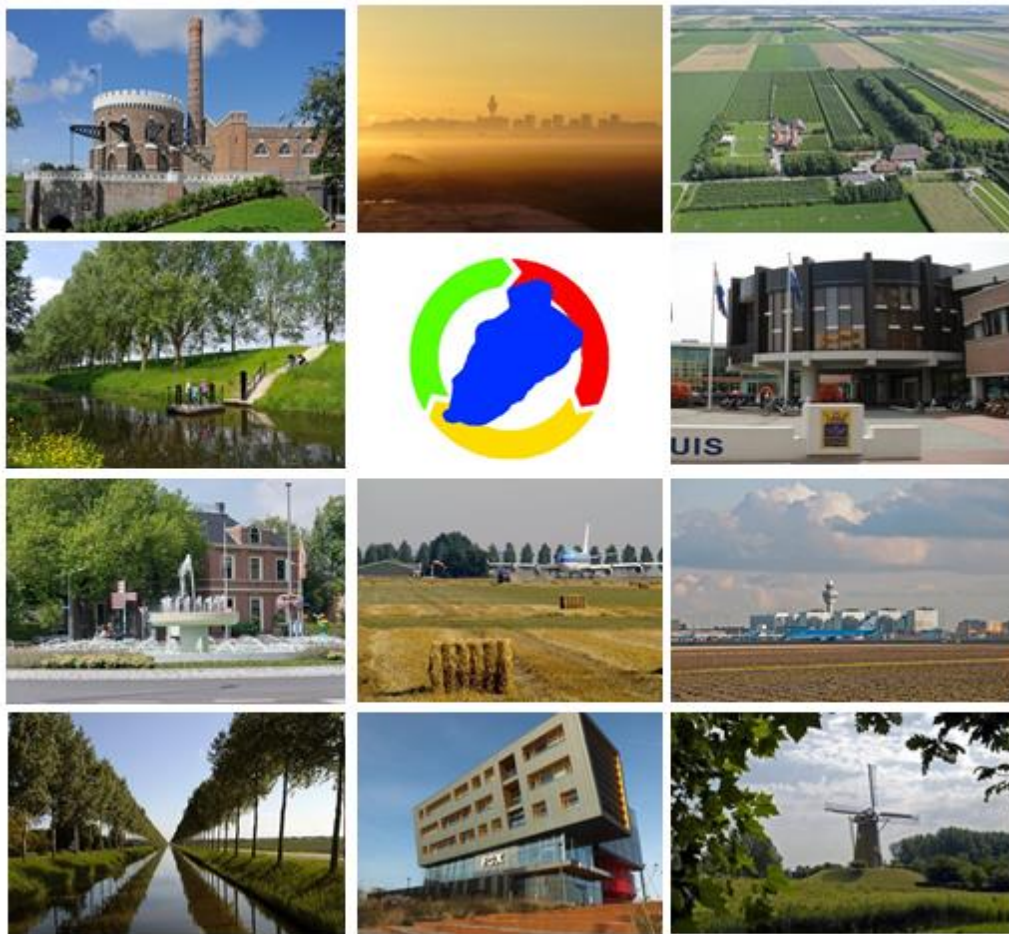


Transition to a Regional Circular Society



The case of Haarlemmermeer

This Master thesis is the final product of the Sustainable Development Master program at Utrecht University. It was handed in on June 29th, 2015, and presented on July 7th, 2015.

The implementation of the activities that are developed in this thesis, including the roles and responsibilities of the various stakeholders, is outside the scope of this study. This is discussed with the relevant stakeholders in a later stage.

Sustainable Development | Energy & Materials
Utrecht University | Faculty of Geosciences

Sybren Bosch
June 2015

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Mohini

Radical Acceptance, Tara Brach (edited)

Mohini was a regal white tiger who lived for many years at the Washington, D.C. National Zoo. For most of those years her home was in the old lion house – a typical twelve-by-twelve-foot cage with iron bars and a cement floor.

Mohini spent her days pacing restlessly back and forth in her cramped quarters. Eventually, biologists and staff worked together to create a natural habitat for her. Covering several acres, it had hills, trees, a pond and a variety of vegetation.

With excitement and anticipation they released Mohini into her new and expansive environment. But it was too late. The tiger immediately sought refuge in a corner of the compound, where she lived for the remainder of her life. Mohini paced and paced in that corner until an area twelve by twelve feet was worn bare of grass.

Perhaps the biggest tragedy in our lives is that freedom is possible, yet we can pass our years trapped in the same old patterns... Like Mohini, we grow incapable of accessing the freedom and peace that are our birthright.

We may want to love other people without holding back, to feel authentic, to breathe in the beauty around us, to dance and sing. Yet each day we listen to inner voices that keep our life small.

Unlike Mohini, however, we can learn to recognize when we are keeping ourselves trapped by our own beliefs and fears. We can see how we are wasting our precious lives. Unlike Mohini, we can choose to leave the cage.

We only see the paradigms we live in. To discover the full prosperity our planet has to offer, we need to step out of the cage we call growth. I invite you to join me.

Sybren Bosch
Utrecht, June 2015

Abstract

The circular economy concept is increasingly being discussed around the world. Haarlemmermeer, one of the leading municipalities in the Netherlands on the circular economy, aims to work towards a *regional circular society*. Such a regional circular society should be able to move beyond individual activities and projects towards a structured system in which material re-use is optimized and material, energy and water cycles are closed locally as far as possible and desirable.

A study of present-day circular economy reporting presents various sets of recommendations to initiate and accelerate the transition to a circular economy. Analyses from system perspectives, a transition framework and an innovation framework conclude that present-day recommendations provide a variety of insights and directions for action, but that additional recommendations are required on high-level system intervention and on supporting innovation.

A set of nine tailor-made activities is developed to start the transition towards a regional circular society in Haarlemmermeer, based on both present-day recommendations by reporting and additional recommendations from literature. This set is shown in figure A.1. The most important recommendation is to initiate the design lab: commonly developing a local meaning behind the regional circular society. The ownership of the concept and its related challenges that such a process creates, can significantly support the development of additional activities. Most other activities can be initiated in parallel, as they are interconnected and strengthen each other.

Far more important than the recommendations is the culture that is required to enable a real transition. Such a new mode of governance, which includes mutual interaction, trust and shared responsibilities among stakeholders, is required to increase and accelerate learning and thereby further enhance the transition process. Future research is recommended on the definition of a circular economy and the role and possibilities of regions to apply circular economy principles in an increasingly globalizing world.

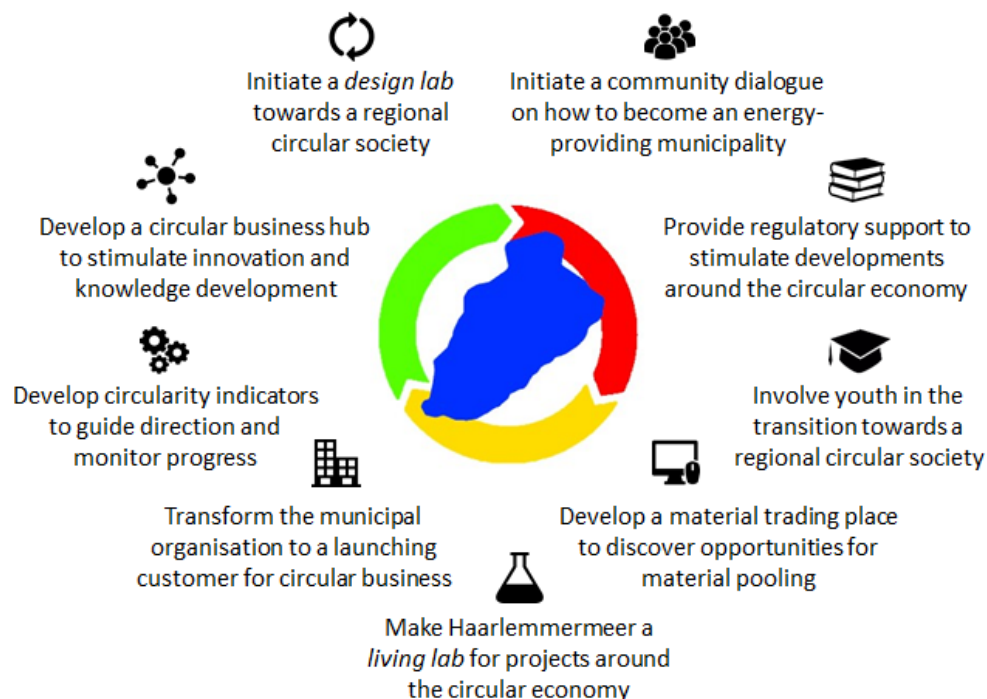


Figure A.1 | Visual of nine activities to start transition to regional circular society

Foreword



Haarlemmermeer started primarily as agricultural land, but during recent decades Schiphol airport has increasingly dominated the Haarlemmermeer skyline and business establishments. This balance between natural materials (agriculture) and technical materials (industry) is still present in Haarlemmermeer.

In this chapter

The transition to a regional circular society is a difficult process, in which providing meaning to the concept is of the highest importance. In this thesis Haarlemmermeer is considered to be a system, which can be argued when looking at the dynamics within Haarlemmermeer. The key in a successful transition process is a change in the mode of governance.

One cannot solve problems with the same thinking that was used creating them

Albert Einstein

Having lived in Hoofddorp until the age of 21, I know the area of Haarlemmermeer quite well. In those years, I have cycled across most of the polder and seen most of its towns. When the opportunity came by to write my Master thesis on the area of Haarlemmermeer in co-operation with the Arizona State University, I took the opportunity to observe the area from a different perspective.

After a Bachelor in innovation sciences, I could no longer stand the word *innovation*. Sometime into my Master program in sustainable development, the word *sustainability* triggered the same respond. And now, after some months of working on the circular economy, I again have started to develop that feeling – the feeling that all these concepts are nice-to-use and nice-to-hear, but remain empty phrases as long as a personal meaning to all participants in the conversation lacks. It is because of this that my first and most important recommendation in this thesis is the development of a common vision on what a regional circular society is, in order to give meaning to the concept and be able to work with the concept in practice.

In the quickly changing world of governmental and business language, words are often hypes, and consequently already replaced before a tangible meaning is developed. Also the circular economy is not as new as it seems. When looking closely, it does not have so much to do with economy at all: the focus is on material flows, with new economic business models as a means to start these flows. The content and thinking behind the circular economy is very familiar with industrial ecology, cradle to cradle and many other schools of thought – only the framing is different because of adding the word ‘economic’, which makes it sound fancy in board rooms. Some do argue that the circular economy is a new economic system, including multiple value creation, where others explicitly link the circular economy to new economic growth. It is therefore most important to locally define what a circular economy means for that specific context, and to develop activities based on that definition.

Throughout this thesis, there has been one underlying assumption: that Haarlemmermeer can be considered as one society, or – in other words – as one system. During the course of the research this assumption has proven to be wrong. The interviews made clear that people in Haarlemmermeer lack a common culture and do not feel a connection to the region. The dominant age group in Haarlemmermeer is 35-50, which is a group naturally reluctant to change. Also, there does not seem to be a problem within the present society: Haarlemmermeer is a nice and safe area to live. Without a problem, it is hard to get people to initiate a process of change. Also businesses, which in Haarlemmermeer have a strong focus on aviation and logistics because of Schiphol airport, are not within a sector that is very open to change.

Zooming out and taking a system perspective, Haarlemmermeer can be described as a junction of flows, including people, materials, water and energy. All flows have strong interaction with both the national and the international environment. The system “Haarlemmermeer” with clear boundaries does simply not exist. Its interconnectedness, combined with the lack of a common feeling and a culture for change, can make it very hard to reach the regional circular society that the municipality aims for.

These characteristics of Haarlemmermeer are very different from large cities like Amsterdam, Rotterdam and Utrecht, which have a stronger common identity, and a younger and more entrepreneurial population. Interestingly, the city of Bristol (UK) has defined exactly the same four domains as Haarlemmermeer on the transition to a sustainable society (Russel 2011): a living, learning, working and playing environment. The Bristol example supports the choice for these four domains in the Haarlemmermeer sustainability program (Gemeente Haarlemmermeer 2015).

Taking a perspective wider than Haarlemmermeer, it is interesting to ask the question what drives Haarlemmermeer to pay as much attention to sustainability and a circular economy. A stakeholder session during earlier research (HBS phase I) showed that sustainability is primarily seen as a means to drive economic growth – with Park 20|20 as prominent example. Combining the focus on the circular economy and the number of ‘iconic projects’ that have been developed with the Amsterdam focus on becoming a Circular City, it almost seems like Haarlemmermeer is in a race with Amsterdam to receive the most attention for ‘their’ circular economy. Adding the lack of involvement of its citizens regarding circularity, it seems Haarlemmermeer is primarily motivated externally.

The real key to success for Haarlemmermeer, in my perspective, would be a change in the mode of governance, especially within the governmental organisation. Present developments, both technological as societal, occur so quickly, that it is very hard to determine what is next. Personal initiatives are required in order to create momentum to start the transition. This calls for support and inspirational leadership by both managers and directors, who are able to release creativity and

A transition calls for support and inspirational leadership by both managers and directors, who are able to release creativity and dedication within all departments and other relevant stakeholders.

dedication within all departments and other relevant stakeholders. Only with inspirational leadership from within the municipal organisation, the activities within this thesis can be developed successfully. Adequately framed, the regional circular society can become a beacon around which activities towards a higher degree of sustainability gather together in order to create a better future.

During the course of this research, I have met many people working on circular economy issues. All are struggling with the same sort of challenges: what material flows can we create locally, how can a broader part of society be involved, how businesses are got on board. Around the country and around the world even, so much is being developed in parallel. This local development creates diversity, which provides a strong basis for radical change. I strongly believe that we should value this diversity, using it as an opportunity to learn. When we take time to look at what others are doing, this will enable us to move forward even more quickly. I am looking forward to discuss this with you.

I owe thanks to the many people who have supported my research: all the interviewees, who have shared their time and knowledge, and my father for re-reading and improving my use of the English language. There are three people who I owe special thanks to. First, Robert Harmsen, my supervisor from Utrecht University with often almost immediate e-mail responses, who provided valuable directions at moments when this was required. Second, Douwe Jan Joustra, researcher at Het Groene Brein and a dedicated practitioner of the circular economy, who supported my thesis strongly and provided valuable additions because of his belief in the final result. And third, last but not most, Fonz Dekkers, who supervised my thesis from Haarlemmermeer perspective and who’s critical approach, knowledge of the field and valuable suggestions have greatly improved this thesis.

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Chapter 1

Introduction



The Hódzemezővásárhely fountain was built at the crossing of Haarlemmermeer's original two main roads: the Hoofdweg and the Kruisweg. The fountain, with in the background the Old City Hall, marks the centre of Haarlemmermeer. The fountain is named after the Hungarian city with a sistership relation to Haarlemmermeer.

In this chapter

The circular economy concept provides guidance on closing material loops, thereby decreasing the pressure on our planet. For the regional application of this concept, Haarlemmermeer defined the *regional circular society*. This thesis aims to determine what the local application of circular economy encompasses, and develops recommendations towards such a regional circular society.

Anyone who believes in indefinite growth in anything physical, on a physically finite planet, is either a mad man or an economist

Kenneth Boulding

1.1 Problem definition

A growing world population, an even faster increasing middle class with growing consumption possibilities and a continuously rising demand for resources from Western countries cannot be aligned with the availability of resources on the planet. Continuing business-as-usual behaviour conflicts with *sustainable development*, defined as development which meets the needs of present generations without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development 1987). When continuing these business-as-usual practices, resources will deplete due to overconsumption and overpopulation (IPCC 2013; UNEP 2011a). One of the key challenges in the coming decades therefore will be to reduce pressure on resources (Jackson 2009). This implies that development according to today's linear take-make-dispose principle will soon no longer be possible (Ellen MacArthur Foundation 2013a), and it is necessary to work on significant reductions in energy and material use.

One of the concepts recently developed to bring this work together is the *circular economy*. A circular economy is a new economic model, in which products are used instead of owned, designed with durability and limited material use as key principles (Ellen MacArthur Foundation 2013a). A circular economy increases material reuse, remanufacturing and recycling of components, and aims for decoupling material use from economic growth (Ellen MacArthur Foundation 2013a). A circular economy goes beyond waste prevention in inspiring innovation within and across value chains, rather than a sector and/or product focused approach (Van Eijk 2015). Awareness regarding the risks of the present-day economy and opportunities of the circular economy is increasing (Bastein et al. 2013; Schoolderman & Matlener 2011). Transforming the linear to a circular economy requires regulatory, institutional, cultural and technological changes, and can only be achieved through closer co-operation and transparency between all actors – governments, businesses, citizens and the science community (Van Eijk 2015).

In Dutch national policy, the concept of circular economy is increasingly drawing attention. The present coalition agreement announced the importance of the circular economy (VVD-PvdA 2012), including the VANG-program (Van Afval naar Grondstof, in English: from waste to resource) (Dutch Ministry of Infrastructure & Environment 2014). Recently, the RACE-coalition (in English: Realisation and Acceleration of the Circular Economy) has been initiated by a group of stakeholdersⁱ, aiming for increased co-operation to further develop the circular economy in the Netherlands.

Quite some recommendations have been made on initiating the transition to a circular economy, however, the scopes and target groups of these studies vary broadly. In China, the concept is aimed at creating a balance between society and nature, and is applied in a broader sense than just closing resource loops (Naustdalslid 2014; Ness 2008). In the practitioner field, recommendations are increasingly done within Europe and for European contexts, among others by the Ellen MacArthur Foundation, the Aldersgate Group, IMSA, TNO and MVO Nederland.

ⁱ Present-day participants in RACE-coalition are MVO Nederland, Circle Economy, De Groene Zaak, Het Groene Brein, ClickNL and the Dutch Ministry of Infrastructure & Environment

Development according to today's linear take-make-dispose principle will soon no longer be possible.

Despite present-day developments and recommendations, barriers still remain for the transition to a circular economy (Het Groene Brein 2015). Linear business models of companies with vested interests hinder the development of circular business models (Wallace & Raingold 2012), just as

limited co-operation within supply chains and wrong incentives provided by resource prices and taxes (Vanner et al. 2014; Groothuis 2014; Benton & Hazell 2013; Schoolderman et al. 2014). Up-front investment costs of infrastructure and materials and short-term agendas of shareholders limit financing possibilities of businesses that want to develop circular business models (Kok et al. 2013; Lawton et al. 2013; Van Tilburg & Weyzig 2014; Lietaer et al. 2012). A lack of knowledge on circular design subsequently leads to products which are more difficult to insert in a circular system (Thomas & Hunter 2013; Bakker et al. 2014). Underdeveloped separation technologies make resource recovery difficult (Benton & Hazell 2013), and additionally the waste system itself is perceived as a hurdle in whether it can assist industry in minimising their material flows (Georgeson & Beasley 2014). There is no sense of urgency within the community, and there is limited consumer acceptance that product ownership will decrease in a circular economy (Schoolderman et al. 2014). Finally, the need for circularity is not shown by the main economic indicator, the GDP (Kok et al. 2013), and financial frameworks and excessive regulations lead to economic depreciation, while products still have value left (Schoolderman et al. 2014; Vanner et al. 2014). Most of these barriers apply on a national or even international level, and so do most recommendations.

At present, it remains unclear which recommendations for the transition to a circular economy can be applied on a regional scale. In general, it is difficult to locally apply circular economy principles when top-down support is limited (Su et al. 2013), which implies top-down support is essential for success. Combining the national-scale assumptions with system's thinking, transition management and innovation perspectives might be able to provide new insights for a regional application of circular economy principles (Rotmans 2014).

1.2 Research question

The municipality of Haarlemmermeer (from now on referred to as Haarlemmermeer when considering the area, or as the municipal organisation when discussing the City Council or the organisation in general) aims to become a *circular society* as stated in its sustainability program 2015-2018 (Gemeente Haarlemmermeer 2015). To assist Haarlemmermeer with the transition process, and considering Haarlemmermeer as a *region*, this thesis addresses the following research question:

- Which recommendations can be provided for transition activities towards a regional circular society?

In order to answer this question, first the *regional circular society* concept is defined. Second, present-day recommendations regarding the transition to a circular economy are identified and subsequently analysed with regard to the leverage points at which they intervene in the existing system, the steps in transition processes and the related functions in innovation systems. Analyses from these frameworks, which are complementary (Markard & Truffer 2008), provide the best-suited recommendations for this transition process. Together with additional recommendations, these will be tested by experts, leading to a final set of recommendations for transition activities. Also landscape factors that influence the transition will be identified.

1.3 Haarlemmermeer

Haarlemmermeer is a municipality situated southwest of Amsterdam, with a population of over 140,000 residents and nearly 9,000 enterprises. The municipality is geographically enclosed by a round canal (in Dutch: ringvaart), and is located below sea level. Haarlemmermeer is also one of the leading municipalities working on circular economy, together with Amsterdam, Almere and Venlo. By becoming partner of the Ellen MacArthur Foundation, being the first municipality in doing so, Haarlemmermeer has recently become part of the world wide knowledge exchange network around the circular economy, and can count on support by the Ellen MacArthur Foundation on further development of circular activities.

Also, Haarlemmermeer has partnered with the Arizona State University in order to link up with a knowledge institution, which has led to the set-up of the Global Sustainability Solution Services (GSSS) program. This supports the development of sustainability solutions by ASU students for Haarlemmermeer cases, and participates through GSSS in a knowledge network for similar developments across Europe.

In the past years, the first phase of the *Haarlemmermeer Beyond Sustainability* (HBS) trajectory has been running (Buch et al. 2014) in order to develop activities to enhance sustainability in the area. Also, many individual projects have successfully been developed in the municipality's *Room for Sustainability* program in the period 2010-2014 (Acceleration Chamber Haarlemmermeer 2014). According to stakeholders in the municipality however, there is a social gap in the application of circular economy as knowledge-sharing is lacking and some connections are missing (Buch et al. 2014). To achieve a regional circular society where this gap is bridged, the first phase of HBS identified the need for a Regional Circular Innovation System (RCIS), which is further elaborated upon in section 3.3.

Leading up to its next four-year sustainability program, the HBS trajectory has delivered a vision, certain values and a set of principles for Haarlemmermeer, which are shown in text box 1.1. These vision, values and principles show a strong focus on commercial and economic growth, and use sustainable development and the circular economy as a means to do so. These assumptions return in the 2015-2018 sustainability program, of which some outlines are summarized in text box 1.2.

At present, it remains unclear which recommendations for the transition to a circular economy can be applied on a regional scale.

This combination of a large number of activities, links with international networks, accordance with national policy, a focus on growth, and some analyses which have already been performed makes Haarlemmermeer an interesting case for implementing circular economy principles. The fact that Haarlemmermeer is a frontrunner is even more interesting, as there are not so many other regions yet which can be looked to as successful examples.

Vision

“Haarlemmermeer will build on its balance with nature and high quality of life to become a preferred commercial center for the Netherlands, Europe and the globe by growing with excellence, connectedness and sustainability.”

Values

- **Diversity** “Flexibility is the future.”
- **Connectedness** “Focus on co-creation, co-sourcing, co-flowing & co-siting.”
- **Responsibility** “There is no way forward unless it is sustainable.”
- **Leadership** “The government evolves from regulator to accelerator.”
- **Innovation** “Embrace multidisciplinary networks of knowledge.”
- **Practicality** “Sustainability is not only for people but also for business.”

Principles

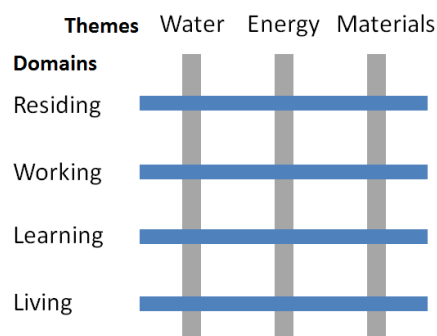
- Strengthen the Market-Based Environment
- Embrace Change
- Think in Closed-loop, Cascading Systems
- Build Resiliency
- Require Renewable Resources
- Create Holistic Value

Text box 1.1 | Vision, values and principles from stakeholder dialogues HBS Phase I (Buch 2014)

“(…) a circular society focuses on new business models and adding value within cycles. New, innovative cooperation in the chain (…) offer employment and new opportunities for Haarlemmermeer entrepreneurs.”

Aims

- 1) In Haarlemmermeer, a sustainable and climate resistant water system will be developed.
- 2) Haarlemmermeer will become an energy supplying area.
- 3) Materials are maintained in cycles as long as possible.



Text box 1.2 | Framework for and ideas behind Haarlemmermeer as a circular society (Gemeente Haarlemmermeer 2015)

1.4 Relevance

This thesis results in recommendations for activities to start the transition to a regional circular society. The recommendations have been specified for the Haarlemmermeer situation. These activities can be seen as accelerators for circular activity; the implementation of these activities therefore can become an important part of the Haarlemmermeer sustainability program 2015-2018. When applying these recommendations in other municipalities, a careful translation should take place. These recommendations do however provide direction for thought.

Scientifically, this thesis provides guidance for applying principles of a circular economy locally, and presents an overview and multiple analyses of present-day recommendations on the transition to a circular economy. A tailor-made set of recommendations for activities is provided based on system thinking, transition and innovation frameworks. Such multi-perspective application of circular economy in a regional environment provides an addition to existing literature.

1.5 How to read?

This thesis consists of 10 chapters, which all consist of an introduction, a data presentation and analysis, a conclusion and a discussion. This thesis continues with the methodology (chapter 2), after which the regional application of the circular economy is defined (chapter 3). Following, present-day recommendations around the circular economy are discussed (chapter 4). These are subsequently analysed from a system's thinking framework (chapter 5), a transition framework (chapter 6) and an innovation framework (chapter 7). Additional recommendations based on the three analyses are developed (chapter 8), leading to a tailor-made set of recommendations for Haarlemmermeer (chapter 9). This thesis closes with a conclusion (chapter 10).

Chapter 2

Methodology



The City Hall of Haarlemmermeer is at the heart of decision-making processes in the municipality. The Council Hall, seen in front, is built at sea level altitude, illustrating that Haarlemmermeer itself is completely below sea level. At present, there are plans for a new City Hall, and ways to make this City Hall more circular are presently under investigation.

In this chapter

This thesis develops activities that start the transition to a regional circular society. This is done through the analysis of present-day recommendations, the development of additional recommendations and the discussion of these recommendations with key stakeholders from the circular economy field and Haarlemmermeer area.

This thesis designs a set of activities that start the transition to a regional circular society, and does so in nine steps. First, the local application of the circular economy is addressed, introducing background information regarding the circular economy (step 1). Second, present-day recommendations for the transition to a circular economy are provided (step 2). These recommendations are then analysed on their level of system intervention (step 3), from a transition framework (step 4) and from an innovation framework (step 5). Additional recommendations are drafted based on the gaps, and are combined with the present-day recommendations (step 6). Through interviews with both experts in circular economy and practitioners from Haarlemmermeer, these recommendations are prioritized (step 7) and landscape factors are determined (step 8). This leads to a final set of activities which start the transition to a regional circular society (step 9). This methodology pathway is visualized in figure 2.1.

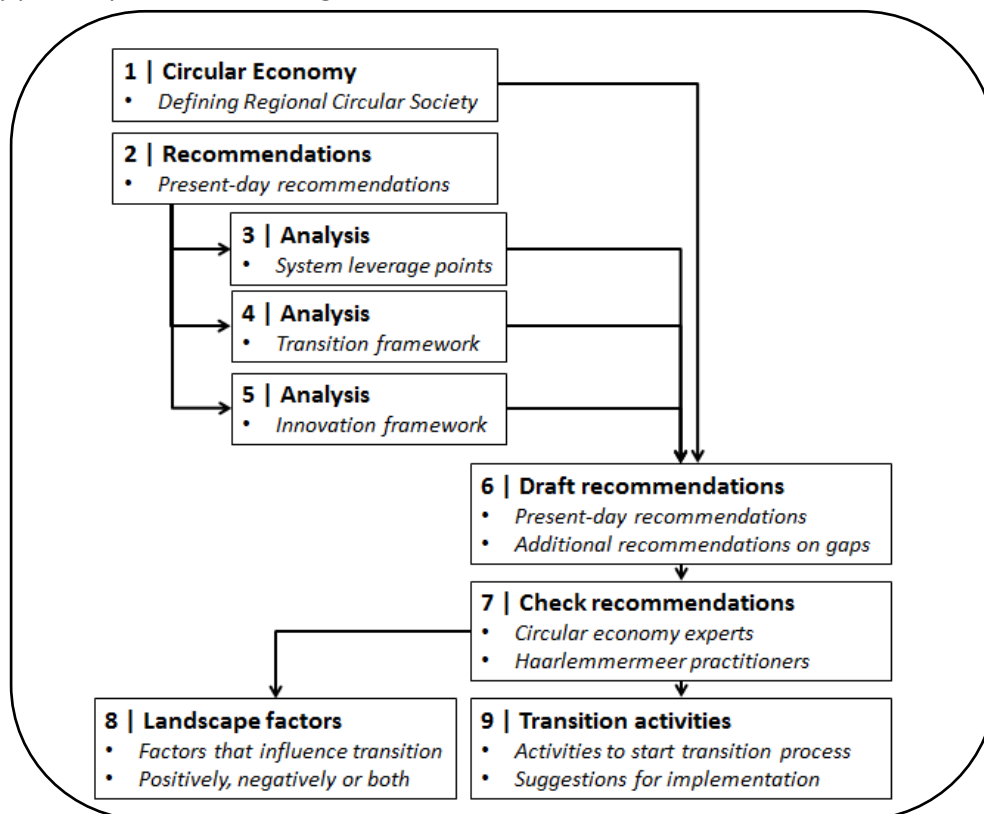


Figure 2.1 | Methodology of the thesis

Step 1: Defining a Regional Circular Society

Background information on the circular economy is presented to provide the basic understanding of the circular economy concept. Primarily, reports by the Ellen MacArthur Foundation are used, as these are internationally leading at the moment when considering the circular economy. Second, the implications for the regional application in a *regional circular society* are discussed, using the Haarlemmermeer situation as discussed in reporting of the Municipality of Haarlemmermeer and the *Haarlemmermeer Beyond Sustainability* trajectory.

Step 2: Overview present-day recommendations

Step two provides an overview of present-day recommendations on the transition to a circular economy, and discusses recurrent elements from these recommendations. Both the recommendations and the background information are mainly derived from consultancy reports, and from scientific literature which is found by running *transition circular economy* and *recommendations circular economy* through Web of Science and Scopus. Only one article was found that provided some tangible steps / recommendations which could be used as input for this study. The consultancy reports are selected through using the Knowledge Map on Circular Economy (Het Groene Brein 2015), which provides a wide range of circular economy reporting.

Steps 3, 4 and 5: Analyses

Steps three, four and five analyse the recommendations from step two using three perspectives: system leverage points, a transition framework and an innovation framework. In all steps first the framework is developed, second the categorization is done, and third the outcomes are discussed.

For the system leverage points, the framework was previously developed by Meadows (1997). For the transition frameworks, scientific peer-reviewed literature is searched for through Scopus and Web of Science using the concepts *multi-level perspective*, *strategic niche management* and *transition management*. Additionally, a workshop at the *Transition Academy* at DRIFTⁱⁱ delivered input for concepts to use with regard to the multi-actor perspective. For the innovation framework, the same method is applied, now searching on *regional innovation system*.

Searching for articles using these concepts, categorizing on citation score, leads to a number of relevant articles. The concepts from these articles, providing direction for success factors, are identified. The most relevant concepts (in the case of the transition framework) or functions (in case of the innovation framework) are brought forward in the framework.

With the framework in place, the categorization is done by going through the backgrounds of the recommendations in the individual reports, having the frameworks in mind. The categorization provides a yes-or-no indication for individual leverage points, transition concepts or innovation system functions. When a recommendation addresses a certain leverage point, concept or function, this is marked in a table. This addressing can either be directly, specifically mentioning the element, or indirectly, when a recommendation results in changing an element. One recommendation can address multiple leverage points, transition elements or innovation functions.

After the analysis the results are discussed, based on the literature behind the framework and the links with the regional circular society. Also, the relevant reports for the next step are selected, based on the number of elements and the intensity of these elements in the reports.

Step 6: Determining draft recommendations

The analyses in steps three, four and five have identified the reports that provide the most complete set of present-day recommendations, and have identified gaps in these recommendations. First, the recommendations from the selected reports are listed. Second, additional recommendations are developed based on the gaps found in the three analyses, using literature from the relevant theoretical backgrounds. Third, the list of recommendations is made more concise.

ⁱⁱ The Dutch Research Institute for Transitions (DRIFT) is part of Erasmus University. More information on <http://transitionacademy.nl/>.

Recommendations which are not applicable in a regional environment or recommendations which are simply notions are excluded. Recommendations which aim for the same result or which stimulate the same sort of process are combined. As the OPAi & MVO Nederland report recommendations are short and explained only generally, these recommendations are only considered when they address missing elements from other sets of recommendations. This leads to one combined set of recommendations from present-day research and from theoretical backgrounds.

Step 7: Check recommendations

The recommendations from step six are checked through twelve expert interviews: six with experts from the circular economy field, and six with practitioners from the Haarlemmermeer region. The twelve interviewees are balanced for within and outside Haarlemmermeer, and are balanced for their variety of backgrounds. The choice for twelve interviewees is considered to create sufficient diversity, and nonetheless an achievable number within the time constraints of this study. The details of the interviewees can be found in appendix VIII.

The expert interviews have been facilitated utilizing a fully-structured interview approach. First, an introduction of the Haarlemmermeer system was provided by explaining the structure as shown in figure 3.3. Second, the interviewee categorized the nineteen recommendations from the previous chapter in the four transition management activity types, being able to put recommendations which were not relevant aside. Third, the interviewee sorted the recommendations in order of importance within the categories, and the relevance of and experience with each recommendation was discussed. Fourth, the interviewee was able to add recommendations from his or her personal view. Fifth, the landscape factors were discussed: what is important to take into account in the transition towards a regional circular society? As a closing, space was provided to discuss additional comments.

Step 8: Identifying landscape factors

In the same interviews as used in step 7, landscape factors are identified, as it is important to know which factors influence a transition process. Interviewees are asked what in their opinion landscape factors are within Haarlemmermeer, and whether these could influence the transition positively or negatively. A landscape factor is added when at least two interviewees address a factor.

Step 9: Formulating transition activities

This step develops activities to start the transition to a regional circular society, using feedback from the expert interviews. These activities are operationalisations of the recommendations from step six, taking into account the interviews in step 7. The categorization of the activities is being done based on the transition management framework by Loorbach (2010), as this provides a strong theoretical backing for structuring activities related to processes of change.

This study sorts the recommendations into categories according to the categorization as done most frequently by the interviewees. The frequency of the sequence (in order of importance) in the interviews has been used to determine which recommendations are brought forward for further elaboration. Based on experts' opinions, recommendations have been combined and minor additional recommendations have been integrated in the activities. Recommendations which have been prioritized lowest have not been integrated in the activities.

The design of the activities is done using the experts' view on the recommendations. First, the background of the activity is addressed, and the various viewpoints are considered. Second, the status quo in Haarlemmermeer is described, based on the closing report of HBS phase I (Buch et al. 2014), the 2013 evaluation of the 2011-2015 sustainability program (Gemeente Haarlemmermeer 2014) and the expert interviews from Haarlemmermeer. If available, an example has been provided of a place where such a recommendation has been put into practice before. These examples are gathered through suggestions by interviewees and through internet research.

Methodological limitations

A number of limitations apply to the various steps in the methodology. First, the report selection has been done based on reports from the Knowledge Map Circular Economy. Other reports from other parts of the world are likely to exist, however this knowledge map has combined the various reports that seem most relevant for the transition to a circular economy in the Netherlands. With regard to scientific literature, there is an increasing availability of articles considering the circular economy, especially on the Chinese situation, but only one article was found that provided a tangible set of recommendations for a transition process, which could be used as input for this thesis.

Second, the frameworks can be discussed. Meadows (1997) argues his theory is work in progress and specifically leaves room for evolution; still, it is published again in different form later (Meadows 2008). The transition framework does encompass most elements that can be found in the transition field, although one could argue that these do not necessarily all need to be taken into account when aiming for a transition. The innovation framework is developed using mainly one paper, supported by a few others: this is because there are very few papers actually discussing functions of regional innovation systems.

Third, the categorization in chapters 5, 6 and 7 has been done by the author, combining background information from the frameworks with the information provided in the various reports. This categorization can leave room for interpretation, which has however been done consistently over all reports. When considering the yes-or-no categorization for specific elements, this can lead to some discussion; when scaling this to the comparison of the reports, the influence is very limited. Consequently, the discussion in categorization can however influence the selection of the reports that are brought forward in step six.

This methodology does however, considering these limitations, provide a thorough way of reviewing a wide variety of present-day recommendations for the transition to a circular economy from three different and complementing theoretical perspectives. More reports and consequently more sets of recommendations could have been reviewed; more theoretical perspectives could have been added to complement the frameworks; however, the general outcomes are likely not to be very different. This methodology does provide a strong basis for the final set of activities, by combining a practical and theoretical perspective for a local application.

Chapter 3

A regional circular society



Park 20|20 is the first Cradle2Cradle office park of the world, and is being designed in co-operation between Delta Development Group and Michael Braungart, one of the founders of Cradle2Cradle. The FOX theatre was one of the first buildings constructed. Park 20|20 is an icon within Europe for the transition to a circular economy.

In this chapter

Haarlemmermeer has defined a regional circular society as a society where cycles in energy, water and materials are closed, applying to the living, working, residing and learning environment. Progress towards such a society in Haarlemmermeer takes place via projects on specific energy, water or material streams and physical project areas where circularity will be integrated as far as possible.

I have yet to see any problem, however complicated, which, when looked at in the right way, did not become still more complicated

Poul Anderson

In any transition, it is important to have a clear picture of what the future system should look like. In this case, the future encompasses elements of a circular economy. The system for this study is the municipality of Haarlemmermeer, including all its stakeholders and institutions. As Haarlemmermeer aims to become a circular society, and the area can be considered a region, the future system will be called a *regional circular society*. The remaining question thereby becomes:

- How are circular economy principles applied in a regional circular society?

As there is no generally accepted definition in literature for a regional circular society yet, this thesis defines such a society as follows, based on the 2015-2018 Haarlemmermeer sustainability program.

A regional circular society is a region with geographical boundaries, in which the principles of circular economy and innovation in the domains water, energy and materials are applied by all stakeholders in the residing, working, living and learning environment.

This chapter first goes into the background of the circular economy (section 3.1). Second, the implementation of a circular economy will be discussed (section 3.2). Third, the principles will be applied to the regional circular society context in Haarlemmermeer (section 3.3). A short conclusion and discussion provide the answer to the research question (section 3.4).

3.1 A circular economy

“A circular economy is a living system which creates value based on usage, instead of consumption. Durability of products and resources is key. Basic principles of the circular economy are using pure and non-toxic products, design for disassembly and using only renewable energy.

A circular economy is a restorative industrial economy, in which materials flows are of two types: biological nutrients, designed to re-enter the biosphere safely, and technical nutrients (non-biological materials), designed to circulate at high quality, with their economic value preserved or enhanced.”

(Ellen MacArthur Foundation 2013a)

The basic idea of an economy of loops was coined first in the 1960's (Boulding 1966), and later addressed in an advice to the European Commission (Stahel & Reday-Mulvey 1981). The first country to put circular economy in practice was China, in its 11th five-year plan from 2006-2010 (State Country People's Republic of China 2006). Recently, the circular economy has been rebranded by the Ellen MacArthur Foundation in its reports series *Towards the circular economy*, in which the definition as stated above was firstly coined (Ellen MacArthur Foundation 2013a; Ellen MacArthur Foundation 2013b; Ellen MacArthur Foundation 2014).

There are quite some views on what a circular economy is or should be; however, none are from peer-reviewed scientific literature. These definitions do not necessarily contradict, but have a different focus. The circular economy is by some perceived as an alternative paradigm for the

management of resources (Kok et al. 2013), whilst others argue that the circular economy is aimed at adding value to the present economic system while decreasing pressure on resources (Vanner et al. 2014; Ellen MacArthur Foundation 2013a). It is clear that the circular economy brings together a variety of historical sustainability concepts, as have been presented in appendix II. Three powerful developments keep returning when discussing the circular economy: the upswing of the share-economy; the development of the 'energetic society' where entrepreneurship is also with citizens; and a shift from product ownership to product use.

Recently, the Ellen MacArthur Foundation rebranded the circular economy in its reports series *Towards the circular economy*.

For this thesis, the circular economy model as presented by the Ellen MacArthur Foundation and which has a focus on materials is leading. This model, shown in figure 3.1, shows material flows in two types: on the left biological materials, and on the right technical materials. New economic models are in this visualisation mainly used as a means to stimulate material flows.

In the biological material cycle, as much value as possible is extracted from 'waste' nutrients, first by extracting biochemical feedstock, then by anaerobic digestion or composting. This leads to restoration of the biosphere. With regard to technical materials, there are four cycles: maintenance of the product; reuse or redistribution of the product; refurbishment of the product and recycling the materials which the product consists of.

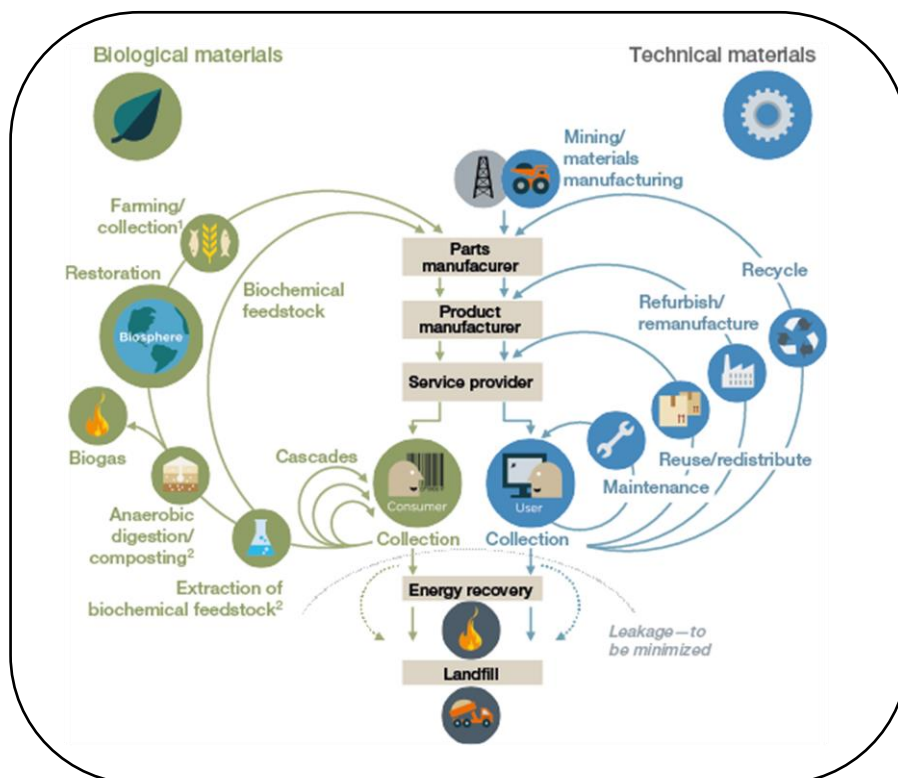


Figure 3.1 | The Circular Economy Cycles (Ellen MacArthur Foundation 2013a)

Product cycling takes place throughout four cycles. First, there is the power of the inner circle, which implies that a product is used as often as possible at its highest value. Second, there is the power of circling longer, which implies that a product can be repaired, redistributed or remanufactured multiple times. Third, there is the power of cascaded uses across industries: the remainders of products in industry X are used in industry Y, etc. Last, there is the power of easier to separate inputs and designs, which enables full reuse of all nutrients. Design for disassembly and using non-toxic materials are essential for these cycles to succeed in practice. This is visualised in figure 3.2.

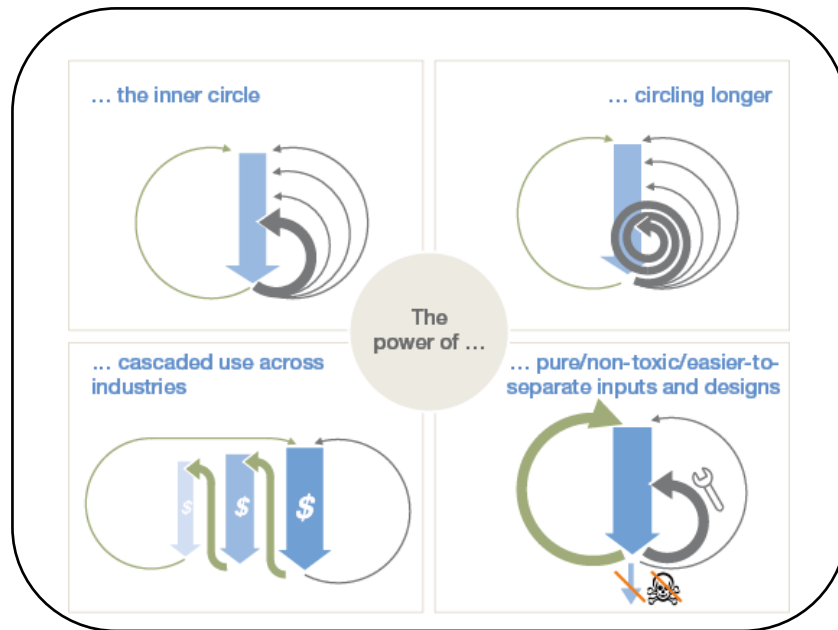


Figure 3.2 | The Power of Circles (Ellen MacArthur Foundation 2013a)

With regard to these four technical cycles, efforts are made to keep a product in the most inner circle. When that is no longer possible, a product moves to a more outer circle. This first leads to increased repairs, second to increased redistribution to a different application, third to remanufacturing of parts of the product into other products, and fourth to recycling materials into other products. This leads to additional value of products, without need for virgin materials.

3.2 Implementation of a circular economy

The practical implementation of these cycles enhances more than changing production processes and material flows: incentives for businesses need to change in order to shift business models towards performance. Too often still, linear business models leading to resource extraction and waste materials are stimulated through policies and tax regimes (Groothuis 2014; Wallace & Raingold 2012). Policy packages have been developed to provide solutions (Vanner et al. 2014; Dutch Ministry of Infrastructure & Environment 2014), but barriers still remain in existing policies and regimes (Het Groene Brein 2015; Kok et al. 2013).

Historical processes of change suggest most transitions start from bottom-up initiatives (Rotmans 2012). At the moment, the same is taking place with regard to the circular economy. The rise of the sharing economy, including its related businesses (such as Peerby), and increased repairing of products (in settings such as repair cafes) can be seen as parts of the technical material cycle.

Also on a policy level, principles behind the circular economy have been put into practice for some time (Vanner et al. 2014), which has led to a linear economy with feedback loops. Two prominent examples of nearly-closed material cycles in the Netherlands are paper and glass (Dutch Ministry of Infrastructure & Environment 2014), although these have been closed before the concept of circular economy existed, and are only now considered to be a vital part of the circular economic system. Increased recycling, changing business models from product to service and increased cooperation in the supply chain are among the elements that accelerate the circular economy (Ellen MacArthur Foundation 2013a).

A circular economy adds value to products with positive impact on the environment and people.

The concept of circular economy is increasingly used in the Netherlands, both on national policy levels as in local developments. The Netherlands wants to develop to a *circular hotspot* (Dutch Ministry of Economic Affairs 2013), and actively aims at promoting the circular economy in its European presidency in the first six months of 2016ⁱⁱⁱ. The RACE coalition (in Dutch: Realisatie en Acceleratie van de Circulaire Economie), a co-operation between MVO Nederland, Circle Economy, Het Groene Brein, De Groene Zaak, ClickNL and the Dutch Ministry of Infrastructure & Environment, aims to bring together science, business and government to enhance the transition to a circular economy in seven areas. These areas can be found in text box 3.1. At the moment, also a national Research Agenda on Circular Economy is being developed for the Dutch National Research Organisation (in Dutch: NWO)^{iv}.

- Defining and stimulating circular design
- Studying and stimulating high-quality reuse
- Making an inventory of (perceived) barriers
- Stimulating and accelerating new value chains
- Creating a portfolio of example circular projects
- Raising public awareness around the topic of circular economy
- Involving young people in the transition towards a circular economy

Text box 3.1 | Seven areas for accelerating the circular economy^v

A full circular economy is still far away, but enhancing the regional application of circular economy principles can achieve increasing circularity without top-down support. Next to just closing material loops, which is already challenging on a regional scale due to present-day high-tech products, a circular economy adds value to products with positive impact on the environment and people, stimulating growth in both the economic, the ecological and the social domain (Ellen MacArthur Foundation 2013a). Despite material flows across the borders of the regional system, it therefore is possible to increase circularity on a regional level.

ⁱⁱⁱ *Nederland als wereldwijde hotspot van de circulaire economie* (in Dutch), available at <http://www.duurzaam-ondernemen.nl/nederland-als-wereldwijde-hotspot-van-de-circulaire-economie/>, visited at 29/05/2015

^{iv} *Onderzoeksagenda Circulaire Economie* (in Dutch), available at <http://hetgroenebrein.nl/kennisagenda-circulaire-economie/>, visited at 21/04/2015

^v *The Netherlands as a circular hotspot*, available at <http://circle-economy.com/projects/regional/netherlands-circular-hotspot/>, visited at 29/05/2015

3.3 A regional circular society

A regional circular society, as defined at the start of this chapter, requires some further clarification before it can be used as a desirable future situation to work towards. With regard to stakeholders, the regional circular society encompasses all stakeholders that are part of the area of Haarlemmermeer. With regard to material flows, all flows that either start or finish in Haarlemmermeer are considered part of this system – flows which just pass through the system, are considered not to be. To address these complex flows and stakeholder processes, circularity on a regional level relates to businesses, their research, products and business models (Ellen MacArthur Foundation 2013b). Innovative developments of businesses on a regional scale are decisive for whether the implementation of circular principles succeeds.

The first phase of the *Haarlemmermeer Beyond Sustainability* (or HBS) program, which has been introduced in the first chapter, has developed the recommendation for Haarlemmermeer to become a *regional circular innovation system* – of which the outlines are discussed in text box 3.2 – where innovation around circularity takes place constantly. Such a system should consist of an adaptive management system, a knowledge management system, space for experiments and development and operations (Buch 2014). As this *regional circular innovation system* is meant as a means to stimulate entrepreneurship and assist in arriving at a high degree of circularity, there is no barrier in using the concept *regional circular society* for the remainder of this thesis.

“A regional circular innovation system synergistically functions with the natural environment, putting less pressure on ecosystems, by retaining market-based economic principles, but being environmentally restorative and socially balanced. (...) Its processes must be intrinsically based on principles of sustainability, resiliency and adaptive governance, and combined with an integrated and responsive systems-thinking approach that holistically assesses value.”

Text box 3.2 | Description of ideas behind a Regional Circular Innovation System (Buch et al. 2014)

The four elements of the *regional circular innovation system* as proposed by HBS phase I and the activities for transition as will be developed in this study are combined in a system’s perspective of the regional circular society.

This structure is shown in figure 3.3. In this structure, a

systemic change towards a regional circular society starts with the history of the system, in this case the history of Haarlemmermeer. This feeds into the present-day state of the system regarding circularity. Progress from the current system towards the regional circular societal system will be made through two areas: first, projects that regard circularity, which take place at the intersections of the domains and the themes as shown in text box 1.2, and second through specific project areas which will be redeveloped from a system’s perspective with regard to circularity. In order to measure the progress of the projects and project areas from the present state to the future state, it is required to assess the circularity. Finally, to make the transition from the current state to the future state, transition activities are required on a higher, more strategic level. The transition process is influenced by landscape factors, that cannot be influenced by the system itself, but that have an influence on the transition within the system.

Innovative developments of businesses on a regional scale are decisive for whether the implementation of circular principles succeeds.

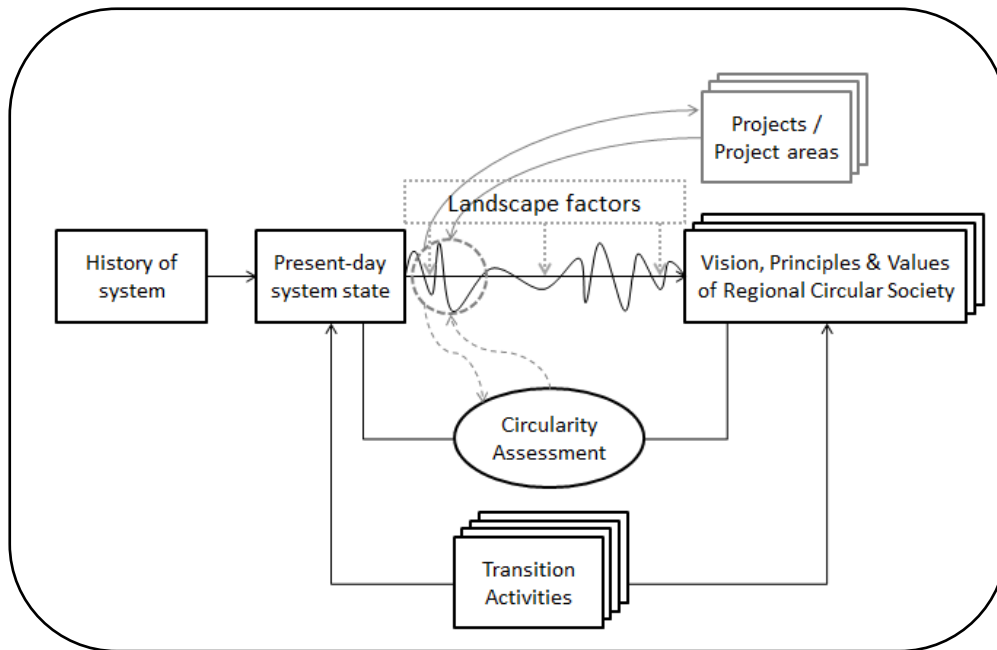


Figure 3.3 | System approach to a Regional Circular Society - adapted from Wiek (2010)

The projects and project areas are part of the transition process, just as the circularity assessment. The transition activities consist of the four activity types in transition processes (Loorbach 2010): strategic activities, tactical activities, operational activities and reflexive activities. The four elements from the RCIS return in the discussion of the transition activities in chapter 9.

Only the development transition activities are within the scope of this study. The circularity assessment will be a topic of future research, separately done by Arizona State University experts. The projects are proposed to be run by project teams, consisting of ASU experts, Haarlemmermeer municipality and other stakeholders. The fact that both the set-up of projects around circularity and the development of circularity indicators return as transition activities, shows that stakeholders consider these as important elements in a transition. More suggestions on how to bring these activities into practice are done in chapter 9.

3.4 Conclusion & discussion

A circular economy is an economic system in which new value is created through increasing circularity in biological and material flows, although there is discussion on the exact definition and scope of the concept. The *regional circular society* is developed to apply the principles behind a circular economy on a regional scale as far as possible, and to take all stakeholders within the system into account in doing so. Progress from the present-day system to the future system is supported by projects, circularity assessment of those projects and a number of transition activities, and is influenced by landscape factors. Both the landscape factors and the activities are discussed in chapter 9 of this thesis.

The concept *regional circular society* remains relatively vague by using the present definition. However, a full circular society is hard to implement on a regional level due to the difficulty of closing material loops on such a scale, just as a full circular economy is hard to implement in any large-scale economic system due to other constraints. The definition of this chapter does at this moment provide space for generating new value through performing projects and other additional activities, and might therefore be very well suited in the present transition stage in which the long-term future is unclear.

Chapter 4

Recommendations for the transition to a circular economy



The Hoofdvaart, the main canal running through Haarlemmermeer, plays a vital role in the municipality's water management. Although the route and the main function of the canal have not changed since its origin, the municipality around it has changed significantly over 150 years. In the future, this part of the canal will run through Park21, one of the largest circular leisure areas in Europe to be developed.

In this chapter

Many reports provide recommendations to move towards a circular economy. Twelve sets of recommendations from eight different reports are presented. There are significant areas of overlap between the recommendations, especially with regard to creating awareness and legitimacy and increased cooperation within the supply chain.

Many of the recommendations went into the 'too hard' box and floated in a bureaucratic malaise until the memory of the flood faded away

Gerald Galloway

Although the concept of circular economy is relatively new, quite some studies have been performed over the last years on what a circular economy should look like and how a circular economy can be brought closer. Both the business sector and national and local governments increasingly have questions on how to start this transition to a circular economy. Also for Haarlemmermeer, recommendations from these studies can provide new insights on what to do next. The research question in this chapter therefore is:

- Which recommendations are made for the transition to a circular economy?

This chapter starts by outlining some reports that have discussed the transition to a circular economy, and by presenting recommendations for the transition (section 4.1). An analysis of the recommendations leads to a discussion of recurrent elements of these reports (section 4.2). These recurrent elements are important in the discussion of the activities in chapter 9. A conclusion and discussion close the chapter (section 4.3).

4.1 Reporting on the transition to a circular economy

In the past two years, quite some studies have been done on how to stimulate the introduction of a circular economy, or in a transition period, how to increase closing material cycles. Also barriers and opportunities, policy requirements and roadmaps with regard to a circular economy were part of these reports. These recommendations from nine sources are shown below, categorized in their twelve source documents^{vi}.

Several research institutions have developed roadmaps for a circular economy. All reports have their specific focus, both in target group and in priority. MVO Nederland (Schuurman 2012), OPAi & MVO Nederland (Schoolderman et al. 2014) and Accenture (Lacy et al. 2014) have a strong focus on businesses. TNO (Bastein et al. 2013) goes into the potential for specific industries, but provides no guidelines for follow-up or implementation. The Ellen MacArthur Foundation (Ellen MacArthur Foundation 2013a) identifies general elements which are important for the transition to a circular economy. The Environmental Services Association (Hayler & Waters 2013) focuses on the waste- and resources industry in the UK specifically, and the Green Alliance (Benton & Hazell 2013) goes in more detail into resource efficiency. The Aldersgate Group (Wallace & Raingold 2012) provides a general overview on growth possibilities within a circular economy by identifying barriers and opportunities. IMSA (Kok et al. 2013) provides the most complete overview with its roadmap to a circular economy, distinguishing between actions to be taken by individual companies and mainstreaming steps to be taken by governments. Also, China's aim to make the transition to a circular economy is analysed, and recommendations to assist in this process are provided (Hongchun 2006).

^{vi} A scan of additional reports shows that these do not provide new insights based on the recommendations in this chapter. These reports are *Gemeentelijke aanpak van de circulaire stad* (in English: *Municipal approach to a circular city*), providing a set of recommendations for local municipalities (Cramer 2014); *Circular Advantage*, asking a number of relevant questions to provide directions for circular development (Lacy et al. 2014) and *Barriers and drivers towards a circular economy*, identifying barriers, drivers and recommendations for a circular economy through a literature study (Van Eijk 2015).

Circular economy in China and recommendations

Hongchun, Zhu (2006) | China | General recommendations

- 1) Building a legal system on the promotion of circular economy;
- 2) Readjusting the industrial structure to optimize economic layout;
- 3) Guiding the development of circular economy through policy guidance;
- 4) Using economic means to build an incentive mechanism for circular economy;
- 5) Developing common and applicable technologies to form the technological support system for the circular economy;
- 6) Quickening demo projects and push for circular economy in an all-round way;
- 7) Carrying out education and publicity activities to create a favourable atmosphere.



Resilience in the Round: Seizing the growth opportunities of a circular economy

Aldersgate Group (Wallace & Raingold 2012) | international | General recommendations

- 1) Creating business models for a circular economy
- 2) Creating consumption for a circular economy
- 3) Design for a circular economy
- 4) Create infrastructure for a circular economy
- 5) Create policy frameworks for a circular economy
- 6) Create procurement for a circular economy
- 7) Create skills for a circular economy
- 8) Transparency for a circular economy



Towards the Circular Economy 3 | proof of concept

Ellen MacArthur Foundation (2014) | international | General recommendations

- 1) Create a preferred list of pure, high-quality materials as the building blocks of tomorrow;
- 2) Define mechanisms for continuous improvement of value creation and cost reduction;
- 3) If solutions are not available today, identify who else in the system can provide support in the short-, medium-, and long-term;
- 4) Jointly agree on business models to allow benefit sharing across the supply cycle;
- 5) Jointly set up a roadmap to achieve the end goal with partner.

Towards the Circular Economy 3 | identifying benefits

Ellen MacArthur Foundation (2014) | international | General recommendations

- 1) Quantify economic impact and secondary benefits;
- 2) Size the economic benefits of achieving pure materials flows;
- 3) Mobilising the public sector and other stakeholders;
- 4) Drive regulatory change to quickly scale up;
- 5) Catalyse investment in new business models and innovations;
- 6) Mobilise advances in information technology.



Ondernemen in de Circulaire Economie

OPAI & MVO Nederland (Schoolderman et al. 2014) | Netherlands | General recommendations

- 1) Start by experimenting;
- 2) Be aware that craftsmanship will return;
- 3) Be aware of growing consumer role;
- 4) Think outside boundaries;
- 5) Develop new business models;
- 6) Work both within and across sectors;
- 7) Design for service;
- 8) Use Dutch industrial design as selling point;
- 9) Invest in knowledge development;
- 10) Transform the built environment from 'house' to 'service';
- 11) Be open for continuous learning;
- 12) Use the energy of the society (civilians);
- 13) Acknowledge the value of resources;
- 14) Develop a long-term vision.



Resource Resilient UK (2013)

Green Alliance (Benton & Hazell 2013) | United Kingdom | Gov., bus. & investor focus

- 1) Clarify the exposure to the risk of the linear economy;
- 2) Co-operate with brokers in the whole supply chain throughout all sectors;
- 3) Enable system design over product design.



Unleashing the Power of the Circular Economy (2013)

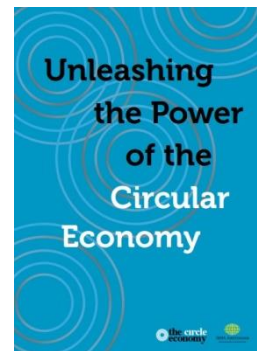
IMSA (Kok et al. 2013) | Netherlands | Government focus

- 1) Replace traditional financial reporting by integrated (True Value) reporting;
- 2) Create a tax shift from labour towards natural resources;
- 3) Implement a new economic indicator beyond GDP;
- 4) Establish international independent systems to organize material flows;
- 5) Adjust national and international policies to stimulate a circular economy.

Ondernemen in de Circulaire Economie (2014)

OPAI & MVO Nederland (Schoolderman et al. 2014) | Netherlands | Government focus

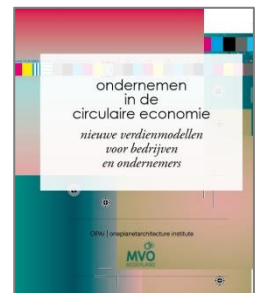
- 1) Phase out the 'old' economy (subsidies, taxes, information obligation);
- 2) Be an active launching customer;
- 3) Develop a strong vision to achieve a critical mass;
- 4) Develop policies for conditional steering.



Unleashing the Power of the Circular Economy (2013)

IMSA (Kok et al. 2013) | Netherlands | Business focus

- 1) Set up a simple index for circular performance;
- 2) Encourage experimentation, innovation and redesign;
- 3) Gather and spread successful business examples;
- 4) Integrate circular economy principles in education and training;
- 5) Develop a long-term company vision;
- 6) Search for material pooling opportunities;
- 7) Promote circular products;
- 8) Prepare roadmaps for established economic sectors;
- 9) Initiate and stimulate stakeholder fora about the circular economy.



Ondernemen in de Circulaire Economie (2014)

OPAI & MVO Nederland (Schoolderman et al. 2014) | Netherlands | Business focus

- 1) Be seduced by the enormous potential;
- 2) Use circular opportunities;
- 3) Choose strategically regarding investment, co-operation and skills;
- 4) Use clear key performance indicators (KPI's);
- 5) Avoid focus on technical details;
- 6) Create space for feedback;
- 7) Prepare for opposition;
- 8) Provide budget and capacity.



Een routekaart voor transformatie van de maakindustrie (2012)

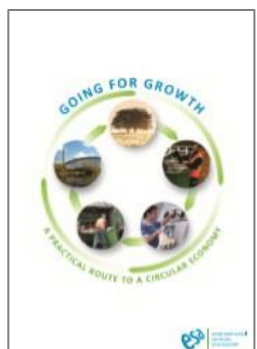
MVO Nederland (Schuurman 2012) | Netherlands | Focus: *Manufacturing industry*

- 1) Focus on eco-efficiency;
- 2) Choose direction;
- 3) Think transformative;
- 4) Co-operate within the supply chain.

Going for Growth (2013)

ESA (Hayler & Waters 2013) | United Kingdom | Focus: *Waste sector*

- 1) Design products for dismantling;
- 2) Optimise collection systems;
- 3) Incentivise the uptake of recycle among manufacturers;
- 4) Create resilient markets for recyclates;
- 5) Provide a stable policy framework.



4.2 Report analysis

As shown in the previous chapter, the transition to a circular economy builds upon a number of principles and assumptions. It is interesting to see what recurrent elements in these reports are; these are derived through an analysis of the recommendations from the previous section. Six main themes stand out.

- Awareness and legitimacy;
- Business models;
- Supply chain co-operation;
- Circular design, technology & infrastructure;
- Experimentation and good practices;
- Policies, taxes and regulations.

Awareness and legitimacy

Only when raising awareness of both consumers and businesses, changes in behaviour can be made (Ellen MacArthur Foundation 2013b; Kok et al. 2013). Part of this process is also the development of a vision and roadmaps, and the development of knowledge and skills around the circular economy through education. Influencing behaviour is difficult, especially when considering a change from product ownership to product use on the consumer side (Schoolderman et al. 2014; Vanner et al. 2014). Influencing businesses also proves difficult because of lock-in in short-term economic thinking, and fear for uncertainty in new business models (Schoolderman et al. 2014; Benton & Hazell 2013). Clarification of the risks of the linear supply chain (Benton & Hazell 2013) and seduction to the enormous potential of circular business (Schoolderman et al. 2014) can help to tackle these paradigms. For a regional circular society, creating awareness and legitimacy on a regional level is essential to get both consumers and businesses convinced about the need for a circular economy.

Business models

Creating new business models is primarily about shifting from product ownership to product use, what is essential to stimulate material cycles (Kok et al. 2013; Ellen MacArthur Foundation 2013a; Schoolderman et al. 2014; Wallace & Raingold 2012). Between full-product and full-service are hybrid product-service systems^{vii}. Frontrunner businesses that have already integrated new business models can be found in networks like the CE100^{viii} and Circle Economy (Circle Economy 2015). From the demand side, circular procurement by launching customers is required to stimulate circular business models (Vermeulen et al. 2014; Wallace & Raingold 2012; Schoolderman et al. 2014). The opportunities for circular business models in the future are perceived to be much larger than opportunities for organisations that continue their present-day, linear model (Ellen MacArthur Foundation 2014). In a regional circular society, stakeholders use existing networks to increase knowledge exchange, and SMEs are stimulated to drive their practices towards circularity.

For a regional circular society, creating awareness and legitimacy on a regional level is essential to get both consumers and businesses convinced about the need for a circular economy.

^{vii} *Infografiek: Wat zijn product-dienst-systemen?*, available at <http://www.plan-c.eu/2013/03/07/infografiek-wat-zijn-product-dienst-systemen/>, visited at 30/10/2014

^{viii} *What is the Circular Economy 100?*, available at <http://www.ellenmacarthurfoundation.org/business/ce100>, visited at 03/03/2015

Supply chain co-operation

In a circular economy, businesses have a significantly lower material use than in a traditional, linear economy. This requires closer collaboration between stakeholders in the supply chain, with the aim to both use waste streams and to share information on material flows (Benton & Hazell 2013; Ellen MacArthur Foundation 2013b; Schuurman 2012; Kok et al. 2013). This requires the identification of material pooling opportunities across supply chains (Ellen MacArthur Foundation 2014; Kok et al. 2013). This can lead to new economic value for stakeholders throughout the system. Material cycles can be closed on a local, regional, national or international level – depending on the type and availability of resource (Lehmann et al. 2014), but should always be closed as locally as possible. In a regional circular society, this means inventorying material pooling possibilities from existing waste streams in close collaboration with stakeholders within the region.

Circular design, technology & infrastructure

The development of circular design is also essential for the transition to a circular economy (Hayler & Waters 2013; Schoolderman et al. 2014; Wallace & Raingold 2012). Designing for circularity can be done in four ways: design for longevity, design for leasing/service, design for re-use in manufacture and design for material recovery (Thomas & Hunter 2013). Such design is possible by selecting materials and components that can be separated and recycled easily, taking into account the complexity of disassembly whilst minimizing material diversity (Welink 2012). It is also of importance to design at a system level, instead of at a product level (Bakker et al. 2014). Circular design mostly takes place within specific projects, project areas or business products.

The more experimentation, the more initiatives, and the higher the odds of finding products and models that work.

Additionally, technologies and infrastructure for a circular economy need to be developed. In the technological field there is mainly need for technologies to retrieve high-quality materials from waste (Hayler & Waters 2013), although this has much to do with product design. With regard to infrastructure, the technologies to be developed are much more diverse: from waste recovering infrastructure (Georgeson & Beasley 2014; Benton & Hazell 2013) to resource information tracking (Kok et al. 2013; Vanner et al. 2014) and knowledge exchange platforms (Bastein et al. 2013). Collaboration with related businesses (with regard to technology) and neighbouring regions (with regard to infrastructure) is essential due to the limited scope of a regional circular society.

Experimentation and good practices

The need for experimentation with circular activities and the sharing of good practices is addressed by many reports when considering the transition to a circular economy (Hongchun 2006; Schoolderman et al. 2014; Kok et al. 2013). Experimentation is required, as there is no blueprint yet on what a circular society or circular business model looks like. The more experimentation, the more initiatives, and consequently the higher the odds of finding products and models that work (Schot & Geels 2008). Scaling good practice projects as a second step is required, although such scaling in a regional environment is often a challenge due to the strong aims for profit and low levels of trust by businesses (Kok et al. 2013). A regional circular society should include a focus on building trust and relations, thereby enabling experimentation and the exchange of knowledge and practices between businesses, governments and academics, both inside the region as with others outside.

Policies, taxes and regulations

Many reports address the necessity of building policy frameworks for a circular economy, just as creating the right incentives through regulations and taxes (Kok et al. 2013; Schoolderman et al. 2014; Wallace & Raingold 2012; Hayler & Waters 2013). Stable policy frameworks are required to provide the right incentives and guidance to both businesses and governmental stakeholders for making long-term decisions. Looking to regulations, the reports mainly addresses the provision of space for innovative circular developments. Considering taxes, there are multiple possibilities, among which a shift from labour taxes to material taxes and the development of a Value Lost Tax, which is further elaborated upon in the Ex'Tax report (Groothuis 2014). Most of these elements are regrettably not applicable in a regional scope, as these are decided upon at a national or even European level. The difficulty is that these elements often cannot be influenced on a regional level, although the potential impact of these on the transition to a circular economy is large. The discussion of this influence continues in the section on landscape factors in chapter 9.

A regional circular society should include a focus on building trust and relations.

4.3 Conclusion & discussion

There have been many recommendations on the transition to a circular economy, with different target groups and focus areas. The majority of the recommendations may be categorized in one of six main themes. *Awareness and legitimacy* are essential in getting the transition towards a regional circular society going. *New business models* are required for all businesses, although SMEs are expected to take the lead, and should be stimulated to do so. More intense *co-operation within and across supply chains* can help in realizing continuous material pooling opportunities, and in increased circularity in business models. *Circular design and technology* is required in order to be able to build circular business models. *Experimentation and good practices* are required in order to develop circular activities and to get an image of what circular activity looks like. *Policies, taxes and regulations* are important enablers for the transition towards a circular society, but are hard to influence on a regional level. These recurrent elements are used to discuss the scope of the recommendations in chapter 9.

Chapter 5

System intervention analysis



Schiphol is one of the largest European airports, and the key employer in the Haarlemmermeer area. The first planes landed at Schiphol in 1916, and after an extensive expansion in the 1960's, the airport opened its fifth landing strip in 2003. There are plans to present Schiphol as the hub of circular developments in the Netherlands during the European chairmanship in 2016.

In this chapter

Triggering change in a system is possible at twelve leverage points. An analysis of the recommendations from chapter 4 shows that most recommendations aim to influence the system on a low to medium impact level. Recommendations for the higher level leverage points, which take more effort but are also more rewarding, largely lack.

A system is an interconnected set of elements that is coherently organized in a way that achieves more than the sum of its parts

Donella Meadows

System analysis is a way of looking at systemic change, which is different from many other theoretical models. Where other models aim to solve a certain problem, or give a descriptive explanation of elements that a transition should encompass, system analysis merely aims to identify leverage points in a system. These leverage points are places within a complex system where a small intervention can result in major changes in the overall system (Meadows 1997). Meadows identified twelve of these leverage points, which can be useful in the transition process towards a circular economy. Based on these leverage points, the research question for this chapter becomes:

- What are gaps in the present-day recommendations for the transition to a circular economy from a system leverage point perspective?

The research question is answered through an analysis, of which the full analysis is shown in appendix IV. The overview provided in this chapter is not aimed at evaluating individual recommendations; its primary aim is to give an overview per report of the leverage points at which the sets of recommendations intervene.

System analysis aims to identify leverage points in a system.

This chapter starts with a short discussion of the leverage points in a system (section 5.1). The analysis of the leverage points in the present-day recommendations and discussion of the findings increases insight in the dynamics around these leverage points (section 5.2). The research question is answered in the conclusion, and the chapter closes by discussing the outcomes (section 5.3).

5.1 Leverage points framework

The *state of the system* is whatever standing stock is of importance: for example, the amount of materials in storage. System states are usually physical stocks, but can be non-material as well. Each stock has inflows and outflows. Next, there is information that causes these flows to change: there is a perceived state, a desired state (a goal), and a discrepancy between this desired and perceived state that will determine the size of the input and output flows. The system also follows certain laws and barriers (Meadows 1997).

When interference takes place at a higher leverage point in the system, it automatically also interferes at all lower leverage points in the system.

In any system, there are twelve leverage points (Meadows 1997), where a small intervention might have relatively large effects on the system as a whole. These leverage points relate to the stocks, flows and other variables in the system, and can be organised through their level of intervention and respective impact. When an intervention takes place at a low systemic

level, the impact will also be relatively low; when intervention takes place at a higher systemic level, the impact will be relatively larger. The twelve leverage points are summarized in text box 5.1. When interference takes place at a higher point in the system, it automatically also interferes at all lower leverage points in the system. Important to keep in mind when aiming for triggering leverage points is that the higher the level (the lower the number) of a leverage point is, the more a system will resist change.

- 12) Constants, parameters, numbers (such as subsidies, taxes, standards)
- 11) The sizes of buffers and other stabilizing stocks, relative to their flows
- 10) The structure of material stocks and flows (such as transport networks, population age structures)
- 9) The length of delays, relative to the rate of systemic change
- 8) The strength of negative feedback loops, relative to the impacts they are trying to correct against.
- 7) The gain around driving positive feedback loops
- 6) The structure of information flows (who does and does not have access to what kinds of information)
- 5) The rules of the system (such as incentives, punishments, constraints)
- 4) The power to add, change, evolve, or self-organize system structure
- 3) The goals of the system
- 2) The mindset or paradigm out of which the system – its goals, structure, rules, delays, parameters – arises
- 1) The power to transcend paradigms

Text box 5.1 | Leverage points in a system (Meadows, 1997)

5.2 Leverage points analysis

The sets of recommendations, provided in chapter 4, are analysed for their system intervention points. It is interesting to see that almost all recommendations are done at a low systemic level: the vast majority is on changing the physical stocks and flows (levels 10, 11, 12). A minority of the recommendations goes into the length of delays (level 9), only a few in negative feedback loops (level 8), and none in reducing positive feedback loops (level 7). Quite some recommendations look at information infrastructure (level 6) or attempt to change the rules of the system (level 5). There are a few recommendations that go one step higher, into the ability of the system to self-evolve (level 4) or setting the goals of the system (level 3). None of the recommendations in the reports which were analysed goes into the mind-set the system was created from, or into transcending paradigms between systems. In the categorizing process, one recommendation can address multiple leverage points. Table 5.1 shows the results of the analysis, with the percentage of recommendations applying to a certain leverage point in grey scale. The full analysis is shown in appendix IV.

System leverage points analysis	12	11	10	9	8	7	6	5	4	3	2	1
2006 Hongchun, China (general)	Dark	Dark	Light	Light	Light		Light	Dark				
2012 Aldersgate Group (general)	Light	Light	Light	Light	Light		Light	Light	Light			
2014 Ellen MacArthur (general, proof of concept)	Dark	Dark					Light	Light				
2014 Ellen MacArthur (general, identifying benefit)	Light		Light	Light			Dark	Light				
2014 OPAi & MVO Nederland (general)	Light	Light	Light	Light			Light		Light	Light		
2013 Green Alliance (govern., buss., investors)	Light		Light	Light			Dark	Dark				
2013 IMSA (governments)	Dark		Light	Light			Dark	Dark		Light		
2014 OPAi & MVO Nederland (governments)	Dark						Light	Dark		Light		
2013 IMSA (businesses)	Light	Light		Light			Dark	Light				
2014 OPAi & MVO Nederland (businesses)	Light			Light					Light			
2012 MVO Nederland (manufacturing industry)	Dark	Dark		Light			Light	Light	Light			
2013 ESA (waste & resource sector)	Dark	Dark	Light									

Table 5.1 | Presence of recommendations for leverage points considering the transition to a circular economy.
Scales of grey show percentage of recommendations in report that address a specific leverage point.
Light: 0-25% | Medium: 26-50% | Dark: >50%

Overall, the recommendations cover most leverage points in the system, except the top four. Large differences can be found by looking at individual reports. Where the ESA only looks at material flows, the OPAi & MVO Nederland report goes into the higher systemic intervention points in more detail. For the transition to a circular economy, a combination between high and low intervention points is required, as quick-wins (easy to execute, with low level of resistance, but limited and often temporary effect) and long shots (hard to execute, high level of resistance, large structural effect) provide different incentives and have different sorts of effects.

The difficulty with recommendations on levels four and three is that these are about processes to reach a systemic intervention, for example *developing a vision* or *being open to continuous feedback*, but that the recommendation itself is still one step away from systemic intervention. Goals of regional systems are often very large-scale and general (for example, providing a comfortable environment for working and living), but when looking more closely, these are not goals of the system, but merely sub goals within the system. The same applies to providing feedback: this is often addressed as feedback to improve the existing system, while this could also be directed for systemic

change (Buch et al. 2014). Therefore, the present-day recommendations on levels four and three are considered to be not specific and difficult to bring into practice.

Three arguments can be thought of regarding the absence of recommendations for high-level system intervention. The first argument could be that, in order to accelerate the transition to a circular economy, one decides to first focus on the low levels of system intervention, in order to start a transition through quick wins. The second argument could be that present-day consultants and policy makers are not willing or not able to identify (and then change) the goals of the system, the mindset of the system or the paradigms between systems. The third argument could be that present-day stakeholders are simply not able to step out of the present-day (economic) system, due to lock-in with regard to gains, or due to fear for unknown development to a different system. Regardless of which of these three arguments, or a combination of these, is true, it is clear that for a structural transition to a circular economy, solely intervening at the leverage points which are addressed now will not be enough.

What is of key importance in systemic intervention is that when one intervenes at a high level in the system, changes will also occur in all lower levels of the system. The higher the level of intervention, the larger the potential effect will be. Theoretically this could mean that by only providing recommendations for high-level system intervention, the whole system could change in the intended direction. However, as intervention at such points is also most difficult, it is recommended to provide recommendations on all levels of systemic intervention.

For a structural transition to a circular economy, solely intervening at the leverage points which are addressed now will not be enough.

5.3 Conclusion & discussion

Leverage points are described as places to intervene in a system. In the twelve sets of recommendations that are analysed, recommendations have been done on ten out of twelve leverage points in the economic system when considering the transition to a circular economy. The focus of the recommendations is on the low levels of system intervention. The two highest leverage points are not addressed by any of the reports; the third and fourth leverage points are only addressed in generic terms, and are often a step away from an intervention. The four sets of recommendations which provide the most variety in system intervention level are the article of Hongchun and the reports of the Aldersgate Group, OPAi & MVO Nederland and IMSA. In order to achieve systemic change, formulating recommendations for the top four leverage points in the system in an in-depth way is necessary as well.

Looking from a system perspective, it is necessary to identify the system that one is intervening in. There are many ways to define a system, among which are looking at material flows, at a geographical environment and at participating stakeholders. Another option is to consider the economic system in Haarlemmermeer. From that perspective, one clear leverage point is growth in general: not only population growth, but also economic growth (Forrester 1971; Meadows et al. 1972). A circular economy, when considered as a new economic system, could open up the discussion on the requirement for economic growth in solving these major global problems.

Chapter 6

Transition framework analysis



The Olmenhorst estate exists since 1854, two years after the Haarlemmermeer polder was created. Since its founding years it has remained a steady oasis in a transforming landscape. At the moment, Olmenhorst combines a number of orchards with some agricultural land and a shop that sells local products. This aerial photograph shows the Olmenhorst estate between its surrounding farmlands.

In this chapter

A transition holds multiple levels in a system and multiple phases and actors in a process. An analysis of the recommendations from chapter 4 shows that dynamics take place throughout multiple system levels; recommendations exist in nearly all phases and most actors are taken into consideration. Improvements can be made by including reflexive activities and involving associations and the wider society more strongly.

This chapter analyses present-day recommendations on the transition to a circular economy from a transition science perspective. To do so, a transition framework is developed by combining multiple transition concepts, like the multi-level perspective and transition management. The framework consists of a set of determinants, being steps in a successful transition process. The research question which has to be answered before the analysis can be performed thereby becomes:

- What are determinants for a successful transition?

When this question is addressed, the second research question is answered by performing the analysis:

- What are gaps in the present recommendations for the transition to a circular economy from a transition management framework?

The chapter will start with drafting the transition framework (section 6.1) through discussing the relevant theories and recommendations. With the framework there, an analysis is performed through categorizing the recommendations from chapter 4 in the framework (section 6.2). The chapter closes with a conclusion and discussion (section 6.3).

6.1 Defining transition framework

Societies are complex systems, which constantly adapt to their environment and the societal need (Haan & Rotmans 2011). Sustainability transitions are long-term processes (one-two generations, 20-50 years), which require radical and structural change in order to transform towards a sustainable societal system (Grin et al. 2010). Such a system can be a city or a region, which applies to Haarlemmermeer. Transition management assumes that systems are complex (a system exhibits properties that cannot be traced back to the individual parts) and adaptive (open and adaptive to the environment) (Grin et al. 2010), which accords with Meadows' view on system dynamics (1997).

Transitions can be viewed from a socio-technical perspective and from a governance perspective. Within the socio-technical perspective, the multi-level perspective (Rip & Kemp 1998) provides the main theoretical body, while from the governance perspective, transition management (Grin et al. 2010) is considered to do so. Where the multi-level perspective describes transition processes through dynamics in niche, regime and landscape levels, transition management presents a new governance model for steering and coordinating large-scale system innovations towards sustainability. The two perspectives provide different insights in sustainability transitions, including different roles of all actors in a transition process (Geels 2012). As the socio-technical and governance perspectives are complementary, both are required in constructing a transition framework.

Transitions are often looked at with scepticism before they take place because present-day technologies are too widespread and locked-in (Markard et al. 2012). Transition studies however show that it is possible to actively guide a transition from the present to a new system. To do so is a challenge that requires a variety of new actors (Schot et al. 1994), with a limited role for governments (Meelen & Farla 2013). One key element of all transition processes is that it is hard to indicate beforehand which transition paths will become dominant in the future (Alkemade et al. 2009), and therefore attempts to define these transition paths beforehand can lead to uncertain images (Geels & Schot 2007). Indicating possible steps in a transition in order to determine the variety in transition paths can guide a transition process (Rotmans 2012).

Transitions are long-term processes (one-two generations, 20-50 years), which require radical and structural change in a societal system.

The multi-level perspective is a suitable approach for experiments and initiating transition processes, but also received some criticisms (Geels 2010). The perspective is argued not to provide enough attention to the role of power in socio-technical transitions (Smith et al. 2005), not to provide enough constructive approaches (Genus &

Coles 2008) and not to have a sufficiently strong link with innovation (Markard & Truffer 2008). To meet these shortcomings, the multi-actor framework is added to the framework to include the role of power, and a separate innovation analysis is done to include the importance of innovation. The constructive approach is present in this study because of the provision of recommendations.

When a transition process occurs, this involves changes in technologies, user practices, policies, markets, industrial structures and supporting infrastructures (Geels 2002) both within and across established value chains (Markard & Truffer 2006). A transition process not only includes the challenge of changing systems, but also of changing criteria that actors use to judge products, services and systems (Kemp & Van Lente 2011). Looking to a circular society, the transition to a regional circular society is not only about materials used by businesses in value chains, but also about consumer behaviour with regard to consumption and waste disposal. The interconnectedness of the system makes one change influence the system as a whole.

This thesis constructs a transition framework by combining the core elements of multiple transition theories. The framework consists of four building blocks, based on two perspectives. The first two building blocks, from the socio-technical perspective, are the multi-level perspective, including strategic niche management and the multi-pattern perspective, and the multi-actor perspective. The last two building blocks, from the governance perspective, are transition management and the transition arenas concept. This is visualized in figure 6.1.

These building blocks complement each other in describing the full picture of transition processes. The multi-level perspective describes the dynamics between the micro, meso and macro level, and allows for both interaction among these. The multi-actor perspective adds the roles of the various stakeholders in the process. Transition management complements these with ways to steer the dynamics in both the multi-level- and the multi-actor perspective. A transition arena adds a way to govern the dynamics at the niche level, which can lead to break-through of a systemic change.

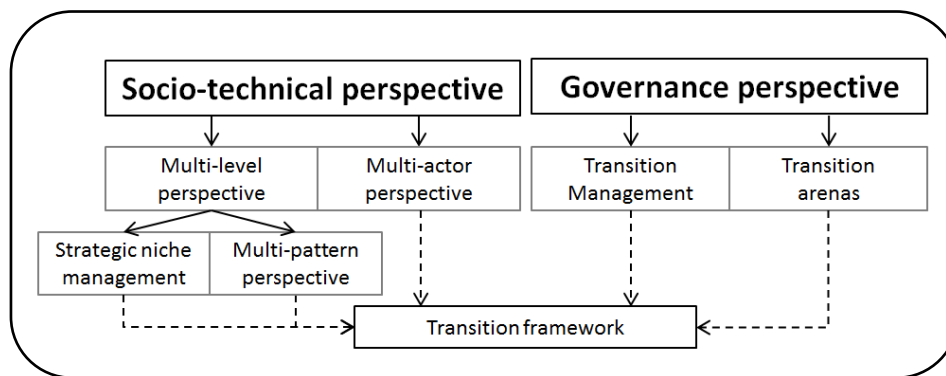


Figure 6.1 | Multiple perspectives within transition theories

Within the multi-level perspective, elements can be identified from both strategic niche management and from the multi-pattern perspective. In strategic niche management, five steps have been identified, which are required to achieve a transition from a niche, ranging from choosing the proper technologies for experiments to breaking down protection (Kemp et al. 1998). The presence of steps for niche technologies forms the first element. Considering the multi-pattern perspective, three dynamics can take place: niche pressure, landscape tension or regime stress (Haan & Rotmans 2011). The multi-actor perspective describes four actor groups, which need to participate in transitions (Avelino & Wittmayer 2015). From the governance perspective, transition management provides four activity types that can be considered as elements in transition processes: strategic activities, tactical activities, operational activities and reflexive activities (Loorbach 2010). Regarding transition arenas, it is hard to identify steps: the arena itself is a way to accelerate the transition, and the presence of such an arena will therefore be the only element for the analysis (Frantzeskaki et al. 2012; Roorda et al. 2014). The combination of these four sets of elements will form the transition framework.

A transition process not only includes the challenge of changing systems, but also of changing criteria that actors use to judge products, services and systems.

Multi-level perspective

- Stimulating niche development (D)
- Stimulating niche pressure (P)
- Stimulating landscape tension (T)
- Stimulating regime stress (S)

Transition management

- Strategic activities (S)
- Tactical activities (T)
- Operational activities (O)
- Reflexive activities (R)

Multi-actor perspective

- State (S)
- Market (M)
- Community (C)
- Associations (A)

Transition arena

- Setting-up arena (A)

6.2 Transition framework analysis

This analysis categorizes the recommendations from chapter 4 by the elements in transition processes. It is interesting to see that there are no recommendations going into niche development and the initiation of transition arenas. Considering the multi-pattern perspective, regime stress is dominant, but landscape tension and niche pressure are also stimulated by the recommendations. In the multi-actor perspective, the majority of the recommendations go into either the state or the market. From a transition management perspective, the focus is on tactical activities, but also strategic and operational activities are recommended. Interestingly, there are nearly no recommendations for reflexive activities. The findings are summarized in table 6.1. The full analysis is shown in appendix V.

	Multi-level perspec.			Multi-actor perspec.			Transition Manag.			Ar			
	Niche Developm.	Niche Pressure	Landscape Tension	Regime Stress	State	Market	Community	Associations	Strategic	Tactical	Operational	Reflexive	Transition Arena
2006 Hongchun, China (general)		Dark	Dark	Dark	Dark	Dark		Dark	Dark	Dark	Dark		
2012 Aldersgate Group (general)		Dark	Dark	Dark	Dark	Dark	Light	Light	Light	Dark	Light		
2014 Ellen MacArthur (general, proof of concept)				Dark	Dark	Dark			Light	Dark	Light		
2014 Ellen MacArthur (general, identifying benefit)		Light		Dark	Dark	Dark			Light	Dark	Light		
2014 OPAi & MVO Nederland (general)		Light		Dark	Dark	Dark			Light	Dark	Dark	Light	
2013 Green Alliance (govern., buss., investors)			Dark	Dark	Dark	Dark				Dark	Dark		
2013 IMSA (governments)			Dark	Dark	Dark					Dark	Dark		
2014 OPAi & MVO Nederland (governments)			Light	Dark	Dark				Light	Dark	Light		
2013 IMSA (businesses)		Dark		Light		Dark				Dark	Dark		
2014 OPAi & MVO Nederland (businesses)				Light		Dark				Light	Light		
2012 MVO Nederland (manufacturing industry)				Light		Dark			Light		Dark		
2013 ESA (waste & resource sector)				Dark					Light	Dark	Dark		

Table 6.1 | Presence of recommendations in a transition framework
 Scales of grey show percentage of recommendations in report that address a specific transition element.
 Light: 0-25% | Medium: 26-50% | Dark: >50%

The analysis shows that none of the recommendations go into strategic niche development in such detail that recommendations on how niches should be developed are described. Niche pressure, landscape tension and regime stress all occur as a consequence of recommendations. This means there is pressure from multiple sides to initiate a regime shift, thereby supporting a transition process. Regime stress by changing present-day practices happens most frequently and is often market-initiated; tension from the landscape is frequently state-initiated, and pressure from niches occurs relatively limited.

In all recommendations, actor groups can be identified. The market is most often addressed in taking the lead for starting a transition; the state (or in the local context, the municipal government) is to provide conditions for making a circular economy possible. It is interesting to see that associations are addressed in two reports only, and both consider education institutes. For the community, only one single recommendation is made. Some other recommendations go into involving the community, but do this as a recommendation to government or to business.

Regarding activity types, strategic, tactical and operational activities are addressed by most authors. The focus on tactical activities in most reports implies that enabling circular developments is at the moment considered most important. Interestingly, the recommendations are often not done in the sequence according to theory, but appear to be done randomly. This implies that the recommendations are done apart from each other, and not aimed at developing a structured transition process. Recommendations for reflexive activities lack almost entirely. It is also interesting to see that market recommendations are more often operational, and government recommendations are more often tactical: this implies governmental role to enable, and a business role to develop activities.

Although some of the reports use the phrasing of *transition* in their process of change, the concept of transition arenas is not addressed anywhere in the recommendations. The key element of transition arenas, bringing a variety of frontrunners from multiple stakeholder groups together, is present in some recommendations. However, the aim for which these frontrunners are brought together in the recommendations (often knowledge exchange) does not match with the aim in the transition arena concept (determining common visions / strategies / values).

The lack of recommendations in strategic niche management and transition arena development is striking. This can be explained in two ways: either that the concepts are too complicated to translate into actual recommendations, or that the organisations making these recommendations are simply not aware of the concepts. This thesis can therefore, by adding these perspectives, provide an addition to existing recommendations. As there have not been recommendations on these concepts before, it will be a challenge to estimate whether these recommendations will be realistic and applicable.

This analysis teaches us that the overall structure within the recommendations is limited. None of the reports builds recommendations on a theoretical framework, or provides recommendations in a meaningful sequence. There are four reports which have quite a wide range of recommendations: Hongchun, the Aldersgate Group, IMSA and OPAi & MVO Nederland. The disadvantage of the OPAi & MVO Nederland report is that all recommendations are short and narrowly-focused; the IMSA report therefore provides a valuable addition. The disadvantage of the Hongchun article is that it has a national, top-down focus. The best would be to combine the IMSA, OPAi & MVO Nederland and Aldersgate report when aiming for a complete set of recommendations from a transition perspective.

6.3 Conclusion & discussion

A sustainability transition is a radical transformation towards a sustainable society, operating in response to persistent problems. The transition to a regional circular society can be considered as such a sustainability transition, which allows applying certain transition frameworks. Elements in successful transition processes can be identified from a socio-technical and from a governance perspective, using the concepts of strategic niche management, the multi-level perspective, the multi-actor perspective, transition management and transition arenas. The analysis using these concepts concludes that none of the recommendations go into strategic niche development. On the contrary, all types of multi-level pressure are addressed. Considering actor groups, the large majority of recommendations are directed towards businesses and governments, very few into associations and into society. In activity types, the strategic, tactical and operational activities are present, although in a random sequence, however the reflexive activities are absent. Neither are transition arenas addressed in any way. Combining the IMSA, OPAi and Aldersgate report will provide the most diverse set of recommendations considering a transition perspective.

It is required to develop additional recommendations for strategic niche development, the engagement of the community and associations, and the initiation of a transition arena, as these are lacking in the present recommendations. There is no need to consider the multi-pressure perspective and the stakeholder groups 'business' and 'market' specifically in additional recommendations, as this is already done by present-day recommendations. Structuring the recommendations in the four activity types of transition management can accelerate the transition process as new activities can build upon activities from the previous activity stage.

The use of the transition management perspective provides an addition to the system's view and the innovation view, by not looking at a specific moment in time, but by looking at a process of change over time. This process approach returns mainly in the various activity types that are required for any process of change. The roles that the various stakeholders play, just as the multiple dynamics that take place within niches, regimes and the landscape, support these processes of change.

Chapter 7

Innovation framework analysis



Cruquius was one of the three steam pumping stations that pumped the water out of Haarlemmermeer between 1849 and 1852, and is thereby a little older than the municipal area itself. Cruquius is still in service and continues to pump water out of the polder to retain the low water level. The station has always been considered a symbol of innovation and technological progress.

In this chapter

Regional innovation systems provide five system functions that determine the strength of an innovation system. An analysis of the recommendations from chapter 4 shows that innovation is addressed only limitedly. Improvements can be made in all functions, but especially in building firm clusters and providing education.

Economists have never allowed their analysis to be influenced by psychologists of their time, but have always framed for themselves such assumptions about psychical processes as they have thought it desirable to make

Joseph Schumpeter

When developing recommendations for the transition to a regional circular society, with the *regional circular innovation system* (Buch et al. 2014) being developed as a means to reach such a circular society, it is useful to include innovation system perspectives in the analysis of the present-day recommendations. An innovation framework consists of a set of functions, being “a contribution of a component or set of components to a system’s performance” (Johnson & Jacobsson 2001), i.e. elements of a successful innovation system. The research question which has to be answered before the analysis can be performed thereby becomes:

- What are functions of a regional innovation system?

When this question is addressed, the second research question is answered by performing the analysis:

- What are gaps in the present recommendations for the transition to a circular economy from an innovation perspective?

The chapter starts by discussing the relevant regional innovation system theories (section 7.1). Second, the analysis will be performed through categorizing the recommendations in the framework (section 7.2). The chapter closes with a conclusion and discussion (section 7.3).

7.1 Defining innovation framework

Innovation systems are defined as conceptual systems, focused on accelerating the development, diffusion and use of innovations (Edquist 2004). Often innovation systems are, just as transition science, often used in a structural re-orientation of economic activity towards sustainability (Hekkert & Negro 2009). However, only a limited number of insights from the field of innovation studies are applied to this growing field of socio-technical change, despite the fact that innovation is perceived to be a key process in achieving this sustainable change (Hekkert & Negro 2009). The core framework that has delivered these insights is the innovation systems framework, which can help to achieve a successful transition by determining the functions of an innovation system (Hekkert et al. 2007).

Through the years the innovation system approach has been criticized for not providing enough practical guidelines for policy makers (Edquist 2005). Despite this remark, the functions of innovation systems, in particular but not only technological innovation systems, are shown to provide useful guidance in the development of systemic change (Hekkert & Negro 2009). The framework for the analysis of the present-day recommendations will therefore consist of functions of innovation systems.

Innovation systems are often used in the structural re-orientation of economic activity towards sustainability.

In literature, innovation systems for analysis have been developed on four different levels: national, regional, sectorial and technological. These different levels are relevant as the drivers and processes on these multiple levels differ. As this thesis is about the transition to a regional circular society, the national system of innovation (NSI) will not be considered. Also, a sectorial system of innovation (SSI) does not apply to this study, as sectors are about sectorial interaction of stakeholders in an international context. The technological innovation system (TIS) could provide a proper guideline, as the transition to a regional circular society could be viewed as technological development. However, a TIS often looks to technological development in an (trans)national scope, which is in contrast with the regional scope as addressed here (Hekkert et al. 2007; Edquist 2005; Bergek et al. 2008). Also, performing a full TIS analysis (Hekkert et al. 2011) is outside the scope of this study.

The only innovation perspective that applies to this study is the regional innovation system (RIS), as a RIS combines stakeholders with various backgrounds within a designated region. The size of a region for a RIS is not strictly defined, and can be both transnational and local (Tödtling & Trippl 2005). As no clear functions have been developed in order to assess a RIS on its innovation strength, this thesis develops these functions.

Regional innovation systems

The concept regional innovation system emerged from combining innovation science and regional science, and attempts to explain the socio-institutional environment from which innovations emerge (Doloreux & Parto 2005). Innovation is seen as a regional process, as innovation often occurs in regional economical, institutional, political and social contexts and in the interaction among these

The only innovation perspective that applies in this study is the regional innovation system, as such a RIS combines stakeholders with various backgrounds within a designated region.

contexts (Malmberg & Maskell 1997; Porter 1990). Linkages with national systems of innovation and technological systems of innovation are however essential for stakeholders within a regional innovation system to succeed (Asheim & Gertler 2005). Important characteristics of regional innovation systems are trust, reliability, exchange and cooperative interaction (Cooke 2001).

There is a discussion on the definition of regional innovation systems. Cooke et al. (1997) describe it as “a set of interacting private and public interests, formal institutions, and other organizations that generate, use, and disseminate knowledge.” Doloreux & Parto (2005) on the other hand identify a RIS “by cooperative innovation activities between firms and knowledge-creating and diffusing organizations, and the innovation-supportive culture that enables both firms and systems to evolve over time.”

Regional innovation systems also lack a clear set of functions, as others (e.g. Hekkert and Bergek) have identified for technological innovation systems. Tödtling & Trippl (2005) however developed a set of problems areas that occur in regions, from which indicators of regional innovation systems can be derived. These problems address three types of regions, each region having problem dimensions, problem areas and problem solutions. The dimensions remain the same for all types of regions; the areas and the solutions change per type of region. Haarlemmermeer can be considered a peripheral region, based on characteristics like the level of R&D, the level of education, the strength of firm networks and the amount of knowledge development and exchange. The related problem

dimensions and general solutions are also addressed in table 7.1. As there is no clear set of functions available for a successful regional innovation system, the problem dimensions will be considered as functions, as these also can be viewed as “a contribution of a component or a set of components to a system’s performance” (Johnson & Jacobsson 2001).

<i>Problem dimensions</i>	<i>General problem areas in peripheral regions</i>	<i>General solutions in peripheral areas</i>
Firm clusters	Clusters are often missing Dominance of SMEs	Strengthen potential clusters, link firms to clusters outside region, attract innovative companies
Firm innovation activities	Low level of R&D and product innovation	Improve strategic and innovation capabilities of SMEs
Education and training	Emphasis on low- to medium-level qualification	Build up medium level skills (technical, engineering, management)
Knowledge transfer	Some services available, but often “thin” structure	Attract branches of national research organisations
Networks	Few links with externals from the region, due to weak clustering and “thin” institutional structure	Mobility schemes, link firms to knowledge providers outside region

Table 7.1 | Problem dimensions and problem areas in a regional innovation system (created with information from Tödting & Trippi 2005)

Innovation framework

The innovation framework for analysis consists of the five indicators from the regional innovation system. This proposed set of functions has a partial overlap with functions of the technological innovation system, especially in the firm innovative activities (TIS: entrepreneurial activities) and knowledge transfer (TIS: knowledge development and diffusion).

Regional innovation systems

- Firm clusters (C)
- Firm innovation activities (A)
- Education and training (E)
- Knowledge transfer (K)
- Networks (N)

7.2 Innovation framework analysis

This innovation framework analysis categorizes the recommendations from chapter 4 according to innovation system functions. The analysis shows substantial differences in functions being addressed. In general, there are very few recommendations that explicitly stimulate innovation systems at all. This can be seen through the dominance of the light grey colour in table 7.2. The full analysis is shown in appendix VI.

	Regional Innovation System				
	Clusters	Firm activities	Education	Knowledge	Networks
2006 Hongchun, China (general)	Dark	Light	Light	Dark	Light
2012 Aldersgate Group (general)	Light	Dark	Light	Light	Light
2014 Ellen MacArthur (general, proof of concept)	Light	Dark	Light	Light	Light
2014 Ellen MacArthur (general, identifying benefit)	Light	Light	Light	Light	Light
2014 OPAi & MVO Nederland (general)	Light	Light	Light	Light	Light
2013 Green Alliance (govern., buss., investors)	Light	Light	Light	Dark	Dark
2013 IMSA (governments)	Light	Dark	Light	Light	Light
2014 OPAi & MVO Nederland (governments)	Light	Light	Light	Light	Light
2013 IMSA (businesses)	Light	Light	Light	Light	Light
2014 OPAi & MVO Nederland (businesses)	Light	Light	Light	Light	Light
2012 MVO Nederland (manufacturing industry)	Light	Light	Light	Light	Light
2013 ESA (waste & resource sector)	Light	Light	Light	Light	Light

Table 7.2 | Presence of recommendations in an innovation framework

Scales of grey show percentage of recommendations in report that address a specific innovation system function.

Light: 0-25% | Medium: 26-50% | Dark: >50%

With regard to the five functions, there is a strong focus on *knowledge transfer* and *network development*. *Firm clustering* is rarely mentioned, and *education* is also addressed limitedly. *Innovation activities by firms* return more often, but mostly as a result of a recommendation, instead of as a direct objective. *Knowledge transfer* is considered more important, looking at the number of recommendations. The most interesting finding is how many reports go into developing *networks*: almost all reports address this need.

Remarkable is, however, that few recommendations use the actual term *innovation*. In the transition to a circular society, one would say that new combinations of products, technologies, business models and governance methods are of the utmost importance. Observing the recommendations shows most remain on a practical level. The advantage is that it is relatively easy to implement these recommendations. The disadvantage is that practical recommendations are expected not to stimulate radical innovation to the maximum extent.

Most recommendations do not stimulate innovation directly: only when bringing these recommendations into practice, can the result stimulate innovation. Considering that Haarlemmermeer wants to transform to a regional circular society, and the HBS closing report addresses the need for innovation in doing so, it is advised to develop additional recommendations based on innovation perspectives. Therefore, these will be provided on the functions of the framework in this chapter. When doing so, it is important to note that some functions may overlap with elements from transition sciences or the systems thinking approach.

7.3 Conclusion & discussion

Functions of innovation systems help determine how an innovation system can be stimulated to become successful. This chapter considers five functions, derived from the regional innovation system approach: firm clustering, firm activities, education, knowledge development and creating firm networks. None of the reports, from which the recommendations on the transition to a circular economy have been analysed, addresses innovation primarily: innovation is often the consequence of a recommendation, not the aim. Building firm networks is a function that is most often addressed in present-day recommendations, while creating firm clusters is only addressed once.

As the innovation focus in all reports is limited, it is recommended to develop additional recommendations for all five system functions when working on a transition to a regional circular society. Adding this innovation framework can contribute significantly to the process of transitioning Haarlemmermeer to a regional circular society.

Taking the innovation perspective shows a different picture than the previous two analyses from a system's framework and a transition framework. Where the previous two analyses showed that the majority of the leverage points and elements were addressed, this innovation analysis provides a different picture. The lack of the use of the word *innovation* can suggest that the reports' authors find the word too abstract to use, or that they have difficulty using the term in practice. Another

Adding this innovation framework can contribute significantly to the process of transitioning Haarlemmermeer to a regional circular society.

possibility is that the challenges which are related to these functions are not considered to be applicable in the transition process towards a circular economy according to the reports' authors. This thesis holds the perspective that stimulating innovation is important, and that these functions should return in the final set of recommendations.

Chapter 8

Recommendations for the transition to a regional circular society



The Geniedijk, part of the Stelling van Amsterdam (Amsterdam defence line), was constructed in 1888 and runs straight across Haarlemmermeer. Since 1996, the dike is a UNESCO world heritage site because of its unique hydraulic engineering. At present, the Geniedijk is a cycling- and walking route with at some points astonishing nature.

In this chapter

A set of nineteen recommendations is presented that can help to start the transition process towards a regional circular society, based on the analyses in the chapters 5, 6 and 7. These nineteen recommendations are partially derived from existing literature and are partially developed from theoretical backgrounds.

When it is obvious that the goals cannot be reached, don't adjust the goals, adjust the action steps

Confucius

This chapter combines the previous chapters, in which the circular economy has been described and the three analyses have been performed. As addressed in the introduction, the aim of Haarlemmermeer is to achieve a regional circular society in three domains: energy, water and materials (Gemeente Haarlemmermeer 2015). To reach this regional circular society, the concepts behind the circular economy are applied on a local scale, as explained in chapter 3. The recommendations from numerous reports, addressing the transition to a circular economy, have been analysed for gaps from three perspectives: systems thinking, transition science and innovation science.

First, this chapter shows which present-day sets of recommendations are most relevant for the transition to a regional circular society. This leads to the core question in this chapter:

- Which recommendations can guide Haarlemmermeer to a regional circular society?

Second, additional recommendations are derived to do so, based on gaps and theoretical backgrounds from the three analyses. These additional recommendations will only be provided on elements that are relevant for the regional context. This leads to four sub-questions:

- Which present-day recommendations can be used best to guide Haarlemmermeer to a regional circular society?
- Which additional recommendations can be developed to guide Haarlemmermeer to a regional circular society, ...
 - ... from a system leverage point perspective?
 - ... from a transition science perspective?
 - ... from an innovation science perspective?

After having made clear which present-day recommendations can be used best, and after developing the additional recommendations in this chapter, the next chapter combines these into one final set of activities that can start the transition towards a regional circular society in Haarlemmermeer.

The chapter starts with the presentation and selection of the present-day recommendations (section 8.1). Second, additional recommendations based on the gaps in the previous chapters are developed from a system's perspective (section 8.2), a transition perspective (section 8.3) and an innovation perspective (section 8.4). Third, the present-day recommendations and the additional recommendations are combined into one set of nineteen recommendations (section 8.5). The chapter closes with a conclusion and discussion (chapter 8.6).

8.1 Selecting present-day recommendations

The analyses in chapters 5, 6 and 7 lead to three reports that, combined, provide the most complete set of recommendations: reports are by Aldersgate, IMSA and OPAi & MVO Nederland. Regarding the system intervention, all recommendations at the highest system intervention points are in these three selected reports. With regard to transition activities, these reports address the whole range of activities. From the innovation perspective, there is one element that is not addressed within the selection, but in a different report, which is *firm clustering*. The article by Hongchun is the only article going into this, and therefore, this *firm clustering* recommendation will be included.

As the recommendations in the OPAi & MVO Nederland report are explained only briefly, these will be disregarded where other reports discuss the same recommendation. Furthermore, some recommendations that are simply notions are excluded. Finally, recommendations that are not relevant for Haarlemmermeer as they are on the landscape level, outside the regional system, are excluded. The selection of these relevant present-day recommendations for the transition to a regional circular society is shown in appendix VII.

8.2 Additional recommendations | System leverage points

This section provides additional recommendations for the top-four system intervention points, based on the conclusion of chapter 5. These system intervention points are:

- 4) The power to add, change, evolve, or self-organize system structure
- 3) The goals of the system
- 2) The mindset or paradigm out of which the system arises
- 1) The power to transcend paradigms

It proves difficult to develop concrete recommendations on these top four leverage points, as this requires a high level of insight in how systems work and function. For leverage points three and four, recommendations are created based on the examples in Meadows (1997). For the top two leverage points, it is very hard to develop additional recommendations, as in the regional system of Haarlemmermeer, a change in paradigms from which the system arises has not been discussed so far – think of paradigms such as the importance of economic growth, and the focus on a healthy and spacious living environment.

- **Create freedom in regulations for projects that aim to enhance the transition to a more circular society in Haarlemmermeer.** Freedom can lead to an initiative or process that is self-organising and evolves in such a way that stimulates the transition towards a regional circular society. The role of the municipality is to remove or simplify regulatory barriers on municipal and assist in removing these barriers on a national government levels.
- **Open up a dialogue with a variety of stakeholders to define the vision and related goals of Haarlemmermeer.** Simply stating goals in a sustainability program is a start, but for setting goals in a system it is important that all stakeholders feel ownership for those goals. A dialogue with a wide selection of stakeholders on the future of Haarlemmermeer can result in common, circularity related, goals for Haarlemmermeer.

It proves difficult to develop recommendations for the top four leverage points.

8.3 Additional recommendations | Transition framework

This section provides additional recommendations based on the transition framework analysis. Chapter 6 recommends formulating additional recommendations on the development of circularity through niches, on involving society and associations, on reflexive activities, and on the development of a transition arena.

Niche development

Considering the development of technologies within niches, the theoretical framework behind strategic niche development discusses five steps in order to do so (Kemp et al. 1998): (1) the choice of the interaction, based on opportunities, returns, consistency with institutional setting and attractiveness for specific applications; (2) the selection of the experiment, where the returns of the interaction are high and the disadvantages minor; (3) the set-up of the experiment, with the proper balance between protection of the interaction and the pressure to perform; (4) scaling up the experiment, with limited support, and (5) breakdown of the protection, where the interaction is mature enough to compete in the real world. The recommendation thereby becomes:

- **Stimulate circular development through demonstration projects in protected niches.** These projects are experiments, which can range from new business models to closing resource loops regionally. These experiments can demonstrate in a safe space if integrating circularity is a possibility.

Multi-actor perspective

The multi-actor perspective provides a large overview of possible roles that multiple actors can take in multiple circumstances (Avelino & Wittmayer 2015). However, it does not link these roles with stages in transition management. It is clear that all actor groups should have a role in the transition process, and it is also clear that recommendations for associations and society are completely lacking at the moment. The recommendation thereby becomes:

- **Involve the community and associations in the transition process.** By not limiting the participating stakeholders to business and government, new insights on roles that associations and the community might play in the transition process become clear. This is important for determining the roles of businesses and governments.

Transition management

With regard to the four transition activity types, the reflexive activity is addressed only to a limited extent. Reflexive activities are an important part of monitoring and responding to feedback, although not many reports have discussed this element. Based on the theory by Loorbach (2010), the recommendation becomes:

- **Develop indicators to monitor progress towards the goals in a regional circular society.** These indicators can determine whether the transition process is taking place, whether it is required to adapt steering mechanisms or whether certain themes require more attention or a different approach.

Transition arena

When a certain area is aiming for a transition, a good way to develop a transition pathway is to use a group of frontrunners for the outline of a possible future, and for developing a roadmap leading to such a future. Setting up a transition arena has been done multiple times before, and assisted in those contexts with determining transition activities. Therefore, the recommendation becomes:

- **Set-up a transition arena with frontrunners and relevant stakeholders from the region to identify a transition pathway to a regional circular society.** Such a transition arena can help in outlining a desired future, in which way other stakeholders can be convinced to join in on the pathway towards this future.

8.4 Additional recommendations | Innovation framework

This section develops additional recommendations based on the analysis in chapter 7. The analysis suggested formulating additional recommendations for all five functions of the regional innovation system, being firm clustering, firm innovative activities, education & training, knowledge development and firm networking.

- **Increase firm clustering through the development of a 'circular business hub'.** Firm clustering can bring together existing innovative firms with regard to circularity, or lead to the development of new firms. A 'circular business hub' could lead to enhanced development of all individual firms, which increases the creation of knowledge in the area.
- **Strengthen strategic capabilities of SMEs in order to stimulate their innovation activities towards circularity.** In order to include existing SMEs in the transition process, it is required to strengthen their strategic and innovation capabilities. This can also be done by **setting up a circularity incubator** to assist start-ups and SMEs by transitioning towards a regional circular society.
- **Develop skills and competences for a circular economy.** In primary, secondary and medium level (in Dutch: MBO) education, the future aim of a regional circular society should be integrated in order to increase awareness and more strongly link educational programs with the regional development.
- **Increase knowledge development and exchange by attracting branches of research institutions.** Taking the lack of higher education institutions, attracting branches of large research institutions can lead to the diffusion of experiences and knowledge from other regions, thereby accelerating innovation and the development towards circularity.
- **Stimulate networking to strengthen knowledge exchange of present stakeholders.** Present stakeholders can increase their knowledge on circularity by more actively participating in existing networks, leading to new insights and experiences.

8.5 Towards one set of recommendations

Combining the recommendations from present-day reports and the three sets of additional recommendations, one list of recommendations is developed. This list of recommendations is the theoretical basis for the qualitative analysis and discussion in the next chapter, resulting in a specific set of recommendations for the transition to a regional circular society in Haarlemmermeer. For now, the recommendations have a random sequence; the next chapter categorizes these recommendations in the transition activity types. Appendix VII shows how the recommendations below have been derived from the existing and the newly developed recommendations.

- **Demonstration Projects** Increase demonstration projects through experimentation in protected niches in order to learn how to design for a circular economy;
- **Knowledge Exchange** Create cohesion between and knowledge exchange among projects and stakeholders by gathering and spreading successful business examples
- **Circularity indicators** Develop circularity indicators / KPI's for measuring circular performance
- **Skill & training** Create skills for a circular economy by integrating circular economy principles in education and training
- **Stakeholder vision** Stimulate stakeholders to develop a long-term vision
- **Stakeholder fora** Initiate and stimulate stakeholder fora about the circular economy
- **Knowledge development** Provide resources for knowledge development through attracting knowledge institutions;
- **Circularity incubator** Provide resources for demo projects, for example through increasing incubator activities;
- **Launching customer** Promote circular products by being an active launching customer;
- **Business models** Develop business models and related product designs for a circular economy, and increase co-operation within and between sectors;
- **Partner selection** Choose strategically with regard to investment, co-operation with others and company skills;
- **Community engagement** Use the energy of civilians in society to assist in developing projects regarding circularity;
- **Feedback & learning** Create space for feedback and be open for continuous learning;
- **Material pooling** Search for material pooling opportunities;
- **Freedom in regulation** Create freedom in regulations for projects that aim to enhance the transition to a more circular society in the region.
- **Transition arena** Set-up a transition arena with frontrunners from the region to identify a transition pathway to and possible future outlooks for a regional circular society, in order to think outside boundaries, identify opportunities and create ownership for the process.
- **Market formation** Guide market formation to stimulate business and society to adapt their practices towards circularity.
- **Circular business hub** Increase cross-sectoral firm clustering by the development of a 'circular business hub'.
- **Support SMEs** Strengthen strategic capabilities of SMEs in order to stimulate their innovation activities towards circularity.

8.6 Conclusion & discussion

In order to arrive at a regional circular society, recommendations exist in present-day reports. The three reports which provide the most elaborate overview are the ones by Aldersgate, IMSA and OPAi & MVO Nederland. The article by Hongchun provides an additional innovation perspective. Based on these recommendations and existing literature, additional recommendations are developed on niche development, involving actors, reflexive activities, developing a transition arena, changing the goals and mind-set of systems, and on how to stimulate innovation from both a regional and a technological innovation system perspective. The existing and the additional recommendations are combined in one set of nineteen recommendations for the transition to a regional circular society.

In the process of combining recommendations into one set, making combinations was essential, although nuances behind specific recommendations varied. The set of nineteen recommendations therefore also includes a one-sentence explanation, which aims to describe these various nuances. Due to the report selection, it is possible that relevant individual recommendations from other reports have been omitted.

The set of nineteen recommendations seems to be complete, encompassing a wide variety of target groups, system leverage points, incentives and transition activity types.

The set of nineteen recommendations seems to be complete, encompassing a wide variety of target groups, system leverage points, incentives and transition activity types. The next chapter discusses this set of nineteen recommendations through a qualitative analysis by a variety of stakeholders, comes up with a set of relevant activities for Haarlemmermeer, and analyses these activities through the three frameworks as a last check.

Chapter 9

Activities towards a regional circular society



The corn mill 'De Eersteling' (in English: the one who is first) was constructed in 1856, being the first mill to be built after creating Haarlemmermeer. Mills that were constructed later, have all disappeared, which makes this the only remaining mill in Haarlemmermeer. After being decommissioned in 1956, the mill was opened up to the public in 1977 as a symbol of Haarlemmermeer entrepreneurship.

In this chapter

Nine activities can be initiated to start the transition towards a regional circular society. These activities are of strategic, tactical, operational or reflexive nature, and range from regionally defining the meaning of a circular economy to the development of indicators for circularity and the building of capacity through community dialogues and involvement of youth.

In the previous chapter, a set of recommendations for the transition to a regional circular society was developed. In this chapter, tangible activities to accelerate the transition process towards this regional circular society are determined. The main question for this chapter becomes:

- What activities are required to accelerate the transition towards a regional circular society?

The chapter starts by identifying the landscape factors relevant for the transition process in Haarlemmermeer (section 9.1). Second, the nine recommendations will be explained, including points of emphasis for implementation and some good practices from other regions (sections 9.2 until 9.10). Both the landscape factors and the activities in this chapter are identified through expert interviews. This chapter finishes with a discussion (section 9.11).

Neither the present-day economic situation, not increasing geopolitical tensions were addressed as landscape factor.

The activities are organized by the transition activity typology of Loorbach (2010). Strategic activities are about long-term developments, such as vision creation. Tactical activities are related to institutions and regulatory frameworks. Experiments and projects are operational activities. Reflexive activities have to do with reflecting, reacting and learning. Within the typology, the activities are organized

based on priorities as given by the interviewees. The list of interviewees and their backgrounds can be found in appendix VIII; the reference numbers to the interviews are provided in text box 9.1.

This study does not encompass the implementation of these activities. When doing so, many activities may be developed independently of one another, as they do not set preconditions for each other. Still, many activities are strongly interconnected, thereby being able to strengthen each other when developed in parallel: this is preferable. Most important is that stakeholders share knowledge and experiences to strengthen and support each other in order to accelerate the transition process.

9.1 Landscape factors

For the transition to a regional circular society, a number of landscape factors are identified. These factors cannot be influenced by the system of Haarlemmermeer, but do influence the transition within Haarlemmermeer. These landscape factors do not return in the recommendations, but are important to take into account in the transition process. Each landscape factor can influence the transition in a positive (+), a negative (-) or both a positive and a negative (+ / -) way.

- 1 | Interview Van Raak, R. (DRIFT), 22/04/2015
- 2 | Interview Hupperts, P. (The Terrace), 28/04/2015
- 3 | Interview Hubold, S. (Ellen MacArthur Foundation), 09/04/2015
- 4 | Interview Joustra, D.J. (Het Groene Brein & IMSA), 08/04/2015
- 5 | Interview Chojnacka, A. (ENGINN), 09/04/2015
- 6 | Interview Van Hecke, R. (Rabobank), 20/04/2015
- 7 | Interview Kuipers, C. (Urgenda), 01/05/2015
- 8 | Interview Buch, R. (Arizona State University), 22/04/2015
- 9 | Interview Van de Graaf, A. (MeerMaker & Tegenstroom), 07/04/2015
- 10 | Interview Gerdan, N. (Municipality of Haarlemmermeer), 23/04/2015
- 11 | Interview Vermeer, A. (DURA Vermeer), 28/04/2015
- 12 | Interview Van Beek, M. (Schiphol Group), xx/xx/2015
- 13 | Interview Van Vlet, W. (Municipality of Haarlemmermeer), 19/06/2015
- 14 | Interview Legendijk, A. (NMCX), 27/05/2015

Text box 9.1 | Interview reference numbers for chapter 9

It is interesting to note that the present-day economic situation is not mentioned once by the interviewees – not as hindering, nor as stimulating. Neither the increasing geopolitical tensions around the globe were addressed. This could imply that interviewees apparently consider the circular society to be independent from outside economic activities and concentrate more on local opportunities instead of distant threats.

Societal initiative (+)

Initiatives by society are increasing, which is important to take into account in transition processes. An illustration of this is the increasing number of energy co-operatives [1], and by the fact that these co-operations are often so well-accepted, that these are able to initiate additional activities [2]. It is important to realize that the highly-educated sections of society take most initiative (Hajer 2011).

Circular Economy concept (+)

Around the world, attention for the circular economy is increasing. This has to do with increasing resource scarcity and geopolitical tensions, but also with increased business opportunities as outlined by the Ellen MacArthur reports [3,4]. Up to now, businesses tend to take these developments more seriously than governments [1,3].

Culture (+ / -)

A number of interviewees were strongly opinionated in the sense that they consider Haarlemmermeer to be a men's world [5,13]. This generally leads to a working atmosphere with a strong focus on vested interests and existing business models [5]. Also the construction and logistics sectors, which are strongly present in Haarlemmermeer, are very conservative [2], and their existing paradigms are hard to break [4]. However, Haarlemmermeer has an entrepreneurial spirit, which can accelerate processes of transformation when new business opportunities arise [6].

Local availability of resources (+ / -)

The regional availability of resources can be considered a precondition for a circular economy [7], and can also provide incentives to keep material cycles closed at regional scales [8]. If no primary resources are available in a certain field, it is challenging to realize cycles around that resource. It is therefore important to use as many regional materials as possible and construct around natural material flows [8].

Higher governmental and political institutions (-)

Political interests are important, as these tend to have a short-term focus and thus often change. As responsibilities and goals of the various political stakeholders differ [8,9], these seem to function in a not-integrated and thereby non-efficient manner [2]. Higher governmental institutions, e.g. the province, can be hindering in regulatory contexts: the case of blocking the wind farm in Haarlemmermeer is the most prominent local example [6].

Interdependency (-)

Schiphol is a dominant factor in Haarlemmermeer, requiring significant people and material flows. These flows make the development of a circular economy more difficult, and can conflict with the aim for closing loops on a regional scale [1,8]. Second, financing the international trade around Schiphol is required for maintaining economic growth in Haarlemmermeer. This limits the possibilities for financing the regional economy [4], and potentially conflicts with the national importance of economic activities around Schiphol airport.

9.2 Transition arena (strategic)



- Initiate a *design lab* towards a Regional Circular Society

Haarlemmermeer recently adopted her sustainability program for the 2015-2018 period (Gemeente Haarlemmermeer 2015). A combined vision and strategy of a variety of stakeholders within the municipal system lacks, which is a requirement to gain support for such a process of change [1,10]. A *design lab* can bring together such a variety of stakeholders to work on the meaning of a regional circular society in Haarlemmermeer through developing a common vision and new activities for government, business and society [1]. Essential to the success of these processes is that people actually meet, get to know and trust each other [2].

Such a design lab has a comparable setting to a formal transition arena, in which 20-25 stakeholders participate on a personal basis for a delimited trajectory. For Haarlemmermeer, the transition arena guide (Roorda et al. 2014) recommends the participation of 20 frontrunners with a diversity of interests. Another way to pick participants is not to look at the diversity of interests, but at the impact participants can have. In this way there is no broad support, but so-called ‘deep’ support (Rotmans 2012): together, the participants form a ‘coalition of the willing’ that can have a significant and structural impact, without need for additional support. The stakeholder analysis in the final report of HBS Phase I (Buch et al. 2014) can provide guidance for choosing participants. In any case, it is important that each individual participant is convinced that he/she is crucial in making the design lab into a success. An independent chair guides the process and secures mutual progress. With a clear common agenda, the participants can become ambassadors for the regional circular society.

Haarlemmermeer also requires a forum where stakeholders come together on a frequent basis to discuss the progress and barriers towards the common circular future, and to identify mutual challenges and opportunities in moving forward [5,6]. After the design lab has developed the common vision and the new activities, the setting can be evaluated with its stakeholders on how to continue. A future setting might include a continuous stakeholder dialogue to exchange learnings [8] and to seek increased synergies and cross-pollinations, as HBS Phase I recommends.

In Haarlemmermeer, a Chamber of Acceleration was set up in 2014, in order to increase collaboration between eight key stakeholders in the municipality. This Chamber has not seen structural and coordinated activity for the last months; this raised questions on its impact. Some perceive the governing bodies of the Amsterdam Economic Board and Amsterdam Metropolitan Region [10] and stakeholder fora like the yearly SHARE conference [6,10] as transition arenas. Particularly SHARE has the aim to both create legitimacy for each other’s activities, and provide input for new ideas [11]. The design lab as explained in this recommendation however has a more specific focus and aim, and serves no interest nor has any responsibility for results. Therefore, the outcomes will have a different sort of support and – related – a different impact.

- A successful (but formal) transition arena has been *Mensenzorg*, a dialogue on the large system change in the healthcare sector (Neuteboom et al. 2009). This transition arena resulted in a transition agenda with a vision on a future system and a set of projects that support such a future system already taking place.

9.3 Community engagement (strategic)



- **Initiate a community dialogue on how to become an energy providing municipality**

Community initiative can increasingly be connected to sustainability challenges: the community has a fast response rate to societal developments, and a high degree of creativity, learning and adaptability (Hajer 2011). Problem ownership by the community, and thereby ownership for possible solutions, is essential for any process of change [1,2]. A community dialogue can bring a variety of citizens together to create such ownership and to use the knowledge and skills of individuals to accelerate the process.

Continuous engagement is difficult and time-consuming, but can be powerful if done properly [5]. It should be done on a tangible issue with sufficient impact, related to circularity, close to citizens [2]: energy. Starting from a problem (energy dependency; disruption risks) [13], a community dialogue and co-created action plan can be used to start changing the energy system and move towards an energy-providing municipality, as stated in the Haarlemmermeer sustainability program (Gemeente Haarlemmermeer 2015). Initiating such a dialogue can serve as a start for dialogues on other topics.

Such community involvement can also solve the three shortages local governments face: a shortage of legitimacy, a shortage of relevant activities, and a shortage of learning from mistakes (Hajer 2011). The shortage of legitimacy is solved by the community co-participation in the drafting of plans. By involving the community in the evaluation process, the municipal organisation is encouraged to a more open attitude. This stimulates the learning from mistakes made.

The challenge is to move from incidental to continuous community involvement over longer periods. Initiating additional community dialogues on a wider variety of themes, one after the other and inviting other citizens, creates co-ownership over municipal practices by citizens. By creating an option instead of an obligation to participate, respondents are more highly motivated [6] and thus more likely to positively contribute [1,2]. Personal contact in such dialogues again is essential [2].

In Haarlemmermeer, the Haarlemmermeer Scenario Studies already show that community engagement is on the rise (Gemeente Haarlemmermeer 2013). At the moment, people approached for this engagement often come from the same, limited group of people [10]. Engaging the wider community can release more power and triggers interest, which can at the moment be seen at Tegenstroom events around solar panels.

- The municipal government of Utrecht recently held so-called *city dialogues* with 166 citizens to draft its plan for an energy neutral city in 2050. This process is aimed at creating legitimacy for the government and ownership with citizens for arriving at an energy neutral city.^{ix}
- The municipal government of Oss has a citizen panel, to which citizens can contribute ideas and suggestions on specific themes when the municipal government makes a request.^x

^{ix} *Stadsgesprek Energie*, available at <http://www.utrecht.nl/utrechtse-energie/stadsgesprek-energie/>, visited at 15/06/2015

^x *Digitaal Burgerpanel*, available at https://www.oss.nl/web/gemeente/bestuur-en-organisatie/gemeenteraad/praat-denk-en-doe-mee/digitaal_burgerpanel.htm, visited at 15/06/2015

9.4 Regulatory support (tactical)



- **Provide regulatory support for developments around the circular economy**

The need to remove regulatory restrictions is addressed very often in the various reports analysed for this thesis. Providing more freedom in regulations is also considered of significant importance in Haarlemmermeer [6,7,8]. As removing regulations is a long-term and time-intensive process, regulatory support in the short term can stimulate circular developments.

There is a variety of views on the role of regulations in the transition to a circular economy. The present regulatory system indeed is pre-dominantly sectorial and has an economic orientation on risks (Van Eijk 2015), thereby providing barriers for business models that include multiple value creation and cross-sector co-operation. From a scientific view, the magnitude of obstructing regulations is not as large as is often perceived [4]. NGO's often call upon governments to remove regulatory barriers [6], while businesses often work around these barriers, which is easier than attempts to change them [11]. The municipal government in turn does not know which regulations are hindering [10].

Providing space in regulations on a regional level is important, as regulations practically always lag behind market developments [4,6]. Combining this with the difficulty of removing regulatory barriers on a higher institutional level, there is more to gain with active support for circular developments. The municipal organisation can provide regulatory support by easing regional procedures and providing space in regional regulations, always in accordance with the appropriate departments and related businesses. National regulations cannot be changed, but can be shut down temporarily through the *crisis- and restore law*^{xi} to provide space for experimentation [4].

To stimulate a circular economy in the long term, the need for providing temporary freedom in regulations is replaced by the need for better regulations and even deregulation (Van Eijk 2015). Less detailed and performance-based regulations can strongly stimulate circular development.

In Haarlemmermeer, the only activities which have resulted in (temporary) deregulation have been in the Schiphol Airport Region by signing Green Deals^{xii}. In many procurement processes, both within governmental organisations as regular businesses, there is still a lot to gain [5,13].

- Amsterdam researched the possibility for a 'sustainable regulation-free zone' and concluded that in the energy field, very few regulations could actually be withdrawn or simplified. Amsterdam is now looking into the possibility of a 'cooperation zone', where barriers for exchanging resources for companies are removed (Van de Wiel & De Bruijn 2012).
- The Merwede-Vierhavens in Rotterdam is a regulatory free zone, with ambitious aims within a strict sustainability framework. This free zone guides development towards innovative manufacturing industries that create new added value (Rotmans 2012).

^{xi} *Nationale Crisis- en Herstelwet*, available at http://wetten.overheid.nl/BWBR0027431/geldigheidsdatum_15-06-2015, visited at 05/05/2015

^{xii} *Green Deal Circulair Inkopen*, available at <http://www.mvonderland.nl/green-deal-circulair-inkopen/green-deal>, visited at 20/05/2015

9.5 Education involvement (tactical)



- **Involve youth in the transition towards a regional circular society**

To start moving towards a regional circular society, it is important to increase awareness of the opportunities a regional circular society offers. Youth, with an open learning attitude, are the ideal messengers for a circular society. Education institutions are a suited means to – via youth – on the one hand increase knowledge within the community and on the other hand create ownership for the transition process by making youth develop circular projects for real-life municipal cases.

Education institutions can play two important roles in involving youth: increasing knowledge and skills on the one hand, and involving students in projects on the other hand. Guiding circular thinking at school helps to determine youth's worldview [5,9]; education in system's thinking and learning from nature provides students with new ways of looking at the world (Joustra 2012) and the main skill relevant in the future is having an open attitude to enable continuous learning [2,11]. Involving youth in projects around circularity builds bridges between schools and businesses, with youth being able to learn from real-life cases instead of theoretical knowledge and businesses being able to generate innovative ideas with very limited resources. Because of the large number of primary school and secondary school students in Haarlemmermeer, the potential impact is significant [10].

In Haarlemmermeer, the nature and environmental centre NMCX plays a key role in involving youth through education institutions [14]. NMCX has recently developed the website Groene Kapstok^{xiii} (in English: green peg), which aims to provide a variety of tools and good practices for schools to further integrate sustainability issues in the areas Campus, Community and Curriculum. This easy-accessible local approach can create tangible results for the local environment, and is preferred over (inter)national concepts like EcoSchools and UNESCO-schools, where schools account to far-away institutions. Within the Groene Kapstok program, NMCX also brings together schools and businesses for the development of regional educational content and constructs programs for improving school operations like energy, catering etc. The present-day structure is received very well by both schools and other local stakeholders, and can be strengthened for increased effects [14].

There are some frontrunner schools in Haarlemmermeer that are integrating sustainability to a large extent. One primary school (OBS De Wilgen) actively involved parents in developing its sustainability policy. Haarlemmermeer holds one EcoSchool (OBS De Ontdekking) and one Technasium (Kaj Munk College). Kaj Munk also participates in the Sustainable Chain Gang network and is already involved in circularity projects across Haarlemmermeer. Parent participation at these schools has increased significantly since the increased focus on sustainability [14].

Strengthening the Groene Kapstok program and framing the regional circular society with the subdivisions in water, energy and materials as a future vision can strengthen school involvement with this vision, and thereby youth involvement with the regional circular society. New connections among schools and between schools and businesses can be made in order to involve more youth in real-life projects around the circular economy, in turn leading to increased parent participation, increased outreach and increased societal involvement for the transition.

^{xiii} *De Groene Kapstok | Over ons*, available at <http://www.groenekapstok.nl/over-ons>, visited at 16/06/2015

9.6 Material pooling (tactical)



- **Develop a material trading place to discover opportunities for material pooling**

Material pooling is the core of the circular economy (Ellen MacArthur Foundation 2013a). As material pooling only takes place structurally when there is transparency in material flows [3,6], a material trading place is required. This can lead to reduced waste, to a reduced need for raw materials [12] and to new business opportunities [6]. Flows can be initiated from both the supply and the demand side: stakeholders can have a certain waste flow (e.g. CO₂ or manure), or can generate materials (e.g. growing agricultural materials at Schiphol grass areas) [12]. Important in material pooling is that there is a business model behind the trading place to retain activity in the long term [4].

At the moment, a material trading place does not exist in Haarlemmermeer, and the scale of material pooling in Haarlemmermeer is limited [11]. A recent report on data sharing in the bio based economy for Amsterdam and Haarlemmermeer showed however that stakeholders are reluctant to share data, as businesses perceive this more often as a risk than as an opportunity. First movers are afraid to be disadvantaged because not all stakeholders will participate, despite their initial positive attitude on such a trading place (Schouten & Van Duin 2014). For the implementation, it is therefore recommended to create a group of frontrunners large enough to start the exchange process themselves, others being able to join in at a later stage.

In such a dialogue, the co-operation with waste processors and other regions nearby is essential for success. One of the difficulties in Haarlemmermeer is the agreement between the municipality and the Afval Energie Bedrijf (in English: Waste Energy Company) in Amsterdam, which obliges the municipality to deliver a certain amount of waste. Waste reduction leads to a less optimal burning process in the AEB facility, and consequently leads to fines for Haarlemmermeer [9]. There are also options for increased re-use within Haarlemmermeer, such as the initiative by Waste Transformers to recover materials from their biomass waste (nitrates, phosphates) and transform the remaining waste into energy^{xiv}. The unique element of its business model is that stakeholders themselves do the physical transformation. The recovered materials are re-used locally for production processes.

To increase regional material cycling, a common dialogue with a large group of relevant stakeholders in the region can lead to identification of the split incentives and the development of directions for structural solutions. A clear common vision of a circular society is essential for stakeholders to feel ownership for their part of the solution. High-level cascading of materials (Ellen MacArthur Foundation 2013a) should be key in such a dialogue.

- In Denmark, the Industrial Symbiosis Park in Kalundborg is an example of coupling material flows and re-using these on a structural basis. Continuous knowledge exchange between the stakeholders is vital [3]. The positive impact of Kalundborg on both the environment and the economy is substantial (Jacobsen 2006).
- In Arizona, the RISN system brings knowledge on the waste flows from 28 municipal stakeholders together in order to improve the local efficiency of material reuse [8].

^{xiv} *The Waste Transformers | Our Technologies*, available at http://www.thewastetransformers.com/?page_id=1182, visited at 16/06/2015

9.7 Demonstration projects (operational)



- **Make Haarlemmermeer a *living lab* for projects around the circular economy**

Demonstration projects, or transition experiments, are vital in the transition to a circular society as these create visibility to all participants in the transition process [1,5]. In Haarlemmermeer, over one hundred sustainability initiatives have been developed over the last years (Acceleration Chamber Haarlemmermeer 2014), of which quite some have to do with circularity. In the sustainability program for 2015-2018, project areas have been defined, as discussed in section 1.3. The living lab concept, increasingly being used as a term to practice innovations in real-life situations, can create a renewed positive vibe around circular projects and also put emphasis on learning efforts.

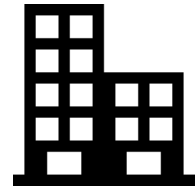
Nearly all stakeholders and reports address the importance of demonstration projects, yet few continue on what these demonstration projects should look like. Important to realise is that local projects tend to have more impact than national projects due to the limited scope they have and the structural change they are able to create [7]. A disadvantage of demonstration projects is that these often only facilitate frontrunner activities [2]: when dividing ambitious goals into small, tangible sub goals and sub activities, more entrepreneurs and SMEs are able to contribute [9]. As a precondition, these demonstration projects require proper regulatory, financial and spacious perspective [10].

In Haarlemmermeer, there are already quite some demonstration projects aimed at locally closing material loops. Most of the 100 initiatives are however not interconnected, and thereby lack the added value of mutual development [8]. The best known project at the moment is the cultivation of *Miscanthus* grass, which can be used as a raw material for many products. Also, the cradle-to-cradle area Park 20|20 closes material loops locally. Meermaker, the Haarlemmermeer investment fund, already co-finances sustainable initiatives, with a maximum of €500.000 and 40% per project [9]. Also, the municipality provides €1.2 million per year for stimulating these projects.

In a living lab, the dynamics around projects are more important than the projects itself. It is on these dynamics that governmental steering can take place. Knowledge exchange around demonstration projects is essential for enhanced development of other projects and the area as a whole [5,7], and sharing knowledge gained actively in an open environment is a means to do so [8]. The municipal role can be to initiate sharing these learnings through facilitation of analysis and presentation. An option might be to oblige new projects to share their learnings in an open source environment. This can lead to new connections among businesses, and external networks and knowledge institutions can join in the learning process by adding their experiences. These dynamics, including an open attitude for feedback and learning from mistakes [8], are essential for a successful living lab.

- The Buiksloterham area in Amsterdam has the objective of becoming highly circular. A consortium of businesses is involved, including Metabolic, Circle Economy, TNO, WUR, Deltares and ECN. Buiksloterham is part of the international Adaptive Circular Cities project. The *living lab* is mentioned in the Circular Metropole strategy (Gemeente Amsterdam 2014).
- In Friesland, new circular initiatives are starting up under the banner of *Circulair Friesland*. The initiative was taken by business, but now involves a wide variety of stakeholders. Acceleration of the process takes place by an external organisation, in this case Urgenda [7].

9.8 Launching customer (operational)



- **Transform the municipal organisation to a launching customer for circular business**

Circular business models exist, but need launching customers for testing, and thus to prove the model works in practice. A municipal organisation as a launching customer for circular business shows that the municipality is serious in its circular ambition [4] and assists circular entrepreneurs in developing their business and proving circular business models are possible [9]. Although there are already many off-the-shelf circular business models [5], entrepreneurs require testing and a certain demand to kick off their business [6].

A governmental organisation, opting for performance-based purchases, stimulates the regional development of the circular economy (Schoolderman et al. 2014). Through changing procurement processes and steering on conditions, the dynamics and incentives for businesses change. Integration of circular business models can also change the way governmental organisations operate [8,13].

Circular business models by a governmental organisation not only show its ambition and assist entrepreneurs, but also provide the local government with a story around its daily practices. This story, if related to the physical environment, can inspire all visitors in also changing to circular business models. The indirect impact of such circular practices through storytelling on businesses and citizens is impossible to measure, but can be enormous when the storyline is developed properly and matches with the visitors' perception on sustainability issues [2,8].

In the municipal organisation, circular procurement is not sufficiently integrated, partially due to different incentives between departments and a low priority of circularity in procurement [10]. To emphasize her frontrunner role, Haarlemmermeer can sign the Green Deal Circular Purchasing, following national and provincial governments and Utrecht as the first municipal government. The Green Deal requires participants to perform two pilots around circular procurement before the end of 2016, receiving support in the process and sharing knowledge gained with other participants^{xv}

For Haarlemmermeer, there is a variety of options next to signing the Green Deal. Circular procurement can be supported through a continuous preference for local and circular partners in procurement departments of the municipal organisation [10]. Also the new city hall, which will be developed in the upcoming years, could be made a showcase for circularity, both stimulating circular businesses in Haarlemmermeer and providing a physical image of what future buildings in a regional circular society can look like. This also greatly supports the municipal circular storyline.

- The town of Brummen has constructed the first cradle-to-cradle city hall of the Netherlands, of which the materials can be re-used completely after decommissioning^{xvi}. As Brummen is a shrinkage town, the construction has been done with a low budget.
- Amsterdam intends to integrate circular procurement in all its procurement processes in the next years (Gemeente Amsterdam 2014), moving past split incentives between and individual contracts of departments.

^{xv} *Green Deal Circulair Inkopen*, available at <http://www.mvonederland.nl/green-deal-circulair-inkopen/green-deal>, visited at 20/05/2015

^{xvi} *Gemeentehuis Brummen*, available at <http://turntoo.com/projecten/testproject/>, visited at 08/06/2015

9.9 Circularity indicators (reflexive)



- **Develop circularity indicators to guide direction and monitor progress**

One of the core questions around the circular economy is how to measure circularity [4]. A transition movement can start with a direction, in this case the decoupling of material use and economic growth, but at a certain moment, indicators are required to monitor progress and provide direction on where to go next [1,6]. A good set of indicators moves beyond materials and looks for a bottom-line positive impact on society [8], at the same time translating these complex themes to all stakeholders, also the less informed ones (Koenders & Vries 2015).

At the moment, there is one set of indicators around the circular economy, which is developed for a product level (Ellen MacArthur Foundation & Granta 2015; explained in detail below). No circularity indicators for a process level or a business level are known at this point. Present-day knowledge exchange and critical assessment around circular activities is often limited due to a mismatch in themes, interests and mutual understanding [2]. Stakeholders in Haarlemmermeer are perceived to be open for learning only up to a certain extent [5,10]. A good set of indicators can ease assessment and comparison, thereby stimulating the willingness for knowledge exchange.

Any index for circular performance should be simple to use, based on a synergy of practical and scientific knowledge, transparent about weighing and limitations, and data should be open for verification (Kok et al. 2013). Indicators can both be quantitative, which makes comparison easier [10], or qualitative through intersubjective review to increase understanding of the dynamics [4]. Indicators can be used best in post-process evaluation instead of in pre-process design, remaining flexible for improvements and able to stimulate knowledge exchange through providing overview.

The lack of indicators for circularity in Haarlemmermeer can be traced back to the lack of meaning behind regional circularity [10]. Haarlemmermeer already developed nineteen indicators in the *Ruimte voor Duurzaamheid* program, but these are hard to build upon as these are often output-structured (e.g. carbon emissions, number of electric vehicles), instead of performing a system assessment (Gemeente Haarlemmermeer 2014). It is recommended to develop indicators for the regional environment in Haarlemmermeer specifically, in co-operation with relevant stakeholders that have to work with the indicators. This development can be one of the roles of the *design lab* (section 10.3). Contact with other local indicator developments is important to share experiences and perform a combined review of the multiple sets of indicators afterwards to learn from one another.

- The Ellen MacArthur Foundation developed seven indicators for a circular economy on a product level. The main indicator is the Material Circularity Indicator, measuring the size of restorative material flows. There are four complementary risk indicators – material price variation, material supply chain risks, material scarcity and toxicity – and two complementary impact indicators – energy use and CO₂ emissions (Ellen MacArthur Foundation & Granta 2015).
- Some KPI's for a circular economy, based on the principles of the power of cycli, have been developed (Schoolderman et al. 2014, p.42-48). Also, some KPI's based on local re-use of resources have been developed for Amsterdam (Zwijenburg & Bosman 2014, p.74).

9.10 Circular Business Hub (reflexive)



- **Develop a circular business hub to stimulate innovation and knowledge development**

Bringing businesses working on the same issues physically together can strongly stimulate innovation [3]: there are plenty of examples around the globe. As the most obvious example is Silicon Valley, Haarlemmermeer often phrases that it wants to become “the Silicon Valley of sustainability” [10]. A circular business hub could be a physical area where a variety of stakeholders work on the circular economy. There should be a strong focus on knowledge exchange and innovation [4], and in order to practice circularity, local material pooling should be key [8]. Such a business hub can have an important role in the reflexive phase, as the environment and attitude are focused on learning and continuous development [4,8].

Such a circular business hub can bring together a variety of functions to stimulate circularity, combining the presence of existing businesses [11], start-ups [4,8] and a variety of education institutions [13]. Supporting existing SMEs towards new business models can also take place in the hub [5,6], both by providing a launching customer in the construction of the physical infrastructure as in the learning infrastructure after the construction phase has finished. Such a business hub can most strongly be initiated in a public-private partnership between the government and a few frontrunner businesses [3]. Changing partnerships with education institutions, being secondary schools, medium level education, higher level education and universities, can provide the required additional knowledge can lead to optimal development of the hub.

The role of an incubator around circular economy businesses is hard to determine. Despite the prominent attention for start-ups from both a European perspective (e.g. Climate KIC) and a Dutch national government perspective (e.g. Startup Delta), an incubator to support these start-ups does not function well automatically. In the Netherlands, there are some successful incubators (e.g. YES!Delft, Impact Hub Amsterdam), but an important precondition of such successful incubators is the strong presence of young, highly-educated people [5,11], which does not fit Haarlemmermeer. This can be seen in the relatively minor performance of the present-day incubator ENGINN [11]. Transforming ENGINN towards a connector between circular initiatives [9] and a supporter for new SME business models [10] in a circular business hub might add more value to circular developments in Haarlemmermeer.

In Haarlemmermeer, efforts are already made to create such a circular business hub in the to-be-developed Schiphol Trade Park, which could become an office park with businesses around the circular economy [5]. Also five farmhouses will be constructed at the area around Rijnlanderweg to showcase the local circular economy. One of these farmhouses will be around entrepreneurship; the other four will be around each a different material flow: plastic, paper, metal and textile.

Development of Schiphol Trade Park and the farmhouses in this way can become the start of a circular business hub in Haarlemmermeer. A combination with the provision of space for demonstration projects within Haarlemmermeer attracts additional circular businesses that perceive business opportunities and possibly also knowledge institutions, increasing interconnectedness and thereby further strengthening knowledge development and knowledge exchange around the circular economy.

9.11 Conclusion & discussion

The Haarlemmermeer municipality has outlined its aim to move towards a regional circular society. As many dynamics in such a society are different from the present-day linear system, the process of change is considered to be a transition. Nine activities have been outlined to start this transition process, spread over four activity types, based on present-day recommendations and expert interviews. Most of these activities are supported by examples from other regions.

- Initiate a *design lab* towards a Regional Circular Society
- Initiate a community dialogue on how to become an energy-providing municipality
- Provide regulatory support to stimulate developments around the circular economy
- Involve youth in the transition towards a regional circular society
- Develop a material trading place to discover opportunities for material pooling
- Make Haarlemmermeer a *living lab* for projects around the circular economy
- Transform the municipal organisation to a launching customer for circular business
- Develop circularity indicators to guide direction and monitor progress
- Develop a circular business hub to stimulate innovation and knowledge development

This set of activities encompasses most of the recommendations which are presented in chapter 4. The analysis of these activities using the frameworks from chapters 5, 6 and 7 shows that an intervention takes place at various levels in the system, up to the development of aims for the system (level 3). From a transition perspective, all activity types are addressed, a transition arena is included, and all stakeholder groups are addressed multiple times. From the innovation perspective, all five functions are addressed, most functions more than once. The analysis is shown in appendix IX.

As discussed in the introduction of this chapter, most activities can be deployed in parallel as they do not build upon each other and often require different stakeholders. Many of the activities are however interconnected and can strengthen each other. To avoid pressure on the municipal organisation, and to avoid doing too much at the same time, other organisations can be involved to develop specific activities. A driving and coordinating body can help to keep focus and monitor progress; such a body can be developed as a follow-up of the *design lab*.

Many of the activities are interconnected and strengthen each other.

This transition process is influenced by a number of landscape factors: the increased societal initiative; the developments around the circular economy concept; the culture in Haarlemmermeer; the local availability of resources; higher governmental and political institutions; and interdependency with other regions. These landscape factors, and their developments, are important to take into account when designing activities towards the regional circular society. By avoiding negative landscape factors and using the other landscape factors actively in a positive way in the implementation process of the nine activities, this is likely to accelerate the transition process.

The activities have been developed based on recommendations from circular economy reporting, literature and expert opinions. With half of the experts from the Haarlemmermeer area and half of the experts from the circular economy field, possible differences in view between these two stakeholder groups have been balanced for. Although the transition activity types were said to be understood by all interviewees, the categorization of the recommendations across the interviewees was very inconsistent. Most recommendations were placed in all four activity types more than once.

This was however strongly related to the roles of the organisations of the interviewees, for example Haarlemmermeer municipality categorizing many recommendations as tactical, and Urgenda and Schiphol categorizing many activities as operational.

There is one main issue throughout all recommendations that still lacks: communication. A strategic approach of communication and marketing of the circular society can play an important role in accelerating the process, as stakeholders are then able to see their potential in participating. It is hard to determine what a specific recommendation on communication should look like, however, a good communication strategy can bring all other activities together and thereby prove essential in bringing the regional circular society closer.

A second issue which is perceived to be lacking is policy development. This has been addressed in some interviews. The nine activities are not intended to form policy or institutionalised structures, but are meant as guidelines for practical solutions. Interestingly, none of the recommendations from the reports in chapter 4 has come up with policy development as an up-front activity. In the context of this thesis, policy is considered a tool to support the nine activities.

It is interesting to note that the recommendations formulated in this chapter overlap with the circular economy plan for Almere, with a focus on waste streams (Doorn et al. 2015), the circular roadmap for the city of Utrecht, with a focus on material pooling (Cramer 2014), the plan Amsterdam Circular Metropolis, with a focus on energy neutrality and resource cycling (Gemeente Amsterdam 2014), the Manifesto for a Circular City in Amsterdam, with a focus on a co-operation (Koenders & Vries 2015) and the recommendations for municipal organisations by Circle Economy^{xvii}. Also, the recommendations address all seven focus areas of the RACE coalition (text box 3.1). The differences between these recommendations can provide alternative perspectives that are also interesting when considering implementation.

The overlap with other reports confirms that these recommendations have the right focus.

The nine activities also have a significant overlap with the closing report of Haarlemmermeer Beyond Sustainability (Buch et al. 2014). First, both have a focus on innovation: in HBS, this was the aim of the *regional circular innovation system*; in this study, both the living lab concept and the circular business hub aim to stimulate innovative activities. Second, both focus on knowledge exchange: in HBS, the development of a Knowledge Management System is suggested, where this thesis suggests the development of indicators and a dynamic project development environment with an open attitude for learning. Third, the management of the transition process is addressed. The HBS report introduces an Adaptive Management System, but does not explain in any depth how such a management system could work. This study suggests a coordinating role by the municipal government, with businesses and citizens taking initiative, and the government facilitating the *design lab* and stimulating knowledge exchange. Fourth, the space for experimentation from HBS returns in the *living lab* in this study. Only the operations from the HBS report, implying funding and staffing by the municipal organisation, are not addressed, as this is related to the implementation of the activities and thereby outside this study's scope. Looking at the larger picture, the significant overlap between two studies with a different methodology underlines the need for action in these areas.

^{xvii} *How Governments are key for a circular economy*, available at <http://www.circle-economy.com/news/governments-key-circular-economy/>, visited at 30/03/2015

Chapter 10

Conclusion



Park Café Groen is the centre of Park 20|20. The café is built in such a way that after deconstruction, all materials can be re-used. All the food at Park Café Groen is locally grown, and residues are used locally as compost. The café is thereby a great example of a business that works according to the principles of the regional circular society.

In this chapter

A regional circular society moves beyond individual projects and recommendations towards a system that structurally re-uses energy, water and materials. After starting these activities, it is recommended to analyse the system from time to time to see which activities have worked, which activities have not worked and which new activities are relevant to develop.

Haarlemmermeer intends to transform to a regional circular society, closing loops in materials, energy and water. This thesis uses a methodology in which any step follows upon the previous ones, leading to the development of nine activities to start the transition process towards a regional circular society in chapter 9. These nine activities provide the answer to the research question:

- Which recommendations can be provided for transition activities towards a regional circular society?

It is important to note that these activities have been developed for Haarlemmermeer, built upon the regional situation with regional stakeholders being 50% of the interviewees. Are these recommendations to be used in a different region, a careful assessment should take place with stakeholders from the designated region to assess which recommendations remain relevant and which recommendations can better be replaced or need adjustment.

When aiming for a regional circular society, such a society should be able to move beyond individual activities and projects towards a structured system in which material re-use is optimized and energy, material and water cycles are closed locally as far as possible and desirable. Most activities in this study provide guidance towards such a structured system. Important in such a system is a clear division of roles among the participating stakeholders, who take up the various challenges and are able to seize opportunities in their personal areas of competence. It is this clear division of roles that

A regional circular society should be able to move beyond individual activities and projects towards a structured system in which material re-use is optimized and energy, material and water cycles are closed locally as far as possible and desirable.

requires the most emphasis in the next few years, to avoid the municipal organisation being over-responsible and businesses and society not taking sufficient action. All recommendations have in common that they stimulate activities by and cooperation between a diversity of stakeholders.

This thesis also points out that there is a variety in the concept definition of a circular economy and a circular society, which leads to suggestions for follow-up research. The most important one seems quite clear: what does a regional application of circular economy principles mean, and how does this differ per region? Other, related questions follow. What material cycles can be closed on a regional scale? What is the influence on the interconnectedness of regions in a continuously globalizing world, when regionally closing material cycles? What are side effects of closing material cycles regionally, to employment rates, to economic growth, to quality of life, and how can these developments be measured? Which social and psychological aspects stimulate a circular economy?

Any transition is a continuous process of change, as the vision of the desired future shifts when progress towards that future takes place. It is important to realize these nine activities are intended for starting the transition process; it is yet unclear which activities will be required when some developments have taken place. As some of these activities create only long-term gain, evaluation in the short term is less useful. A study in some years can combine the findings of this study with implementation experiences, and develop other activities that better suit the situation at that time.

Appendices



The magic of sunrises is always the unexpected beauty. Such unexpected beauty is always present, however only to those who are open to receive this beauty. The future of Haarlemmermeer can be beautiful, but it requires an open attitude at unexpected moments to be able to access the potential of this beauty. This photo shows a sunrise at Schiphol airport.

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Appendix I | Reference list & credits

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Chapter 1	Fountain	Kees van de Veer
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Appendices	Sunrise	Lydia Lucke

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^{xix} <https://www.pinterest.com/pin/362258363746097385/>, retrieved at 28/06/2015

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Appendix II | Previous studies Haarlemmermeer

This appendix provides a short overview of previously performed studies related to sustainable development.

Haarlemmermeer is a large municipality in the West of the Netherlands, with a little over 160.000 inhabitants. The municipality has been focusing on sustainability for some years now: In the period 2010-2014, Haarlemmermeer has been running its sustainability program *Ruimte voor Duurzaamheid*, within which a project-based approach led to great success (Gemeente Haarlemmermeer 2012b). However, these projects are dispersed throughout the community and lack formal coordination. As a result, there is an inability to expand from the knowledge gained (Buch et al. 2014). Also, in 2012 the Haarlemmermeer developed a Structural Vision 2030, in which sustainability plays an important role (Gemeente Haarlemmermeer 2012a).

There are four relevant studies which have been performed the last years. First, a Sustainable Area Development study has been done by Fonz Dekkers in 2010 in order to develop an integrated sustainability vision and feasible chances for specific projects. Second, the Sustainable Haarlemmermeer Scenario Study has provided foundational elements for sustainability in Haarlemmermeer. Third, the Better Airport Regions Project delivers guidelines for integrating airports within the municipal surroundings. Fourth, and most recent, a roadmap for sustainable area development has been developed as a Master thesis by Jaap van der Veen.

Sustainable Area Development

In order to deliver an integrated sustainable vision for the municipality of Haarlemmermeer, including the feasible chances, opportunities and potential for specific planned project, a Master thesis study was done by Fonz Dekkers in 2010. The study determined twelve principles for sustainable area development of the Haarlemmermeer. Second, over twenty technologies have been analysed on their technological performance, ecological benefits, financial feasibility and social acceptance. The main conclusion is that the implementation of these technologies is very well possible, but needs a structured strategy in order to achieve (Dekkers 2009).

Better Airport Regions

Haarlemmermeer is also participating in the Better Airport Regions Research Project, which aims to deliver guidelines for decision-makers in policy, industry and academia, to provide a conceptual model of integration between airports and cities and to produce transformation scenarios to discuss on the future of airport regions. Amsterdam Airport Schiphol is one of the important pilot areas for the BAR project. As the final report is classified, this report cannot be used as input for this thesis.

Sustainable Haarlemmermeer Scenarios Study

In 2012/2013, a Sustainable Haarlemmermeer Scenarios Study has been done (Gemeente Haarlemmermeer 2013). The developed scenarios have four foundational elements: (1) respect for opportunities for future generations; (2) harmony between social, ecological and economic dimensions of development; (3) resiliency, so that future uncertainties can be addressed; and (4) the pursuit of a value-based quality of life. The core principle of the scenarios is *room to manoeuvre*, deduced from three components: the current situation (status quo in municipality), values (motivation for actions) and critical uncertainties (aviation-airport; climate-water and governance-society). The infographic (in Dutch) is shown in figure II.1.

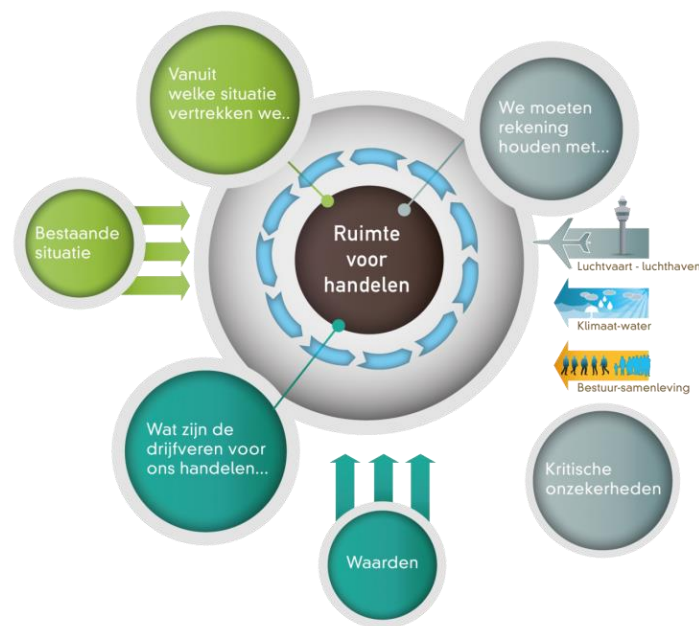


Figure II.1 | *Room to manoeuvre* in the Haarlemmermeer Sustainable Scenario Studies (in Dutch)

Sustainable Area Development

In order to construct Schiphol Trade Park in the most sustainable way, a roadmap was developed to sustainable area development through a Master thesis study by Jaap van der Veen in the period 2013-2015 (Van der Veen 2015). Schiphol Trade Park is to be one of the circular hotspots to be developed in the Haarlemmermeer. In this study, an analysis is performed of multiple transition frameworks models and guiding principles (Hassi et al. 2009; Vergragt & Quist 2011; McFeeley 1996; Ingram & Hamilton 2014), and combined these into one coherent roadmap. This roadmap is used to develop a strategy for sustainable area development for Schiphol Trade Park, a newly built office park in Haarlemmermeer. The roadmap has also been implicitly used to develop the Haarlemmermeer sustainability program 2015-2018 (Gemeente Haarlemmermeer 2015).

The roadmap can be seen in two parts. The first part (steps 1 – 6) of the roadmap can be described as the ‘preparation’-process, the second part (steps 7 – 11) as the ‘implementation’-process. With regard to the second part, this only provides a general outline of which processes return in the implementation phase. It is very hard to specify this for the transition to a regional circular society, as this is a dynamic, multi-level process, and not a linear one. Step eleven (end-of-life) also does not apply to a regional circular society. However, the first half of the roadmap provides important insights in how a transition process is designed, and stakeholders in Haarlemmermeer are familiar with these steps (Van der Veen 2015). The roadmap is displayed in figure II.2.

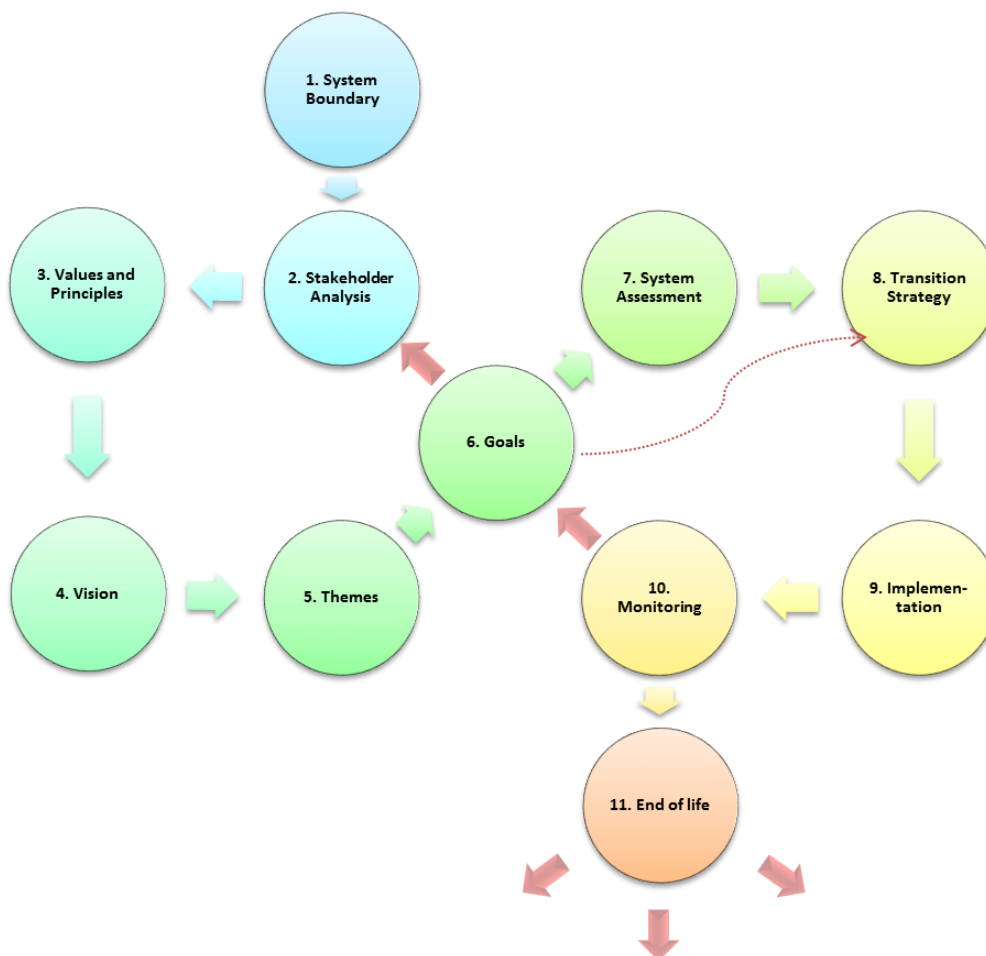


Figure II.2 Roadmap to sustainable area development (Van der Veen 2015)

Appendix III | Sustainability concepts

In this appendix, an overview is provided of the various sustainability concepts. The development of these concepts throughout the years has played a role in the development of 'circular economy'.

Sustainable Development

In 1972, *Limits to Growth* (Meadows, 1972) provided a first response to the continuous economic growth and resource extraction, and gave insight in the problems that economic development had caused. Following *Limits to Growth*, the United Nations acknowledged the urgency of addressing the link between economy and environment. In 1987, *Our Common Future* (also called the Brundtland report) was published (World Commission on Environment and Development 1987), which provided the first definition of sustainable development: *development which meets the need of the current generation without compromising the needs of future generations*.

Regenerative design

In the 1970's, landscape architecture students were challenged to envision a community in which activities were based on the value of living within the limits of the available resources without environmental degradation (Lyle 1994). This research developed the concept of *regenerative design*: processes within all systems renew, restore, revitalize or regenerate their own sources of energy and materials through the integration of natural processes, community action and human behavior^{xx}. Developing these local communities as independent, regenerative systems without net material input is an important element of circular economy.

Industrial ecology

Frosch & Gallopoulos (1989) made the explicit analogy between biological ecology and industry from the perception that human economic activity is causing unacceptable changes in environmental systems. This idea was built upon by Allenby (Graedel & Allenby 1998), who further developed the concept of industrial ecology. The systems-oriented concept suggests that industrial design and manufacturing processes cannot be performed in isolation. Industrial ecology views economic systems in interaction with their surroundings in order to seek optimization of the total industrial materials cycle from virgin material to ultimate disposal (Graedel 2000). The analogy between the industrial and the biological ecosystem is not perfect, but much could be gained if the industrial system were to mimic the best features of the biological analogy. Closing resource loops is an important element in circular economy thinking; industrial ecology in that way provides a specific contribution to the concept.

Performance economy

In addition to the concept of industrial ecology, the *Performance Economy* is an economy where one pays for performance of a product. Such an economy produces higher wealth and economic growth with considerably lower resource consumption; promotes business models that focus on the performance of goods and services; and creates more manual and skilled jobs with reduced resource consumption (Stahel 2006). The transition from paying for ownership to paying for performance (or service) is an important aspect of business models in a circular economy.

^{xx} *Regenerative Design Group*, available at <http://www.regenerativedesigngroup.com/home>, visited at 03/02/2015

Cradle to cradle

The *cradle to cradle* model (McDonough & Braungart 2002) reframes design as a beneficial, regenerative force, focused on designing out waste. It expands the definition of design quality to include positive effects on economic, ecological and social health. Principles for materials and manufacturing processes within cradle to cradle are material health; material reutilization; renewable energy; water stewardship and social fairness^{xxi}. The design principles of cradle to cradle are almost identical to those of circular economy.

Biomimicry

Biomimicry, developed in the 2000's, seeks sustainable solutions to human challenges by imitating nature's designs and processes for solutions in a human context: animals, plants and microbes design all waste as food. Biomimicry is used primarily as a design approach, not only for reducing waste, but also for improving performance (Benyus 1997). Biomimicry does not explicitly return in circular economy thinking, however the concept inspires many in designing for a circular economy.

Bio based Economy

A *bio based economy* is an economy that runs on biomass as its primary resource, also using biomass for non-food applications. Also ecosystem services and social innovation in multi-stakeholder practices by farmers and SMEs can be seen as part of a bio based economy (Schmid et al. 2012). Important aspects of a bio based economy are the relations between food security, food safety, 'green' energy production, the development of sustainable non-food products for industry, to the processes of waste management, recycling and disposal (Van Dam et al. 2005). A bio based economy provides elements that can also be used in circular economy thinking, as biomass is a biological material in the circular economy loops.

Green Economy

The *Green economy* is an economy, defined by UNEP, that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities (UNEP 2011b). In the present economic crisis, countries are stimulated to 'green' their economies, whilst the definition of 'greening' still proves vague and a specific definition does not exist (Brand 2012). The explicit link between economic and environmental performance however returns in circular economy thinking.

Blue Economy

The *Blue Economy* is an economic philosophy to provide handholds on solving today's crises. In a blue economy, business models shift towards multiple value creation; natural systems cascade nutrients and eliminate waste; diversity is promoted over standardization; and nature works with what is locally available, both in resources, culture and traditions (Pauli 2010). The core of the Blue Economy is the shift from sufficiency to abundance, in contrast with the present economic model that relies on scarcity as a basis for production and consumption (Pauli 2010). Blue economy thinking is a holistic, problem-solving approach by intervening at systemic levels. The core principles of the blue economy (multiple value creation, diversity, nutrient abundance) also return in circular economy thinking.

^{xxi} *Cradle to Cradle Certification Overview*, available at <http://www.mbdc.com/cradle-to-cradle/cradle-to-cradle-certified-program/certification-overview/>, accessed at 30/01/2015

Appendix IV | System intervention analysis

In this appendix, the system intervention analysis is performed. The method for this analysis is described in chapter 2. The results of this analysis are discussed in chapter 5. In this appendix, the recommendations are – per section, report or article – shown in a table. Each recommendation is categorized in a step of system intervention. Below each table, the argumentation for the categorization is provided.

2006 China (general)	12	11	10	9	8	7	6	5	4	3	2	1
1) Building a legal system								X				
2) Readjusting industrial structure	X	X	X				X					
3) Guiding development through policy	X	X						X				
4) Using economic means to create incentive	X	X			X							
5) Developing applicable technologies	X	X										
6) Quickening demo projects to push CE	X											
7) Carrying out education				X			X					

Explanation China (Hongchun, 2006), p.110-114

Zhou describes the transition to the circular economy in China. Based on the steps that have been made by the government, and also on the barriers that are still present, the article formulates seven recommendations to accelerate the transition.

- 1) *Building a legal system for a circular economy* describes an overarching framework, and enhances more than just changing taxes. Therefore, this can be seen as changing the rules of the system (level 5). The article however remains vague on how to do so.
- 2) *Readjusting the industrial structure, increasing high-tech innovation and information exchange*, can be related to changing the information infrastructure (level 6), but also the infrastructure of flows (level 10), the sizes of buffers (level 11) and the sizes of flows (level 12).
- 3) *Establishing a stable policy environment* again can be seen as changing the rules of the system (level 5), with stimulating policies adjusting the sizes of stocks (level 11) and taxations as constants (level 12).
- 4) *Using economic means to create incentive through a strict 'polluter pays'-principle* regards investment policies as the sizes of buffers (level 11) and taxations as constants (level 12). Also, a strict 'polluter pays'-principle can relate to the strength of negative feedback loops (level 8).
- 5) *Developing applicable technologies through research and improving design technology* can be seen as changing the sizes of flows of products and materials (level 12), and changing business models as changing the sizes of buffers (level 11).
- 6) *The development of demonstration projects in key regions and key industries* can be seen as new constants in the system (level 12), which do not address information exchange itself.
- 7) Finally, *the publicity and education can aid leaders, enterprises and institutions to make people better aware of the importance of a circular economy*. Increasing this education and awareness can influence the structure of information flows (level 6) and the length of delays (level 9), due to greater awareness of the need for circularity through this education.

2012 Aldersgate (general)	12	11	10	9	8	7	6	5	4	3	2	1
1) Creating business models for a CE	X	X										
2) Creating consumption for a CE	X											
3) Design for a CE	X											
4) Create infrastructure for a CE			X									
5) Create policy frameworks for a CE								X				
6) Create procurement for a CE				X	X							
7) Create skills for a CE									X			
8) Transparency for a CE							X					

Explanation Aldersgate (2012), p.18-19

The Aldersgate report addresses opportunities for a circular economy, as well as enablers, barriers and timescales. In the chapter on Exploration, eight steps in which exploration towards a circular economy is required, are described. These steps can be read as recommendations for a transition. The report describes what should happen in each step, but does not give any information on how this should happen.

- 1) *Creation of new business models* changes the size of the buffers – businesses – relative to their flows (level 11), and also the sizes of flows (level 12).
- 2) *Creating consumption for a circular economy* influences the size of the flows (level 12).
- 3) *Design for a circular economy* influences the sizes of material flows (level 12), but also logistics as the infrastructure (level 10).
- 4) *Infrastructure for a circular economy* also addresses changes in the structure of the flows (level 10).
- 5) *Policy frameworks for a circular economy* are – depending on their completeness – aimed at changing the rules of the system (level 5).
- 6) With *procurement for a circular economy*, the Aldersgate Group attempts to strengthen negative feedback loops (level 8) and shorten the length of delays (levels 9).
- 7) The *search for the right skills, required for a circular economy*, attempts to influence the change and self-evolution of the system (level 4).
- 8) *Transparency for a circular economy* has to do with the availability of information (level 6).

2014 Ellen MacArthur (proof of concept)	12	11	10	9	8	7	6	5	4	3	2	1
1) Creating a list of high-quality materials	X											
2) Define mechanisms for value creation improvement	X	X										
3) Identify support providers in the system	X	X					X					
4) Agree on business models to allow benefit sharing	X	X										
5) Set up a roadmap to achieve end goal								X				

Explanation Ellen MacArthur (2014), p.67-68

The third Ellen MacArthur report addresses the acceleration and scale-up of the circular economy through global supply chains. In the chapter on *joining forces to make the change*, two different lists of recommendations have been formulated: one to achieve the proof of concept of circular economy, and one to identify the benefits of a circular economy.

- 1) *Creating a list of high-quality materials* can influence the materials that will be chosen by relevant stakeholders. This can in turn influence the sizes of material flows (level 12).
- 2) *Defining mechanisms for continuous improvement of value creation and cost reduction for material flows* can increase these material flows (level 12), but also the sizes of its buffers (level 11).
- 3) *Identifying the support providers* can imply changing the supply chain of material flows (level 12), the sizes of stocks of these material flows (level 11), and the information infrastructure (level 6).
- 4) *To jointly agree on business models to allow benefit sharing* can influence the sizes of business models as buffers (level 11) and the sizes of flows (level 12).
- 5) *Setting up a roadmap to jointly achieve the end goal* implies setting the rules of the system (level 5); defining an end goal in itself is no part of this list of recommendations.

2014 Ellen MacArthur (identify benefits)	12	11	10	9	8	7	6	5	4	3	2	1
1) Quantify economic impact and secondary benefits				X	X							
2) Size economic benefits of pure material flows	X			X	X							
3) Mobilize public sector and other stakeholders							X					
4) Drive regulatory change to quickly scale up								X				
5) Catalyse investment in new business models	X											
6) Mobilise advances in information technology							X					

Explanation Ellen MacArthur (2014), p.68-70

The second list of recommendations in the same Ellen MacArthur report provides six recommendations in order to identify the benefits of a circular economy.

- 1) *Quantifying the economic impact and secondary benefits* can influence the strength of negative feedback loops of the existing economic system (level 8), and is a way of quantifying the delays in the system (level 9).
- 2) The same applies for *quantifying the size of economic benefits for pure material flows*, although this also influences the material flows itself (level 12).
- 3) *Mobilizing the public sector and other stakeholders* primarily seems to influence the information structures (level 6), as this has no direct influence on material stocks and flows.
- 4) *Driving regulatory change*, when done in a thorough way, can change the rules of the system (level 5).
- 5) On the contrary, *catalysing investments* only seems to stimulate the size of flows (level 12).
- 6) *Advances in information technologies* can influence the information infrastructure (level 6).

2014 OPAi & MVO Nederland (general)	12	11	10	9	8	7	6	5	4	3	2	1
1) Start by experimenting	X	X										
2) Be aware that craftsmanship will return												
3) Be aware of increasing consumer role												
4) Think outside boundaries									X	X		
5) Develop new business models	X	X										
6) Work both within and across sectors			X				X					
7) Designing products for service	X	X	X									
8) Use Dutch industrial design as selling point												
9) Invest in knowledge development				X			X					
10) Transform built environment from 'house' to 'service'	X	X										
11) Be open for continuous learning				X					X			
12) Use the energy of the society (civilians)												
13) Acknowledge the value of resources	X					X						
14) Develop a long-term vision										X		

Explanation OPAi & MVO Nederland (2014), p.65-66

OPAi & MVO Nederland have considered the business perspective in their Dutch report *Doing business in a circular economy*, and have identified recommendations for the transition to a circular economy. These fourteen general recommendations are part of an elaborate complete set of recommendations, which also includes business and government perspectives. The report only addresses these recommendations very shortly, and does not go into detail. Some recommendations can therefore not be categorized.

- 1) *Starting by experimenting* can apply to opening up new businesses opportunities, and can in that perspective be seen as influencing the size of stocks (level 11) and flows (level 12).
- 2) The notion that *craftsmanship will return* has nothing to do with system intervention and can therefore not be categorized.
- 3) The same applies for the notion that *the role of the consumer is getting stronger*.
- 4) *Thinking outside boundaries to identify a vision and ask others how they can contribute* can be an intervention at a high level in the system – it can be on the power to add to or change the system itself (level 4) or on identifying goals (level 3). However, this recommendation has to be carried out before the system intervention can take place.
- 5) The *development of new business models* can change both the sizes of flows (level 12) as the size of the buffers relative to these flows (level 11).
- 6) *Working both within and across sectors* can lead to increased cross-sectorial knowledge exchange, influencing the structure of both the flows of materials (level 10) and information (level 6).
- 7) *Designing products for service* is likely to influence the sale of products as material flows (level 12), and the sizes of stocks relative to these flows (level 11).
- 8) The notion on *Dutch Design* has nothing to do with system intervention, and can therefore not be categorized.
- 9) *Knowledge development* has primarily to do with the length of delays (level 9) and the structure of the information system (level 6). One could argue that it also influences the ability of a system to self-organise, but for that, the recommendation is too vague.
- 10) Regarding the *built environment, changing the business model from house to service* can influence the size of the flows (level 12) and the size of its buffers (level 11); the infrastructure of the flows is not changed in this situation.
- 11) *Being open for continuous learning* implies influencing the length of delays (level 9), but is also a relatively high level of system intervention when related to changing or self-organising the system (level 4). To realise an intervention at level 4, continuous learning should also take place in practice.
- 12) *Using the energy of the society* only shifts initiative from one stakeholder to the other, but does not change business models, material flows or feedback loops. Therefore, this recommendation does not intervene in the system and cannot be categorized.
- 13) *Acknowledging the value of resources* is likely to change the sizes of material flows (level 12), but might also effect the delays in the system (level 9).
- 14) *Developing a long-term vision* is a way to influence the goals of the system (level 3), however, this vision first has to be developed and implemented before the intervention is done.

2013 Green Alliance (governments, business & inv.)	12	11	10	9	8	7	6	5	4	3	2	1
1) Clarify the exposure to the risk of the linear economy							X					
2) Co-operate with brokers in the whole supply chain	X	X						X				
3) Enable system design over product design			X	X			X	X				

Explanation Green Alliance (2013), p.34-38

The Green Alliance formulated recommendations for the transition to a circular economy in the British perspective. In chapter five, a *draft action plan for a resource resilient UK*, three recommendations are provided. For each recommendation, specific actions for governments, businesses and investors are defined as well in the report. As these actions are not specified here, the three general recommendations should be looked at from a multi-disciplinary perspective.

- 1) *Clarifying the exposure to risk of the linear economy* has much to do with material tracing, material insecurity and risk identification, which implies changing the structure of information flows (level 6).
- 2) *Co-operation with brokers along the whole supply chain* is already required for high-risk sectors, states the report, and can provide benefits for others by influencing the sizes of material flows (levels 12) and the related stocks (level 11). Also, sector-specific roadmaps can be developed, and governments can stimulate co-operation by taking away hindering regulations, which both influences the rules of the system (level 5).
- 3) *Enabling system design* means addressing the material and market barriers that prevent particular materials or products from becoming more circular. Designing a renewed system influences the infrastructure around material flows (level 10) and information flows (level 6), but also the length of delays (level 9) and the rules of the system (level 5).

2013 IMSA (governments)	12	11	10	9	8	7	6	5	4	3	2	1
1) Replace financial reporting by integrated reporting				X			X					
2) Create a tax shift from labour towards resources	X							X				
3) Implement a new economic indicator beyond GDP								X		X		
4) Establish independent material flows systems	X		X									
5) Adjust policies to stimulate a circular economy	X		X				X					

Explanation IMSA (2013), p.24-28

In her report *Unleashing the potential of the circular economy*, IMSA identifies five mainstreaming steps – and implies these have to be taken by governmental actors. These five mainstreaming steps follow nine specific steps, which will be categorized later.

- 1) *Replacing financial reporting with integrated reporting* can influence the structure of information flows (level 6), but also the length of delays in the system (level 9).
- 2) *Creating a full tax shift from labour to resources* can change the basic rules of the system by shifting incentives (level 5), although one could also argue that it only influences the flows, which it does in any case (level 12).
- 3) *Implementing a new economic indicator beyond GDP* changes the rules of the system (level 5), but more importantly, also the goals of the system (level 3).
- 4) *Establishing independent material flow systems* can have to do with the infrastructure around (level 10) and size of (level 12) material flows.
- 5) *Adjusting policies* is in this report described extensively, and includes accounting mechanisms which change the structure of information flows (level 6), redeveloping regulations with regard to competition and waste, influencing the strength of flows (level 12) and the infrastructure around these flows (level 10).

2014 OPAi & MVO Nederland (governments)	12	11	10	9	8	7	6	5	4	3	2	1
1) Phase out 'old' economy stimuli	X						X	X				
2) Be an active launching customer	X											
3) Develop a strong vision to achieve a critical mass								X		X		
4) Develop policies for conditional steering	X											

Explanation OPAi & MVO Nederland (2014), p.66-67

The OPAi & MVO Nederland report, addressed before, also formulates recommendations for governments. These four recommendations are described only generally in the report, and remain quite abstract.

- 1) *Phasing out the 'old' economy* addresses removing stimuli for such an old economy, including the removal of tax advantages; a shift from labour to resource taxing, and innovation-stimulating regulations. These influence the information structure (level 6) and the rules of the game (level 5), and additionally also the flows in the system (level 12).
- 2) *Being an active launching customer*, as the government, only influences the size of flows (level 12) because of increasing consumption patterns.
- 3) *Developing a strong vision to achieve a critical mass* redefines the rules of the system (level 5) but also the goals of the system (level 3).
- 4) *Policies for conditional steering* only influence individual flow sizes (level 12).

2013 IMSA (businesses)	12	11	10	9	8	7	6	5	4	3	2	1
1) Set up a simple index for circular performance	X											
2) Encourage experimentation, innovation and redesign	X	X										
3) Gather and spread successful business examples							X					
4) Integrate CE principles in education and training				X			X					
5) Develop a long-term company vision								X				
6) Search for material pooling opportunities	X	X										
7) Promote circular products	X	X										
8) Prepare roadmaps for established economic sectors								X				
9) Initiate stakeholder fora on circular economy							X					

Explanation IMSA (2013), p.24-28

In her report *Unleashing the potential of the circular economy*, IMSA identifies nine specific steps, which are followed by five mainstreaming steps which are mentioned before. These specific steps are to be taken by businesses.

- 1) *Setting up an index for circular performance* in this report is addressed as a simple, easy-to-use index, only influencing processes and streams, and therefore is expected only to change the sizes of flows (level 12).
- 2) *Experimenting, innovation and redesign* help developing new businesses opportunities, and can be seen as influencing the size of stocks (level 11) and the size of flows (level 12).
- 3) *Gathering and spreading successful business examples* implies adjusting the information infrastructure (level 6), although more elaboration is required on how to do so.
- 4) *Integrating the principles of a circular economy in education* can influence the structure of information flows (level 6) and the length of delays (level 9) due to greater awareness of the need for circularity.
- 5) *Developing a long-term vision* from a company perspective can lead to changing the rules of its system (level 5), as the incentives and drivers of business may change.
- 6) *Searching for material pooling opportunities* typically influence the size of stock (level 11) and size of flows (level 12) of materials.
- 7) The same applies for *promoting circular products*; this also only can influence the stock (level 11) and the flow (level 12) of materials.
- 8) *Preparing roadmaps for established economic sectors* goes into changing the rules of the system (level 5), however for that specific sector only.
- 9) *Initiating stakeholder fora* has to do with changing the structure of information flows (level 6).

2014 OPAi & MVO Nederland (businesses)	12	11	10	9	8	7	6	5	4	3	2	1
1) Be seduced by the enormous potential												
2) Use circular opportunities	X											
3) Choose strategically with regard to investment, co-operation with others and company skills												
4) Use clear KPI's				X								
5) Avoid focus on technical details												
6) Create space for feedback									X			
7) Prepare for opposition												
8) Provide budget and capacity	X											

Explanation OPAi & MVO Nederland (2014), p.66

The OPAi & MVO Nederland report, addressed before, also formulated recommendations for businesses. These eight recommendations are in the report described only generally, and remain abstract quite often.

- 1) *Being seduced by the enormous potential* has nothing to do with system intervention, and can therefore not be categorized.
- 2) *Using circular opportunities within the existing strategy* mainly has to do with resource efficiency, and therefore with the size of flows (level 12).
- 3) *Choosing strategically with regard to investment, co-operation with others and company skills* is a recommendation within the existing system, and does not initiate systemic change.
- 4) *Using clear KPI's* relates to reporting, and influences thereby only the information provided (not information infrastructure), and the length of delays (level 9).
- 5) *Avoiding a focus on technical details* is a recommendation that has nothing to do with system intervention, and cannot be categorized.
- 6) *Creating space for feedback* has a high level of systemic intervention, having to do with the power to change and self-evolve the system (level 4). However, this recommendation first has to be put into practice before the system intervention takes place.
- 7) *Preparing for opposition* again does not intervene with the system, but is a direct result of starting the process of systemic change.
- 8) *Providing budget and capacity* only influences the size of flows (level 12).

2012 MVO Nederland (manufacturing industry)	12	11	10	9	8	7	6	5	4	3	2	1
1) Focus on eco-efficiency	X											
2) Choose direction	X	X										
3) Think transformative	X			X				X	X			
4) Co-operate within the supply chain	X	X					X					

Explanation MVO Nederland (2012), p.10-20

MVO Nederland (2012) provides a roadmap for a transformation in the manufacturing industry. This roadmap consists of four main recommendations, which are all explained in the report in more detail. Although the manufacturing industry is not representative for the economy as a whole, these recommendations provide additions to other reports.

- 1) The first step, *a focus on eco-efficiency*, is about improving the ecological performance of products. This is an intervention at a low systemic level; only the flows itself are changing (level 12).
- 2) *Choosing directions* is about making decisions, which in turn depend on the path a company currently follows. These decisions can influence the business model, being the size of the material stocks (level 11) and flows (level 12).
- 3) *Transformative thinking* is in this report specifically explained as thinking about changing the rules of the game (level 5), in order to change the industry as a whole by creating new possibilities and new system dynamics (level 4). Performing life-cycle assessments (LCAs) helped transformative thinking by changing the flows (level 12) and delays (level 9) in a system.
- 4) *Co-operation along the supply chain* mainly influences the flows of materials (level 12), their stocks (level 11) and the structure of information flows (level 6).

2013 ESA (waste & resources sector)	12	11	10	9	8	7	6	5	4	3	2	1
1) Design products for dismantling	X	X										
2) Optimise collection systems			X									
3) Incentivise recylate uptake among manufacturers	X	X										
4) Create resilient markets for recyclates	X											
5) Provide a stable policy framework												

Explanation ESA (2013), p.9

The ESA report, which is focused on the waste and resources sector, defines five areas in which action is required. Taking into account the partners views, ten more recommendations have been formulated in this report: however, as these are focused narrowly on the British waste industry, they are less relevant for this thesis.

- 1) *Designing products for dismantling* can influence the sizes of flows (level 12) and the relative stocks of materials (level 11).
- 2) *Optimizing collection systems* can influence the infrastructure around material flows.
- 3) *Incentivising uptake of recylate among manufacturers* can influence the stocks of the materials (level 11) and its flows (level 12).
- 4) *Creating resilient markets for recyclates* also has to do with flows of resources (level 12).
- 5) *Providing a stable policy framework to reduce investment risk* is a recommendation that does not incentivize systemic change, and therefore cannot be categorized.

Appendix V | Transition framework analysis

In this appendix, the transition framework analysis is performed. The method for this analysis is described in chapter 2. The results of this analysis are discussed in chapter 6. In this appendix, the recommendations are – per section, report or article – shown in a table. For each recommendation is indicated whether the element from the transition framework is present. Below the table, the argumentation for the categorization is provided.

2006 China (general)	Multi-level perspec.				Actor groups				Activity types				Arena
	D	P	T	S	S	M	C	A	S	T	O	R	A
8) Building a legal system			X		X					X			
9) Readjusting industrial structure				X	X	X			X				
10) Guiding development through policy			X		X					X			
11) Using economic means to create incentive				X	X					X			
12) Developing applicable technologies		X						X	X		X		
13) Quickening demo projects to push CE		X			X	X		X			X		
14) Carrying out education								X					

Explanation China (Hongchun, 2006), p.110-114

Hongchun describes the transition to the circular economy in China. Based on the steps that have been made by the government, and also on the barriers that are still present, the article formulates seven recommendations to accelerate the transition.

- 1) *Building a legal system for a circular economy* increases landscape tension on the regime. The state is the primary actor in this field. This can be seen as a tactical activity (reorganizing institutions) on moving a different direction.
- 2) *Readjusting the industrial structure* can in this article be seen as regime stress; through changing structures, regimes change. Markets and state are the primary actors in this field. The activity type is strategic by creating a future outline of the system.
- 3) *Policy guidance* is in this article not specified, and is therefore categorized as landscape tension. Again, the state is the main actor. Policy guidance is a typical tactical activity.
- 4) *Using economic means* is primarily about pricing mechanisms. These create regime stress. The actor to execute this mechanism is again the state. Initiating a pricing mechanism is again a tactical type of activity.
- 5) *Developing technologies* is in this article described as a strategic process. However, next to the state, associations play an important role here. Also experimentation is addressed here, which is operational. The article does not elaborate in detail on how these technologies should reach society; however, this increases niche pressure.
- 6) *Quickening demonstration projects* is about increasing niche pressure to shift regimes. Leading actors are state, market and associations. Demonstration projects are typical operational activity types.
- 7) *Carrying out education* has nothing to do with technology spreading, and therefore does not apply to the transition or MLP framework. Education is carried out by associations.

2012 Aldersgate (general)	Multi-level perspec.				Actor groups				Activity types				Arena
	D	P	T	S	S	M	C	A	S	T	O	R	A
9) Creating business models for a CE		X		X		X					X		
10) Creating consumption for a CE		X				X	X						
11) Design for a CE		X				X							
12) Create infrastructure for a CE			X		X					X			
13) Create policy frameworks for a CE			X		X					X			
14) Create procurement for a CE				X	X					X			
15) Create skills for a CE								X					

Explanation Aldersgate (2012), p.18-19

The Aldersgate report addresses opportunities for a circular economy, as well as enablers, barriers and timescales. In the chapter on Exploration, eight steps in which exploration towards a circular economy is required, are described. These steps can be read as recommendations for a transition. The report describes what should happen in each step, but does not give any information on how this should happen.

- 1) *Creating business models for a circular economy* increases regime stress and niche pressure by developing new businesses who challenge the existing regime. Actors in this recommendation are primarily market players. Business models are a typical operational activity type.
- 2) *Creating consumption for a circular economy* can also be seen as initiating niche pressure, as this is a new sort of consumption that aims to change existing business models. Consumers are the actor group that is addressed, but by governmental intervention. Creating consumption is not an activity type in a transition process.
- 3) *Designing for a circular economy* is a part of niche development, increasing niche pressure. The involved actor is the market. Creating design is not an activity type in a transition process.
- 4) *Creating infrastructure for a circular economy* influences landscape tension, with the state as primary actor group. The activity type is tactical.
- 5) *Creating policy frameworks for a circular economy* is also a tactical state activity, influencing landscape tension.
- 6) *Creating procurement for a circular economy* creates regime stress, and is a state activity. It is a tactical activity type.
- 7) *Creating skills for a circular economy* is about education. This has nothing to do with development in a multi-level perspective, and is primarily done by associations. It is also no activity type in a transition process.

2014 Ellen MacArthur (proof of concept)	Multi-level perspec.				Actor groups				Activity types				Arena
	D	P	T	S	S	M	C	A	S	T	O	R	A
6) Creating a list of high-quality materials					X								
7) Define mechanisms for value creation improvement				X	X					X			
8) Identify support providers in the system					X					X			
9) Agree on business models to allow benefit sharing				X		X							
10) Set up a roadmap to achieve end goal					X				X				

Explanation Ellen MacArthur (2014), p.67-68

The third Ellen MacArthur report addresses the acceleration and scale-up of the circular economy through global supply chains. In the chapter on *joining forces to make the change*, two different lists of recommendations have been formulated: one to achieve the proof of concept of circular economy, and one to identify the benefits of a circular economy.

- 1) *Creating a list of high-quality material* is a state activity. In both the multi-level perspective and in the activity type perspective, this is not applicable.
- 2) *Defining mechanisms for value creation* creates regime stress. It is a state activity, and a tactical activity type, as it changes incentives for businesses.
- 3) *Identifying support providers in the system* is a tactical state activity, by initiating co-operation among businesses. It has however nothing to do with development in an MLP perspective.
- 4) *Agreeing on business models to allow benefit sharing* creates regime stress. This is done by market actors. It is not an activity type from a transition perspective.
- 5) *Setting up a roadmap* is about strategy development, and is initiated by the state. From a multi-level perspective, this does not influence transitions.

2014 Ellen MacArthur (identify benefits)	Multi-level perspec.				Actor groups				Activity types				Arena
	D	P	T	S	S	M	C	A	S	T	O	R	A
7) Quantify economic impact and secondary benefits				X	X					X			
8) Size economic benefits of pure material flows					X					X			
9) Mobilize public sector and other stakeholders					X								
10) Drive regulatory change to quickly scale up		X			X					X			
11) Catalyse investment in new business models						X					X		
12) Mobilise advances in information technology				X	X	X				X			

Explanation Ellen MacArthur (2014), p.68-70

The second list of recommendations in the same Ellen MacArthur report provides six recommendations in order to identify the benefits of a circular economy.

- 1) *Quantifying the economic impact and secondary benefits* creates regime stress, and is a state activity. It is a tactical activity type, as it changes incentives for business.
- 2) *Sizing the economic benefits of pure material flows* is a state activity. This has nothing to do with either technology development. It can be seen as a tactical activity, again to change incentives for businesses.
- 3) *Mobilizing the public sector and other stakeholders* is a state activity, which does involve the community, but is not a recommendation for the community. Gaining support is not applicable to either technological development or transition activity types.
- 4) *Driving regulatory change* increases landscape pressure. This is a tactical state activity, as it is about changing institutions.
- 5) *Catalysing investments in new business models* is an activity that has to be carried out by the market itself. This is an activity in the operational phase, as investments lead to operations.
- 6) *Mobilizing advances in information technology* is both a state and a market activity, leading to increasing regime stress. It is a tactical activity type, as it changes the institutions.

2014 OPAi & MVO Nederland (general)	Multi-level perspec.				Actor groups				Activity types				Arena
	D	P	T	S	S	M	C	A	S	T	O	R	A
15) Start by experimenting		X			X	X					X		
16) Be aware that craftsmanship will return						X							
17) Be aware of increasing consumer role						X							
18) Think outside boundaries					X	X			X				
19) Develop new business models		X		X		X					X		
20) Work both within and across sectors					X	X				X			
21) Designing products for service				X		X					X		
22) Use Dutch industrial design as selling point						X							
23) Invest in knowledge development						X							
24) Transform built environment from 'house' to 'service'				X		X					X		
25) Be open for continuous learning						X						X	
26) Use the energy of the society (civilians)					X	X							
27) Acknowledge the value of resources						X							
28) Develop a long-term vision						X			X				

Explanation OPAi & MVO Nederland (2014), p.65-66

OPAi & MVO Nederland have considered the business perspective in their Dutch report *Doing business in a circular economy*, and have identified recommendations for the transition to a circular economy. These fourteen general recommendations are part of an elaborate complete set of recommendations, which also includes business and government perspectives. The report only addresses these recommendations very shortly, and does not go into detail. Some recommendations can therefore not be categorized.

- 1) *Starting by experimenting* is both a state and a market activity, and is an operational activity type that stimulates niche pressure.
- 2) *Being aware that craftsmanship will return* is not applicable to transition perspectives and technology development. This can be perceived as a market activity.
- 3) *Being aware of the changing consumer role* is also not applicable to both perspectives. This can also be seen as a market activity.
- 4) *Thinking outside boundaries* can be done by both state and market, and is a strategic activity as it is about vision development.
- 5) *Developing new business models* is a market activity that creates both niche pressure and regime stress. It is an operational activity type.
- 6) *Working within and across sectors* applies to both state and market. This recommendation is not applicable to technology development. It can be seen as a tactical activity type.
- 7) *Designing products for service* is a market activity that creates regime stress. It is an operational activity type.
- 8) *Use Dutch industrial design as a selling point* is not applicable to transition perspectives and technology development. This is a market activity.
- 9) *Investing in knowledge development* is done by associations. This is not applicable to transition perspectives or technology.
- 10) *The transformation of the built environment* is an operational market activity. This creates regime stress within the housing sector.
- 11) *Being open for continuous learning* applies in this study to market players. This is a reflexive activity type.
- 12) *Using the energy of the society* is a recommendation for both market and state, in which citizens are solely involved in the execution of the recommendation. This is no transition activity type and has nothing to do with technology development.
- 13) *Acknowledging the value of resources* is primarily a market activity. This is not applicable to circular development or to designated activity types.
- 14) *Developing a long-term vision* is in this report meant for both the government and market stakeholders, and is a strategic activity. It has however nothing to do with the development of circularity from the multi-level perspective.

2013 Green Alliance (governments, business & inv.)	Multi-level perspec.				Actor groups				Activity types				Arena
	D	P	T	S	S	M	C	A	S	T	O	R	A
4) Clarify the exposure to the risk of the linear economy			X	X	X								
5) Co-operate with brokers in the whole supply chain				X		X					X		
6) Enable system design over product design				X		X							

Explanation Green Alliance (2013), p.34-38

The Green Alliance formulated recommendations for the transition to a circular economy in the British perspective. In chapter five, a *draft action plan for a resource resilient UK*, three recommendations are provided. For each recommendation, specific actions for governments, businesses and investors are defined as well in the report. As these actions are not specified here, the three general recommendations should be looked at from a multi-disciplinary perspective.

- 1) *Clarifying the exposure to the risk of the linear economy* is a state activity. This activity creates both landscape tensions as regime stress. It is not an activity type in a transition process, as it does not create a vision or change an institution.
- 2) *Co-operating with brokers in the whole supply chain* can increase regime stress by changing interactions among stakeholders. This is a market activity that can be seen as operational, as it is about the way business models are carried out.
- 3) *Enabling system design over product design* is also a market activity that creates regime stress by changing business models. However, this activity is not applicable to the transition activity type perspective.

2013 IMSA (governments)	Multi-level perspec.				Actor groups				Activity types				Arena
	D	P	T	S	S	M	C	A	S	T	O	R	A
6) Replace financial reporting by integrated reporting				X	X					X			
7) Create a tax shift from labour towards resources			X		X					X			
8) Implement a new economic indicator beyond GDP			X		X					X			
9) Establish independent material flows systems				X	X					X			
10) Adjust policies to stimulate a circular economy			X		X					X			

Explanation IMSA (2013), p.24-28

In her report *Unleashing the potential of the circular economy*, IMSA identifies five mainstreaming steps – and implies these have to be taken by governmental actors. These five mainstreaming steps follow nine specific steps, which will be categorized later. All of these activities are performed by the state.

- 1) *Replacing financial reporting by integrated reporting* is a tactical activity (changing institutions, rules) that creates regime stress.
- 2) *Creating a tax shift* increases landscape tension, and is also a tactical activity due to changing institutions.
- 3) *Implementing a new economic indicator beyond GDP* also increases landscape tension, and can also be seen as a tactical activity.
- 4) *Establishing an independent material flow system* increases regime stress due to increasing competition, and is also a tactical activity type.
- 5) *Adjusting policies to stimulate a circular economy* again increases landscape tension, and is also a tactical activity type.

2014 OPAi & MVO Nederland (governments)	Multi-level perspec.				Actor groups				Activity types				Arena
	D	P	T	S	S	M	C	A	S	T	O	R	A
5) Phase out 'old' economy stimuli			X		X					X			
6) Be an active launching customer				X	X						X		
7) Develop a strong vision to achieve a critical mass					X				X				
8) Develop policies for conditional steering					X					X			

Explanation OPAi & MVO Nederland (2014), p.66-67

The OPAi & MVO Nederland report, addressed before, also formulates recommendations for governments. These four recommendations are described only generally in the report, and remain quite abstract. All recommendations are done for governments, which is here shown as 'state'.

- 1) *Phasing out 'old' economy stimuli* is an activity that creates landscape tension. It can be seen as a tactical activity (changing institutions)
- 2) *Being an active launching customer* can create regime stress, and is an operational activity type.
- 3) *Developing a strong vision to achieve a critical mass* is typically a strategic activity. This does not influence development in the multi-level perspective.
- 4) *Developing policies for conditional steering* is a tactical activity, which is not applicable in the multi-level perspective.

2013 IMSA (businesses)	Multi-level perspec.				Actor groups				Activity types				Arena
	D	P	T	S	S	M	C	A	S	T	O	R	A
10) Set up a simple index for circular performance				X		X				X			
11) Encourage experimentation, innovation and redesign		X				X					X		
12) Gather and spread successful business examples		X				X					X		
13) Integrate CE principles in education and training						X							
14) Develop a long-term company vision						X			X				
15) Search for material pooling opportunities						X				X			
16) Promote circular products		X				X					X		
17) Prepare roadmaps for established economic sectors						X			X				
18) Initiate stakeholder fora on circular economy				X		X				X			

Explanation IMSA (2013), p.24-28

In her report *Unleashing the potential of the circular economy*, IMSA identifies nine specific steps, which are followed by five mainstreaming steps which are mentioned before. These specific steps are to be taken by businesses, here called *market*.

- 1) *Setting up an index for circular performance* increases regime stress, and is a tactical activity by changing the institutions.
- 2) *Encouraging experimentation* increases niche pressure, and is a typical operational activity type.
- 3) *Gathering and spreading successful business examples* is an operational activity type, which again increases niche pressure.
- 4) *Integrating circular economy in education and training* programs is not a transition activity type, and also is not applicable to the multi-level perspective.
- 5) *Developing a long-term company vision* is a typical strategic activity type, although this cannot be combined with the multi-level perspective.
- 6) *Searching for material pooling opportunities* is a tactical activity, but cannot be considered from a multi-level perspective.
- 7) *Promoting circular products* increases niche pressure and is also an operational activity type.
- 8) *Preparing roadmaps for established sectors* is a typical strategic activity type that is however not linked with the multi-level approach.
- 9) *Initiating stakeholder fora* is a tactical activity type. This can change relations between regimes, and therefore can be seen as initiating regime stress.

2014 OPAi & MVO Nederland (businesses)	Multi-level perspec.				Actor groups				Activity types				Arena
	D	P	T	S	S	M	C	A	S	T	O	R	A
9) Be seduced by the enormous potential						X							
10) Use circular opportunities						X					X		
11) Choose strategically with regard to investment, co-operation with others and company skills				X		X				X			
12) Use clear KPI's						X				X			
13) Avoid focus on technical details						X							
14) Create space for feedback						X							
15) Prepare for opposition						X							
16) Provide budget and capacity						X							

Explanation OPAi & MVO Nederland (2014), p.66

The OPAi & MVO Nederland report, addressed before, also formulated recommendations for businesses. These eight recommendations are in the report described only generally, and remain abstract quite often. All these activity types are for businesses, in this case *market*.

- 1) *Being seduced by the enormous potential* is not a multi-level perspective and is not a transition activity type.
- 2) *Using circular opportunities* can be viewed as an operational activity type, which is however not related to the multi-level perspective.
- 3) *Choosing strategically with regard to investment, co-operation with others and company skills* is a typical tactical activity type. It can also create regime stress.
- 4) *Using clear KPI's* is a tactical activity (changing institutions), but is however separate from the multi-level perspective.
- 5) *Avoiding focus on technical details* can also not be addressed here.
- 6) *Creating space for feedback* is a typical reflexive activity, which is however not linked to the multi-level perspective.
- 7) *Preparing for opposition* again is a recommendation that is separate of activity types.
- 8) *Providing budget and capacity* is an operational activity, which is also not related to the multi-level perspective.

2012 MVO Nederland (manufacturing industry)	Multi-level perspec.				Actor groups				Activity types				Arena
	D	P	T	S	S	M	C	A	S	T	O	R	A
5) Focus on eco-efficiency						X					X		
6) Choose direction						X			X				
7) Think transformative						X			X				
8) Co-operate within the supply chain				X		X					X		

Explanation MVO Nederland (2012), p.10-20

MVO Nederland (2012) provides a roadmap for a transformation in the manufacturing industry. This roadmap consists of four main recommendations, which are all explained in the report in more detail. Although the manufacturing industry is not representative for the economy as a whole, these recommendations provide additions to other reports. The actor in all recommendations is the market.

- 1) *Focusing on eco-efficiency* is an operational activity type. It is not part of the multi-level perspective.
- 2) *Choosing direction* is a strategic activity type. Also this activity cannot be viewed from the multi-level perspective.
- 3) *Thinking transformative* is also a strategic activity type, which can also not be viewed from the multi-level perspective.
- 4) *Co-operating with the supply chain* is an operational activity type, which can create regime stress.

2013 ESA (waste & resources sector)	Multi-level perspec.				Actor groups				Activity types				Arena
	D	P	T	S	S	M	C	A	S	T	O	R	A
6) Design products for dismantling						X							
7) Optimise collection systems						X					X		
8) Incentivise recycle uptake among manufacturers				X		X			X		X		
9) Create resilient markets for recyclates				X		X				X			
10) Provide a stable policy framework				X		X				X			

Explanation ESA (2013), p.9

The ESA report, which is focused on the waste and resources sector, defines five areas in which action is required. Taking into account the partners views, ten more recommendations have been formulated in this report: however, as these are focused narrowly on the British waste industry, they are less relevant for this thesis. All recommendations are done for the *market*.

- 6) *Designing products for dismantling* is not an activity in a transition process, and is also not relevant in the multi-level perspective.
- 7) *Optimizing collection systems* is an operational activity that is again not relevant in the multi-level perspective.
- 8) *Incentivizing recycle uptake among manufacturers* is an operational activity, that can lead to regime stress due to changing co-operations among companies.
- 9) *Creating resilient markets for recyclates* is a tactical activity, which can also initiate regime stress.
- 10) *Providing a stable policy framework* from a company perspective is a tactical activity, which can also lead to regime stress.

Appendix VI | Innovation framework analysis

In this appendix, the innovation framework analysis is performed. The method for this analysis is described in chapter 2. The discussion of the results is done in chapter 7. The recommendations are – per section, report or article – shown in a table. For each recommendation is indicated whether the function from the innovation system is addressed or stimulated. Below the table, the argumentation for the categorization is provided.

2006 China (general)	Regional Innovation System				
	C	A	E	K	N
15) Building a legal system					
16) Readjusting industrial structure	X			X	X
17) Guiding development through policy					
18) Using economic means to create incentive					
19) Developing applicable technologies	X				
20) Quickening demo projects to push CE				X	
21) Carrying out education			X		

Explanation China (Hongchun, 2006), p.110-114

Hongchun describes the transition to the circular economy in China. Based on the steps that have been made by the government, and also on the barriers that are still present, the article formulates seven recommendations to accelerate the transition.

- 8) *Building a legal system for a circular economy* is not directly related to stimulating innovation, however, it can stimulate market development through shifting incentives. This does not strengthen the innovation system.
- 9) *Readjusting the industrial structure* addresses the spread of information, tax regimes, but also the focus and output of industry and labour use. This is about firm clustering, knowledge transfer and networks.
- 10) *Policy guidance* is in this article about providing resources and stimulating regulations. None of the functions apply in a regional innovation system.
- 11) *Using economic means* primarily focuses on pricing mechanisms. This is a way of assisting in market creation, but does not strengthen the innovation system.
- 12) *Developing technologies* specifically addresses innovation, although from a strategic point of view. Resources have to be provided, new technology zones created, new technologies developed, and circular economy has to be addressed in a long-term scientific plan. This addresses creating firm clusters.
- 13) *Quickening demonstration projects* focuses on scaling up good practices. This is primarily about knowledge transfer.
- 14) *Carrying out education* returns in the regional perspective. As the knowledge development and transfer in the innovation systems is focused primarily among firms, these do not apply.

2012 Aldersgate (general)	Regional Innovation System				
	C	A	E	K	N
16) Creating business models for a CE		X			
17) Creating consumption for a CE					
18) Design for a CE					
19) Create infrastructure for a CE					
20) Create policy frameworks for a CE					
21) Create procurement for a CE		X			
22) Create skills for a CE			X		

Explanation Aldersgate (2012), p.18-19

The Aldersgate report addresses opportunities for a circular economy, as well as enablers, barriers and timescales. In the chapter on Exploration, eight steps in which exploration towards a circular economy is required, are described. These steps can be read as recommendations for a transition. The report describes what should happen in each step, but does not provide guidance on how to do this.

- 8) *Creating business models for a circular economy* addresses firm innovation activities.
- 9) *Creating consumption for a circular economy* does not apply to any of the regional functions.
- 10) *Designing for a circular economy* is not applicable when considering innovation systems, as it is about single activities within single firms.
- 11) *Creating infrastructure for a circular economy* is in this report addressed as physical infrastructure. This has no relation with the innovation system perspective.
- 12) *Creating policy frameworks for a circular economy* is not related to the regional innovation perspective.
- 13) *Creating procurement for a circular economy* has to do with stimulating innovative firm activities, as they can no longer continue their present-day business model.
- 14) *Creating skills for a circular economy* is in this report about education.

2014 Ellen MacArthur (proof of concept)	Regional Innovation System				
	C	A	E	K	N
11) Creating a list of high-quality materials					
12) Define mechanisms for value creation improvement		X			
13) Identify support providers in the system					X
14) Agree on business models to allow benefit sharing		X			
15) Set up a roadmap to achieve end goal					

Explanation Ellen MacArthur (2014), p.67-68

The third Ellen MacArthur report addresses the acceleration and scale-up of the circular economy through global supply chains. In the chapter on *joining forces to make the change*, two different lists of recommendations have been formulated: one to achieve the proof of concept of circular economy, and one to identify the benefits of a circular economy.

- 6) *Creating a list of high-quality material* does not directly relate to stimulating innovation. The only perspective that can be taken is that it helps in providing resources.
- 7) *Defining mechanisms for value creation* stimulates firm innovation activities.
- 8) *Identifying support providers in the system* has to do with creating networks among businesses and other stakeholders. Knowledge dissemination among these other stakeholders is not discussed in this recommendation.
- 9) *Agreeing on business models to allow benefit sharing throughout the supply chain* is primarily a recommendation on innovative activities within firms, however, knowledge development and dissemination is required to do so. This is however not addressed in the recommendations.
- 10) *Setting up a roadmap* is not related to any of the regional innovation functions.

2014 Ellen MacArthur (identify benefits)	Regional Innovation System				
	C	A	E	K	N
13) Quantify economic impact and secondary benefits					
14) Size economic benefits of pure material flows					
15) Mobilize public sector and other stakeholders					X
16) Drive regulatory change to quickly scale up					
17) Catalyse investment in new business models					
18) Mobilise advances in information technology				X	

Explanation Ellen MacArthur (2014), p.68-70

The second list of recommendations in the same Ellen MacArthur report provides six recommendations in order to identify the benefits of a circular economy.

- 7) *Quantifying the economic impact and secondary benefits* is not related to stimulating innovation.
- 8) *Sizing the economic benefits of pure material flows* also not directly related to innovation.
- 9) *Mobilizing the public sector and other stakeholders* is an activity that stimulates network development. From a technological perspective, it is not related to innovation.
- 10) *Driving regulatory change* is also not related to stimulating innovation.
- 11) *Catalysing investments in new business models* is not applicable from the regional innovation perspective.
- 12) *Mobilizing advances in information technology* relates to knowledge dissemination between firms and other stakeholders.

2014 OPAi & MVO Nederland (general)	Regional Innovation System				
	C	A	E	K	N
29) Start by experimenting		X			
30) Be aware that craftsmanship will return					
31) Be aware of increasing consumer role					
32) Think outside boundaries					
33) Develop new business models		X			
34) Work both within and across sectors					X
35) Designing products for service					
36) Use Dutch industrial design as selling point					
37) Invest in knowledge development				X	
38) Transform built environment from 'house' to 'service'		X			
39) Be open for continuous learning					
40) Use the energy of the society (civilians)					
41) Acknowledge the value of resources					
42) Develop a long-term vision					

Explanation OPAi & MVO Nederland (2014), p.65-66

OPAi & MVO Nederland have considered the business perspective in their Dutch report *Doing business in a circular economy*, and have identified recommendations for the transition to a circular economy. These fourteen general recommendations are part of an elaborate complete set of recommendations, which also includes business and government perspectives. The report only addresses these recommendations very shortly, and does not go into detail. Some recommendations can therefore not be categorized.

- 15) *Starting by experimenting* stimulates firm innovation activities.
- 16) *Being aware that craftsmanship will return* is not applicable to both innovation perspectives.
- 17) *Being aware of the changing consumer role* is also not applicable to both perspectives.
- 18) *Thinking outside boundaries* is also not related to both innovation perspectives.
- 19) *Developing new business models* is a typical activity that stimulates firm innovation activities.
- 20) *Working within and across sectors* aims at creating new firm networks.
- 21) *Designing products for service* is not directly related to this innovation framework, unless when it is seen as stimulating entrepreneurial activities.
- 22) *Use Dutch industrial design as a selling point* is not relevant from an innovation viewpoint.
- 23) *Investing in knowledge development* is important in the regional framework.
- 24) *The transformation of the built environment* stimulates firm innovative activities.
- 25) *Being open for continuous learning* is not related to an innovation perspective.
- 26) *Using the energy of the society* is not related to a regional innovation perspective.
- 27) *Acknowledging the value of resources* is no activity that relates to an innovation perspective.
- 28) *Developing a long-term vision* is not related to a regional innovation perspective.

2013 Green Alliance (governments, business & inv.)	Regional Innovation System				
	C	A	E	K	N
7) Clarify the exposure to the risk of the linear economy					
8) Co-operate with brokers in the whole supply chain				X	X
9) Enable system design over product design					

Explanation Green Alliance (2013), p.34-38

The Green Alliance formulated recommendations for the transition to a circular economy in the British perspective. In chapter five, a *draft action plan for a resource resilient UK*, three recommendations are provided. For each recommendation, specific actions for governments, businesses and investors are defined in the report. As these actions are not specified here, the three general recommendations should be looked at from a multi-disciplinary perspective.

- 4) *Clarifying the exposure to the risk of the linear economy* does not stimulate innovation from a regional perspective.
- 5) *Co-operating with brokers in the whole supply chain* increases knowledge transfer between businesses, and also increases firm networks.
- 6) *Enabling system design over product design* does not stimulate innovation from a regional perspective.

2013 IMSA (governments)	Regional Innovation System				
	C	A	E	K	N
11) Replace financial reporting by integrated reporting					
12) Create a tax shift from labour towards resources		X			
13) Implement a new economic indicator beyond GDP		X			
14) Establish independent material flows systems				X	
15) Adjust policies to stimulate a circular economy					

Explanation IMSA (2013), p.24-28

In her report *Unleashing the potential of the circular economy*, IMSA identifies five mainstreaming steps – and implies these have to be taken by governmental actors. These five mainstreaming steps follow nine specific steps, which will be categorized later.

None of these five steps is related to a regional innovation perspective.

- 6) *Replacing financial reporting by integrated reporting* does not relate to innovation perspectives.
- 7) *Creating a tax shift* increases firm innovation activities, although this tax shift is hard to achieve on a local scale.
- 8) *Implementing a new economic indicator beyond GDP* stimulates firm innovation activities, as value propositions for businesses can change. However, this again is hard to achieve on a local scale.
- 9) *Establishing independent material flow systems* assists in knowledge exchange.
- 10) *Adjusting policies to stimulate a circular economy* does not apply to a regional innovation perspective.

2014 OPAi & MVO Nederland (governments)	Regional Innovation System				
	C	A	E	K	N
9) Phase out 'old' economy stimuli					
10) Be an active launching customer					
11) Develop a strong vision to achieve a critical mass					
12) Develop policies for conditional steering					

Explanation OPAi & MVO Nederland (2014), p.66-67

The OPAi & MVO Nederland report, addressed before, also formulates recommendations for governments. These four recommendations are described only generally in the report, and remain quite abstract.

- 1) *Phasing out 'old' economy stimuli* is not related to stimulating innovation.
- 2) *Being an active launching customer* is not relevant to the regional functions.
- 3) *Developing a strong vision to achieve a critical mass* is also not relevant to the regional functions.
- 4) *Developing policies for conditional steering* neither is related to the innovation perspective.

2013 IMSA (businesses)	Regional Innovation System				
	C	A	E	K	N
19) Set up a simple index for circular performance					
20) Encourage experimentation, innovation and redesign		X			
21) Gather and spread successful business examples				X	
22) Integrate CE principles in education and training			X		
23) Develop a long-term company vision					
24) Search for material pooling opportunities					
25) Promote circular products					
26) Prepare roadmaps for established economic sectors					
27) Initiate stakeholder fora on circular economy				X	X

Explanation IMSA (2013), p.24-28

In her report *Unleashing the potential of the circular economy*, IMSA identifies nine specific steps, which are followed by five mainstreaming steps which are mentioned before. These specific steps are to be taken by businesses.

- 1) *Setting up an index for circular performance* is not related to innovation perspectives.
- 2) *Encouraging experimentation* increases firm innovation activities in a regional perspective.
- 3) *Gathering and spreading successful business examples* is a way of knowledge dissemination.
- 4) *Integrating circular economy in education and training* returns in the regional innovation system functions.
- 5) *Developing a long-term company vision* is not related to the regional perspective.
- 6) *Searching for material pooling opportunities* is not related to the regional perspective.
- 7) *Promoting circular products* primarily is not related to the regional functions.
- 8) *Preparing roadmaps for established sectors* is not related from a regional perspective.
- 9) *Initiating stakeholder fora* is typical activity to create networks among firms, but also to stimulate knowledge exchange among businesses.

2014 OPAi & MVO Nederland (businesses)	Regional Innovation System				
	C	A	E	K	N
17) Be seduced by the enormous potential					
18) Use circular opportunities		X			
19) Choose strategically with regard to investment, co-operation with others and company skills				X	X
20) Use clear KPI's					
21) Avoid focus on technical details					
22) Create space for feedback					
23) Prepare for opposition					
24) Provide budget and capacity					

Explanation OPAi & MVO Nederland (2014), p.66

The OPAi & MVO Nederland report, addressed before, also formulated recommendations for businesses. These eight recommendations are described only generally in the report, and remain abstract quite often.

- 1) *Being seduced by the enormous potential* is not related to an innovation perspective.
- 2) *Using circular opportunities* can be considered a recommendation to stimulate entrepreneurial activities and firm innovation activities.
- 3) *Choosing strategically with regard to investment, co-operation with others and company skills* is a recommendation on creating networks and working on knowledge exchange among businesses.
- 4) *Using clear KPI's* is not related to an innovation perspective.
- 5) *Avoiding focus on technical details* can also not be addressed in an innovation perspective.
- 6) *Creating space for feedback* is also not related to innovation perspectives.
- 7) *Preparing for opposition* is not related to the regional functions.
- 8) *Providing budget and capacity* is also not related to the regional functions.

2012 MVO Nederland (manufacturing industry)	Regional Innovation System				
	C	A	E	K	N
9) Focus on eco-efficiency					
10) Choose direction					
11) Think transformative					
12) Co-operate within the supply chain				X	X

Explanation MVO Nederland (2012), p.10-20

MVO Nederland (2012) provides a roadmap for a transformation in the manufacturing industry. This roadmap consists of four main recommendations, which are all explained in the report in more detail. Although the manufacturing industry is not representative for the economy as a whole, these recommendations provide additions to other reports.

- 1) *Focusing on eco-efficiency* is not related to regional innovation functions.
- 2) *Choosing direction* is not related to an innovation perspective.
- 3) *Thinking transformative* is also not related to regional functions.
- 4) *Co-operating with the supply chain* is a way to stimulate knowledge exchange and network development among firms.

2013 ESA (waste & resources sector)	Regional Innovation System				
	C	A	E	K	N
11) Design products for dismantling					
12) Optimise collection systems					
13) Incentivise recylate uptake among manufacturers					
14) Create resilient markets for recyclates					
15) Provide a stable policy framework					

Explanation ESA (2013), p.9

The ESA report, which is focused on the waste and resources sector, defines five areas in which action is required. Taking into account the partners views, ten more recommendations have been formulated in this report. However, as these are focused narrowly on the British waste industry, they are less relevant for this thesis.

- 1) *Designing products for dismantling* is not related to an innovation perspective.
- 2) *Optimizing collection systems* is also not related to an innovation perspective.
- 3) *Incentivizing recylate uptake among manufacturers* is also not related to an innovation perspective
- 4) *Creating resilient markets for recyclates* is also not related to an innovation perspective.
- 5) *Providing a stable policy framework* is also not related to an innovation perspective.

Appendix VII | Selection of recommendations

In this appendix, the recommendations from the present-day reports are selected. The recommendations are – per section, report or article – shown in the text boxes on the first two pages. Text box IX.1 shows the more elaborate recommendations from Hongchun, Aldersgate and IMSA. Text box IX.2 shows the more simple recommendations from OPAi & MVO Nederland. Recommendations that are simply notions or recommendations that are not relevant for the regional level are excluded. Recommendations are considered to be simply notions when the report provides no relevant background to possible activities to be developed.

Table IX.1 on the third page of this appendix shows the translation of these present-day recommendations into the set of nineteen recommendations as presented in chapter 8.

Hongchun, 2007

- 1) Readjusting the industrial structure to optimize economic layout;
- 2) Quickening demo projects and push for circular economy in an all-round way.

Aldersgate, 2012

- 1) Creating business models for a circular economy
- 2) Creating consumption for a circular economy
- 3) Design for a circular economy
- 4) Create infrastructure for a circular economy
- 5) Create policy frameworks for a circular economy
- 6) Create procurement for a circular economy
- 7) Create skills for a circular economy
- 8) Transparency for a circular economy

IMSA, 2013 (governments)

- 1) Replace traditional financial reporting by integrated (True Value) reporting;
- 2) Create a tax shift from labour towards natural resources;
- 3) Implement a new economic indicator beyond GDP;
- 4) Establish international independent systems to organize material flows;
- 5) Adjust national and international government policies to stimulate a circular economy.

IMSA, 2013 (businesses)

- 1) Set up a simple index for circular performance;
- 2) Encourage experimentation, innovation and redesign;
- 3) Gather and spread successful business examples;
- 4) Integrate circular economy principles in education and training;
- 5) Develop a long-term company vision;
- 6) Search for material pooling opportunities;
- ~~7) Promote circular products;~~
- 8) Prepare roadmaps for established economic sectors;
- 9) Initiate and stimulate stakeholder fora about the circular economy.

Text box IX.1 | Recommendations from Hongchun (2007), Aldersgate (2012) and IMSA (2013)

Recommendations are excluded when they are not relevant for a regional scale (grey) or when they are simply notions (strikethrough).

OPAi & MVO Nederland, 2012 (overall)

- 1) Start by experimenting;
- ~~2) Be aware that craftsmanship will return;~~
- ~~3) Be aware of growing consumer role;~~
- ~~4) Think outside boundaries;~~
- 5) Develop new business models;
- 6) Work both within and across sectors;
- 7) Design for service;
- ~~8) Use Dutch industrial design as selling point;~~
- 9) Invest in knowledge development;
- ~~10) Transform the built environment from 'house' to 'service';~~
- 11) Be open for continuous learning;
- 12) Use the energy of the society (civilians);
- 13) Acknowledge the value of resources;
- 14) Develop a long-term vision.

OPAi & MVO Nederland, 2012 (governments)

- 1) Phase out the 'old' economy (subsidies, taxes, information obligation);
- 2) Be an active launching customer;
- 3) Develop a strong vision to achieve a critical mass;
- 4) Develop policies for conditional steering.

OPAi & MVO Nederland, 2012 (businesses)

- ~~1) Be seduced by the enormous potential;~~
- ~~2) Use circular opportunities;~~
- 3) Choose strategically with regard to investment, co-operation with others and company skills;
- 4) Use clear KPI's;
- ~~5) Avoid focus on technical details;~~
- 6) Create space for feedback;
- ~~7) Prepare for opposition;~~
- ~~8) Provide budget and capacity.~~

Text box IX.2 | Recommendations from the OPAi & MVO Nederland (2012) report
Recommendations are excluded when they are not relevant for a regional scale (grey) or when they are simply notions (strikethrough).

<i>Origin</i>	Recommendation	New recommendation
HC	Quickening demo projects all-round	Demonstration projects
AG	Creating business models for CE	Business models
AG	Creating consumption for a CE	Market formation
AG	Creating design for a CE	Business models
AG	Creating procurement for a CE	Launching customer
AG	Create skills for a CE	Skills & Training
IMSA	Set up an index for circular performance	Circularity indicators
IMSA	Encourage experimentation	Demonstration projects
IMSA	Gather and spread business examples	Knowledge exchange
IMSA	Integrate CE principles in educ. & train.	Skills & Training
IMSA	Develop long-term company vision	Stakeholder vision
IMSA	Search material pooling opportunities	Material pooling
IMSA	Initiate and stimulate stakeholder fora	Stakeholder fora
OPAi	Start by experimenting	Demonstration projects
OPAi	Develop new business models	Business models
OPAi	Work both within and across sectors	Business models
OPAi	Design for service	Business models
OPAi	Invest in knowledge development	Knowledge development
OPAi	Be open for continuous learning	Feedback & learning
OPAi	Use the energy of society	Community engagement
OPAi	Be an active launching customer	Launching customer
OPAi	Develop strong vision to achieve critical mass	Transition arena
OPAi	Choose investment, co-operation strategically	Partner selection
OPAi	Use clear KPI's	Circularity indicators
OPAi	Create space for feedback	Feedback & learning
r ST	Create freedom in regulations	Freedom in regulations
r ST	Start dialogue with variety stakeholders	Transition arena
r TF	Demo projects in protected niches	Demonstration projects
r TF	Involve the community and associations	Community engagement
r TF	Develop indicators to monitor progress	Circularity indicators
r TF	Set up a transition arena	Transition arena
r IF	Develop circular business hub	Circular business hub
r IF	Support SME capabilities	Support SMEs
r IF	Develop circularity incubator	Circularity incubator
r IF	Develop skills & competences	Skills & Training
r IF	Increase knowledge development & exchange	Knowledge development / Knowledge exchan.
r IF	Stimulate networking among firms	Knowledge exchange

Table IX.1 | Original recommendations translated to combined set of recommendations

Sources of origin: Hongchun (HC); IMSA; OPAi & MVO Nederland (OPAi); recommendations system's thinking (r ST); recommendations transition framework (r TF) and recommendations innovation framework (r IF)

Appendix VIII | Overview interviewees

This appendix provides an overview of the experts that have been interviewed for this study. In total, fourteen experts have been interviewed. Twelve of these experts were interviewed on drafting the recommendations, of which six are from the field of circular economy and six are practitioners from Haarlemmermeer municipality. The two other experts (Arjanne Lagendijk and Wendy van Vliet) have been interviewed on review of the developed recommendations – both of these experts were from Haarlemmermeer area. All experts have been interviewed from their formal role in their organisation.

Circular economy field

Douwe Jan Joustra (OPAi & Het Groene Brein)

Douwe-Jan Joustra is a researcher at the One Planet Architecture Institute and is connected to Het Groene Brein, the network of scientists for a new economy. Douwe-Jan has contributed to many reports regarding the circular economy, among which the reports by IMSA and by OPAi & MVO Nederland.

Roel van Raak (DRIFT)

Roel van Raak is a researcher at DRIFT, the Dutch Research Institute for Transitions. Within DRIFT, Roel has been working mainly in the circular economy and the healthcare field. In both areas the focus has been on transition processes.

Rajesh Buch (Arizona State University)

Rajesh Buch works within the School of Sustainability at the Arizona State University. Rajesh is responsible for the project Haarlemmermeer Beyond Sustainability, and therefore has knowledge on the Haarlemmermeer situation.

Stephanie Hubold (Ellen MacArthur Foundation)

Stephanie Hubold works in the Regional Support section of the Ellen MacArthur Foundation. Before, Stephanie has worked with McKinsey, where she has been working on the first report of the Towards a Circular Economy-series.

Pierre Hupperts & Jacobien Crol (The Terrace)

Pierre Hupperts is founder of The Terrace; Jacobien Crol has been working at The Terrace for four years. The Terrace is a strategy and communication consultancy company, focusing on sustainability challenges. The Terrace has been involved with many Cradle to Cradle initiatives, and also with circular economy concepts.

Christiaan Kuipers (Urgenda)

Christiaan is working at Urgenda on circular economy projects, especially in the province of Fryslan. Urgenda is the national action organisation which aims for enhancing the transition to a sustainable society in the Netherlands.

Haarlemmermeer

Andrea van der Graaf (MeerMaker & Tegenstroom)

Andrea is the director of Tegenstroom, the local energy company of Haarlemmermeer, and MeerMaker, an investment fund for sustainability initiatives. Before, Andrea has been working at Meerlanden (waste processing company), Urgenda and Greenpeace.

Anna Chojnacka (ENGINN)

Anna Chojnacka is director of ENGINN, the incubator of Haarlemmermeer. ENGINN is presently evolving towards becoming a connector between its founders, who are in need of sustainable solutions, and innovative start-ups who can provide these solutions. Before, Anna has been a founder of the 1% Club.

Ruud van Hecke (RaboBank)

Ruud van Hecke is regional director Haarlemmermeer of Rabobank. During the years before his present function, Ruud was responsible for the airport Schiphol region. Before Rabobank, Ruud has been working at ABN Amro.

Nurullah Gerdan (Municipality of Haarlemmermeer)

Nurullah Gerdan is policy advisor on Spatial Planning & Environment at the Municipality of Haarlemmermeer. Before, Nurullah has been working at the Strategic Program department for two years. Nurullah has a background in Governance of Complex Systems.

Age Vermeer (DuraVermeer)

Age Vermeer is a division director of DuraVermeer, and has been working for the company for 35 years. Age is the son of the founder of the Vermeer company, and has been part of the Board of Directors for six years. Age is also involved with the project Cirkelstad Amsterdam.

Marcel van Beek (Schiphol Group)

Marcel van Beek is Manager Sustainability & Innovation at Schiphol Group. From 2008 Marcel has been responsible for the value Sustainability of the Schiphol Group, and the two paths Climate Friendly Aviation and Resources & Recycling.

Arjanne Lagendijk (NMCX) – for review

Arjanne Lagendijk is director of NMCX, the sustainability- and nature education centre of Haarlemmermeer. Arjanne also participates in various national environmental education working groups.

Wendy van Vliet (Municipality of Haarlemmermeer) – for review

Wendy van Vliet is strategic policy advisor on Knowledge and Innovation for the Municipality of Haarlemmermeer. Wendy aims to connect various stakeholders within the municipal organisation, and is the account manager for the ASU Global Sustainability Solution Services program.

Appendix IX | Activities analysis

This appendix analyses the activities, developed in chapter 9, from the system leverage point perspective, the transition framework and the innovation framework. The actor *state* from the multi-actor framework is here applied as *government*, as the regional government is no state, but the implications for implementation are similar.

System leverage points	12	11	10	9	8	7	6	5	4	3	2	1
22) Initiate a design lab								X	X	X		
23) Initiate a community dialogue							X		X			
24) Provide regulatory support									X			
25) Involve education institutions												
26) Develop a material trading place							X					
27) Make Haarlemmermeer a living lab	X	X	X									
28) Transform municipality to launching customer	X											
29) Develop circularity indicators				X			X					
30) Develop a circular business hub			X	X			X					

- *Initiating a design lab* can influence the rules of the system (level 5), the power to add, change or self-organise the system structure (level 4) and the goals of the system (level 3) by bringing a wide variety of stakeholders together with the ability to think outside the existing possibilities. If done properly with powerful stakeholders who represent no interest, this design lab might even provide direction on how to shift the paradigm out of which the system emerges (level 1 and 2).
- *Starting a community dialogue* can influence the rules and institutions of the system (level 4), by providing a different way of designing plans. It can also lead to structural changes in information flows (level 6).
- *Providing regulatory support* influences the rules and regulations in the system (level 4).
- *Involving education institutions* has the opportunity to change information flows (level 6) by raising awareness; however, as this is done only implicitly with a limited degree of succes, this recommendation is considered not to influence the system.
- *Developing a material trading place* strongly influences the information flows in a system (level 6).
- *Making Haarlemmermeer a living lab* has to do with demonstration projects, and only influences the flows (level 12), the stocks (level 11) and the structure of flows (level 10) in a system.
- *Transforming the municipal organisation to a launching customer* influences the flows (level 12) of circular products within a system.
- *Developing circularity indicators* influences the length of delays (level 9) and the information flows (level 6) in a system.
- *Developing a circular business hub* influences the structure of flows in a system (level 10), the feedback in a system (level 9) and the information flows between stakeholders in the system (level 6).

Transition framework analysis	Multi-level perspec.				Actor groups				Activity types				Arena
	D	P	T	S	S	M	C	A	S	T	O	R	A
1) Initiate a design lab		X			X	X	X	X	X				X
2) Initiate a community dialogue				X			X		X				
3) Provide regulatory support			X		X					X			
4) Involve education institutions								X		X			
5) Develop a material trading place				X		X				X			
6) Make Haarlemmermeer a living lab		X				X					X		
7) Transform municipality to launching customer		X			X						X		
8) Develop circularity indicators		X		X	X	X						X	
9) Develop a circular business hub		X		X	X	X						X	

- *Initiating a design lab* is a form of a transition arena, and should include all stakeholders: state, market, community and associations. It is categorized as a strategic activity type, and stimulates niche pressure due to the development of new directions based on the common vision.
- *Starting a community dialogue* primarily involves the community, and is also a strategic activity. This can create regime stress because of conflicting interests in the energy production field (local renewable versus central fossil-based).
- *Providing regulatory support* is a government activity, influencing the market. This is a strategic activity, creating landscape tension.
- *Involving education institutions* primarily involves schools, which are associations. As education is an enabling system for operational activities, it is marked tactical.
- *Developing a material trading place* creates regime stress due to new combinations of material streams. It is a market activity. As this is a structure that enables operations, this is categorized as a tactical activity.
- *Making Haarlemmermeer a living lab* creates niche pressure due to the new developments popping up. It is a primarily market activity, and is clearly operational.
- *Transforming the municipal organisation to a launching customer* also creates niche pressure to existing business models. This is a government activity, and also operational.
- *Developing circularity indicators* creates both regime stress and niche pressure, as present-day processes will be rated differently compared to new innovations. It is a combined market and government activity, and reflexive as it responds to operational activities.
- *Developing a circular business hub* also creates regime stress and niche pressure, due to new business developments. This also is a combined market/government activity, and is – when the focus is primarily on learning – a reflexive activity.

Innovation framework	Regional Innovation System				
	C	A	E	K	N
1) Initiate a design lab					
2) Initiate a community dialogue					
3) Provide regulatory support					
4) Involve education institutions			X		
5) Develop a material trading place				X	
6) Make Haarlemmermeer a living lab		X		X	X
7) Transform municipality to launching customer		X			
8) Develop circularity indicators				X	
9) Develop a circular business hub	X	X			

- *Initiating a design lab* is not related to supporting innovation systems functions.
- *Initiating a community dialogue* is also not related to supporting innovation system functions.
- *Providing regulatory support* is also not related to innovation system functions.
- *Involving education institutions* has to do with education and training.
- *Developing a material trading place* results in knowledge exchange around material flows.
- *Making Haarlemmermeer a living lab* stimulates firm innovation activities, and also stimulates firm networking. Knowledge exchange in the evaluation phase is an essential part.
- *Transforming the municipal organisation to a launching customer* also stimulates firm innovation activities.
- *Developing circularity indicators* enables more easy knowledge transfer.
- *Developing a circular business hub* primarily clusters firms, but also stimulates firm innovation activities because of the firm clustering.