 1986 Theron, 2013
8.1.6	Procedural fairness in the funeral industry	Kopp & Kemp, 2007 Yardwood, 2014
8.1.7	Attitude in the funeral industry	Beard & Burger, 2017 Crabtree, 2010 Davies, 2017 Gadberry, 2000 Harker, 2012 Kelly, 2012 Lee, 2008 Smith, 2017 Walter, 1991

Table 8.1: Results of the literature study applied in chapters 8.1.1-8.1.7.

8.2 Factor comparison between funeral and waste management industries

Where section 7.3 highlights the seven chosen factors (and more) in the context of waste management, section 8.1 analysed these factors from the funeral industry perspective.
This section focuses on the comparison between these two industries, starting with an overview in table 8.1. Finally, the key similarities and differences are discussed.

8.2.1 Comparative overview

Table 8.1 below features the comparative overview of the seven values in the context of both industries. The data in the *waste management industry* column is based on the data from tables 7.1-7.5. Data from the *funeral industry* column is based on the literature research of section 8.1.

Value	Waste management industry	Funeral industry
Commu-nity	A group of environmentally conscious users are likely among the first to embrace a new sustainable system. Through their effort and enthusiasm, more people become inspired to perform better. The executing organisation should occasionally create events where people can provide feedback or have their questions answered. Being approachable for the users creates a stronger bond between the community as a whole. Once a majority of users is convinced of the system's added value, a state of social control is created that pulls more people in. Educational events that involve children and schools are also successful.	Integration of technical elements in funeral services, combined with a digital platform allows funeral homes to connect to a broader audience. Attendance of family and friends at a funeral helps the bereaved to cope with their loss. As a result of their (emotional) support, social ties are reinforced. Involvement in the planning of a professional funeral service can further help the bereaved. As it is common for people to die in the care of medical professionals, these people become part of the closely connected network of mourners as they help them to cope with their (future) loss. As society nowadays has a bigger emphasis on the individual, funerals need to adapt to reflect this individuality, while still including symbols and rites that are accepted in society at large.
Connec-tedness	Connecting the community through organised events and educational systems helps to spread awareness of the environmental problems that mankind faces and the things that consumers can do to contribute to a solution. People who are inspired to make the world a better place and have a medium through which they can talk with like-minded people to share experiences will generally perform better within the boundaries of the provided system.	Funeral customers make a purchase that befits the principles the deceased had in life. The ability to find a product that matches your desires in an otherwise unwelcome and unpleasant situation is of great importance for customer satisfaction. If the need arises to purchase another funeral in the future, customers are likely to return to that with which they have experience. When the bereaved participate in the ritual, they are more likely to perceive the funeral as meaningful and helpful in coping with their loss.

Family	As the new waste system requires more effort from the user and takes up a bigger part of their daily routine, people are more likely to make it a topic of discussion. This is especially true when a new system is introduced that people still need to adapt to. Family members are likely to exchange stories of their perception of the new system, as well as share their experience and skills with it. Members of a family that are more passionate about the system are more likely to help each other managing their waste better, or do the tasks for others during an absence.	Quality family time leading up to the inevitable death contributes to a higher acceptance of that person's death. Familial bonds are strengthened when the desired funeral is described in the deceased's will, as the described wishes are generally respected. Furthermore, death rituals experienced as meaningful also increase family cohesion. Funerals also act as reunions, as it brings many people (often family) together who may not have seen each other in a long time. Family members can emotionally support each other, but also provide council and advise. However, considering the stressful events leading up to the funeral, and the emotional state at a funeral, intrafamilial conflicts can arise.
Cleanliness	The physical aspects of waste management relate to waste which can be seen, smelled, or that which starts to rot, attracts flies, etc. This needs to be minimised for the user's comforts, or otherwise the system won't be accepted at all. Once these conditions are met, people look beyond their homes at the local environment around them. A system that actively helps to reduce the amount of waste in the local environment is a system that people are more likely to adapt to.	Cleanliness relates to the physical aspects of a funeral and is particularly perceivable by the next of kin who helped to plan and prepare the ceremony. Some factors, such as the preparation of the body for viewing and the tidiness of the rooms influence the service quality perception. However, all work that deals with (human) bodies is considered to be 'dirty work'. The general public does not want to consciously think about it, nor acknowledge its presence in society, but they realise the work's necessity. Oddly enough, (death by) fire is historically seen as purifying
Trust	People are at first skeptical of new systems and their supposed effectiveness. The authority of the executing organisation is not as relevant as the perceived up- and downsides of the system. To counter the skepticism, the user base will have to be informed, and preferably involved in the development phase. Through these informative sessions, a bond can be created with the organisation behind the new system and a fair scenario can be formed as to what the expectations of the people are, the tasks of the executing organisation and the results that will be achieved through the new system. If these are appealing to both groups, trust can be established between the users, the system operators and the system processes.	In the past, (American) funeral homes have abused their customer's unfavourable decision-making conditions to trick them into spending (too) much on their funerals. Through new legislation, mourning customers are better protected from extortion. Since then, trust in the funeral industry has been restored. Whereas the industry has been traditionally conservative, the new open-minded approach is well received by the public. Through technological innovations, (future) customers can make a decision or acquire information in a no-pressure environment. Through active participation in the planning and execution of the ceremony, the bereaved generally create more trust for funeral directors and their work, and in return perceive their effort as more valuable.

Proce-dural fairness	People find it important that the same rules apply to all people. It is therefore important to communicate why rules are created the way they are, why this is the most fair to the majority of the people, but also why they are different than for example those of a neigh-bouring municipality. When the same rules apply to everyone, there are always certain groups of people living in certain conditions that feel hindered by them more than others. It is important to clarify to them why the system is fair as it is, and possibly how they can improve their situation to better adapt to the rules.	It is common for burial grounds and crema-toriums to have different options when it comes to burying and spreading the ashes. Similarly, there are difference between the extent to which a green burial site allows non-organic materials in their burial grounds. Concerns about potential pollution from the bodies in green burials were eased through discussion. Due to the psychological condi-tions of the consumers when they purchase a funeral, they have a desire to finish the process as quickly as possible. As a result, they hardly ever do thorough research into the possibilities. To help simplify the deci-sion-making process, many funeral homes offer their products and services in bundles. People are likely to end up paying for more services because of this. Post-purchase price-quality evaluations are often neglected for fear of the return of unpleasant memories.
Attitude	People generally have two types of attitude towards waste management. Those who act for their own convenien-ce, and those who intrinsically value the environment and are willing to put in more effort to do the socially desired things. Perceived effectiveness of the system may attract or deter people from willingness to put in more effort. Additionally, financial (or other) benefits can also convince people the system is worth their time. Through clear commu-nication of the functioning of the system and the expected results, people can be convinced that their time and effort put into the system will repay itself. Ultimately, legal pursuers are the last step available for a municipality to change the attitude of a user (group) towards the waste management system.	The topic of death is still somewhat of a taboo. Death is not perceived as a natural occurrence, but as a problem that needs to be solved. There is a growing demand for both green and budget alternatives to the relatively expensive and unsustainable buri-als and cremations. The integration and conservation of sustainable funerals in urban green planning increases its visibility and gives the public a realistic view of other alternatives after passing on. Through the personal touch of death care, communities can be rallied together for the cause of maintaining and restoring their shared part of a green burial ecosystem. Acceptance of circular funeral technologies also depends on the meaning of 'nature' among the public. If human beings would be included in this perception, it would be much more logical to return them to nature after their passing. Modern societies have a much stronger focus on the individual, whereas the group was more important in the past. Death threatens to halt the individual potential. Funerals serve as memorialisation of the uniqueness of that person. Each deceased can be seen as a collection of various roles in society, connecting those who share these roles.

Table 8.2: Comparative overview of the seven values in context of both industries.

8.2.2 Core similarities between both industries

Based on table 8.2, the similarities between the selected values of both industries are analysed. Although the core objective is the identification of the differences between the two industries (see subsection 8.2.3), it is interesting regardless to see where they have common ground. Additionally, the differences are easier to put into perspective once the similarities are known. These similarities are listed below and categorised per value.

Community
Sustainable alternatives in both industries generally appeal to environmentally conscious people. Through their early adaptation to the new system, other people also become more familiar with the new technology. Both industries attempt to be more approachable to the public, as the respective organisations realise that communication with, and clarification to the general public is important for the acceptance of their products and services.
The social groups active in both industries each have a strong individual as well as a communal component, but the order in which they affect each other is different. During a funeral ceremony, a group comes together to memorialise an individual. Whereas in waste management, an individual separates and disposes their waste for the benefit of society.

Connectedness
It is true for both industries that active participation in the system provides a more meaningful experience for the users. It is relatively new for both industries to try and connect with people through the use of technological features such as social media and their own website. By lowering the barrier of entry, they hope more people will show interest in learning more about their organisation and the products and services they offer. Consumers are more likely to accept a technology when there is a specific, recognisable expert from the executive organisation available.

Family
Both industries are subjects that people are likely to discuss amongst the family. However, the intensity and gravity of these two topics is completely different. In both cases, previous experiences with specific organisations and technologies will be discussed. Family members may also discuss the extent to which a new technology may be relevant or interesting to them.

Cleanliness
Both industries are considered to be relatively 'dirty' work. Funerals possibly slightly more so, as some people don't like the idea of organisations making money of other people's misfortune and thereby also being 'emotionally dirty'. However, people do realise that both lines of work are necessary for the functioning of society. An insufficient level of cleanliness is off-putting for users of both services and reflects mostly to physical aspects. The physical aspects of cleanliness are essential for the acceptance of a system or technology in either industry.

Trust
People are usually skeptical about new technologies, and might even try to hinder their introduction into their local society. This skepticism can be reduced when the responsible organisation clearly communicates their intentions to the local communities, listens to their feedback, and preferably even includes them in the development of the product or service. Through discussions in which both parties listen to each other carefully, a professional relation can be built between both sides. Only through time and positive experiences will the users eventually start to trust a new technology. By working closely with the organisation in the operation of the product or service, people experience it as more valuable and are more likely to trust the organisation behind it.

Procedural fairness

People want to compare available technologies in both industries and find the alternative that best reflects their own demands, although the basis of this comparison is different, as is their influence over the final decision. In the case of both industries, people's opinion about a specific technology is heavily influenced through comparison to alternatives they have had prior experiences with. One problem of the funeral industry is that many purchase-related decisions have to be made in a short time, which has resulted in funeral homes offering their products and services in bundles. This is comparable to the more extensive services provided by waste management organisations who run a variety of waste collection schemes for different types of waste flows.

Attitude

Both industries have two types of consumers: those that intrinsically care about the environment and are willing to put in more effort for a better result, and those who prefer to stick to the more straightforward method which they find more convenient and already have experience with. Financial benefits of a specific technology may attract more people to make use of it, whereas others value their intrinsic beliefs over financial compensation (which works both ways). Despite the natural origin of death, people do not want to consider it as such and rather see it as a problem that needs to be solved, very similar to the way we currently treat our waste. Only by acknowledging the true nature of death, and the value contained within bodies, a revolution similar to that of new waste management technologies can be started. This waste management revolution also perceives waste as a new resources, rather than a problem that needs to be solved.

By extracting resources from waste (either household or dead bodies), new business models can be created that can ultimately benefit the user through financial compensation. Making green burial grounds visible to the public can show them that there are other alternatives available, and it might get them to reconsider their ideas about their own funeral or that of others. This is similar to the idea that people want to see the value recovered from waste management return to the (local) community. Much like funeral ceremonies are personalised to reflect the life of the deceased, household waste describes the consumption pattern of those who produce the waste.

8.2.3 Core differences between both industries

The overview provided in table 8.1 is elaborated upon to identify the differences between the selected values in both industries. By making this comparison, factors that are successful for the social acceptance of waste management that have not yet been implemented in the funeral industry are found. These factors are then integrated into the funeral industry with the knowledge of the literature studies and expert interviews in chapter 9. The differences are listed below categorised per value.

Community

Whereas environmentally conscious people can help to persuade people to separate their waste better through example and gradual improvements, this is not the case for sustainable funerals. There is no 'learning curve' here, as it all comes down to a single, unrepeatable event. Through this singular event, other open-minded people will have to be persuaded to choose for a more sustainable option themselves. As a result, this chain reaction through the funeral community will likely take much more time than it would in the waste management scenario.

The waste management industry attempts to connect with people through educational events, occasionally aimed particularly at schools and children. It would be significantly more difficult for funeral homes to organise similar events, as death is still somewhat of a taboo. Many people would find it unethical to introduce sustainable funeral technologies to schools and children for educational purposes. As was already discussed in the similarities of subsection 8.2.2, the link between the individual and group aspects within the communities is also reversed.

Connectedness

One notable difference in how the users connect with the service provider is the frequency in which they interact with them. Waste management services usually have biweekly collection schedules, in which the user has to somehow interact with the waste management organisation. Funerals are a one-time purchase, although it is likely an individual is involved with the planning of multiple funerals throughout their life.

Furthermore, each municipality has an appointed waste management organisation. The municipality's inhabitants have little choice but to accept whichever organisation this is. In the case of planning a funeral, people do have a free choice. Although their decision-making capabilities are often diminished because of the poor emotional state and time pressure they find themselves in. Going by what little experience the consumer has is often a large indication for the funeral home they end up making their purchase at.

Family

Reverse collection schemes take up more time and become a larger part of people's daily routine, therefore becoming more easily discussible with others. Funerals only happen rarely, and death is still a topic surrounded by somewhat of a taboo. The frequency at which the topics are discussed is therefore very different. Furthermore, a funeral is much more likely to heavily impact the familial structure or hierarchy. The gravity of these discussions is much more severe and warrant their own meetings and get-togethers to mourn over the family's loss. Waste management is a topic that can randomly appear during any other meeting, and is not likely to be the reason for a family meeting. Lastly, due to the intensity and emotional state of meeting surrounding funeral, there is a chance for intrafamilial conflicts to come up, or become intensified. Waste management is far less likely to be the cause of intrafamilial conflicts.

Cleanliness

In the waste management sector, cleanliness of a system generally relates to the level of discomfort the user experiences at their own home as a result of seeing or smelling waste. In the funeral industry, cleanliness is mostly perceived during the funeral ceremony, away from the user's home. However, exposure to unclean scenarios during these few moments can lead to disgust and an overall unpleasant experience of the event. In waste management, consistent or frequent exposure to waste or its negative side effects will ultimately affect an individual's opinion of the system. Although the comparison between cremation as funeral technology and incineration as waste management technology was made prior in this study, the public's perception of cleanliness of both technologies is vastly different. Cremation, or other spiritual use of fire, has historically been considered as purifying.

Trust

The emotional conditions that people find themselves in when they make contact with a funeral director to discuss the passing of a family member are very different than the emotional state of someone who seeks to deposit their household waste. In waste management, trust in a new technology is partly reflected by the amount of effort required from the user to participate in the new system. In the funeral industry, people trust in the funeral director to plan the ceremony according to their desires and their ability to make it a meaningful experience for all attendees, that helps the bereaved to cope with their loss. It has also been reported in the past that (American) funeral homes abused the weak emotional state of their customers to trick them into buying unwanted services for unreasonable prices. Through new legislation, this is a thing of the past and the damaged trust has been restored.

Procedural fairness

The specific waste management technology that is applied in a municipality is based on the waste management operator active in that area, leaving its inhabitants with little to no choice. Funeral technologies on the other hand are either selected pre-death in a will, or post-mortem by the family of the deceased. Funeral technologies can therefore be more specific and diverse, as it gives people a relevant choice (although it can be argued that the customers are not always able to make the right decision due to their emotional circumstances). Waste management technologies need to be more generic and serve a much wider audience. Still, communities need to be persuaded that the chosen waste management technology is the best suitable for the municipality's needs. It is also important to explain why the applied technology and supportive legislation is different between municipalities, as this can strike certain people as unfair. When it comes to post-purchase evaluations, people are generally much more critical about the service provided by waste managers than of those by funeral homes.

Attitude

The topic of death is still considered to be somewhat of a taboo, whereas waste and waste management are widely discussed within our modern society. An odd duality exists between literature that states the potentially beneficial effects of grouping humans into our perception of nature, whereas the waste management industry tries to separate as many resources as possible into different segments.

Death is something that our current society wants to prevent at all costs. Waste, on the other hand, is something that we seem to be willing to produce increasingly more of. Although we don't like the process of dealing with waste, only few are willing to lower their consumption pattern to preemptively decrease their waste output.

Another key difference is the goal that both industries have. Waste management seeks to increase their process efficiency to an optimal point, ideally towards a scenario where we create no more waste. The funeral industry seeks to provide a meaningful ceremony with rituals that reflect the ideals and interests that the deceased had in life, which helps the bereaved to cope with their loss. Efficiency does not really play a role in this, as the outcome of a funeral is always 'the processing of a body', regardless of the applied technology. Although it can be argued that a shift should occur where all (or some) value remaining in the human body is somehow recovered and utilised elsewhere. However, this is currently not a goal of the funeral industry. They only seek to provide new technologies that their consumers have demand for or show interest in.

Lastly, it should be noted that consumers of a funeral cannot be pressured into using a specific technology through law enforcement. Everyone chooses a technology based on the predescribed desires of the deceased, or an estimation of what would best reflect unwritten desires.

8.3 Conclusions

In the fourth research chapter, the funeral industry was analysed with a special focus on the values that were previously discovered to have a high impact on the social acceptance of sustainable waste management technologies. All seven values were integrated into a literature study, that resulted in several interesting findings. With information about the effect of the values known of both industries, a comparative table was created that helped to provide overview. Mainly based on this table, the following research question could be answered:

How do the identified factors that improve the social acceptance in the chosen waste management sectors compare to the funeral industry? What are their differences and similarities?

The seven values that were analysed in the literature study were separated and described per value, as can be seen in subsections 8.1.1 - 8.1.7. Similar to the waste management industry, a lot of overlap between certain values was found. In particular *family* being part of the bigger *community*, and the *connections* they had with the professional organisation. Furthermore, the *attitude* value would appear in several different occasions. The goal of this literature study was not to create one cohesive story, but rather to find useful data to be applied in further research, which explains the loose structure of the text. Overall, enough valuable data was found to continue the comparison with the waste management industry.

Because the content of the literature study was already divided into the same seven segments as data from the waste management case studies, a comparison was relatively easy to establish. The overview of this comparison can be found in subsection 8.2.1, whereas subsections 8.2.2 and 8.2.3 discuss the similarities and differences between both industries respectively. At the beginning of this study, the assumption was made that funeral- and waste management industry are comparable on a theoretical level. As the similarities from this research have shown, the two industries also have many practical aspects in common. To some extent, this further validates this study. Especially the two *attitudes* segments had many features in common, which bodes well for the potential integration of this study's results in the funeral industry.

The differences between both industries are more important for the research goal of this study. Based on these identified differences, recommendations are made for potential adaptations to the funeral industry to prepare it for a more successful transition towards sustainable funeral technologies. Because these seven values have proved to be valuable for social acceptance in the waste management industry, they may also be beneficial for the funeral industry, if they can be fit correctly into their new scenario. It is promising that, generally speaking, more differences were found than similarities, as that gives more potential for interesting new ideas for the funeral industry. Additionally, it is also nice to note that the differences are spread almost evenly across all seven values, meaning many different factors can be utilised for suggestions and ideas in a variety of ways.

Although this chapter does not provide a concrete answer to the research question, enough data is available to continue the research with. Chapter 9 focuses on these recommendations and implements expert feedback through a series of interviews.

9. Recommendations to improve the social acceptance of (quasi-)circular funeral technologies

In this final research chapter, the differences between the funeral and waste management industries regarding the seven selected values established in chapter 8 is further analysed to create a valuable guideline which will serve to increase the social acceptance of new sustainable funeral technologies. These results are presented to a selection of experts from the funeral industry. This is the last part of this study, as is depicted in figure 9.1 below.

Figure 9.1: Research goal of this chapter in relation to the complete study.

By constructing a list of concrete tips and recommendations, followed by involving funeral experts to evaluate these, the fifth research question can be answered:
5) *What recommendations can be made to the Dutch funeral industry to increase the social acceptance of (quasi-)circular funeral technologies?*

Throughout this study, the technical and social aspects of both the funeral and waste management industries have been researched. This has provided a complete picture of the relevant technologies within these industries. While chapter 8 has stated several interesting differences and similarities, no concrete ideas has been developed yet. Further detailing of these ideas can be found in section 9.1.

The goal of each of the interviews conducted in this chapter is the same. However, the precise content of each interview changes depending on the expert and information obtained through previous interviews. An overview of the interviewed experts and the information obtained from them is briefly discussed in section 9.2.

Section 9.3 evaluates the feedback provided by the experts and describes how their knowledge and expertise are implemented to improve the recommendations. After these changes have been applied, the final guideline, which includes two scenarios, is presented.

9.1 Idea generation for the improvement of social acceptance

No predescribed, structured method is applied to generate ideas to improve the social acceptance of (quasi-)circular funeral technologies based on the results of chapter 8. Instead, strategic analytical thinking and prior experience from the field of industrial design engineering are used to develop ideas based on the data previously gathered. The structure of this segment is similar to that of chapter 8, in which the seven chosen values are listed and analysed in order.

At least one unique idea should be developed per value. By doing so, a range of different ideas is guaranteed. The degree to which each of these ideas is equally plausible or likely to lead to a helpful recommendation for the industry will vary. As with all idea generation sessions, some will be more successful than others.

The goal of this study is to find factors that influence the social acceptance of sustainable funeral technologies, but it is possible that some of the ideas listed below can positively affect the social acceptance of currently used funeral technologies as well.

A primary goal for the funeral industry would be to decrease the taboo surrounding death, dying and all related processes. When the topic of death has been (fully) opened for discussion, it becomes a lot easier for funeral homes to get into contact with their (future) customers about new options, such as sustainable funeral technologies. Breaking the taboo would certainly benefit all of the ideas listed below, but felt too generic to include in this list. It is something the funeral industry will have to gradually work on, as cultural shifts generally happen over longer periods of time.

9.1.1 Idea generation for the community value

It is important for people to be exposed to funerals more frequently in order to get a better grasp of the available options and alternatives. Bonds throughout communities can be increased when more people attend their funerals, which would also help to achieve this.
Because people do not always have the time (or desire) to be physically present at funerals, a stronger focus on digital aspects could help to attract bigger audiences. Alternatively, a collection of funerals could be selected and combined in a 'newsletter'-like article that can help to inform the public through showcasing events and highlighting their unique and inspiring aspects.
While the topic of death is still a taboo, it is important for these type of articles that are targeting a wider, public audience to be relatively casual and non-confronting. It is also beneficial to focus on the promotion of local news.

A digital platform could be created by funeral homes that allow easy access to such articles. This platform could further be used to share some kind of 'trial' videos of various funeral technologies and ceremony types. Through these tutorials, people can get educated about death care in a non-personal and pressure-free environment.
Alternatively (or additionally), sharing local news could also be done through a (printed) magazine. This magazine could for example feature an overview of recent deaths in the local area, along with a list of utilised funeral technologies, pictures of the funeral ceremony, and inspirational quotes or life lessons from the deceased. Naturally, these personal pieces can only be concluded in close cooperation with the bereaved family.

Generally speaking, funerals communities have an individual and a communal component. The community comes together during a funeral ceremony to memorialise the individual, through increasingly personalised events. In contrary to waste management, the (deceased) individual has stopped being beneficial to the wider community. It is likely that people would sooner accept a funeral technology that enables the deceased to benefit the community. This can be done in several ways, including but not limited to public green memorial areas, or perhaps the inclusion of life lessons in public ceremonies. A more extreme example would be the use of the nutrients in their body to nurture local green areas.

9.1.2 Idea generation for the connectedness value

People will generally only feel connected to a system when they interact with it frequently and in a meaningful way. Particularly because people make a deliberate choice when connecting with a specific funeral home (whereas waste management organisations are appointed through the municipality). Therefore, new ways need to be found in which people can contact a funeral home, without there being a direct need to organise a funeral in the near future. Examples of this could be:
- Personal, interactive 'profile'
- Platform or forum for discussion, shared mourning, sending condolences, etc.
- Organising events in which people can think about and discuss their desires for their own funeral, or about what is generally perceived as a meaningful ceremony.
- A new business model that (financially) rewards people for visiting more frequently before the moment of death.
- Paying up front for services the funeral director can perform pre-death, for example lessons in dealing with the loss, or other preparations for the final parting.

As funerals are experience-based purchases, where the emotional value is more important than the economic value, it may be worth considering to provide additional services during, or after the ceremony to create a closer bond with the funeral attendees. These services should always be on voluntary base, yet offer enough benefits for people to want to stay longer at a funeral. Besides connecting with the funeral director or their represented organisation, these events could also be used to create a stronger bond amongst funeral attendees.
- 'Lectures' from the funeral director about many possible topics, such as dealing with the loss.
- Life lessons from either the deceased or the mourners.
- Community feedback on the funeral service.
- Promotion of societal groups which benefit both individuals and the community at large, such as suicide prevention groups.

9.1.3 Idea generation for the family value

Naturally, the taboo surrounding death plays a major role in the way family members discuss death amongst each other. Current conversations about death only have two notable scenarios:
In the circumstance that nobody has recently passed away or is expected to do so in the near future, death and funerals are not discussed at all.
Alternatively, when someone has passed away or is expected to do so, discussions about death and funeral arrangements completely take over the lives of close friends and family.
When comparing these scenarios with the context of waste management, it can be concluded that a more even distribution of the intensity of the conversational topic is desirable. One way of doing so would be to make death a slightly larger part of people's everyday lives, so they are already prepared once that unfortunate moment eventually strikes.
To make death more discussable in a familial setting, the intensity, personal identity and gravity of the discussion should be lowered, to create a more serene and casual conversation. Once this has been achieved, discussions surrounding death can be more easily held in regular family meetings, and do not require specifically arranged meetings to discuss the (sudden) passing of a family member. If the desires related to the funeral arrangements of family members are more commonly known amongst the family, intrafamilial conflict as a result of having to suddenly make these decisions can be avoided. If any of the other suggestions were to be popularised, discussion of these ideas within a familial setting would further improve their acceptance and overall success. The familial setting provides a safe environment where experience, tips & tricks and opinions are freely shared. The opinion of a (vocal) family member can make or break the perception of a new technology, which is why this aspect is particularly important.

9.1.4 Idea generation for the cleanliness value

Both the funeral and waste management industry are currently considered to be 'dirty' work by the public. If this perception were to change, so would their perception and acceptance of the technologies connected to these industries. Although there are some psychological factors connected to the perception of 'dirty' work, the biggest impact of such work is created by the physical attributes. Users are more likely to perceive the technology as 'clean' when they cannot see or smell these physical, dirty elements. Whenever possible, anything that can be perceived as 'dirty' would be either hidden from sight or having its scent masqueraded.
Another, more symbolic, method that may be successful is changing the user's perception of 'dirty' processes is through the inclusion of purifying fire in the ritual. Unfortunately, the use of actual fire in the funeral ceremony will result in the (partial) loss of recoverable value contained in the body.

9.1.5 Idea generation for the trust value

A clear difference in emotional state is noticeable when people make contact with their funeral or waste management organisation. This difference is also present when using the technologies utilised by both these industries. The emotional state when contacting a funeral home is in part a result of being unknowing of how to approach this new situation in which many things have to be arranged in a short time. Therefore, this emotional state can be controlled by being prepared and already knowing what to do. Funeral homes can potentially play more into this knowledge gap from the users.

In waste management, trust in the organisation and technology is reflected by the required input effort by the user. This effort is not only applicable to the physical process, but also the decision-making processes, to name an example. If the funeral industry can lower the total required effort by the user, while delivering the same quality standards, the level of trust by the community in the industry will likely increase.

Another parameter of the funeral experience that can be changed besides user effort to increase the trust in the industry is the overall meaningfulness of the whole funeral experience. The current trend is the personalisation of funeral ceremonies, which can be continued to provide a more unique experience. Furthermore, the planning and organisation process could be adjusted to the family's desires.

Lastly, trust can be improved when funeral directors show they continue to care for their consumers, even after the paid service has ended. Whereas waste management has continuous feedback opportunities because the waste collection process is never ending, people do generally not take the opportunity to extensively share their opinion with the funeral director after the ceremony. A voluntary, scheduled meeting that takes place a week or two after the ceremony could not only provide funeral homes with valuable feedback to improve their services, but can also help the bereaved to cope with the loss if they have not done so already. Some people manage these losses better than others, whereas some may even need professional help. Funeral directors would be able to identify these cases and help everyone to cope better with the loss of their loved ones. If it has been established that everyone has mentally recovered, it could be beneficial to discuss the ceremony, ask for feedback and try to identify what could be improved for the next time.

9.1.6 Idea generation for the procedural fairness value

Contrary to waste management technologies, funeral technologies are not directly bound to the executive organisation. This is beneficial, as one funeral home can offer many different alternatives. It enables consumers to have both a free choice of funeral home, as well as a free choice of funeral technology. The downside to this is that it leaves consumers with a lot of decisions to make, at a time in which they are not always fully competent to do so. The amount of decisions that need to be made can be overwhelming. Funeral homes have tried to combat this problem by offering their services in bundles. The variety of different bundles, both in size, price and content can still be potentially overwhelming for consumers.

The diversity of available alternatives should be embraced, but reformatted to allow for a structural approach that deals with only one choice at a time. Where this format to be digital, users could easily pause and continue later, or look up new information before making a choice. It could be a system that allows for step-by-step progression through all aspects of a funeral. It could delve into both the practicalities of arranging a funeral, as well as personal details of the deceased (or user, if the document is arranged pre-death) to further personalise the funeral and create a unique experience. The system could inspire people by offering many different examples of unique funeral ceremonies. If all aspects would have been chosen, an automatic price estimation could be provided that should increase the clarity of pricing policies in the funeral industry. By following this complete and transparent road through all aspects that go into the planning of a funeral, people do not only get a greater understanding of the possibilities, but will also perceive the procedure as a whole more fairly.

If this (digital) document were to be authorised and legally accepted, it could perhaps be integrated similarly to the organ donation law that is currently in effect in the Netherlands and described in the 'Donorregister' (2018). By having people fill in this document mandatorily, everyone is prepared for their own death. Furthermore, it would be much easier for family to arrange the funeral, as everyone more or less has a will. As a result, the planning will be considerably less stressful, and the family can deal with their loss better as a result of that.

This idea could also be integrated to a lesser extent with the currently existing Donorwet, which would allow for people to donate much more than just the currently specified tissue and organs. Potentially, people could 'donate' every valuable element of their body. Based on how much of their body people are willing to donate to help society, fewer funeral technologies would remain available, as not all technologies have the same value recovery rate.

9.1.7 Idea generation for the attitude value

The general attitude towards death has historically been shrouded by a taboo. Breaking taboos is a slow process, but organisations like Yarden (2017) have slowly started to make death more discussable through public advertisements. Creating public discussion is the right way to break the taboo. These discussions can be started with things people are already familiar with. A good starting point for sustainable funeral technologies may be to remind people about the value of human organs and tissue, which is already part of the Dutch legislation (Donorregister, 2018). If people find it acceptable to donate their organs, why would it be different to put other parts of their body to good use after their deaths? By explaining what value is contained within the human body, and what could be achieved by recovering this value, more people may become open to funeral technologies that enable these resources to be recovered.

As Dutch citizens have gotten used to (online) donor donation registration, a potential next step would be the expansion of this program to also include the option to return the value of the rest of the body to society. At a later stage, options regarding choosing a funeral technology and ceremony could be added.

Alternatively, as this study makes the comparison between waste management and the funeral industry, if society works hard to prevent people from dying, they would also work hard to minimise waste output. Both of these aspects are socially desired and generally have the public's support. Similarly, the public becomes more supportive of recovering value from waste. A sensible next step would be the value recovery of human bodies.

Throughout this study, waste management and funeral technologies were stated to have two main parameters: the process efficiency, which describes how much effort is required by the user in relation to the perceived process output, and the meaningfulness of the process. Whereas waste management processes focus more in the prior aspect, funeral technologies have a stronger focus on the latter. To create the best user experience, both would be combined. Sustainable funeral technologies should have meaningful ceremonies, while also recovering value from the body. Alternatively, as a step to prepare society, technologies that at the least do not pollute the environment would also be acceptable.

Currently, the funeral industry is looking to implement new ceremony styles and technologies that their customers have a demand for. However, what the customer wants does not always fully align with that which is beneficial for society at large. It is an important step to also offer alternatives that are not only desirable by the consumers, but also serve the greater good of societal wellbeing.
If people are currently being taught to waste less and recover value from waste, why not continue this process after their deaths?

Before (quasi-)circular funeral technologies can really be accepted by the public and integrated into the market, general 'clean' and non-polluting funeral technologies such as green burial need to be popularised. After that, a move towards the introduction of processes that actually focus on value recovery can be made. As with all social changes, it is important to gradually adapt that which the public is used to.

9.2 Expert feedback

Section 9.1 presents the first draft of ideas that could be implemented to increase the social acceptance of circular funeral technologies. However, these ideas are largely based on theoretical data, combined with personal insight. It requires practical knowledge from the industry and years of experience to judge whether these ideas actually have some merit and potential to them.
The feedback of these experts is used to make the ideas more robust and ready for implementation. The experts selected for this process have varied backgrounds, to generate ideas and obtain feedback from different perspectives. Two experts have a experience with various aspects of the funeral industry, whereas the other two consulted experts are predominantly experienced in waste management, but have been involved in projects or jobs related to death care.
A list of these experts and a brief function description can be found in the methodologies subsection 4.5.2. The complete notes which were made during the interviews can be found in appendices D.1-D.4. Although the vast majority of the data was obtained through discussion with these experts, a few additional pieces of information were acquired from other sources. These people are thanked for their time, interest and input in the preface.

The expertise and knowledge of the people who were consulted during these interviews improved the ideas presented in section 9.1 considerably. The Dutch funeral industry context was discussed elaborately, going over topics such as recent developments and innovations, as well as updates on national legislation and municipal regulations. Through a better understanding of the current situation of the Dutch funeral industry, the proposed ideas could be discussed more accurately.
It was particularly interesting to see the diverse reactions of the individual experts on each of these ideas. The mixed reactions of the experts can be partly attributed to their diverse backgrounds. Although no single concrete idea could be selected as 'the best', getting mixed responses stimulates one to continue the development of the ideas. With their input and feedback, some ideas were rejected, whereas others were improved or combined.

Through the combination of these improved ideas, a set of guidelines and recommendations is created. Together with the analysis of the current developments in the Dutch funeral industry, two likely scenarios were identified. These are further described in section 9.3.

9.3 Feedback integration

The preliminary ideas in section 9.1 are based directly on a comparison of the most impactful values of the framework for social acceptance of circular funeral technologies. As the majority of the data of chapter 8, on which these preliminary ideas are based, comes from the literature, it is necessary to verify this data with the knowledge and practical experiences of funeral experts. This information was obtained through a series of interviews, based on which, it was discovered that there were some differences between the literature data and the current, Dutch scenario. As a result, the preliminary ideas are updated to better reflect the context of this study. One of such updates is the newly defined differentiation between 'sustainable funeral alternatives' and 'circular funeral technologies'. The new ideas are combined with the other expert feedback, to develop a set of guidelines consisting of strategies that should smoothen the introduction of both sustainable funeral alternatives, as well as (quasi-)circular funeral technologies.

9.3.1 Popularising sustainability in the funeral industry

The environmental awareness of people must first be adapted to include new alternatives in the funeral industry. The best way of doing so is by adjusting the currently available alternatives, as people are already familiar with these technologies and therefore more likely to accept a more sustainable version of them. Funeral technologies can be made more sustainable by reducing the material input into the process, or choosing for an alternative with a relatively low environmental impact, for example by choosing a modest coffin, rather than an elaborately decorated hard wooden one. Another option is to recycle, remanufacture or reuse (waste) resources from the funeral process, such as tombstones and viewing caskets. Another approach entirely is to motivate people to live more sustainably by sharing an inspiring speech or life story of the deceased during the ceremony. These could also be collected and shared through an online platform.

The question remains to what extent sustainable consumer behaviour in the funeral industry can be 'regulated' or 'promoted' through governmental influences. The currently applied legislation regarding the post-mortem donation of organs is something that could potentially be expanded upon in order to include more funeral related wishes. Through this platform, sustainable funeral alternatives could be presented to consumers early, in order to introduce them to the available options. This service should at all times remain neutral and not become a place of advertisement for specific options. However, the views of experts vary regarding the potential of this idea, as some believe that the customers would be pressured too much.
They believe sustainable alternatives should first have a solid foothold to give people a chance to get acquainted with the way these alternatives function and can provide meaningful experiences, before the consumers are expected to make a formal decision.

The Netherlands is an ideal place to start with a more widespread integration of sustainable funeral alternatives. Dutch citizens are generally open minded and are to a certain extent already aware of the environmental problems we face as society. That being said, current legislation does not allow for many sustainable funeral technologies. However, the first natural burial grounds have opened and a few crematories have implemented waste heat recovery systems. The extent to which these alternatives are accepted and utilised is still relatively low. Citizens of rural areas generally have a stronger connection with nature and their local environment, but are also more conservative with their traditions. People in urban areas are more progressive, but sometimes lack this connection with nature. They still care about sustainable alternatives, but they do generally accept these faster in the form of technological solutions than inhabitants of rural areas would.

One new upcoming development is the construction of the first Dutch electric powered cremation oven in Groningen (DELA, 2018). As electric technologies are generally perceived to be sustainable, it will be interesting to see how people react to this new alternative. As far as the process and ceremony go, nothing changes. In particular, the combination of waste heat recovery and electric powered cremation ovens is worth closer attention. If both could be popularised simultaneously, people may also have less ethical concerns when waste heat recovery is applied in traditional gas-powered crematories. It is possible that in the future cremation ovens may also run on hydrogen. Whereas regulations can make new sustainable (and circular) technologies available for the masses, it can also provide a set of norms for the construction of new, more sustainable, death care related infrastructure. A great example is the planned electric crematory by DELA, which is in its entirety built conform norms for near energy neutral building (DELA, 2018). If all future death care infrastructure would be built according to the same norms, the industry as a whole would become more sustainable as a result.

Regardless of the chosen method to make a funeral more sustainable, it is important to consider the impact of the funeral technology in relation to the complete event. Funerals in general can also become a lot more sustainable by encouraging people to travel to funerals, or visit the place of rest / memorial by more sustainable means, such as the bicycle or public transport. Reducing travelling while also making funerals personal and meaningful can be contradicting values. If an individual had a strong connection with a certain location, which is desired to be included in the funeral ceremony, one option would be to locate (a part of) the ceremony at this special location. However, through immersive visual and audio technology, the feelings associated to that special place can be conveyed anywhere. Integrating such technologies could also be a step towards the reduction of the ecological footprint of funerals, while maintaining the ability to personalise the ceremony.

Besides environmental benefits, digital tools or applications could also be applied to further enhance the experience of the funeral planning phase, the ceremony, and the processing of the loss afterwards. The introduction of a digital app or platform which allows the user to go through all upcoming decisions in the planning of a funeral process, they will be better prepared when the time eventually arrives. As the pre-arrangement of funerals is likely to become more popular in the future, it is interesting to see how a neutral, non-economically incentivised platform can contribute to these decisions. Generally speaking, a pre-arranged funeral involves a less resource intensive ceremony, as people are generally more modest when deciding for themselves than for a beloved friend or family member. As a result, the environmental impact of funerals is expected to go down if they are pre-arranged. Another notable upside of digital platforms is that they can help to create a non-personal, pressure-free environment in which people are more confident to discover new alternatives and think about their own funeral related wishes.

As the taboo on death in urban areas has ceased to exist since approximately the last six years, these sustainable alternatives can be broadly announced, explained and advertised through public television, radio, magazines, newsletters and online platforms. Because death and funerals affect everyone within society and do not discriminate between age, gender, intellect or wealth, it is important that any public advertisement is understandable by everyone. In other words, the topic of sustainability in funerals needs to be presented broadly, in clear language, and preferably through concrete examples. In some instances, sustainable alternatives may be more expensive than their regular counterparts. However, when sustainability is achieved through more efficient resource management, financial benefits can often be achieved as a result. Sustainable as well as financial benefits should be communicated clearly to the consumers. Mass media provides the means of more continuous exposure, which will ultimately result in a faster acceptance.

Although the scope of this study was originally set on urban areas, some insights were gained into rural areas as well. In these areas, the taboo on death is not considered to have passed to the same extent as it has in urban areas. As a result, advertisement using mass media is likely to result in more public backlash. A more personalised approach, for example through (funeral) magazines, is advised for these areas, with a focus on alternatives that rely more on natural solutions rather than technical ones. Technical solutions will be accepted once they have become more mainstream in urban areas.

Through wider integration of sustainable alternatives into the funeral industry and proper advertisement, public discussion about their relevance and added value will increase, which leads to an overall greater social support. Although these advertisements are important to increase overall awareness, word of mouth and real funeral experiences will also help to convince people that these technologies are actually meaningful and worthy alternatives to what they are accustomed to. Another method can be the inclusion of other organisations or individuals that already have a substantial following to promote sustainable alternatives. An example of such a relatable organisation would be to approach Natuurmonumenten to promote natural burials. Their members are active in the maintenance of green areas and generally appreciative of nature. As a result, their values align perfectly with those represented by natural burial. Reaching out to existing networks also reinforces the notion that the community is important in the acceptance of death care technologies. Regardless of the chosen method for advertising and informing the people, it is important to reach them well before the moment of their own, or one of their family members' passing.

The upcoming funeral technology resomation, which is currently being looked into for legalisation in the Netherlands, is at an interesting place where, depending on how the technology is introduced, it can be either a sustainable alternative or a (quasi-)circular technology. The default resomation technology, which operates on the basis of alkaline hydrolysis, pressurises heated water, allowing the chemical process to operate at much lower temperatures than cremation requires. Despite the added chemicals, the overall environmental impact of resomation is considerably lower than that of the other options currently available (Keijzer & Kok, 2014). In the 'default' version of resomation, the effluent of the process is flushed down the sewers to be treated by an WWTP (wastewater treatment plant). The extent to which WWTPs recover value from their treatment processes is relatively low. However, new technologies capable of recovering more nutrients and energy are being researched and developed.

Resomation as 'sustainable alternative' may be the correct way of introducing the technology in urban areas. As relatively few people in those areas have gardens to use the nutritious effluent on, they might not have as much interest in the value recovery potential as inhabitants of rural areas (with their own gardens) would. It is highly likely that there will be ethical concerns about sending the remains of a beloved one down the sewer. Besides that issue, resomation only leaves the harder elements of the human body, such as bones and teeth, to be collected as tokens of memorialisation.

Once these alternatives have obtained a sufficient level of popularity amongst the public and the integration of sustainability in the funeral industry is accepted, the next steps towards circularity can be slowly introduced. As with all socio-technological innovations, changes need to be brought into society slowly to allow people to adapt and get used to the new scenario, while also slowly changing their mindset. Especially the latter goes faster in some countries (or even cities) than others. The relative long intervals between funerals do not necessarily have to slow this process down.

9.3.2 Introducing (quasi-)circular funeral technologies

The scenario described below is realistically only going to happen once sustainable funeral alternatives (see subsection 9.3.1) have acquired enough societal support. It is difficult to allege a specific level of market penetration for these sustainable alternatives, but they must be common enough that the vast majority acknowledges their existence and understands the merits to these alternatives. Ideally, the market share of these sustainable funeral technologies is big enough that they start to replace non-linear, unsustainable alternatives whose development rate for new projects diminishes as a result. However, depending on when the first truly (quasi-)circular funeral technology is introduced to the market, it is likely it will also start the slow process of being accepted, albeit at a slower pace than the sustainable alternatives presented in the previous section.

As years go by and the public support for sustainable funeral technologies increases, a shift in the digital competence of the (by then) elderly occurs simultaneously. As the use of smartphones and the internet is interwoven increasingly more with our social lives, so does the level of comfort that the (majority of the) public has with using digital tools in their everyday lives. This will ultimately also be the case for funeral related activities. Whether an online platform is used to spread awareness of the passing of an individual, allowing (distant) friends and families to send their condolences or let people watch the ceremony through a live stream, the internet can undeniably contribute to the reach of multiple funeral aspects.

Furthermore, these services can be integrated with informative tools that can aid people in the pre-arrangement of their own funerals, or help with the planning of the funeral of a deceased loved one. Whereas setting up one's funeral wishes through a digital application could be done without professional help, the expertise and emotional support a funeral director can offer is unmissable after the recent passing of a love one. Either way, such applications will realistically only be able to assist in the selection of the material aspects of a funeral. Another likely scenario is the development of a digital checklist that prepares the planning individual for all the choices that will have to be made. Increasing the decision-making process' user-friendliness will also reinforce the user's trust in the funeral home, as they feel like the industry put in special effort to help their customers.
If this tool were to include a financial estimation of the total funeral with a clear breakdown of the costs of individual components, the procedural fairness as perceived by the users would increase. Additionally, if customers approach a funeral director with an estimation of the costs and overview of desired services of a pre-arranged funeral, the actual process of arranging the funeral will be much more efficient, without having the risk of paying (too) much for unnecessary services.
An example of such a tool would be one that guides the user step-by-step through all decisions leading up to the funeral ceremony.

This tool could add inspiring visual samples from other funerals to convey the atmosphere of specific choices. Integration of digital tools that people can access both from home as well as at a funeral home with a professional, would not only provide the user with more information and an easier decision-making process, it would also increase the overall connectedness between the user and the funeral homes by engaging with their products and services more actively and frequently. Another potential interesting feature of such a digital tool is the ability to share one's choices and wishes with both funeral director as well as family members. After all, it is important that an individual's next of kin are aware of that person's wishes. Not only would such a tool increase their awareness of the decision, it can also involve them in the discussion of the available options. Making death and dying discussable within familial setting will help to prevent intrafamilial conflict when the moment of passing eventually strikes and no decisions had been made. If death were to be more openly discussable in familial settings, so too would the development and introduction of new funeral technologies. This would naturally be beneficial to the social acceptance of these technologies.

While awareness and appreciation of sustainable alternatives is increased, new (quasi-) circular technologies can be further researched and legalised. Many new technologies have been theoretically developed, but lack concrete adjustment to local regulation. Adjustments are necessary for these alternatives to be legalised, while at the same time the legislation is adapted to make room for more of these technologies. Not only circular technologies suffer from a lack of legal support, but also sustainable alternatives such as natural burial still struggle to find acceptance for the opening of new burial grounds. A more lenient legal system towards a more flexible approach to death care would considerably help the development, introduction to the market and success of both sustainable and circular funeral technologies.

A flexible legislative system regarding funeral technologies allows the consumers to have the option to choose from more diverse funeral alternatives, as well as to be more flexible in the arrangement of the planning, ceremony and disposal of the remains. Additionally, if legislation balances out across municipalities, the perceived procedural fairness of the funeral industry would greatly increase.

Although legislative support for more death care alternatives is not an item that frequently appears on the agenda of political parties, D66 has recently announced their support in achieving this (D66, 2018). Among their plans is the legalisation of resomation. Whereas subsection 9.3.1 describes resomation as a sustainable alternative, it also has the potential to be the first (quasi-)circular funeral technology to be introduced in the Netherlands if the nutrient-rich effluent can be used as a new resource. By recovering the value of the effluent, it's treatment by a wastewater plant is avoided. This by itself will satisfy those consumers who find it unethical to send the remains of the dead down the sewers. Two realistic alternatives for the use of this effluent are described for this scenario.

In the first option, the next of kin take the effluent home where they can use it provide any trees or other greenergy with nutrients. Besides closing the loops from a technical perspective, the cycle of life is also continued in a more spiritual way. The remains of the deceased stay close to them and provide a meaningful, personal experience. This could even be combined with the earlier idea of having a post-funeral meeting with the funeral director to evaluate how the bereaved have dealt with the loss. In this meeting, a new ceremony could be introduced in which the nutrients are applied to the garden or other natural area. By involving this final ritual in the total funeral package as an added service, it will reinforce the people's trust in the funeral home as they perceive them to have guided them through the entire process in a meaningful and personal way.

The other alternative is for the effluent to be used in a more public manner, which could be organised by either the organisation in the possession of the resomation installation, or the municipality. It is common for crematories to have a garden in which the ashes can be scattered. A similar concept could be realised for the deposit of the resomation-effluent, which can then continue to nurture this garden, while creating a semi-public location for memorialising the dead. Alternatively, the municipality can use the effluent to provide nutrients to public parks and gardens. By using this method, the death of an individual is turned into a societal benefit through the creation and maintenance of public green areas, and can therefore possibly find broader societal support. Despite the efficiency and environmental friendliness of these circular funeral technologies, their ethics, meaningfulness, functionality and cosmetic appeal should all be considered and optimised before introduced onto the market. While designing all these aspects, the requirements and wishes of all actively involved actors should be considered. This is a recurring theme in the development of many successful socio-technical systems, and circular funeral technologies should not be an exception.

Which of these two alternatives will become dominant mostly depends on the local regulation (once resomation is included in the national law on death care), much like the possibilities of scattering ashes also differ per municipality.

9.4 Tracing the results back to the social acceptance frameworks

The two scenarios that are provided in section 9.3.1 and 9.3.2 can be considered as the outcome of this study. Within these scenarios, a large variety of recommendations is made which can be interesting to multiple stakeholders. A brief overview of these concrete recommendations can be found in section 11.3.

As many of the recommendations in the two previously described scenarios are based on the results of the literature study of the seven values in the social acceptance framework, it is only logical that the provided suggestions are closely tied to the custom framework. As appendix C.11 shows, three of these values originate from the FAF's social values cluster. This is not surprising, considering the importance of social factors in this study. More surprising is the inclusion of a value from the idealistic values cluster, as the interviews with ROVA's Hemmo Hagedooren indicated that people care much more about the physical aspects of the waste management system. The remaining three values originate from the TAF.

When the greater societal picture is analysed, the structure of the framework, which is based on CTA, becomes relevant. In order to increase the social acceptance of (quasi-)circular funeral technologies and other sustainable funeral alternatives on a practical level, the public must be informed through bridging events with experts related to the industry. Considering the social complexity of funerals, providing the right information to the people at the right time is critical. The suggestions which are provided in the two scenario sketches give an indication of the type of information that the public requires. The time at which this is best presented is a lot more complex and cannot be defined for the general public as a whole. The moment (if ever) when someone chooses a specific technology and ceremony for their own funeral varies greatly between people. Some people are very conscious about their limited time on earth and plan well ahead, whereas others do not plan anything at all. Other people may make a choice when they unexpectedly lose someone who was dear to them. Besides the source and timing of the information exchange, the location is also a relevant factor. As previously discussed, people in rural areas react differently to certain news which can be perceived as socially shocking than inhabitants of urban areas. Furthermore, people may react differently to news when confronted outdoors rather than in the safety of their own homes. Managing all these factors is key to provide the most meaningful and effective bridging events.

Each value described in the selection cycle creates a different demand for information by the public. This demand is not only directed towards funeral directors, but all other relevant experts that operate within the enactment cycle (as described by the CTA framework). For example, funeral homes have a lot more influence over distributive fairness, whereas the municipality plays a much larger role in the procedural fairness of a given technology. The parameters involved in the development of bridging events make it near impossible to do so without the availability of specific information relevant to the context in which the social acceptance is to be improved.
In this section, several examples of relevant information to determine the correct way of organising bridging events for the seven selected values are provided. The information that the public needs in order to evaluate certain values gives the experts an accurate idea of where to focus their effort on research and development.

The public's **attitude** towards sustainability must change before sustainable funeral technologies will ever become popular. Participation through the waste management system is actually a good way to involve people and educate them about the importance of sustainability and value recovery. Information is most likely best provided by the municipality, as they can easily connect with other local actors which promote sustainable behaviour. Funeral homes can educate people about the relevance of sustainability in the context of funerals specifically. They can only successfully do so when the public has a solid foundation of knowledge about sustainability.

The importance of a **community** strongly varies between urban and rural areas. Although society as a whole has become more individual over the years, this is especially true in densely populated areas. A member of a community in which more people care about each other, and as a result are more involved when someone passes away, is more likely to choose a funeral technology that is beneficial for society as a whole. This naturally translates to a sustainable funeral technology that not only has a lower environmental footprint, but also contributes something meaningful to the people who are left behind. An example of such a meaningful approach to death care is the utilisation of the nutritious effluent of the resomation technology which can continue the life cycle. It is difficult to pinpoint an actor from the enactment cycle that can help to reinforce the importance of communities within a society.

Digitalisation of services could play an important role to improve the **connectedness** between the public and the funeral industry. Especially their ability to convey information in a pressure-free manner whenever it suits the user is a convenient upside, which could be utilised as (part of) the bridging events for other values. The connectedness between the deceased, the mourners and the funeral home can also be increased through the utilisation of immersive audio and video technology during the ceremony. This is an aspect that the funeral industry has a lot of control over, although they may have to engage in new collaborations to achieve these goals.

Whereas the information for the other selected values can be provided by one or more group of experts, **families** mostly interact amongst themselves. These familial discussions can be indirectly influenced by ensuring that truthful information is readily available and presented in a cohesive, clear and understandable format for everyone. Essentially, funeral homes need to ensure that details of their available (sustainable) funeral technologies are easily accessible and able to spark interest for discussions, which can eventually be continued over a cup of coffee or a glass of wine with family members during their next visit at a birthday party or other social event.

Cleanliness is a value that in the context of funerals mostly comes down to an orderly presentation of the facilities and thorough preparation of (public) ceremonies and other preparatory work with the next of kin. Especially the introduction of a new funeral technology may leave people wondering to what extent the technology is safe and clean. Researchers and developers of this new technology should be able to provide this information to the funeral homes which are interested in utilising it, as well as the government for legislative support. Once verified, the funeral homes will have to persuade the public and potential consumers that the new technology meets the expected standards in regards to safety and cleanliness.

The **distributive fairness** is perceived differently per potential user. It is common that specific user groups have more information and therefore perceive systems differently than others. When everyone has the same perception of fairness, the system can be tuned to satisfy as many people as possible. Educating the people through the provision of information about the system, its pricing policy and expectations from the users helps to bring everyone to an equal level. Ideally, a state is achieved in which the public perceives sustainable funeral technologies to be distributively fairer than traditional funeral technologies. Funeral homes should have the information available prior to the introduction of a new sustainable funeral technology to convince the public of its distributive (and procedural) fairness.

As **trust** in the funeral industry is increased when the consumer can properly plan ahead and learn about the expected procedures through a more user-friendly decision-making process, funeral homes should prioritise finding ways to do so. As everyone has different preferences when it comes to starting the process of learning about and analysing the available funeral options, a digital tool that allows the user to do so at a moment of their own choosing is beneficial. A further increase of the user's trust in the funeral industry can be achieved by providing a personal and complete package of processes and ceremonies leading up to, during and after the funeral. The introduction of a new funeral technology should also consider these additional processes and ceremonies to create a complete experience for its future users.

9.5 Conclusions

The goal of the fifth and final research chapter is to integrate all information previously obtained in order to set up a realistic set of recommendations for the funeral industry to allow for a faster and smoother acceptance of sustainable funeral alternatives by Dutch citizens. A selection of experts was consulted to provide insight into how these ideas could be improved to be better reflect the funeral industry as they perceive and experience it on a daily basis, rather than (sometimes dated) data from literature. Based on their feedback, a set of recommendations was developed. These guidelines are also the answer to the research question of this chapter:
What recommendations can be made to the Dutch funeral industry to increase the social acceptance of (quasi-)circular funeral technologies?

The preliminary ideas based on the comparison described in chapter 8 are presented in section 9.1 per originally identified value. A selection of ideas, ranging from abstract to concrete, was created for each of these categories. Some are generally applicable, others are much more specific. Each value is well represented in the idea generation process, which created a diverse set of recommendations. Examples of these ideas are recommendations for new approaches to advertisement, digitalisation, system interactions, improved pre-arrangement, extended services, and legislation.
Through this diversity, it is likely that anyone professionally associated with the funeral industry will find something to their liking. In the end, it is hard to quantify, or even estimate, which recommendation will have a bigger (if any) impact on the social acceptance of these technologies.

Section 9.2 provides an overview of the experts who provided a lot of valuable feedback through a selection of different interview methods. Although all affiliated with the funeral industry, the experts cover a wide range of different backgrounds. Through their diverse backgrounds, each of them analysed the proposed ideas from a unique perspective. As a result, not all experts had the same opinion about every statement presented in this chapter. Especially the proposed presence of a taboo on death and dying in the Netherlands was disputable. Regardless, through their insight and input, the preliminary ideas from section 9.1 were adapted to reflect the current state of the Dutch funeral industry more accurately. As a result of these interviews, a clearer distinction is made between sustainable funeral alternatives and new technologies that actually strive towards (quasi-)circularity.

The updated ideas are presented more coherently in section 9.3, where they are restructured in two new categories: a set of guidelines that focuses primarily on the acceptation of sustainable alternatives, and a set of guidelines that are directed towards (quasi-)circular funeral technologies. In these guidelines, the original ideas that received the most positive feedback are described more elaborately and put into a realistic context. Through the new subdivision, it also becomes clearer which ideas can be integrated on a (relatively) short term, and which may have to be integrated at a later time, when sustainable funeral alternatives have already established a certain degree of social support. Additionally, section 9.3 features a few new concrete, recent developments in the funeral industry that were encountered during the expert interviews. Especially the resomation technology was discussed frequently with experts, as it is the technology that is currently being looked into for legislation and introduction on the market.

The guideline presented in 9.3 is the conclusive research segment. It provides a variety of recommendations that should accommodate a smoother introduction of sustainable funeral alternatives as well as new, (quasi-)circular funeral technologies. Additional ideas can be found in section 9.1, although they are not as robust, elaborate and refined as those in the final guideline.

10. Discussion

The research questions have been successfully answered, but there are still a few aspects worthy of consideration. During the study, many decisions regarding the scope and research methods have been made that (in)directly influence the outcome of the study. The objective of and approach to this study lend itself exceptionally well to exploratory research methods, which resulted in certain methodologies being applied in a completely new context. Due to its uniqueness in both topic as well as research method, it will be difficult to compare the results with 'similar studies', for the simple fact that there are no similar studies. The highly qualitative, exploratory approach to the study makes it vulnerable to interpreter bias. Besides these rather generalistic drawbacks of the applied research methods, there are some more nuanced decisions that impact the research throughout the study. These are discussed in section 10.1, whereas further research suggestions are elaborated in section 10.2. Section 10.3 briefly discusses the broader relevance and novelty of this study and its applied methodologies. The topics are presented in order of appearances in the main report.

10.1 Reflection on choices and limitation of the research

Although the material flows identified in chapter 5 were based on professional LCA studies, the procedure of selecting the resource flows to represent the funeral industry was a personal choice. Had other flows been selected, different waste management technologies would have been found, which would have led to other case studies, etc. Even the selection of the specific waste management technologies through the literature study may have ended up with different technologies if other sources were used.

One of the key decisions that was made in this study was the selection of three social acceptance frameworks (in chapter 6). Although the reasoning for the selection of these specific frameworks, and the changes that were applied to match them with the funeral industry were described, less attention was spent on the validity of combining these three frameworks. It is important to note that each of these three frameworks originates from a different context and research background. As a result, they are technically not compatible, as the values described in these framework have different meanings within their intended contexts. Therefore, it is questionable to interchange the values of different frameworks like the way it was done in this study. Whereas the values of one framework are already focused on the context of death care, another takes a much more technological approach to the social acceptance of the placement of energy plants. The third has a much stronger focus on the development of new technologies. However, it was decided that these frameworks would be combined for this study. This decision was made on the basis of several reasons.

First of all, the goal of the custom framework was to be as complete as possible and cover as many relevant elements as possible. Searching the literature for examples in different contexts was ultimately going to lead to this problem, but also allowed the framework to be as close to complete as possible.
Secondly, this study is exploratory by nature, and although the combination of these frameworks may not be completely scientifically correct, it was expected to lead to interesting and useful results. Looking back, it is safe to say that the results are indeed satisfactory, which largely because of the unique take of the custom framework.
Lastly, it should also be noted that death care, and particularly the development of new funeral technologies, is a highly complex topic that involves many cultural, demographic and technical aspects. To some extent, it can be reasoned that it's only logical to include frameworks that originate from different fields when researching this topic.

The case studies that were ultimately selected for this research did not completely align with the description provided in the technology description. For example, the composting case study should have been about in-vessel composting, but a different composting technology is utilised in the chosen case study at the ROVA installation in Zwolle. However, the technologies were deemed to be similar enough to be viable to use as case study.

Additionally, it is important to note that both case studies are managed by the same organisation. A variety in organisations could have lead to interesting perspectives on different approaches to push new sustainable technologies onto the market. Through source sorting by the users, the two selected waste streams are each processed differently. Organic waste is transported to the fermentation and composting facility in Zwolle, whereas the 'regular', non-organic MSW is processed at the nearest MSW treatment plant. As a result, the user group, defined as the origin of the waste that needs to be processed, is identical for both cases. For diversity sake, it would have been nice to have more diversity in the user feedback. Because both case studies share the same user group, their opinion could not be put into perspective with another group. Perhaps this group was particularly flexible or progressive, which made them much more likely to accept the new technology by default. However, implementing the same users' feedback simultaneously for cases operated by the same organisation also has its advantages. Data is distributed and perceived equally in both cases, which makes for an honest and truthful comparison.

Furthermore, it must be added that a total of two case studies (one for each waste management technology) is rather low. It was found difficult to obtain valuable, quantitative information about such cases in the Netherlands, both in the literature and in practice. Ideally, at least one more case study was found for each technology, in order to be able to compare the data to a similar case. Alternatively, if another comparative study was found in the literature, the results thereof could have been used to reason whether the data from the two current case studies was conform the expectations. Either way, the data that was obtained from the current selection of case studies does match with information that is commonly found in the literature. However, considering the context of this study and the need for information from specific waste management systems, the use of case studies is justified. It adds a concrete element to an otherwise abstract study.

Chapter 8 focuses on the factors identified through the comparison with the waste management industry. The goal of the study is to look for elements from sustainable waste management that can be integrated into the funeral industry, so only factors that were marked as highly impactful were analysed. There are however also factors such as religion and ritual that were not found to be meaningful in the waste management case studies, but were mentioned numerous times throughout death care literature. As the goal of the study was to integrate elements that were found to have a positive influence on the social acceptance of sustainable developments in the waste management industry, it was decided to leave these other factors out of the literature study for the funeral industry. It would be interesting to discover what potentially new outcomes the study of other values would provide.

As chapter 8 analyses social acceptance in the context of death care, it is worth to consider to what extent it has overlap with the original work from Bergen & Van den Hoven (2018). Their goal was to create a framework for the moral acceptability of new (and currently available) funeral technologies to help policy makers decide which of these technologies are worth to consider for legalisation, and how the current law needs to be adjusted to support the introduction of this new technology. If the technology is deemed to be morally unacceptable, it also provides guidelines to improve the technology so that it may increase its moral acceptability in the future.

Although this study does utilise a significant part of Bergen & Van den Hoven's framework, it does not have the intention to directly affect the legislation process. It operates under the assumption that a technology is already legalised and is looking to create a foothold on the market and expand its market share. Additionally, this study does not analyse each funeral alternative separately, but bundles them under the banner of (quasi-)circular funeral technologies. As a result, the acquired data and final list of recommendations is much more broadly applicable.

Another key difference between both studies is the comparison with the waste management industry that this one makes. Through this exploratory approach, a whole new set of data and insights became available. If anything, it can be considered that both studies complement each other, rather than simply trying to fill the same knowledge gap.

A different item of the applied research structure that is worth considering is that the comparison between both industries is based on different types of studies. Whereas data from the waste management industry is obtained through case studies, literature studies were conducted to find data for the funeral industry. This is mostly due to a lack of applied sustainable developments in the funeral industry. On the other hand, no appropriate literature was found about circularisation in the waste management industry, where it was known that these aspects are currently being considered, developed and integrated into society. As a result, this mismatch in data collection methods was unavoidable. It is difficult to determine to what extent this is a problem at all. After all, the comparison yielded interesting and useful results.

During the expert interviews, the practical differences between highly urbanised, mildly urbanised and rural areas became clear. For the sake of clarity in research terminology, only 'urban' and 'rural' areas were distinguished. However, mildly urbanised areas such as Zwolle still show a fairly strong tie to (religious) traditions. Whereas this study perceives Zwolle as an urban area, local experts had a tendency to treat it as such to a much lesser extent.

Despite the goal of this study to research the social acceptance of (quasi-)circular funeral technologies, no actual interviews or other data acquisition methods were utilised to obtain information directly from the public. In similar vein, no bridging events were organised with the target audience, although this would certainly benefit the CTA aspect of the custom framework.

The preliminary ideas were created based on the differences listed in subsection 8.2.3. As with any idea generation process, it is impossible to list all possibilities. There are arguably still some good ideas left unexplored. However, the list that is provided in this report features enough interesting, different ideas. A downside of the idea generation process was that it was performed individualistically.

It would have been an interesting idea to take the same list of differences, but generate ideas with other (Industrial Ecology) students or funeral experts. Furthermore, no properly defined idea generation methodology was applied. Other idea generation methodologies may have provided different ideas, which could have resulted in a different set of recommendations.

The original goal of the study was to research the social acceptance of (quasi-)circular funeral technologies, but the majority of the ideas pitched in scenarios described in section 9.3 are focused on sustainable alternatives, rather than new (quasi-)circular technologies. As a result, a new subdivision had to be made to work around this phenomenon. The final recommendations may have been different is all focus was maintained on (quasi-)circular funeral technologies. However, it was deemed to be more important to keep the research as relevant as possible to the 'real' scenario of the current Dutch funeral industry.

10.2 Recommendations for further research

Besides describing new research topics as result of finding new questions during this study, it is also worth noting that in general, the field of sustainability in the funeral industry is unexplored. As this study showed, interesting research can be created by comparing the funeral industry to a completely different one. Although the similarities may not always be obvious, exploratory research allows for creative research methodologies that can not only reveal the presence of these similarities, but also use developments in the other industry as a source inspiration.

In this study, only the seven values of community, connectedness, family, cleanliness, trust, procedural fairness and attitude were thoroughly analysed. Other values that do not have a strong effect on the acceptance of waste management technologies are left unexplored, but may have a high impact on the acceptance of sustainable funeral technologies. New (literature) studies on these other values could provide additional insight as to how the social acceptance of sustainable funeral technologies could be improved.

Previous research (Van der Burgh et al., 2017) showed that the impact of a funeral technology in comparison to the complete ceremony and travelling associated with visiting the site of memorial is relatively small. It would be very interesting to see how these external factors can be changed to further minimise the environmental impact of funerals. Researching these aspects falls beyond the scope of this study, and it is more important to adjust them to the new technology in order to create a cohesive, meaningful experience. Therefore, the technology would need to be accepted and implemented into society first regardless.

Although section 9.4 provides some ideas for the initiation of bridging events, no concrete plans towards this goal are presented as many parameters are dependent on time, location and the characteristics of the people who live there. It would be highly beneficial for interested experts to conduct a real CTA and develop realistic plans for bridging events based on that research. They have more accurate information about the required parameters and can therefore analyse specific cases, such as the area in which a funeral home operates, more strategically.

On a final note, because this research was exploratory, serious contemplation of integrating the results of this study in practice may require further research to validate the research outcomes. Especially when it comes to developing a 'first impression' of a new technology to the public, it is of utmost importance to do this right. Validating the research could for example be achieved by analysing new case studies with the customly developed framework to see if the same values appear to be important. In particular, this study could be expanded upon by testing the custom framework more thoroughly, conduct a CTA study through the introduction of area-specific bridging events and real analysis of the public and their opinion towards the information and suggestions presented here.

10.3 Broader relevance and novelty

Utilising frameworks from the literature in new research cases is a common occurrence. In this research study, not just one framework was used, but a combination of three frameworks with different theoretical backgrounds. Furthermore, these frameworks are applied in a new research context which is hardly explored in the literature. Besides the innovation of combining three social acceptance frameworks, this study offers additional academic novelties to each of the individual frameworks.

Traditional CTA studies use the framework for its process-oriented approach to the development of new technologies. This study focuses on new technologies only partly. Already developed technologies, such as cremation and burial, are also analysed. Using the CTA framework to study the social acceptance of sustainable developments of an already existing technology is new. Not only is the utilisation of CTA unusual to study sustainable developments, the undeniably difficult social position of death care and funerals provides another interesting research perspective for CTA. Furthermore, this study experiments with the restructuring of groups included in the enactment and selection cycles. In particular, this study excludes all parties other than the general public from the outsiders cycle. By doing so, the social acceptance of this specific group is studied.
If this study shows the possibilities of adding complementary value frameworks to CTA, other studies might find new combinations of frameworks that can be combined. Whether these new combinations are more academically robust, or as explorative as the approach of this study, the results will be interesting undoubtedly.

The FAF was originally only available in Dutch, and therefore had to be translated to be added to the report. This translation will hopefully allow other (international) studies to benefit from this well developed framework, as the modernisation of the legislation surrounding death care will sooner or later become relevant in most other countries as well. Additionally, this study shows that the FAF can be combined with other frameworks that include social values. In this study specifically, the values, which were developed for the analysis of the funeral industry, are applied to waste management technologies. It may be interesting to see what other industries and systems the list of values can be applied to.

A new approach to the use of the TAF is introduced by interchanging specific values. For example, it was shown that both the social and personal norm can be replaced by a much more elaborate list of values which describe a specific context. By interchanging these elements, the framework can be applied to completely new topics, as was done in this study.

The custom framework which is developed to research the funeral industry can potentially be applied to other loaded topics which are difficult to discuss publicly or are otherwise controversial. An example of such a topic which is closely related to the funeral industry is the legislation of euthanasia. But also other topics entirely, such as bioengineering fetuses to obtain certain characteristics or other traits, or the integration of artificial intelligence in our daily lives.

11. Conclusion

In this study, a large variety of aspects relating to both the funeral as well as the waste management industry were researched. The order in which both technical and social aspects were treated in each research question is depicted in figure 11.1 below. This chapter offers both a general conclusion of the analysed research questions and their respective answers, as well as a list of concrete recommendations to relevant stakeholders in the funeral industry.

Figure 11.1: Research goals of the sub questions in this study.

11.1 The five sub research questions and their respective answers

After the introduction of the topic, the comparison between the funeral and waste management industries was elaborated. Through an LCA study on the currently applied funeral technologies in the Netherlands, it was established that two types of material flow are the most representative of the funeral industry: organic content with high nutrient value and non-organic components containing valuable materials. Through a literature study, the first research question could be answered:
1) *With which waste management technology or system can the funeral industry be best compared?*,
Two waste management technologies, aerobic decomposition of organic matter and non-organic (municipal) waste treatment were found to be the most comparable. These processes were specified through further research as in-vessel composting and the sorting and recycling of mixed MSW.

With the contextual knowledge of both industries in which the social acceptance is researched, a suitable framework was created that allows such research. Fifteen established social acceptance frameworks were found through a literature study, covering a wide variety of different social aspects in various contexts. The most appealing ones were selected and specified to better reflect the context of this study. By doing so, the second research question could be answered:
2) *Which pre-existing frameworks describing social acceptance are available in the literature, and to what extent can they be adapted and combined to better reflect the funeral industry?*
Using Binder's criteria, the Technology Acceptance Framework (TAF), the Constructive Technology Assessment (TCA) and the Framework for Alternative Funerals (FAF) were adapted and combined to create a social acceptance framework for circular funeral technologies. This framework features a set of concrete, social, identity-driving and idealistic values that determine the social acceptance.

Two case studies were selected that represented recent changes in sustainability of both waste management technologies. The new framework was applied to find which values were particularly influential in the collection and fermentation processes of organic waste from households in Amersfoort to produce compost and biogas. Additionally, the framework was applied again to analyse which values had the largest impact on the social acceptance of a reverse collection scheme of MSW in Amersfoort and Zwolle. By doing so, the third research question was answered:
3) *What type of factors in the successful introduction of circularisation methods in the chosen waste management systems influenced the social acceptance according to this specialised framework?*
Data for each value in the framework from both case studies was collected through a series of interviews. After analysing the data, it was concluded that Community, Connectedness, Family, Cleanliness, Trust, Procedural fairness, and Attitude were the most important values that impact the social acceptance of sustainable waste management technologies.

The seven most influential values in the waste management sector were then implemented in the funeral industry. Through a literature study, it was found how the seven chosen values impact the funeral industry. With an extensive dataset for each of the values in both industry scenarios, a comparison could be made, thus providing a means to answer the following research question:

4) *How do the identified factors that improve the social acceptance in the chosen waste management sectors compare to the funeral industry? What are their differences and similarities?*

It is important to note here that, although many of the values in the framework originated from a death care-based scenario, only the values with the largest impact on the waste management industry were selected. After all, the goal of this study is to analyse how successfully accepted aspects from sustainable innovation in the waste management sector can be integrated into the funeral industry. Regardless, all seven values were found to be meaningful in the funeral industry. By directly comparing the data obtained from the waste management case studies to the funeral industry literature study for each value, both industries could be compared. Through this comparative analysis, differences and similarities were found. Whereas the similarities prove the initial theory of comparing the waste management and funeral industries, the differences provide an interesting potential for new ideas to improve the social acceptance of circular funeral technologies. The differences between both industries are used to continue the research, as ideas are generated that implement factors proven successful for the social acceptance of sustainable innovation in the waste management industry to the funeral industry.

A selection of different ideas was generated for each value, to create a broad scope of potentially interesting suggestions that would appeal to a variety of perspectives from the funeral industry. Some of these ideas are more technology-oriented, whereas others focus more on social aspects. To test the validity and increase the likelihood of success of these ideas, they were presented to a group of experts, each affiliated with the funeral industry in a different way. The suggestions that were developed as a result of these discussions are therefore answering the following research question:

5) *What recommendations can be made to the Dutch funeral industry to increase the social acceptance of (quasi-)circular funeral technologies?*

During the expert interviews, it became apparent that the definition of 'circular funeral technologies' did not properly capture all current and suggested developments in the industry. A new distinction is therefore introduced between 'sustainable funeral technologies' and the originally intended '(quasi-)circular funeral technologies'. Whereas the prior category focuses on reducing resources and emissions from and into the processes, the latter actively recovers resources from the human body. For each of these new categories, the original ideas to increase their social acceptance were updated with the experts' feedback. Furthermore, they were combined wherever possible with actual developments within the industry to make these suggestions as robust and realistic as possible. Through this process, a list of recommendations was created that should smoothen the introduction into the market and consumer acceptance of these new (or updated) funeral technologies. It is concluded that an approach that focuses on the awareness and introduction of sustainable alternatives to currently available funeral technologies would be best. Because people are already familiar with these technologies, they are more likely to accept modifications that increase their sustainability. Only when people have grown accustomed to the presence of sustainability in the funeral industry and have adapted them into their own funeral rites, the introduction of (quasi-)circular technologies should be considered.

11.2 Answering the main research question

By formulating, researching and ultimately answering the five research questions as discussed in section 11.1, the main research question can be answered:
What type of factors are essential for the improvement of the social acceptance of novel, (quasi-) circular funeral technologies, and how can they be integrated in recommendations to achieve this goal?

Looking back on the research that has been conducted throughout this study and the achieved results, it can be concluded that the comparison between both industries was valid from both a theoretical as well as a practical perspective. By applying the social acceptance framework for (quasi-)circular funeral technologies in two waste management case studies, it is discovered that the factors which are essential for the social acceptance of sustainable systems are social values originating from the Technology Acceptance Framework and the Framework for Alternative Funerals.

Not only have many similarities been found between the waste management and funeral industries, but the differences between them are also successfully incorporated in the development of a set of guidelines that can improve the acceptance of both sustainable funeral alternatives as well as (quasi-)circular funeral technologies. Furthermore, the expert feedback was remarkably positive upon hearing of this comparison, and they were curious to learn about and contribute to the results of this study, which further validates this comparison and research approach.

The guidelines, consisting of ideas to introduce and popularise these sustainable innovations, cover a wide spectrum of topics relevant to the funeral industry as a result of incorporating the seven values which were found to be effective in the introduction of sustainable technologies in the waste management industry. Through the incorporation of case studies, literature studies and expert interviews, the final recommendations are well-grounded and robust. As a result, the Dutch funeral industry can consult these recommendations and utilise them in their own endeavours to make their industry more sustainable, while maintaining its meaningfulness, personal approach and ethical responsibilities. However, it is important to note that this research was conducted on an exploratory basis. More information regarding the limitations of this research can be found in chapter 10.

The complete list of recommendations to the funeral industry, subdivided into two scenarios, can be found in section 9.3. A short list of concrete recommendations selected for the main stakeholders can be found in section 11.3.

Finally, besides the impact of an individual's funeral technology in contrast to the entire funeral ceremony, it is also important to consider the impact of an individual's funeral in contrast to that person's entire life. Sustainable funerals will not be the critical piece to solve the puzzle of our environmental challenges. It can, however, be the final piece to complete that puzzle on a personal level.

11.3 Concrete recommendations to involved stakeholders

To conclude this report, an overview of concrete recommendations to the three main stakeholders is presented. These primary stakeholders are the funeral industry and the Dutch government, whereas researchers are selected as the other group of interest. More details can be found in chapter 9.

The **Funeral industry** should first and foremost continue to make the currently available technologies more sustainable. As more of such options become available and start to comprise a larger segment of the market, the public will become more intrigued as to what these alternatives have to offer for them. As their awareness of environmental problems increases, more people will become open to including alternatives with a lower environmental footprint in their funerals. The extent to which people are willing to do so varies greatly. Therefore, a personal approach, as is usually offered by funeral homes, is an excellent way to get a feel for the degree to which people are considering the inclusion of sustainable alternatives. In order to prepare the funeral industry for a technological transition, they should look for cooperation with digital platform developers. Making this digital system independent, transparent and informative, will increase the public's trust in the funeral industry. It will also make them more likely to pre-arrange their own funeral, which comes with its own respective advantages. Another way to increase the likeliness of an individual pre-arranging their funeral is to make death care more easily discussable as a topic. This can be achieved through more frequent exposure to the topic.

The **Dutch government** is tasked with modernising the laws on death care and funerals. As funeral homes are well aware of the desires and complaints of their consumers, it is only logical to involve them in the development of a new legislative system. Including sustainability goals into this new system would allow future sustainable funeral technologies to be legalised and introduced onto the market more easily. The government could also look into the connection between the laws on death care and those about donor registration, and potentially in the future, those on euthanasia.
As is discovered in this research, an important distinction can be made between sustainable funeral alternatives and (quasi-)circular funeral technologies. Ideally, new legislation will continue to see this difference and provide opportunities for both aspects to increase their market share. (quasi-)Circular funeral technologies can only function when (a part of) the value contained in the human body is recovered and utilised elsewhere. The government has the tools to further promote sustainability amongst the public. Wider public awareness of environmental problems and solutions available within society are a great way to attract more people towards sustainable funeral alternatives. It would also beneficial if the national legislation included precise guidelines for the municipalities, in order to reduce the inequity between local procedures. Municipalities of similar order should have a highly similar legislative system in place. However, a distinction between urban and rural areas would be sensible, as the approach to death care and its related social norms is vastly different.

In the interest of other **researchers**, this study features a slew of new research approaches, which have potential for further optimisation in new research projects. Section 10.3 proposes some new ways in which researchers can utilise the methods explored in this study. As far as research dedicated to new funeral technologies is concerned, it is important to cooperate with funeral directors to analyse which new technologies the industry and their customers have interest in. These technologies should then be conceptualised to the point where representative pilot studies can be performed to provide the government with data required for their inquiry towards the legalisation procedures. Once these concepts have reached a state in which they are legally acceptable, further research should be conducted as to how they can be best introduced to the public. A complete CTA study could prove to be useful for this purpose. The final design of the technology should be adapted to accommodate the outcomes of these social acceptance studies.

12 Appendices

Appendix A.1 - Flowchart of burial

In (traditional) burial, the body is wrapped in a burial shroud and placed in a, usually high-end decorated, coffin. Via an elevator, the coffin is lowered into the grave that is dug mechanically. Over a timespan of an amount of years predetermined in a contract with the funeral home, the area around the grave is maintained. When the contract expires, the remains are dug up and transferred to a mass grave. Valuable non-organic materials are filtered out during the transfer process. The area around the mass grave will also be maintained. The flowchart of the (traditional) Dutch burial scenario is presented in figure A.1 below.
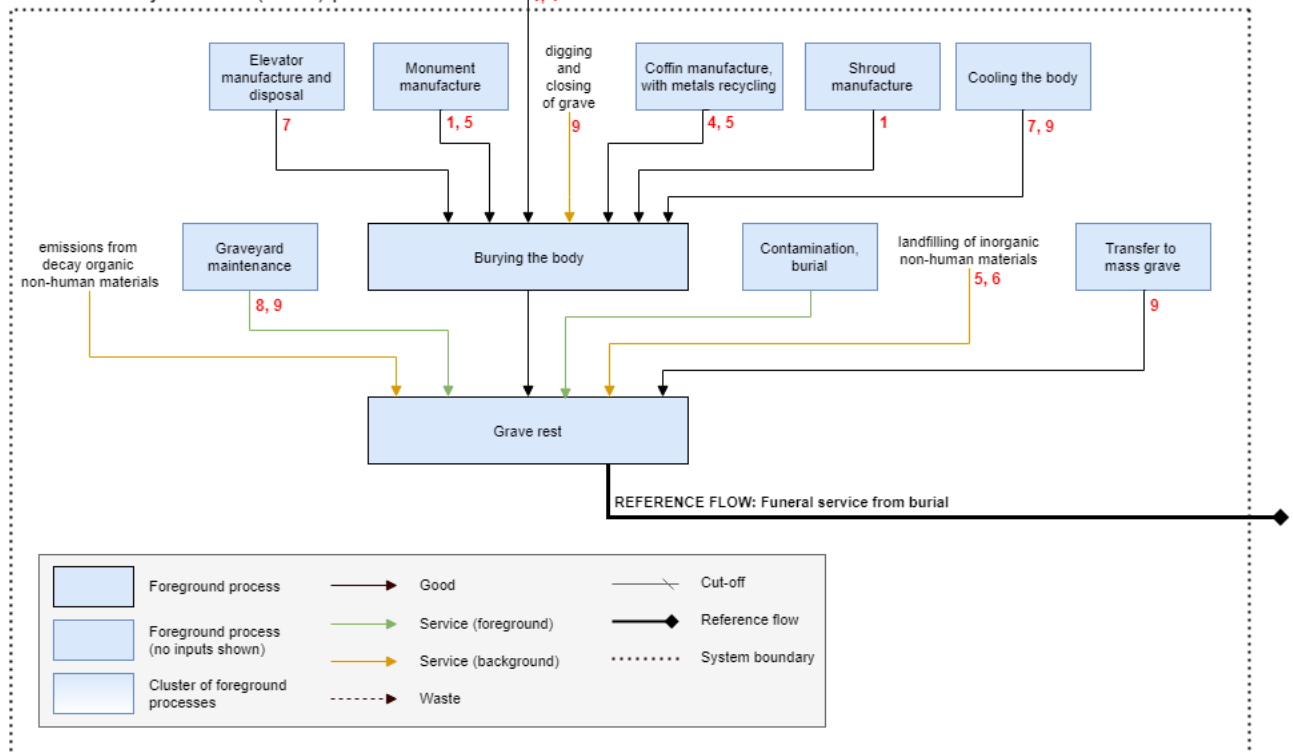
Figure A.1: Flowchart of the burial funeral technology for the Dutch context. Explanation of numbers in table 5.1.

Appendix A.2 - Flowchart of cremation

The bodies enter the cremation process in a burial shroud. However, the decorated coffin used during the ceremony is replaced with a more simplistic version once the body enters the cremation oven. After the cremation, the remains are pulverised and contained together with the ashes in an urn. The oven itself also needs to be cleaned and maintained, during which valuable non-organic components are separated. Depending on the deceased person's wishes, or those of close family, the ashes are dispersed into the environment. Its flowchart is depicted in figure A.2 below.
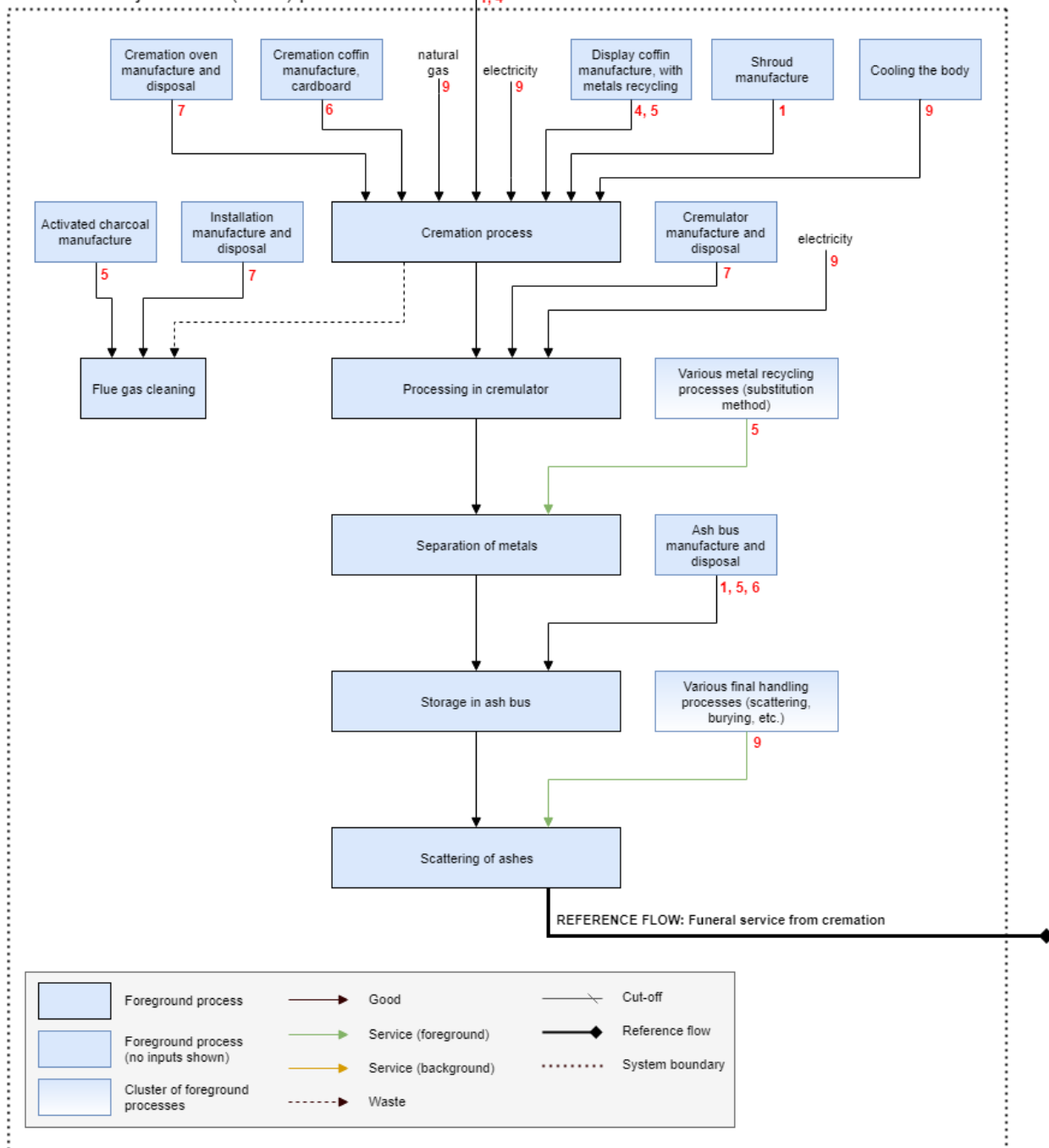
Figure A.2: Flowchart of the cremation funeral technology for the Dutch context. Explanation of numbers in table 5.1.

Appendix A.3 - Flowchart of natural burial

Natural, or green, burial has many similarities with traditional burial, but has a stronger focus on organic materials and connectedness to nature. Grave rest is eternal, and there is more manual labour involved in the maintenance of the burial grounds. The flowchart for the Dutch green burial scenario is depicted in figure A.3.

Figure A.3: Flowchart of the green burial funeral technology for Dutch context. Explanation of numbers in table 5.1.

Appendix B.1 - Social acceptance literature study

B.1.1 Analytic Hierarchy Process - AHP

In the field of healthcare, the analytic hierarchy process (AHP) is a commonly applied method to deal with multi-criteria decision-making challenges (Morrissey et al., 2004). According to the author, "AHP can support individual decision makers, as well as groups of decision makers. The AHP aims to support shared decision making, decisions on clinical guidelines, decisions on the development of new technology, organizational decisions, and decisions on health policy, such as regulatory decisions, reimbursement decisions, or allocation of public research funding." (Hummel et al., 2014). This method could be interesting when informing close family members in the time leading up to, or shortly after the death of their beloved, about this new death care technology. People may put faith in the structural approach this method offers and therefore see the new technology as a more appealing alternative.

B.1.2 Constructive Technology Assessment - CTA

The Constructive Technology Assessment (CTA) framework aims explicitly at influencing the shape of new technologies (Van den Ende et al., 1998). It helps to shape upcoming technologies to the demands of society, by taking the stakes of both insiders as well as outsiders into account.
By including many social actors, the decision-making process of the new technology is broadened to optimally align societal and technological developments. See figure B.1 below.
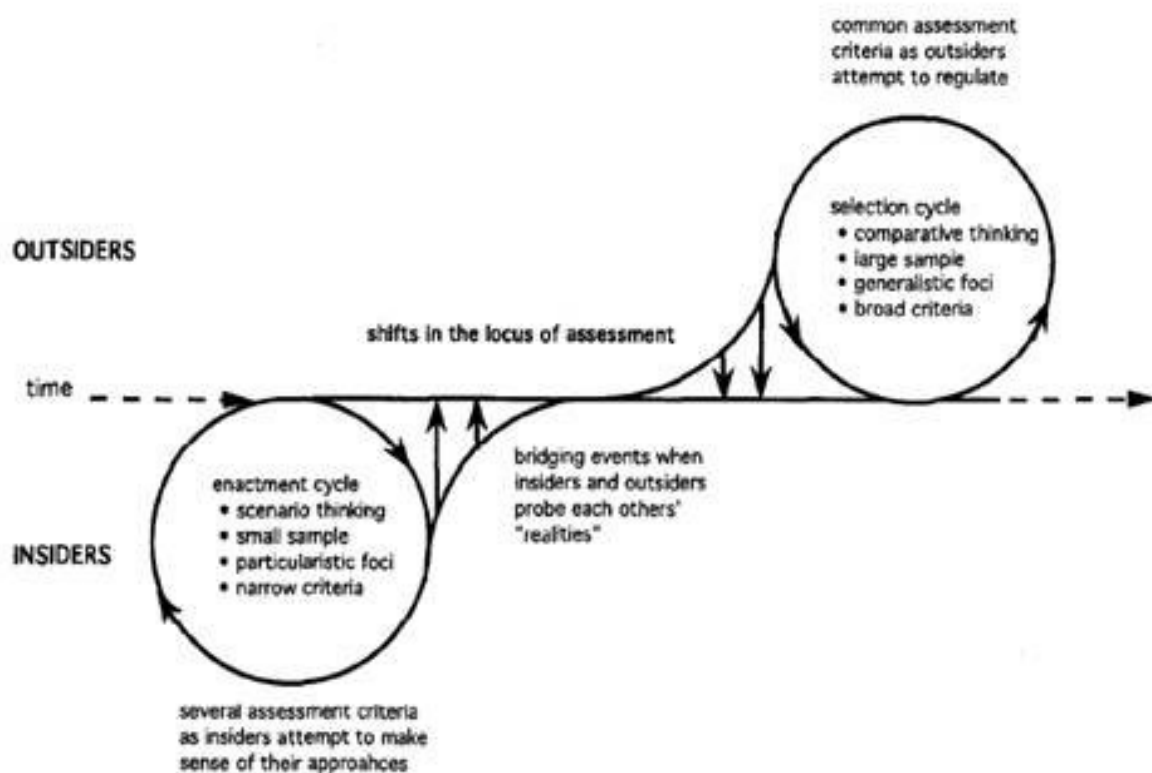
Figure B.1: Framework of the Constructive Technology Assessment method (Garud & Ahlstrom, 1997).

B.1.3 Dimensions of social acceptance - DSA

The study by Wüstenhagen et al. (2006) identified social acceptance as a combination of three dimensions: socio-political-, community- and market acceptance, as visualised in figure B.2 below. In order for a new (sustainable) technology to be successfully implemented, all three dimensions need to be adequately represented. Projects in the past have ran into the trap of neglecting one (or more) of these dimensions, resulting in lash backs from the (local) community and an overall unsuccessful implementation of the technology. Furthermore, the level of acceptance is linked to time and follows a U-curve. During the planning phase, communities are generally more willing to accept the technology. The acceptance level reaches its lowest point at the construction and launch phases. Once the project has been running smoothly for a while, acceptance starts to climb back up. This same three-way separation of social acceptance is acknowledged by the Advocacy Coalition Framework (ACF) (Wolsink, 2010). This study does not offer a model which is directly applicable.

Figure B.2: Three dimensions of social acceptance (Wüstenhagen et al., 2006.

B.1.4 ESTEEM

Another supportive framework that provides insight into the social acceptance of any project is the ESTEEM framework. This six-step method helps with interfacing for the public (Cohen et al., 2014).
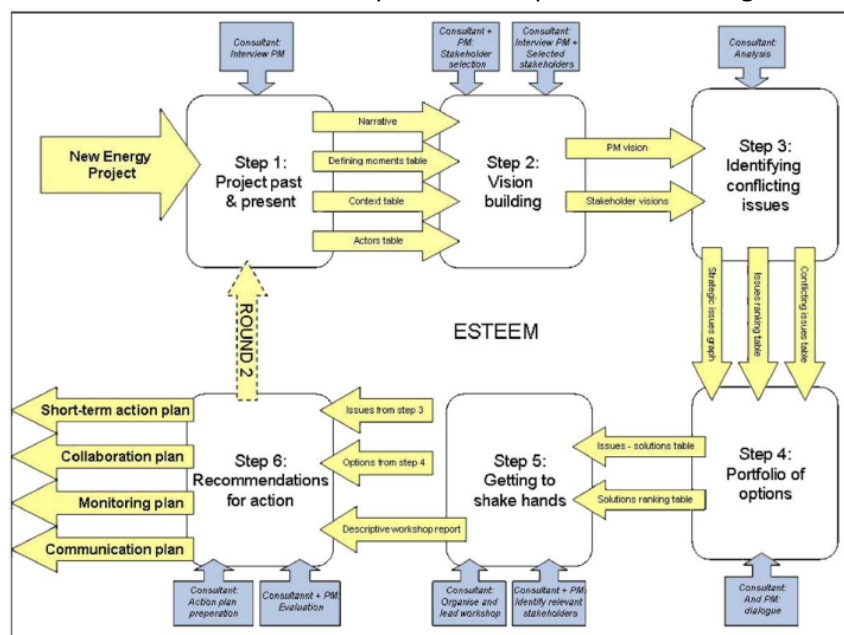
Figure B.3: The six steps of the ESTEEM framework (Raven et al., 2009).

Although this framework, depicted in figure B.3, offers a very complete list of steps that need to be taken, it does not seem very suitable for this study as it focuses on the social acceptance of an existing, well defined idea or technology.

B.1.5 Framework for Alternative Funerals - FAF

In a study commissioned by the Dutch government, Bergen & Van den Hoven (2018) researched the factors that influence the decision of legalising (alternative) funeral technologies. Although the study is performed to provide policy makers a framework on which they can base their decisions, a lot of attention goes out to the general public and their perception of the funeral technologies. This aligns well with the target group for this study. One of the first notable steps in the research is the identification of a list of actors that are present in the funeral industry. Then, the study utilises a combination of literature and empirical research to find a selection of values that are either common among all actors or relative to a specific actor.

Besides the actor-neutral factors, those that are specifically relevant for the people who may at some point have to choose a funeral technology for either themselves or someone close, are particularly interesting to analyse, as they are the focus group of this study. See figure B.4.
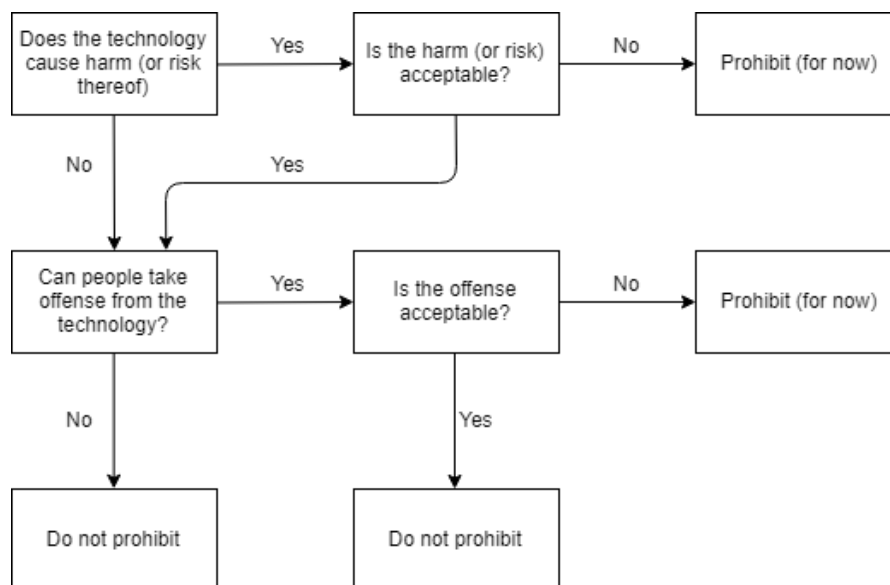
Figure B.4: Decision hierarchy for the legislation of alternative funeral technologies. Based on Bergen & Van den Hoven (2018).

B.1.6 Family Evaluation of Hospice - FEH

Frameworks have been established to help mourning relatives of people that recently died with analysing and improving the quality of end-of-life care, such as the Family Evaluation of Hospice care (Teno, 2005) (Caserett et al., 2008). However, during the testing phase of this program, respondents expressed concerns about the fact that death care is offered by healthcare providers. The controversy surrounding this topic is also reflected in the current discussions surrounding euthanasia, either discussed or executed by those same healthcare providers.

B.1.7 Human Exemptionalism Paradigm - New Ecological Paradigm - HEP-NEP

The HEP-NEP model describes the movement of people becoming more environmentally aware as a result of obvious problems of environmental concern affecting the planet (Castro, 2006). An individual's mindfulness for the environment is measured through 15 Likert-scale rated questions (Dunlap et al., 2002). The model is an environmental belief system; it offers a mostly psychological approach to environmental science. Scientists, such as Mainieri, Barnett, Valdero, Unipan and Oskamp are sceptical about the model's ability to predict environmentally responsive consumption (Bechtel et al., 2002).

B.1.8 Integrated Sustainable Waste Management - ISWM (1)

The Integrated Sustainable Waste Management (ISWM) model distinguishes three dimensions in waste management systems: Stakeholders with an interest in SWM, the movement of the material flow through stages of generation to final disposal, and aspects through which the system is analysed (Guerrero et al., 2013). One thing worth noting is that the model has been primarily used for projects in developing countries. These projects generally involved the establishing of (municipal) solid waste management (Anschütz et al., 2004). Therefore, the model may need some adjustments to make it suitable for this study. The ISWM framework is visualised in figure B.5.
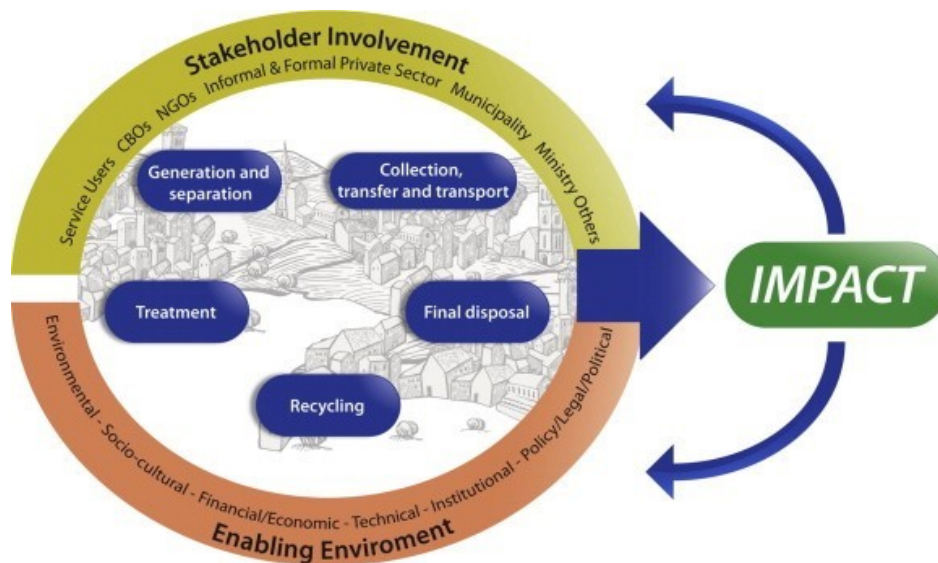
Figure B.5: Visualisation of the ISWM framework (Guerrero et al., 2013).

B.1.9 Integrated Solid Waste Management - ISWM (2)

Another waste management strategy by the abbreviation of ISWM exists: the Integrated Solid Waste Management framework. It is a theoretical model that allows to either optimise existing systems, or design brand new ones (Marshall et al., 2013). A limiting factor in its use is that realistically, only one factor can be changed at a time. The model is depicted in figure B.6.
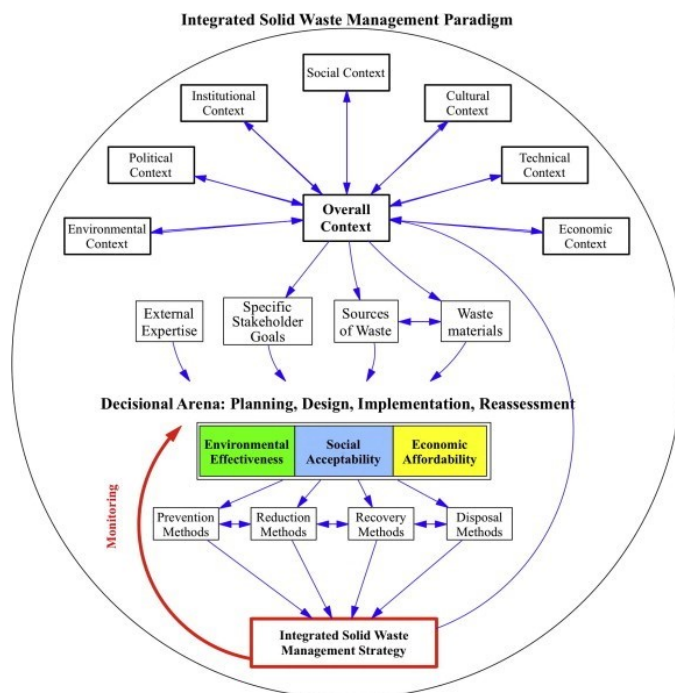
Figure B.6: The Integrated Solid Waste Management strategy (Marshall et al., 2013).

B.1.10 Methodological Approach - MA

According to Garnett et al. (2017), The framework displayed in figure B.7 is built on the idea that there are many context-specific factors, i.e. the type of waste management facility, local cultures, previous projects in which the local community was involved and the likeliness for controversy to arise. Resource recovery is perceived as a positive outcome from waste disposal. Energy recovery from waste incineration, however, is met with controversy due to perceived risks to human health and the environment. Non-thermal waste management processes are starting to increase their foothold within the industry. Examples of such technologies are anaerobic digestion (AD) and composting. However, for these technologies to be successful, waste input needs to be separated, collected and transported. From the community's side, waste output varies, the overall waste mix may deviate and separation requires a certain level of dedication to do well. The demand for quality of the waste streams is high. This may be problematic and requires analysis via the framework.
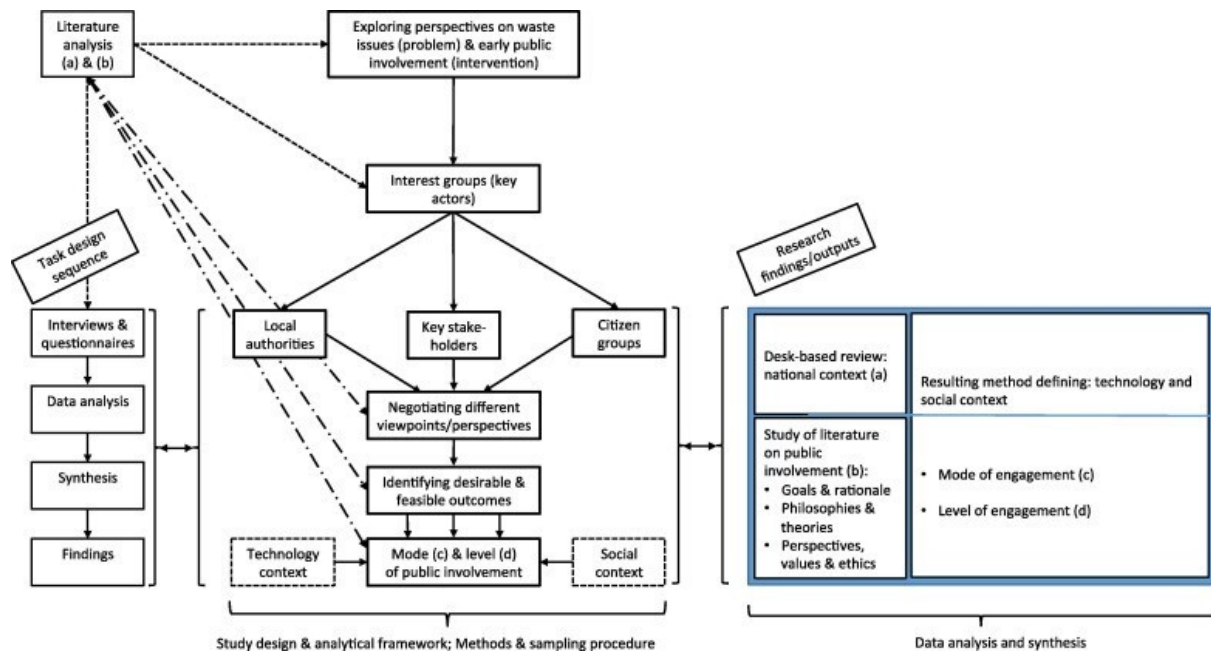
Figure B.7: The Methodological approach as a conceptual framework (Garnett et al., 2017).

B.1.11 Social Impact Assessment - SIA

The next framework that is briefly discussed is the Social Impact Assessment (SIA). A visual overview of the framework can be found in figure B.8.
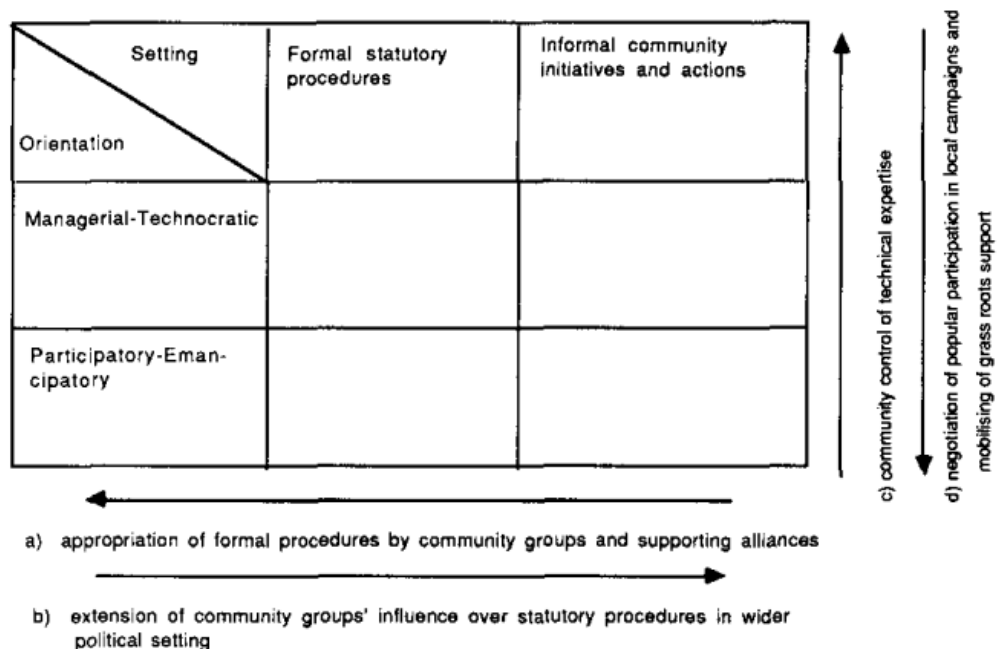
Figure B.8: Social Impact Assessment (SIA) by Gagnon et al. (1993).

Gallagher et al. (2005) stress the importance of the location of waste management facilities in relation to the social acceptance of local communities. Furthermore, they link the impact that the construction of waste facilities has to property values over time. Like many other studies, Gallagher et al. also claim that communities that were informed and involved during the planning phase have a greater social acceptance towards the program. A second issue with location of waste management facilities exist: The further they are located from the source of the waste, the higher the environmental impacts of managing the waste flow, as a result of required transport (Price et al., 2000) (Joseph, 1999).

B.1.12 Soft System Methodology - SSM

The next presented framework is Soft Systems Methodology (SSM). This method offers a problem-oriented approach to provide insight into the actions of different groups, and what decisions, perceptions and judgements these were based on. Waste management and the involvement of local communities is a perfect example of a social challenge that can be analysed through SSM. SSM is empirical of nature and suitable for qualitative studies (Checkland, 1999). See figure B.9.
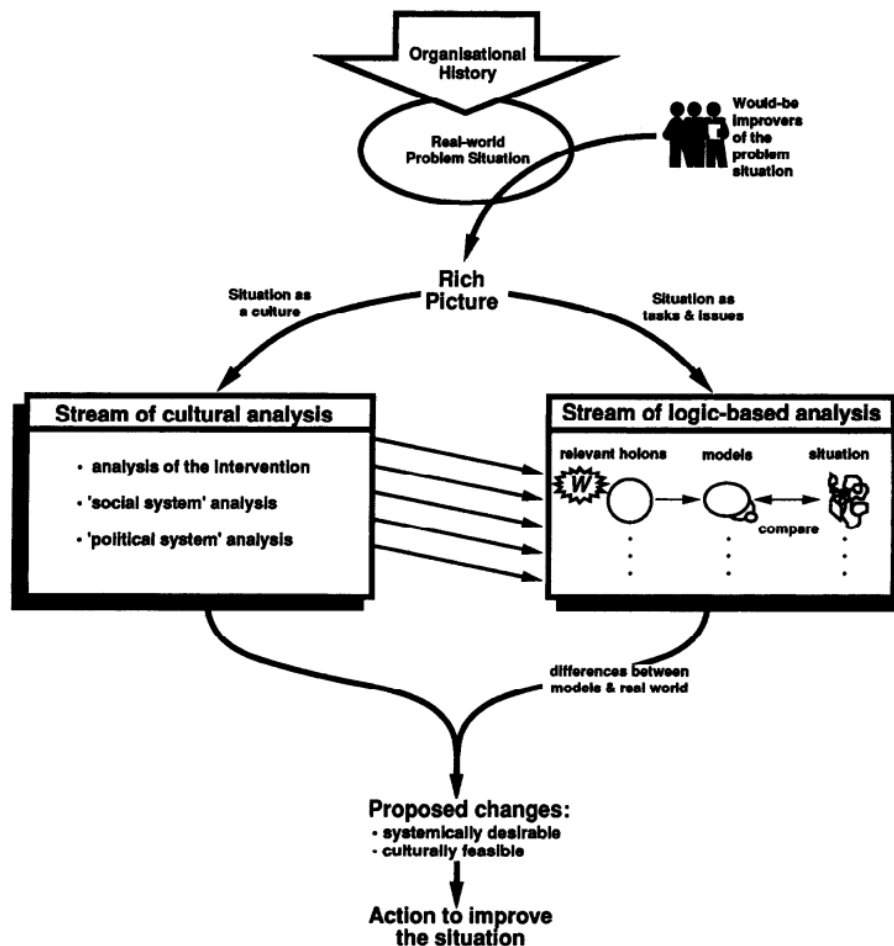
Figure B.9: The Soft System Methodology (SSM) (Lane et al., 1998).

B.1.13 Technology Acceptance Framework -TAF

The framework developed by Huijts et al. (2012) provides a comprehensive approach to energy technology acceptance, based on empirical studies and review of theories. According to this method, social norms, perceived behavioural control, attitude and personal norm are the main influential factors towards acceptance of novel sustainable energy technologies.

Three important goals are distinguished that influence behaviour: gain-, normative- and hedonic goals. Depending on which goal is focal, individuals will base their choice on different aspects. When applied to determining the acceptance of a certain technology, the determining factors are either (1) an overall evaluation of costs, risks and benefits; (2) moral evaluations based on the environment or society; (3) feelings towards the technology.

It is important to note that this framework establishes the view of an individual towards a certain technology, not that of a social group. Although the framework is designed for (sustainable) energy technologies, which this study does not intend to analyse, its core elements can still be useful.

The technology acceptance framework has incorporated the work of Theory of planned behaviour (appendix B.1.14) and reformatted it to be in line with the rest of the framework. See figure B.10.
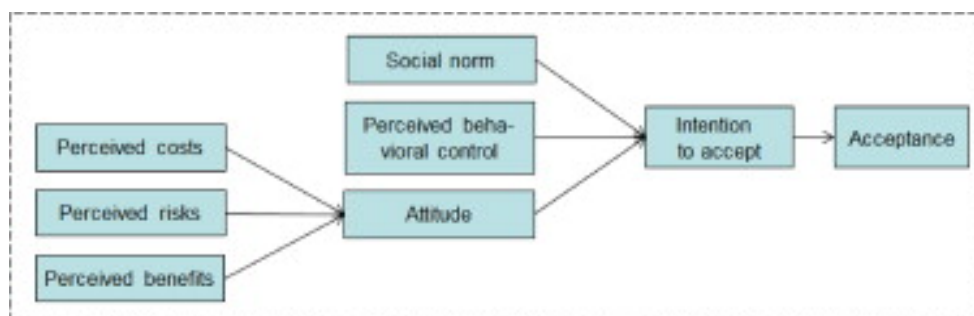
Figure B.10: Integration of the Theory for planned behaviour in the technology acceptance framework (Huijts et al, 2012).

However, there are more influential aspects that need to be included in the model. These have been incorporated in figure B.11, which shows the full schematic representation.
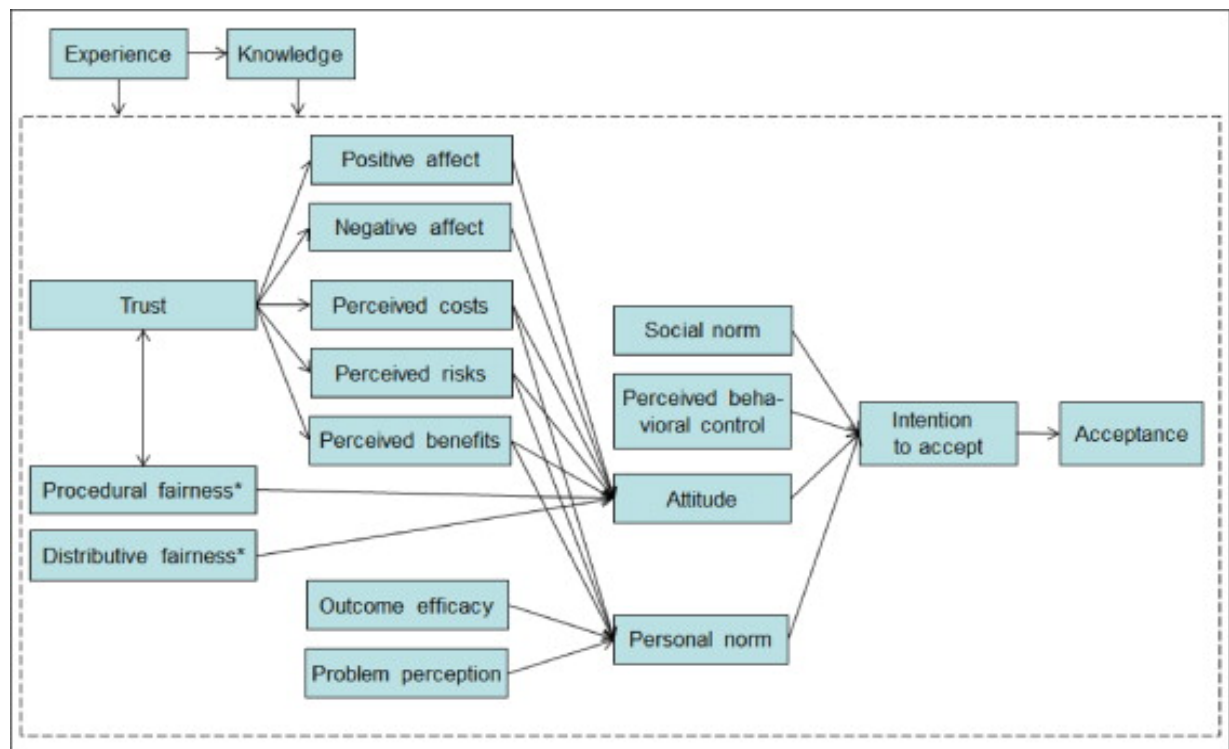
Figure B.11: Complete schematic representation of the technology acceptance framework (Huijts et al., 2012).

B.1.14 Theory of Planned Behaviour – TPB

Another approach to defining social acceptance is discussed in the framework of the Theory of Planned Behaviour (TPB), which distinguishes three conceptually independent factors of intention (Ajzen, 1991). An individual has to a certain degree a favourable or unfavourable perception of a specific behaviour. Secondly, the individual may feel social pressure to either align with or oppose to a specific behaviour. Finally, it is questioned how the individual perceives his/her ability to perform the specific behaviour, based on past experiences and anticipated future obstacles. Ultimately, the behaviour of the individual can be influenced by changing either of the three factors of intention. The theory is visualised in figure B.12 below. This theory is also utilised in the Technology Acceptance Framework (Huijts et al., 2012) and reformatted to fit their framework.
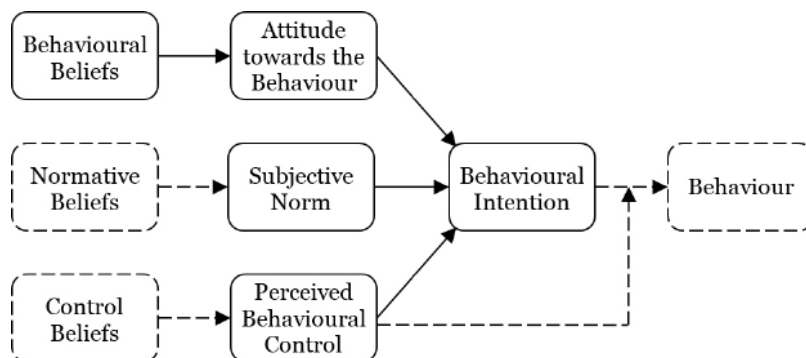
Figure B.12: Framework of the Theory of Planned Behaviour (Ajzen, 1991).

B.1.15 Value Sensitive Design - VSD

The first framework is Value Sensitive Design (VSD). This framework acknowledges the importance of social aspects in the design of technical systems through human values. the framework is very design-focused, particularly at the concept design stage. It is built upon three core principles: Conceptual investigations, Empirical investigations and Technical Investigations (Friedman et al., 2002). As Taebi et al. (2014) show in their study, VSD can be used to analyse public values in interdisciplinary research.

Appendix B.2 - Binder's framework

B.2.1 Analytic Hierarchy Process - AHP

Purpose: The AHP framework is made to *structure, support and facilitate shared decision making*.
Target: In an eight-step procedure, AHP guides *experts of various fields*, such as technology developers, clinical decision makers, health policy experts, etc., to engage in discussion and joint decision making with clients. Both experts and clients can be either individuals or groups.
Process: Acceptation is changed through *evaluation and discussion of a structured problem statement*. A multitude of different solutions is analysed, which factor in the values and desires of the clients based on the discussions. Because of their provided input, clients are more likely to accept the outcome.
Problem: *Experts in a large variety of fields* are the problem owner, as they guide the clients through the decision-making process.
Levels: *Micro*. The framework is designed to facilitate the decision-making process for a (small group of) individuals. The outcome offers a fairly personal solution that is not likely to impact society at large.

B.2.2 Constructive Technology Assessment - CTA

Purpose: The goal of CTA is to *shape the development phase of new technologies* into directions which are desirable by both micro and macro social levels.
Target: CTA can be applied to many different technologies, and therefore has no distinct target group. Some technologies require information from different stakeholders, but it is part of the framework that *the relevant stakeholder(group)s* are well represented.
Process: The CTA framework *excels in interaction between inside and outside experts, relative to the technology that is being developed*. The insiders are experts in the relevant field, whereas outsiders are experts that are not directly involved with the development of technology, but who are key to domains such as regulation and sponsorships. The latter of the two expert groups is more likely to have connections with indirect stakeholders whose acceptance needs to be improved.
Problem: The problem owner is the *technology developer*.
Levels: *Macro ↔ Micro*. Between representatives for groups, but also research into acceptance of communities at large, information about the social aspects of the target group enter the development phase via the outsiders. As development goes through many iterations upon which the outsiders can give feedback, this information will ultimately be implemented into the design. Once fully developed, the technology has the potential to influence both micro and macro levels of society.

B.2.3 Dimensions of social acceptance - DSA

Purpose: The framework identifies three dimensions, namely: socio-political, community and market acceptance as core aspects of social acceptance. *All three aspects need to be adequately represented* in order for a new (sustainable) technology to become successfully implemented in society.
Target: The framework was originally developed to research the social acceptance of renewable energy technologies. Therefore, the target audience are the *consumers of renewable energy* supplied by the technology, but also *local communities who have to deal with the installation and infrastructure*.
Process: The interests of the indirect stakeholders are well represented in this framework. The public's interests are gathered through both quantitative and qualitative methods. By *implementing this information into the development of the new renewable energy technology*, its choice of location and every-day usage should result in less conflict from the affected societies.

Problem: The problem owner is the *project manager* of the renewable energy technology project.

Levels: *Macro*. The input data gathered from society is mostly based on that of groups, rather than individuals. Become of these macro dynamics, the technology is not developed with specific individuals in mind and aims to be accepted by communities at large, who often share the same interests.

B.2.4 ESTEEM

Purpose: The goal of the ESTEEM framework is to *prevent social opposition to new technological projects*.

Target: The framework seeks to analyse and approach *the people living in the neighbourhood of the planned project*. This is normally a group of people, although they are not necessarily represented by a single goal or vision.

Process: By *preemptively informing the people and asking for their feedback*, their interests can be integrated in the final stages of the development of new technologies, thereby avoiding (costly) conflicts later on. Acceptation of the technology is improved through information and education. But the neighbouring people also are more likely to accept the project because its managers come to them for feedback.

Problem: *The project manager* is the problem owner, as he is responsible for a troubleless execution of the project.

Levels: *Micro → Macro*. By contacting individuals (assumed to be unrepresented), the technology or its implementation may be altered, thereby affecting the local society.

B.2.5 Framework for alternative funerals - FAF

Purpose: The FAF provides insight into the moral acceptability of funeral technologies. If a technology is deemed morally unacceptable, the framework also *offers areas of improvements that can increase its acceptability* and make it considerable for legalisation.

Target: The target audience whose social (and moral) acceptance is researched is *the general public*. Anyone could at a later stage be a potential consumer, but is also confronted with knowledge of the technology's existence at earlier stages. It is therefore important for funeral technologies that people have grown accustomed to them and gained their acceptance before they inevitably choose a funeral for either themselves or someone close to them.

Process: A very broad scope of *personal values related to death and funerals is analysed and integrated into the framework* which tests for potential harm created by, or offense taken from the new funeral technology. If neither is the case, there's a chance people may accept the technology and could therefore be legalised.

Problem: The organisations with most interest in the legalisation and social acceptance of new funeral technologies are *funeral houses*.

Levels: *Macro → Micro*. Although the data input is clearly based on that of a community at large, death care and funerals are so personal that it is difficult to predict how groups of people will react to new alternatives. Although people affiliated with a certain cultural group or background may respond similarly, there are too many potentially conflicting values to draw a coherent line between groups who do and those who do not accept the new technology.

B.2.6 Family Evaluation of Hospice - FEH

Purpose: The Family Evaluation of Hospice framework aims to provide feedback to experts in the medical field to *improve the end-of-life-care provided to patients*. The potential for this framework to analyse the effects of discussing available funeral technologies with patients through this framework is particularly interesting.

Target: *People who have reached the final stage of their life* are the primary focus on this framework, as their final care is discussed with medical experts.

Process: *Discussing life closure with medical experts* is important for patients to reach a state in which they are at peace with dying. Through these discussions, patients can mentally prepare themselves, become "at peace with themselves" and find a "sense of meaning of life". Discussing the desired funeral technology is part of the process in which people come to term with death.

Problem: The problem owner are both the *medical experts as well as the patients*, as it is important for both groups that a desirable solution is found.

Levels: *Micro*. Medical conditions and end-of-life matters are personal and vary greatly.

Downside: Due to the individualistic and personal approach of the topic, it is difficult to construct a framework that is applicable for everyone.

B.2.7 Human Exemptionalism Paradigm - New Ecological Paradigm - HEP-NEP

Purpose: The goal of HEP-NEP is to *make people more environmentally aware*.

Target: The target group is *the general public*, although it is more likely to reach (groups of) people who are already environmentally aware, or are open minded to such behaviour.

Process: Through *a Likert-scale test of fifteen different environmental-related items*, an individual's awareness for environmental problems is tested. A final score tells the individual about their awareness.

Problem: The framework is mostly used for scientific purposes. Therefore, *the executing scientists* can be considered to be problem owners.

Levels: *Macro → Micro*. The model describes the behaviour of individuals as a result of macro-scale problems affecting the planet.

Downside: Various scientists are sceptical about this model's ability to predict environmentally responsive consumption.

B.2.8 Integrated Sustainable Waste Management - ISWM (1)

Purpose: The ISWM (1) aims to bring three core aspects (namely: involved stakeholders, waste system elements and environmental aspects) together to *develop an optimal waste system strategy*.

Target: The framework can help to *positively influence people's perception of and attitude towards waste management* and the people working in that industry. This is mostly applicable to the direct region for which the waste management strategy is developed.

Process: Acceptation is changed mainly by *looking closely at the demands of all stakeholders*, including the local population which is affected by the new waste management system. These people are not necessarily contacted, nor will they necessarily receive additional information or education about the new system.

Problem: The problem owner is the organisation or *group responsible for developing and maintaining the new waste management system*. In many cases, the municipality is responsible.

Levels: *Macro → Micro*. Although the new waste management system will be based on the values of the local population, they could not directly contribute to its development. They will have to adapt to the system as it was developed originally.

B.2.9 Integrated Solid Waste Management - ISWM (2)

Purpose: The ISWM (2) strives to *balance the three pillars of sustainability in the context of SWM*, which have previously been largely dominated by its technical solutions to become economically viable.

Target: This framework analyses the needs of *the local community* whose waste will be managed, as involving them in the scheme is necessary for its success. Other local stakeholders' perspectives are also integrated.

Process: The model doesn't specify whether information from the local communities is gained through empirical research in the specific area, the use of previously known social studies or direct involvement of one or more community members in the development phase. Regardless of the chosen technique, in the end *their interests are represented during development*.

Problem: *The municipality* is often the problem owner in waste management schemes, although this role can be shared with the head of *the waste management company*.

Levels: *Macro*. Assuming the information input is based on the local community, the development and execution of the new integrated waste management scheme will also affect the community at large.

Downside: The model only allows for the (re)modelling of one new factor at a time.

B.2.10 Methodological Approach - MA

Purpose: The Methodological Approach offers a framework that analyses *public involvement in waste management* systems.

Target: The main target is the *people who will be affected by new waste management*. It is important to note that the Methodological Approach is only interested in citizen groups, not in individuals. The framework seeks to connect these people to experts from the industry and others that are affiliated to the project such as policy makers.

Process: By identifying people who will be affected by the technology and *involving them in its development phase*, their input can be used to prevent conflict at a later stage. The framework offers insight into a desirable mode and level of engagement with the public.

Problem: The problem owner is *the development department* of the new technology.

Levels: *Macro*. As this framework includes citizen groups into the development phase, more attention will go out to the desires of the group, rather than those of individuals.

B.2.11 Social Impact Assessment - SIA

Purpose: SIA explores the impact of *empowering local communities in the development process* of new technologies or new infrastructure of existing technologies.

Target: The social acceptance of *those who will be indirectly affected by the new technology* or infrastructure is sought to be increased by giving them power in the design of said plan.

Process: The *acceptation of local communities is changed due to their direct involvement in the research and development* of a new technology or infrastructural unit, which could potentially affect them negatively. Through their participation in its design, not only do they become more educated about it, but can also change its development to better align their own goals and vision.

Problem: The problem owner is *the project manager*, who wants to prevent social backlash during and/or after the development of the project.

Levels: *Macro ↔ Micro*. Communities are invited to actively help shaping the new technology, which upon its successful development will bring changes on the macro level. This macro level translates back to the acceptation of the individuals, who helped to shape the macro level in the first place.

B.2.12 Soft System Methodology - SSM

Purpose: The SSM framework creates a variety of perspectives on a given problem statement and is geared towards *addressing the socio-political aspects of interventions*. This process generates an idealistic view of human behaviour.
Target: SSM can be applied in really any kind of situation that involves *human interactions based on interventions*.
Process: By *analysing idealistic views and comparing these to realistic scenarios*, a large variety of potential solutions can be found. The idealistic position of the involved actors can be compared with their current situation, and changes can be proposed to reach a position that is closer to the ideal.
Problem: *The project manager* is the problem owner.
Levels: *Micro → Macro*. The input of a select few actors is used in the analysis to develop a strategy that will improve the current situation for everyone involved or affected.

B.2.13 Technology Acceptance Framework - TAF

Purpose: The TAF helps to *research the acceptance of new sustainable energy technologies* by its consumers and affected citizens. However, the framework can also be applied in non-energy cases where environmental aspects still play an important role.
Target: Two different aspects can be analysed through this framework, depending on the target group. On the one hand can the framework analyse the acceptance of *future consumers* of the new technology, to better serve their needs and goals. On the other hand, the new technology must not unnecessarily impact other *affected groups or individuals*. Although they do not need to be consumers of the new technology, they must be able to comfortably live with its presence.
Process: Through analysis of psychological factors (other factors are assumed to be represented indirectly), *the likelihood of social acceptance of a sustainable technology is researched*. The model is largely based on empirical research, which also signifies the need for input data directly from the affected people. By researching the parameters that affect the acceptability and intention to accept, new sustainable technologies can be developed in such a way that they are indeed more likely to be accepted.
Problem: The problem owner is *the project manager* of the new sustainable technology
Levels: *Macro ↔ Micro*. The psychological traits of individuals, as well as social norms of broader groups are used as input for this framework, which cover both the micro and macro levels. After development and introduction of the new technology, both social levels are impacted.

B.2.14 Theory of Planned Behaviour - TPB

Purpose: TPB analyses several social factors that can *determine the level of acceptance of a technology* by those who are affected by it.

Target: A TPB acceptance study is generally performed for *those who will be directly involved with the new technology*. This could be a new product, but also the installation of a new waste management system or a new behaviour to which people need to adapt.

Process: By actively *studying the three core social factors that influence acceptance*, new technologies will be better received by its intended audience. An individual has to a certain degree a favourable or unfavourable perception of a specific behaviour. Secondly, the individual may feel social pressure to either align with or oppose to a specific behaviour. Finally, it is questioned how the individual perceives his/her ability to perform the specific behaviour, based on past experiences and anticipated future obstacles.

Problem: The problem owner is *the development department* of the new technology.

Levels: *Macro ↔ Micro*. Both the individual and an individual's place in relation to a larger group is considered in the TPB. This is integrated in the development of new technologies and strategies, which in turn impact both individuals as well as groups of people.

B.2.15 Value Sensitive Design - VSD

Purpose: The purpose of VSD is to help *account for human values* during the design process of new technologies.

Target: VSD considers both *direct and indirect stakeholders* which are affected by the to-be-designed technology.

Process: Acceptation of the technology is improved by *taking into consideration which factors do, and do not align with the values of both direct and indirect stakeholders*. These values are implemented in the design phase, which should result in the release of technologies that are well adapted to the needs and values of its customers. In essence, VSD does not further adapt the acceptation of technologies by its stakeholders, but rather tries to make sure that the technology will be accepted at release.

Problem: The problem is *owned by the companies* (and indirectly the designers) who develop the new technology.

Levels: *Micro → Macro*. The values of (individual) stakeholders are used to design a new technology, which will shape the macro level upon implementation in society.

Appendix B.3 - Highlight of the selection cycle in the social acceptance framework for circular funeral technologies
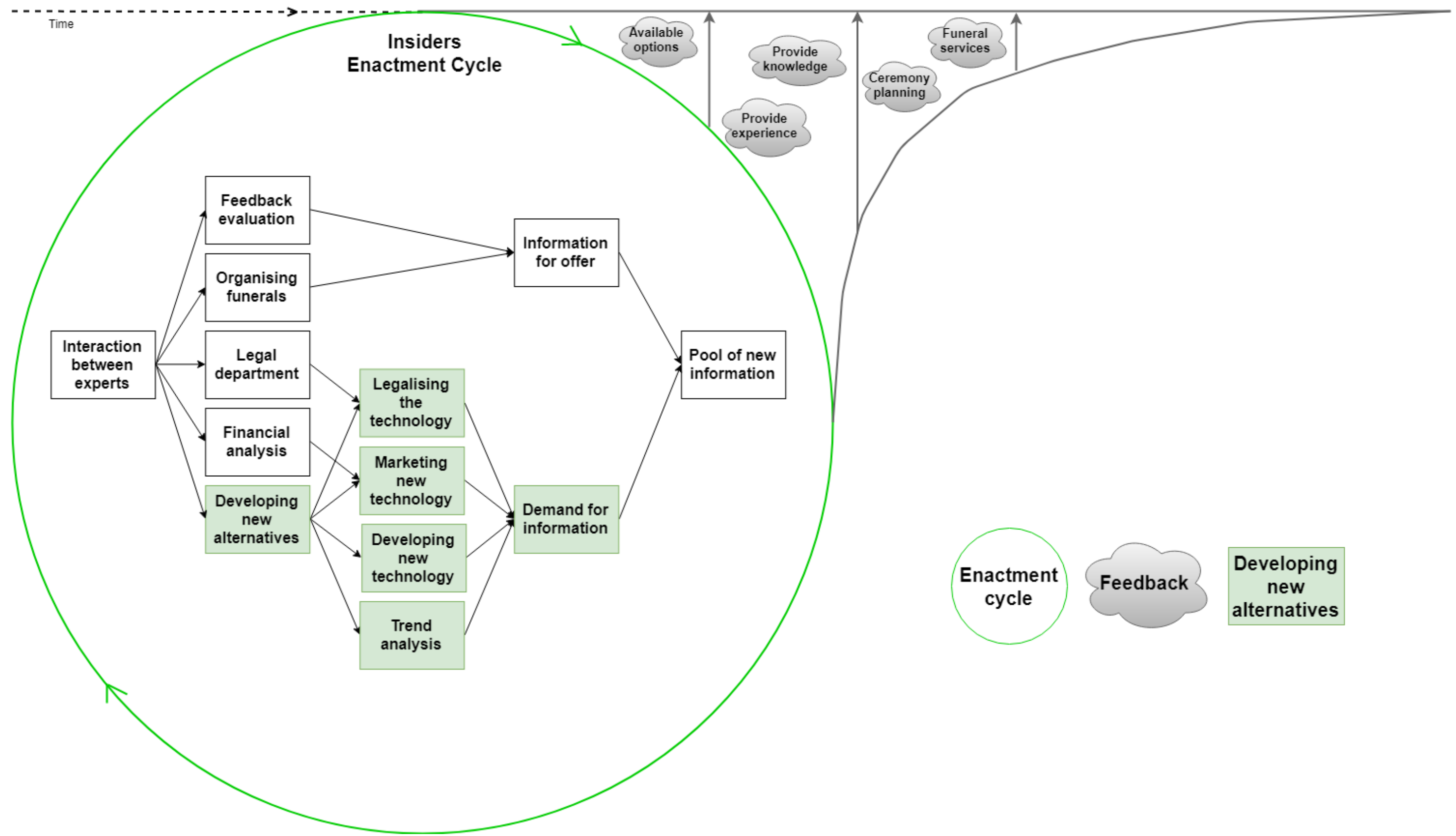
Appendix B.5 - Overview of the social acceptance framework for circular funeral technologies
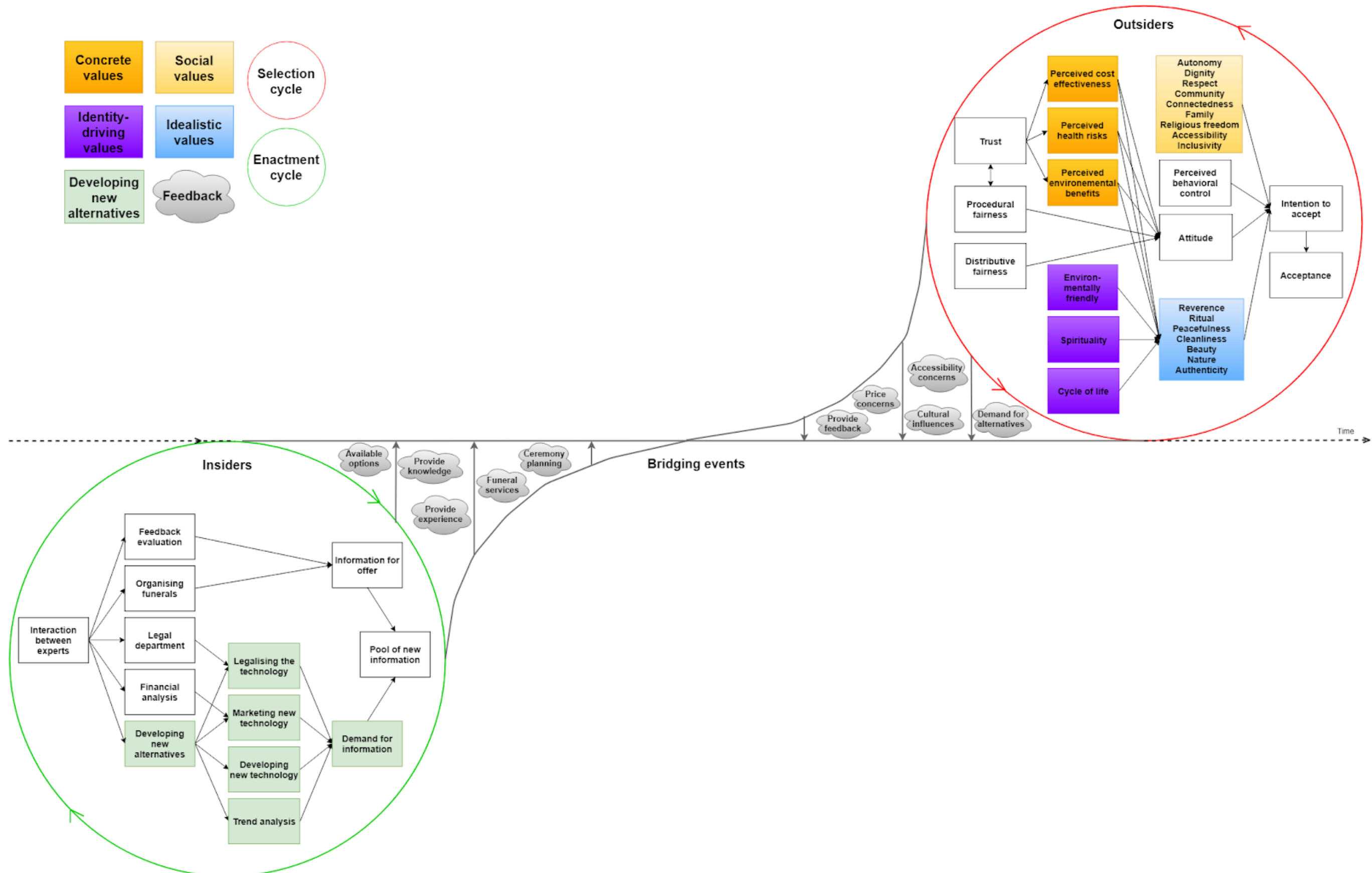
Appendix C.1 - Composting interview with ROVA representative Hemmo Hagedooren (31-07-2018, Amersfoort)

Interviews unavailable in the public document. For further information, contact the author at robvanderburgh@gmail.com

Appendix C.2 - Comparison between both composting scenarios

Value	Old situation	New situation	Scenarios comparison
Concrete values			
Percei-ved costs	Some degree of home-composting to cut costs, majority follows the regular system, low invest-ments, fixed rate results in no economic incentive for the users to perform better	Investments are communicated to the users, no advantage for home-composting, no economic benefit for users from efficient waste management process, economic incentive to sort waste through DIFTAR	New facility too efficient for people to compete with home-composting, new economic model encourages waste separation including organic waste. Not always clear why other municipalities have different economic models
Percei-ved health risks	Worse sorting resulting in organic waste producing stench in multiple bins, always required to wait for collection day, waste kept close to home	Better separation results in less stench, organic waste is still collected biweekly but mixed waste can be emptied at personal schedule, no more home-composting results in less nuisance, extra bin means less waste per bin	New system provides lower perceived health risks due to concentrated organic waste, people feel more in control of their disposal schedule, bins are less likely to overflow
Percei-ved environ-mental benefits	Organic matter has historically always been perceived to be valuable, people felt like they were contributing to a better environment by compost-ing at home, no know-ledge about ecological benefits of separating waste properly	Home-composting is outper-formed by the new facility, education helps people to rea-lise the importance of proper waste separation, seeing practical examples of resources obtained from waste inspires people to do better	Education and providing practical examples makes people realise the importance of proper waste separation to the environment, advanced centralised installations are perceived to be more efficient than low-tech home installations
Social values			
Autono-my	Effort of home-composting is a deliberate choice, majority follows a low-effort system with few choices and limited commitment	Reverse collection requires more effort from the user to separate their (organic) waste, more decisions need to be made more frequently, increa-sed levels of (social) control	Introducing reverse collection requires people to put in more effort and conscious decision-making in the separation of their waste, more rules and guidelines to abide, (social) control in case these are not followed
Dignity	Majority of people treat their waste as trash, preferably get rid of it with	Through education and involve-ment, awareness is increased, the conscious decisions people	The dignity people have for their waste increases when they are educated about its potential value

	low effort: fast and clean, people with home-composters see the value of their organic waste	make in regards to managing their waste makes them more open to see the potential value remaining within and will therefore treat it with more dignity	and more involved during the waste management process, this is particularly true for organic waste as people can see its potential value implemented in society easier
Respect	There is not much control over the sorting quality of the people, most people don't really care about their waste, as a result not much respect for the waste management system and operators	A stronger bond is created between waste operators and the people through communi-cation and interaction, 'a face' behind the organisation, motivated to see the results of their separation power the garbage collection trucks in town	Improved interaction with the community in terms of education and feedback moments greatly improves the people's respect to the waste management system and operators, people want to know that their actions lead to relevant improvements and (preferably) tangible results
Commu-nity	Individualistic approach to waste management, compost projects were also single-household activities, a neighbour or family member would be helped occasionally	Communities grow a little closer through organised events by ROVA, special events to the fermentation facility in Zwolle are also organised to show people the potential of organic waste, involvement of the public leads to social control as they want their communities as a whole to do well	A passionate and engaged community influences others to also participate and manage their waste better, a state of social control is created to make sure the area/community as a whole manages their waste well, active interaction between the community and ROVA through (educational) events to stimulate people and create awareness of the potentials of waste
Connec-tedness	People want waste disposal to be as quickly and effortless as possible and feel therefore not connected to the system, interaction with it is brief, those with home-composters are more connected but mostly to their own system	By involving people in the sorting process and having them make frequent conscious decisions, people are bound more closely to the system, its operators and other users, people are more likely to start a conversation based on their personal experiences or opinions	Operating organisations who seek contact with their user base for informative and feedback mee-tings can expect stronger social ties between and with the com-munity, the awareness of the underlying environmental pro-blems of waste management become clear to the people, the community as a whole strives to do better as a result
Family	People occasionally help their family with their waste management tasks when they are on holiday, ill, or otherwise unable to complete the tasks them-selves. These small favours are done without much hassle and easily returned	Higher levels of interaction be-between community members also applies to the interaction between family members, sha-ring experiences and opinions during social events amongst each other is common, increa-sed responsibility leads to pla-cing excess waste in a family's	As people are generally more committed to the system they more frequently exchange their experiences and are more willing to help others, familial ties are used more positively, people are generally more willing to help others who also believe in the system

		green bin rather than a personal non-green bin	
Religious freedom	Religion was not found to be a relevant value in this waste management sector, neither the waste flow nor the infrastructure should provide any issues	Religion was not found to be a relevant value in this waste management sector, neither the waste flows nor the infrastructure should provide any problems	Religion was not found to be a relevant value in this waste management sector, neither the waste flows nor the infrastructure should provide any problems
Accessibility	Home-composters are an accessible alternative for those with enough space, the regular system is accessible due to low commitment	Organic waste is still collected through a bin at the side of the road, the separation process itself became more challenging, events organised by ROVA are usually local and on voluntary basis, centralised collection points are generally strategically positioned	Both the old and new organic waste collection system are accessible to those who can reach the road, more focus on the sorting process itself, which is regulated more strictly
Inclusivity	Home-composting takes some experience and effort, the regular waste collection process is easy to adapt to due to the fixed collection schedule, separating waste poorly goes unpunished	The collection system is equally inclusive as the old scenario, the separation process is more complex and strictly regulated, social backlash as a result of poor sorting is possible, not all social backgrounds may cope well with the higher expectations	As systems become increasingly more complex, limiting factors will come into play that reduce the overall inclusivity of the system, by involving all groups early in the development stage, these problems can be identified and dealt with accordingly, some groups may fall behind during the execution of the new system, solutions need to be found to get these groups to function the same as the others
Identity-driving values			
Environmentally friendly	By means of external factors such as documentaries and (online) series, the environmental awareness of the public slowly rises, the correlation with waste management is not always found, although there are conscious groups who take effort to consume (and waste) less	Besides external factors, ROVA now actively pursues the goal of educating the public about the importance of waste management in the context of environmental problems, through these programs people are inspired to sort their waste better, whether they do it for the environment or the financial benefits attached to the new program, the benefit of good organic waste management in particular is well	Through both internal and external sources of education, the public is becoming more aware of the environmental problems we are facing in the now and (near) future. ROVA actively makes the link between these problem and waste management to stimulate the people to separate better, although skeptic at first, the community now begins to realise that they can contribute to a more sustainable future

		known because of the practical examples such as the biogas	
Spiritu-ality	Spirituality was not found to be a relevant value in this waste management sector	Spirituality was not found to be a relevant value in this waste management sector	Spirituality was not found to be a relevant value in this waste management sector
Cycle of life	Home-composters are well aware of the lifecycle of organic waste, although organic waste has histo-rically been used by the general public, this ideo-logy has faded through extensive urbanisation, organic waste is not seen as 'dirty' and is preferably stored away from house as it attracts flies is stenches	Through educational events, ROVA informs the public about the potential value recovery of organic waste, by seeing practical examples of the possibilities with resources recovered from waste, the public will be more inspired to sort their waste better to accommodate these processes	In today's society, lifecycles are perceived as a technical, rather than an idealistic element, people slowly become aware of the tech-nical capabilities to extract new resources from waste, but they hardly ever separate their waste for idealistic reasons, the diffe-rence between natural and indus-trial value recovery processes is too abstract, even when organic waste is composted or fermented
Idealistic values			
Reve-rence	Home-composters have to some degree reverence to their personal organic waste disposal process as they get something useful out of it, for the others it is merely a matter of removing their waste	ROVA's (educational) events inspire people to separate their waste better and to commit to the system, by seeing the results of value recovery first-hand the public gets stimulated more, the most enthusiastic people sign up for the 100-100-100 challenge which further intensifies their reverence	Through participation and active involvement with the system people adapt faster to and create a stronger bond with the system, people who do not only value the waste being removed but also the resource recovery aspects will generally separate better, reveren-ce is further reinforced when con-sumption patterns are adapted
Ritual	Waste disposal preferably occurs quick and cleanly, in the case of organic waste without attracting flies and producing stench in or around the house, no further thoughts are committed to this process, the exception are home-composters who put in significantly more effort to manage their organic waste	The new waste separation process requires more effort and conscious decision-making from people, as a result they have to think and act more carefully, which connects them a bit closer with the system, the increased efficiency and obtained results through the new system also makes people appreciate the process more as it clearly improves the situation, these forms of appreciation mostly reflect on the physical	Improved waste processing results stimulates people to put in more effort and creates appreciation for the system, for most people the system is merely a means to an end, other systems with similar results and required effort would also be accepted, the appreciation and willingness to participate is mostly linked to the physical aspects of the waste management system, people do not seem to strongly consider the spiritual side of the process

		properties of the system, not necessarily the idealistic ones	
Peaceful-ness	It is expected that the chosen waste manage-ment system does not (unnecessarily) disturb or otherwise bother the people, public areas should remain unaffected and no people should have to deal with the stench of the process	Knowing how successful the new waste management process could become, some groups of people become more willing to give up some personal quietness or comfort in return for serving the greater good, by doing so they also create a state of 'peace of mind' for doing the 'right' thing	Not being disturbed by the waste and its collection process is the physical aspect of peacefulness, that people are willing to sacrifice to some extent in return for the emotional peacefulness of doing 'the right thing', ideally, both conditions are met simultaneous-ly, because people dispose of organic waste similarly as mixed MSW there is no distinct differen-ce there, despite being naturally closer to the 'beauty of nature' and its associated peacefulness
Cleanli-ness	People dislike the look and smell of waste in and around their house, particularly that of organic waste, especially home-composting people are aware of this, they value the upsides of this natural process over its downsides	When people separate their waste better and don't contami-nate other waste types with organic waste, the overall side effects of storing organic waste can be better controlled, A waste management system that motivates its users to dispose their waste properly and educa-tive meetings that show people the value of waste can result in people leaving less litter outdoors and in public areas, which improves cleanliness	Awareness of environmental problems as well as communi-cated value recovery progression helps people to perceive the impact of waste on the environ-ment around them, by managing their waste better they improve the cleanliness of their own home and the environment around them, cleanliness is one of the factors that can positively spiral the positive attitude of people towards a system upward due to its immediate noticeability
Beauty	People treat the system as a technical solution to a problem, they do not see the beauty of the system, only indirectly by waste not being in and around their homes	Despite having the knowledge of the success of the value recovery potential of the new waste management system, people still treat it as an artifi-cial / industrial process, biogas obtained from the fermentation process is not considered green / natural, the compost to some extent is, but it is not (directly) put back into the local commu-nity so people are less aware	The value of beauty gains a deeper meaning when the awareness of environmental problems of the users increase, not only the result of the system (collected waste) but also the goal of keeping society clean is taken into consideration now, however the processes applied to do so are largely industrial and are in itself not considered as 'beautiful', only as 'functional'
Nature	Because organic waste is collected similarly to other non-organic waste streams, the connection with nature is lost in the	Organic waste is still collected similarly to non-organic waste, but the value recovery potential of organic waste is better com-municated to the public, but as	Through the executive organisations' efforts the users' knowledge of the applied waste management technologies has increased, but people are

	prior waste flow, the difference between the two types of waste flows is for most people too abstract, waste = waste to them	the applications of the recovered resources are not locally applied in natural manner, people don't associate the recovered products as completely natural	generally more interested in the results than the actual processes, whether these processes are natural or not does not particularly concern them
Authenticity	Organic waste has historically been used in natural process to extract value for local use, the old collection system only recovered limited resources due to contaminated waste flows, the parts that were composted to some degree were therefore authentic	Resource recovery is significantly higher, although not all processes are similar to those used in the past, the aspect of recovering value feels authentic, but the means by which this is achieved do not, old societies did not know the concept of waste and reused almost all materials, the circular economy seeks to achieve this again	As systems become more technically advanced and complex, less of the historically applied organic waste value recovery techniques can be recognised, as a result these systems feel less authentic although the ideology of moving towards a waste-free society is something that was originally seen as normal, taking care of the environment around resonates with some people as authentic behaviour
Miscellaneous values			
Trust	Duo bin kerbside collection systems have been in use for a long time and people trust in what they are familiar with, the system has only a few variables which makes it easy to use and control, home-composting is in the user's own control	The new system requires a lot more effort of its users, people need to be convinced through ROVA that the extra effort result in something beneficial, people are skeptical at first and not always happy when a system they got used to changes, time and effort can change the user's perception	Introducing a new system that has higher expectancies of people generally reduces their trust in that system, it needs to prove itself to be worth the extra effort and time to get used to by clearly showing the results are better than what the old system could achieve, this needs to be communicated clearly
Procedural fairness	The procedures of the old system are considered fair because they were very comparable with other municipalities and low (social) control meant everyone could cope with the system, not a lot of effort was required as the options were limited and there would be no repercussions for incorrect use of the system	As regulations and social control become stricter not everyone feels like they like the new system, clear communications and early involvement of the public in development helps to adapt the people to the new system, those user groups that wish to do more for the environment and don't mind the extra effort managing their waste are happy with the new system as it enables them to fulfil their needs, those part of certain	All people using a specific system are expected to follow the same procedure: people have the same bins and follow the same collection schedule, however as more restrictions are applied some groups may feel the procedure does not match well their distinct consumption patterns, people can also perceive procedural (un)fairness if the system they use is different to that of another municipality, it needs to be clarified which rules apply in which region for what people

		demographic groups feel the system falls short to their needs	
Distributive fairness	As different municipalities use different systems, so to do the economic models differ, people find it unfair why service X is priced differently for people in a different nearby municipality	The new system rewards good waste separation and lower consumption patterns through DIFTAR, users who put in the required effort will consider this fair as they have to pay less, users who do not put in much effort will pay more	Differences between economic models remain a point of frustration for users of the more expensive system, although some people are intrinsically motivated to separate their waste better, others would only do so for financial compensation
Perceived behavioural control	The individualistic approach people take to the system means they learn little from other users, they are not expected to improve their performance and would neither be rewarded for doing so	Communities on a wider level are engaged by reverse collection systems, when enough motivated people actively partake, a state of social control is created that improves the behaviour of others, seeing recovered resources return to their local society also stimulates them	When the system rewards its users for managing their waste well and feedback is provided that shows the system is working, people will be motivated to perform better, these motivated people will encourage others to also try their hardest, those who slack behind will be told to put in more effort, in the end people want to belong to the majority who are motivated
Attitude	People with no intrinsic motivation to separate their waste better and to recover more value have a positive attitude towards this system, those that wish to do more have the possibility to compost at home	The new system requires more effort from its users, which is not something everyone appreciates equally, those who wish to perform better in their waste management now have an outlet to do so and are rewarded for that, which has a positive effect on their attitude, people who prefer the low-effort system will have a somewhat negative attitude towards the new system	People who intrinsically value the environment have a strongly different attitude towards putting in more effort into managing their waste than those who care more about their own convenience, everyone has a personal ratio between required effort and resource recovery result that shapes their attitude towards a waste management system, (financial) compensation is a tool to change the attitude of people

Table C.1: Comparison between both composting scenarios in relation to the social values.

Outsiders
Selection Cycle

Legend:
- Concrete values
- Social values
- Identity-driving values
- Idealistic values
- Feedback
- Selection cycle

Some degree of home-composting. The majority follows the low investment system with fixed rates. Fixed rates provide no economic incentive to perform better

Bad sorting habits results in organic waste rotting and producing stench in multiple bins. Users have to keep their waste untill collection

Organic waste has historically been value for people to recover value from for local use. Those people with a home-composter have this benefit again. The general public has little knowledge of the importance of waste separation

Duo bin kerbside collection is a system that has been used for a long time and people have grown familiar to it. It has only a few variables which makes it easy to control. People trust it for it's non-complexity

Procedures of the old system are considered to be fair, as they are comparable to other municipalities. The options are limited and repercussions from the authorities are unlikely

Slight differences exist between the financial models per municipa-lity. People can perceive it as unfair when the same service is costed differently in another region.

External factors help to improve the awareness of environmental problems by the public. However, the link between these problems and their effort in waste management does not always go noticed.

Spirituality is not a value that people associate with waste management

Home-composters are well aware of the lifecycle that organic waste goes through. Those who make use of the kerbside collection scheme do not realise this, as they stop caring once the waste has been collected. They know little of the system processes

The effort of home-composting is a deliberate choice, whereas others follow the more autonomous low-effort system. These users treat their waste as actual trash and act only to get rid of it, preferably with low effort, quickly and cleanly. They have little dignity or respect for the waste or the system that treats it. The kerbside collection approach to waste management is very individual. Interaction with the system operators is brief and indirect, which meaks people feel unconnected. Home-composting projects are completely stand-alone and are more likely to involve the family. This system requires certain skills and knowledge, whereas kerbside collection with limited waste separation requirements is inclusive and accessible for almost everyone.

The individual approach people take to kerbside collection systems means they learn little to nothing from other users. There are no high expectancies or any form of social control about efforts people put into waste separation.

People with no intrinsins motivation to separate their waste well and to enable value recovery from waste have a positive attitude towards this system as it allows them to continue with low effort input. Home-composting is an option for those who wish to do more.

A low commitment system with poor value recovery, but easy to operate and inclusive to all

7.3

Home-composters have some reverence to their personal organic waste disposal process, as they can clearly see the benefits. The users of the regular system see no benefit other than getting rid of the waste. It happens effortlessly and quickly, with no thoughts of a ritual behind the users' actions. As both systems only affect the areas in and around the house, the peacefuness of the public space is remained. Organic waste has a tendency to start smelling badly and attracting flies, especially in summer. People can perceive this as unclean and it can be a real nuisance, especially because organic waste is sorted poorly and ends up in multiple bins. People treat the system as a technical process and don't see any (natural) beauty in it. Composting is an authentic process as it recovers value from organic waste like mankind has done for a long time. The current system only has a low value recovery rate due to contaminated flows.

low commitment vs high efficiency

"Fine as it is"

Inability to do 'more'

External awareness

Demand for alternatives

Time

Appendix C.5 - MSW interview with ROVA representative Hemmo Hagedooren (12-06-2018, telephone)

Interviews unavailable in the public document. For further information, contact the author at robvanderburgh@gmail.com

Appendix C.6 - Analysing the citizen satisfaction survey of Amersfoort

The survey sent out to all participating users had a response rate of 50% for a total of 537 responses. The average age was 49 years, and the average household consisted of 3.1 people.
Before the pilot starts, people in the designated area informed through the municipalities' regular communication platforms. Additionally, throughout the duration of the pilot, people can contact the 'waste coaches' who are the main link between the municipality and the participating pilot members. Their communication goes both ways, as they both educate the people about the system and warn the municipality when things go awry (Gemeente Amersfoort, 2015). Not only did the municipality reach out to individual households, they also contacted platforms such as the commission for residential advice and the Amersfoort Platform for Handicapped and Patients (Gemeente Amersfoort, 2016a). Based on initial surveys before the start of the pilot, the participant's biggest concern was the location of the mixed waste containers. Reverse collection as a concept is broadly supported. In 5 out of 10 locations for these containers, the final placement is changed based on community feedback. As a result, support for the location of the containers has increased. The project leader or responsible alderman visited or otherwise contacted concerned individuals personally to clarify the reasoning behind the municipalities' goals and plans. Furthermore, a 'user group' of 30 volunteers was established who will provide additional feedback.
At the end of the pilot, this user group made 4 recommendations:
1) Distribution of information during community meetings must reach everyone involved, not just attendees.
2) Timely and accurate communication both before and during the pilot is of utmost importance.
3) Education about the (post collection) waste treatment processes is very important.
4) Many participants of the user group volunteer to be an ambassador when the system expands.

The main conclusion of the pilot survey is that 75% of the users is positive about the reverse collection waste management system. 50% of the users was already positive before the launch of the pilot, an additional 25% became convinced throughout the duration of the pilot.
70% of the people are happy about the placement of the underground containers for mixed waste. The biggest point of concern is the frequency of PMD collection, which should happen more often according to almost half the users.

3% Of the households admits depositing their mixed waste in one of the sorted bins, for various reasons. 20% of the users says they are not adequately informed about the required separation of PMD (plastic packaging, metal and beverage board). However, the majority is positive about the separation of PMD. 72% thinks it doesn't take a lot of effort to do so, whereas 80% states to find it important for the environment that PMD is collected separately. 55% Claims they have become more aware of separating their other waste since they have to take out the PMD manually.
84% of the users believe the municipality has informed them adequately, the others either believe to be missing relevant information (12%), or believe they had obtained false information (3%). Almost 60% would like to see more information, about a large variety of topics (Gemeente Amersfoort, 2016b).

Appendix C.7 - Comparison between both MSW management cases

Value	Old situation	New situation	Scenarios comparison
Concrete values			
Percei-ved costs	Low investments, no incentives to perform better, fixed rate	Investments in the system are visible to the users, only marginal economic incentive to sort their waste better	People realise municipalities are investing in waste management systems, but feel like they are not rewarded enough for their efforts
Percei-ved health risks	Poor sorting resulting in stench, waste kept long and close to home	Waste collection in and around the house has become more orderly and cleaner, the underground containers are properly maintained	Sorting at the source decreases waste nuisances, giving people the option to empty their (mixed waste) bin when they see fit means there is generally less waste present around the house
Percei-ved environ-mental benefits	Low resource recovery rate which is invisible to the public, uninspiring	Education directly from ROVA and its affiliated partners helps people to understand what good waste management can do to create a healthier environment	Environmental awareness is created through education and information by the executive organisations, through this awareness, many users attempt to separate their waste better
Auto-nomy	'Old' system the people are used to, runs almost automatically due to few choices and low commitment	Reverse collection and separation of four flows requires more effort and active thinking from the users, there are more rules and restrictions	Introducing a new system that involves more complex and fre-quent decision making moments is naturally going to need time to be adapted to by the users
Dignity	People treat their waste as trash, they want to get rid of it as fast and cleanly as possible	Through the increase of awareness, people stop seeing their waste as something purely negative, but also see the potential value recovery	People's perspective of waste changes when they learn of the potential value still embedded, this is also true for the waste management system
Respect	As there are no benefits to sorting well, people care little about the system and the people operating it	As they interact more with the system, the people also treat it more respectfully, this also relates to the people operating the system	Respect is earned through the perceived effectiveness of the system, when the executive organisation relays information about the effectiveness, respect by the users in increased
Commu-nity	Very individualistic approach, at best a	Local communities can push its members to perform better through social control if the	An engaged community creates a state of social control that pushes other members to more active

	neighbour is helped during holidays	majority believes in the success of the system	participation, the reach of this control and communication also expands as more people are actively engaged with the system
Connec-tedness	Other than the moments in which the bins are brought to the street, there is no connection with the system	Sorting waste has become a process which requires continuous conscience and as a result binds people more closely to the system, its operators and the other users	When operating organisations seek contact with the user base, stronger social ties are developed that stimulate the users and in-crease their awareness of under-lying environmental problems
Family	Aside from family members helping their (grand) parents or members on holidays, there is not much interaction between them	The increased levels of interaction between community members also apply to family members, who also share their waste separation experiences with each other during social events	Related to the increased connectedness people experience when their awareness improves, so do their connections with their family, enthusiasm for a system results in more frequent exchanges of experiences and willingness to help others
Religious freedom	Not a relevant value in this waste management sector	Not a relevant value in this waste management sector	Not a relevant value in this waste management sector
Access-ibility	Generally well accessible due to low commitment	Some aspects of the increased commitment requirement happen close to the users' homes, whereas others require the user to bring their trash to collection points, however those points are strategically located and constructed	Reverse collection points are chosen strategically, but will always require people to move further than kerbside collection systems, it is important for the municipality to explain that the chosen location for the underground bins is optimal
Inclusi-vity	The choices in the separation process are obvious and simple to make, the fixed collection schedule is easy to adapt to	The overall increased complexity and required commitment of the system does decrease its overall inclusivity, as it is more likely that a person is (physically or mentally) unable to do one or more of the new tasks	With more intricate aspects to a system, more limiting factors will come into play that reduce the overall inclusivity of the system, however, by involving those involved groups early in the design phase, solutions can be found to circumvent exclusion of these groups
Identity-driving values			
Environ-mentally friendly	Overall awareness of environmental problems and importance of waste	The new system raises awareness through education and active participation of the users, with this knowledge they	Although external factors help to create awareness for environmen-tal problems related to product consumption and waste patterns,

	management slowly rises through external factors	learn about the environmental problems we face, this also occurs through external factors	the waste collection organisation plays an important role in educating the people about their own waste, treatment methods, and value recovery
Spirituality	Not a relevant value in this waste management sector	Not a relevant value in this waste management sector	Not a relevant value in this waste management sector
Cycle of life	As resource recovery is very limited, the concept of circularity is not promoted through this system	The concept of circularity is much more present, as people learn about the value recovery the new system enables, circularity is mainly seen as an industrial process, not a natural one	Through the educational systems of waste management organisations, the principles of material life cycles are introduced to consumers, the difference between natural and industrial cycles is mostly too abstract for most people and requires further education
Idealistic values			
Reverence	Because people get nothing back from the system other than getting rid of their waste, they have little to no reverence for it	People get inspired by the idea they can help to make a difference, seeing the results that proper sorting has on the value recovery rate they are more likely to try even harder	Active involvement in the system helps people to adapt faster to a new way of thinking (and acting upon those ideas), if the system has favourable results based on those actions, people are more likely to keep trying their best
Ritual	The process of dispatching the waste must be clean and quick, no further thoughts are committed to it, the process is done almost absentmindedly	People put more thought into the process of managing their waste and make more active decisions, as much as they respect the functionality of the system, it is still a means to an end	In the case of waste management, the system is considered to be a means to an end, required effort is accepted as long as the result is acceptable, but other means with similar results would also be accepted
Peacefulness	Waste storage and collection of the bins should not unnecessarily disturb the people	When people are inspired by the results achieved by the system, they are to a certain extent willing to give up some peacefulness of their daily lives in return for 'peace of mind' for doing the 'right' thing	Not being disturbed by the waste and its collection process is the physical aspect of peacefulness, that people are willing to sacrifice to some extent in return for the emotional peacefulness of doing 'the right thing', ideally, both conditions are met simultaneously
Cleanliness	People dislike the look and smell of waste in and around their house, the impact of waste on the	Through better sorting, the smell of waste in and around the house is reduced, however it has become more visible with	The people's perception of cleanliness expands beyond their own homes as their awareness of environmental problem increases,

	environment concerns them less	an increased number of bins, the underground containers are well maintained, prevent stench and make waste less visible	not only do they want waste gone from their own perception, they want it treated by the system
Beauty	People only see the function of the system (getting rid of waste), which involves little to no beauty	People also consider the underlying value of resource recovery and environmental benefits in their perception of the system, which improves their views of an otherwise grey and industrial system	The value of beauty gains a deeper meaning when the awareness of environmental problems of the users increase, not only the result of the system (collected waste) but also the goal of keeping society clean is taken into consideration now
Nature	Kerbside collection of MSW is a very handmade, industrial process, there is no real awareness of the processing of organic waste, the difference between the two is too abstract	Reverse collection of MSW is a very handmade, industrial process, the awareness of the processing of organic waste has improved, but the difference between the two is too abstract for people to take notice	Through the executive organisations' efforts the users' knowledge of the applied waste management technologies has increased, but people are generally more interested in the results than the actual processes, also whether these processes are natural or not
Authen-ticity	Kerbside collection with limited sorting at the source has been implemented for a long time, people have grown accustomed to it, giving it an authentic feel	Reverse collection and source separation of four flows is a new concept that takes time for the user to adapt to, it requires continuous decision making which will take time for people to get truly used to, therefore it feels inauthentic	Systems with increased complexity that require more frequent and complex decision-making moments are generally less authentic, however, the appeal of taking care of the environment resonates with some people as authentic behaviour
Miscella neous values			
Trust	It is a convenience-based system people are familiar with, trust is further increased by the system's stability through its simplicity	Not all people are keen on changes, more is required of them for no real tangible benefit, people need to be convinced through the new system's effectiveness at recovering value from waste	Introducing new systems that have higher expectancies of people generally reduces their trust, unless the system can prove the extra effort pays itself off in terms of better results, both the new demands, the process and the results need to be communicated clearly
Proce-dural fairness	Quality expectations from the old system are low and there is no (social) control, everyone in a	All people participating in the reverse recovery pilot are expected to sort their waste to equal standards, but some	All people using a specific system are expected to follow the same procedure: people have the same bins and follow the same collec-

	neighbourhood uses the same bins that are collected equally often	demographic household groups produce more waste of a specific type than others	tion schedule, however as more restrictions are applied some groups may feel the procedure does not match well their distinct consumption patterns
Distri-butive fairness	A common problem is confusion about economic models between different municipalities	A common problem is confusion about economic models between different municipalities, furthermore, people would like to be economically rewarded if they separate their waste better	Differences between economic models remain a point of frustration for users of the more expensive system, although some people are intrinsically motivated to separate their waste better, others would like a financial compensation
Percei-ved behavi-oural control	The individualistic approach people take to this system means they learn little from other users, they are not expected to improve their performance	Communities on a wider level are engaged by reverse collection systems, when enough motivated people actively partake, a state of social control is created that improves the behaviour of others	Through raising awareness, people get motivated to separate their waste better, motivated people stimulate others to do better as well
Attitude	People with no intrinsic motivation to separate more waste have a positive attitude towards this system	People with an intrinsic motivation to separate their waste better have a positive attitude towards this system, people who do not have to be convinced by the trade-of between effort and results	People who intrinsically value the environment have a strongly different attitude towards putting in more effort than those who care more about their own convenience, everyone has a personal ratio between effort and result that shapes their attitude towards a system

Table C.2: Comparison between both MSW management cases in relation to the social values.

Legend:
- Concrete values
- Social values
- Identity-driving values
- Idealistic values
- Feedback
- Selection cycle

Outsiders Selection Cycle

No true perspective on associated costs. No real investments are visible. No incentive to perfrom better

The system operates with low user involvement which leaves them rather free when it comes to sorting their waste. People aren't naturally motivated to put in more effort and society doesn't demand it. The system is easily accessible through its ease of use and low commitment. With no awareness of the relevance of waste management, neither the goal nor the tool are inherently respected. The system is used on an individual level, where family bonds or connections to others rarely tie in. Religion has no special role.

The system is stagnant and based on convenience. Due to it's simplicity it less likely to go wrong, but fails to inspire people to do better

Due to poor sorting practices, green waste could build up and create stench which people perceive as unpleasant

People are not inspired by the environmental benefits of this system. Very low resource recovery rate, mostly incinerated

Kerbside collection of two waste types is a very low commital, individual system. As little can (theoretically) go wrong, there is not much to learn from neighbours.

All people within a neighbourhood are expected to sort and dispose of their waste equally, but the quality expectations are low

Kerbside collection and seaparation of green waste is relatively easy and has been common practice for years. People's attitude towards the behaviour is generally positive, although there is a small group who wants to do more

Low commitment system to get rid of waste leaves people uninspired

7.3

Confusion about different economic models between municipalities is common. The sorting practices themselves are perceived as fair once they have integrated successfully

Awareness of environmental problem slowly rises, but the impact of waste management is not obvious

Spirituality is not a value that people associate with waste management

As resource recovery is very limited, the concept of circularity is not connected with waste separation

Not all people have inherent reverence for nature, but this can be changed through awareness from external sources. Once this is in place, people will respect the goal of waste management, but are generally unfazed by the specific method through which this is achieved. They have seemingly no preference for a technological or natural solution. In a system with low resource recovery, waste is negatively perceived and people want to get rid of it as fast as possible to return to a state of cleanliness. They expect the system to support this demand. They see no beauty in the process, nor its goals. Kerbside collection has been in use for a long time, giving it an authentic feel which helps with its acceptance. Ritual has no role, as people dispose their waste rather absentmindedly.

low commitment vs high efficiency

"Fine as it is"

Inability to do 'more'

External awareness

Demand for alternatives

Outsiders
Selection Cycle

Concrete values

Social values

Identity-driving values

Idealistic values

Feedback

Selection cycle

The economic incentives for reverse collection currently don't affect the people. Ideally, they would also benefit economically to further motivate them

Reverse collection of 4 different waste flows requires a lot more user effort. They are more restricted by rules set up by the waste treatment industry. However, once they become aware of the significance of proper waste management, they become more respectful towards the system. Local communities will push each other to obtain even higher efficiencies. People interact with neighbours and family to increase their personal efficiency and tell about their experiences. Multiple organisations from within the community were approached to determine the best locations for the underground containers

Not all people are keen on changes, especially when they are required to do more for no tangible benefits. As the pilot progressed, people grew accustomed to the new system and perceived it as a positive change

Waste collection around the house has become more orderly and cleaner. The underground containers are properly maintained

Through education, people's awareness of the underlying environmental importance of waste separation and resource recovery increases

Reverse collection engages entire communities. With enough participation, a state of social control is created where people instruct others who do not participate.

All residents in the pilot area are expected to sort their waste to the same standard. However, depending on demographic characteristics of a household, they may have more waste of a specific type than others

Some people were worried beforehand about the new system, but as they got used to it their attitude changed positively. As their interest in and knowledge of waste separation grow, so do their intentions to do better in the future

High commitment system raises awareness of environmental challenges

7.6

Although people are generally motivated to separate their waste for it's intrinsic value, they would like to be economically rewarded if they put in more effort

Through active participation in environmentally responsible programs, the awareness of the users also increases. They become aware of (some of) the environmental problems we face, and what they can do to help

People experience first hand that they can do their part for a sustainable future, and it inspires them to do more. Processing their waste sustainably is becoming a purpose. Through better sorting practices, waste in and around the house and the neighbourhood as a whole is managed better, resulting in a prettier living environment. However, the difference between natural and industrial processes remains too abstract. By having to make deliberate choices during the separation of waste, the systtem requires more thought, which makes people more aware of the relevance of the system. However, it does not speak to people on an idealistic level. People have to get used to the new system, and all new choices make it relatively unauthentic

Spirituality is not a value that people associate with waste management

The concepts of life cycles and circularity are a lot more present, especially to those people who obtain information from (post separation) waste treatment processes

Cultural influences

Interest in information

Takes time to get used to

Happy to do more

Create awareness

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Appendix C.10 - Definitive waste management comparison results

Value	Impact	Waste management system comparison
Concrete values		
Percei-ved costs	Neutral	Although the public can see investments are being made into the system, the opinions on the financial model (that affects them directly) vary greatly. Those who intrinsically value environmentally conscious behaviour appreciate being rewarded for their behaviour, those who do not feel like they should be rewarded more for their increased efforts. Either way, the system should be clearly communicated so people know what costs they can expect.
Percei-ved health risks	Neutral	Perceived health risks reduction is achieved by spreading the same amount of waste (or preferably less) across more bins. Therefore, a bin is less likely to overflow. Organic waste has a tendency to start rotting, produce stench and attract flies (particularly during summer). Through better separation practices, the organic waste is more concentrated and can be dealt with easier. Additionally, when people can dispose (mixed) waste at a personal schedule, there is no need to 'top off' any other bins with it. Either way, there are legislative targets in place that any waste system should meet.
Percei-ved environ-mental benefits	Neutral	Most environmental benefits are not obtained in the local area where waste management takes place. They are therefore not directly perceivable by the public. Environmental problems, and solutions to them, are generally communicated either indirectly through external factors such as documentaries, or directly through internal factors such as communication by the waste manager or the local government.
Social values		
Auto-nomy	Neutral	As systems get complexer and more rules and regulations are created for the users to abide to, the users need to make more conscious decisions. Historically humans lived in a waste-free society, but this has drastically changed. Managing organic waste flows should speak to this history and come autonomous to the users. Urbanisations has put us further away from nature and these habits, and we have to relearn to put effort into not making waste or managing it better.
Dignity	Neutral	Waste is currently still treated as a problem and not as an opportunity. When this perspective changes, which it can through education and communication, people will see the potential value of their waste. When they see the value, they will treat waste more as a valuable resource, and like things of value, more carefully. This process is slow and some groups are more susceptible than others.
Respect	Neutral	The level of respect that people have for a system mostly comes forth from the perceived success the system has in relation to the effort they have to put in. It is therefore of great importance for the executing organisation to clearly communicate the effectiveness of their system. Results that are directly perceptible by the users score higher.

| Commu-nity	High	A group of environmentally conscious users are likely among the first to embrace a new sustainable system. Through their effort and enthusiasm, more people become inspired to perform better. The executing organisation should occasio-nally create events where people can provide feedback or have their questions answered. Being approachable for the users creates a stronger bond between the community as a whole. Once a large majority of users is convinced of the system's added value, a state of social control is created that pulls more people in. Educational events that involve children and schools are also successful.
Connec-tedness	High	Connecting the community through organised events and educational systems helps to spread awareness of the environmental problems that mankind faces and the things that consumers can do to contribute to a solution. People who are inspired to make the world a better place and have a medium through which they can talk with like-minded people to share experiences will generally perform better within the boundaries of the provided system.
Family	High	As the new waste system requires more effort from the user and takes up a bigger part of their daily routine, people are more likely to make it a topic of discussion. This is especially true when a new system is introduced that people still need to adapt to. Family members are likely to exchange stories of their perception of the new system, as well as share their experience (positive and negative) and skills with it. Members of a family that are more passionate about the system are more likely to help each other managing their waste better, or do the tasks for them during an absence.
Religious freedom	Low	Religious freedom was not found to be a relevant value in both waste management scenarios. Neither the waste flows nor the infrastructure should provide any problems for any given religious background.
Access-ibility	Neutral	As waste management is a service everyone should be able to use comfortably, required infrastructure should be placed within easily accessible reach for every intended user. This reflects to both (temporal) storage containers, intended collection points and any road or path between them. The overall distance of these points to the homes of the users and potential obstacles along these ways are also important to consider. All users have different desires when it comes to placement of this infrastructure and it is important to include their desires during the development phase and integrate their feedback.
Inclusi-vity	Neutral	When systems become more complex, there is a potential that they alienate some users through their complexity. It is important to test the system during development with many different demographic user groups to identify these problems early and tackle them where possible through adaptations in the system or training of the particular users. If it is not possible to make the system inclusive for everyone, end-of-pipe solutions need to be implemented to circumvent complete exclusion of these users.
Identity-driving values		

Environ-mentally friendly	Neutral	External factors such as news reports and documentaries help to shape a general picture of the environmental challenges we face. Internal factors such as communication from the waste management organisation play an important role in educating the people how their waste and consumptions patterns can be changed, what waste treatment methods are available, and what resources can be recovered through these systems. The community is generally skeptic about the potential value recovery at first, and needs to be shown first-hand in order to be convinced that their additional effort in waste management results in something environmentally beneficial.
Spiritu-ality	Low	Spirituality was not found to be a relevant value in both waste management scenarios. People generally only consider the physical and otherwise perceivable aspects of a waste management system.
Cycle of life	Neutral	As people become more aware of the technical capabilities to extract new resources from waste, they are open to increase their waste separation efforts to stimulate this technical process. Because organic waste is also treated through heavily industrialised processes, the difference between technical and organic value recovery processes is too abstract for most people. Life cycles of resources are rarely considered on an idealistic level. It is more common that people have the knowledge that value can be extracted from a certain product through a series of technical processes. Waste is separated with the goal of value extraction in mind, not because waste should not exist in an ideal world.
Idealistic values		
Reve-rence	Neutral	Active participation in a new system helps people to adapt faster to it. If the system rewards those people for their positive involvement, they are more like to continue their efforts. When the users also realise that through their actions, they can help to do their part to create a better / cleaner world, they have yet another reason to keep trying their best. When all these factors align, the users will show increased reverence for the system.
Ritual	Neutral	In the case of waste management, the system is merely a means to an end. The goal for most people remains getting rid of their waste, not recovering value from it. However, if both can be achieved through the same system, they are willing to put in more effort. If another system is introduced that requires less effort, extracts more value for the same effort, or is simply cheaper, most users would have no problem switching. As most people only consider the technical aspects of waste management, these three elements are the most important. The journey of the waste and the rituals / processes it goes through is less important.
Peaceful-ness	Neutral	Peacefulness has two aspects: those aspects of waste management that can be perceived and are 'real', and a more idealistic side of aspects that cannot be literally perceived but bring peace-of-mind. People don't like to see or smell waste in and around their house and preferably also are not disturbed by noisy waste collection trucks. A notably smaller group of people is affected by the idealistic aspects. They mostly worry about their consumption patterns and its effects on the environment. They value a system from which they know that their waste is treated well and most of its value is recovered.

Cleanli- ness	High	The physical aspects of waste management relate to waste which can be seen, smelled, or that which starts to rot, attracts flies, etc. This needs to be minimised for the user's comforts, or otherwise the system won't be accepted at all. Once these conditions are met, people look beyond their homes at the local environment around them. A system that actively helps to reduce the amount of waste in the local environment is a system that people are more likely to adapt to.
Beauty	Neutral	Although waste management mostly speaks to the user on a technical level, the awareness of the environmental problems does make people more perceptive of the problems in their local area. As people and politicians alike become more aware of the environmental problems we face, their agenda for expanding and maintaining nature in urban areas (and also beyond) grows. With a good waste management system in place that educates and cares for its users, people are more likely to contribute to a more beautiful nature by not littering their waste.
Nature	Neutral	People are much more interested in the results of the applied system than the processes that it uses. The difference between natural and industrial processes is too abstract as they usually both take place indoors regardless. Only when a natural processes takes place in the open and artificial elements are minimised, people clearly perceive the process as natural.
Authen- ticity	Neutral	Historically, waste streams produced by humans have mostly consisted of organic matter. Through various means, value was recovered from these waste flows to put to use locally. Producing waste while not recovering value has been a growing problem and mankind has strayed further from their origin of a waste-free society. People have gotten used to carelessly dispose their waste, resulting in low-effort systems to feel authentic. With a new focus on strict waste management policy and the goals of a circular economy, municipalities return to the ideology of a waste-free society.
Miscella neous values		
Trust	High	People are at first skeptical of new systems and their supposed effectiveness. The authority of the executing organisation is not as relevant as the perceived up- and downsides of the system. To counter the skepticism, the user base will have to be informed, and preferably involved in the development phase. Through these informative sessions, a bond can be created with the organisation behind the new system and a fair scenario can be formed as to what the expectations of the people are, the tasks of the executing organisation and the results that will be achieved through the new system. If these are appealing to both groups, trust can be established between the users, the system operators and the system processes.
Proce- dural fairness	High	People find it important that the same rules apply to all people. It is therefore impor- tant to communicate why rules are created the way they are, why this is the most fair to the majority of the people, but also why they are different than for example those of a neighbouring municipality. When the same rules apply to everyone, there are always certain groups of people living in certain conditions that feel hindered by them more than others. It is important to clarify to them why the system is fair as it is, and possibly how they can improve their situation to better adapt to the rules.

Distributive fairness	Neutral	As with all things, people don't like spending unnecessarily much money on waste management. The baseline of the system needs to be affordable, but through financial benefits, people can be motivated to put in more effort to separate their waste better. Not all people are intrinsically motivated to separate their waste well, some only will when there is a financial compensation for their effort. Similar to the system regulations, the financial model should be communicated clearly so people know what they can expect and why the costs are distributed as they are. This also includes the explanation of differences between municipalities.
Perceived behavioural control	Neutral	Raising the public's awareness of environmental problems and the importance of a good waste management system is crucial to get people motivated to put in the required effort to separate their waste well. When a group of people has formed that perform well, are positive about the system and share their experiences with others, more people are likely to join in. In a matter of time, the majority will have adapted to the new system, which attracts more people who want to be part of the group. Finally, the last will be pressured into following the expectations through social control, and potential repercussions for the local government.
Attitude	High	People generally have two types of attitude towards waste management. Those who act for their own convenience, and those who intrinsically value the environment and are willing to put in more effort to do the socially desired things. Perceived effectiveness of the system may attract or deter people from willingness to put in more effort. Additionally, financial (or other) benefits can also convince people the system is worth their time. Through clear communication of the functioning of the system and the expected results, people can be convinced that their time and effort put into the system will repay itself. Ultimately, legal pursuers are the last step available for a municipality to change the attitude of a user (group) towards the waste management system.

Table C.3: Relative importance of the values for the given waste management systems.
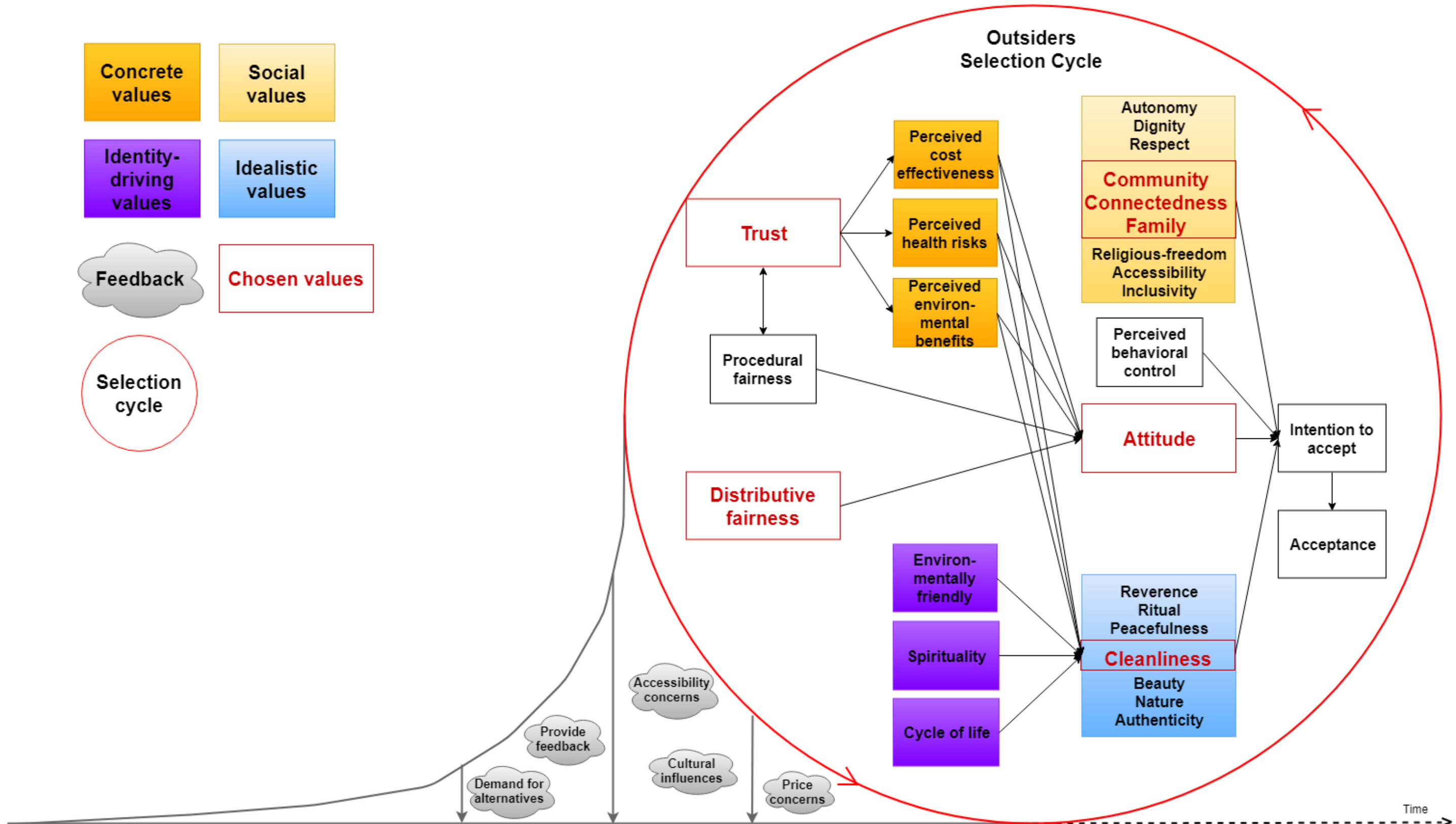
Appendix D.1 - Interview funeral expert Peter van der Aa (09-11-2018, Poeldijk)

Interviews unavailable in the public document. For further information, contact the author at robvanderburgh@gmail.com

Appendix D.2 - Interview funeral expert Guus Sluiter (15-11-2018, telephone)

Interviews unavailable in the public document. For further information, contact the author at robvanderburgh@gmail.com

Appendix D.3 - Interview waste expert Guus Rang (19-11-2018, e-mail)

Interviews unavailable in the public document. For further information, contact the author at robvanderburgh@gmail.com

Appendix D.4 Interview waste / funeral expert Marinus Heldoorn (28-11-2018, telephone)

Interviews unavailable in the public document. For further information, contact the author at robvanderburgh@gmail.com

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