AMSTERDAM CIRCULAR

EVALUATION AND ACTION PERSPECTIVES

CIRCLE ECONOMY

Copper8

City of Amsterdam

PREFACE

In 2017, the municipality carried out two ambitious circular programmes: *Amsterdam Circular, Learning by Doing* and the complementary *Circular Innovation programme*. The Mayor and Deputy Mayors have promised the City Council to evaluate these programmes in early 2018 and to come up with a proposal for their deployment in 2018 and beyond. The results of this evaluation, including further recommendations, are presented in this report. I can proudly inform you that the evaluation shows that the chosen approach has been successful and that we have achieved the goals we set ourselves.

The aim of both programmes was to demonstrate that the circular economy is a realistic and profitable concept. The evaluation shows that this is indeed the case. The approach to *Learning by Doing*, in which the municipality, private companies and knowledge institutions share their knowledge amongst them, appears to be successful. Cooperation in the preparation and implementation of the programmes, as well as in the validation of the evaluation, has been active and interdisciplinary in nature. We have evaluated 73 projects and more than 100 private companies were involved in the validation. During the evaluation we tried to keep an open and vulnerable attitude.

The *Sustainable Amsterdam Agenda* (2015) includes our ambition to be a global leader in the transition to the circular economy. We want to share our approach with others while integrating the lessons learned elsewhere into our approach. As Chair of the Circular Economy Task Force of Eurocities – an international partnership of large cities - we were able to share our knowledge. That our pioneering role was appreciated, is shown by winning the international World Smart Cities award in November 2017 as well as by the requests we receive from other cities to support them in shaping their programmes.

To my mind, the transition to the Circular Economy is becoming more widely accepted. Starting from the Sustainability, Innovation and Economy portfolio, the principles are now recognised more broadly in our own organisation as well as in the city. However, the transition is still at the stage where a small group of front runners are implementing system changes. It is important to involve a next – and larger – group. To this end, the evaluation provides five guidelines in the shape of concrete action perspectives. It is up to the next Mayor and Deputy Mayors to determine the next steps to be taken and to set priorities.

Abdeluheb Choho
Alderman Sustainability

Amsterdam has won the World Smart City Award for circular economy. The price was presented at the Smart City Expo World Congress in Barcelona on Wednesday, November 15, 2017. With the award, the organisation expresses its appreciation for the progressive Amsterdam circular economy programme and for the city's efforts to develop a policy for circular economy at an urban level in several areas: local production of sustainable and seasonal food, local production of electricity, reduction of fuel consumption and improvement of waste recycling.

SAMENVATTING

RESUME

In the coming years, Amsterdam will be facing a number of urban issues. With rising population density, increasing pressure will be placed on the living environment, available resources, energy and the climate. For this reason, the municipality has invested heavily in the transition from a linear to a circular economy during the recent years. Amsterdam has expressed the ambition to be the leader in this transition. This ambition has been confirmed, among other things, by winning the World Smart City Award for circular economy.

The transition to a circular economy is one of the ten top priorities for the current European Commission, led by the Juncker cabinet.[21] The Dutch National Government is focusing on creating a sustainable, fully circular economy by 2050.[35] In January 2018, five transition agendas were published. The Amsterdam Metropolitan Area has also adopted circular programmes (such as the *MRA Action Agenda*) for the transition to a circular economy.

The circular economy reduces the environmental impact of the city and simultaneously strengthens the local and regional economy. Cycles are closed on the smallest scale possible while maintaining value as high as possible. This leads to more local transactions of higher value products, parts and materials, as well as retaining more jobs in the region.

In 2015, the Municipality of Amsterdam – as the first city in the world – explored the opportunities for the circular economy. The results were presented in the publication *Amsterdam Circular: Vision and Roadmap for City and Region*. Based on this Roadmap, as well as on a market consultation, two programmes were drawn up in 2016:

- *Amsterdam Circular, Learning by Doing*, and the
- *Circular Innovation Programme, 2016-2018.*

These programmes have led to a great variety of projects that have been carried out. Parallel to the development of these programmes, the *Waste Implementation Plan* was also drawn up.

In determining these programmes, it was agreed to conduct an evaluation and identify 'action perspectives' at the same time in early 2018. These 'action perspectives' include roles for market parties and issues for the municipality during the next management period.

APPROACH

Up to the end of 2017, 73 projects were carried. This makes a thorough evaluation possible. The project results have been retrieved by means of a digital survey as well as during an in-person meeting with all project leaders involved. Consequently, the lessons learned and all action perspectives were tested during a market validation, in which some 100 companies participated. The draft report was validated by the Amsterdam Institute for Advanced Metropolitan Solutions and the Amsterdam University of Applied Sciences (AUAS). Project leaders of Amsterdam programmes also commented on the report. The evaluation and market validation show that Amsterdam is seen as a frontrunner, both home and abroad.

EVALUATION RESULTS

Both evaluation and market validation show that Amsterdam is seen as a leader both home and abroad. There is evidence that a circular economy is realistic as well as profitable. The current municipal approach of *Learning by Doing* and focusing on the value chains Construction and Biomass & Food has been successful.

Transition to a circular economy: realistic and profitable

The evaluation of the projects shows that the transition to a circular economy is realistic and profitable. Realistic, because the technical possibilities are great: existing projects as well as new innovations show that resource loops can be closed locally and are of a high quality. Profitable, because circular projects are financially more competitive than traditional projects when external costs are taken into account.[7,19] In this respect, an (inter-)national shift in taxing resources, rather than labour, needs to be made. During the transition, the greatest challenge lies in actually implementing the technical applications as well as financial securities, as currently, the application of linear principles is still standard procedure.

Evaluation of the Construction value chain

- Together with market parties, the Municipality of Amsterdam developed the *Roadmap Circular Land Issue*.[37] This Roadmap was successfully applied in four circular tenders. These circular starting points – included in the development strategy of the City-Port area - can now be applied in other areas as well. On the level of knowledge development and sharing experiences, the municipality has also taken the lead. With that, research, networking and the exchange of information have shown to be the most important tools in the Construction chain.
- Market parties are willing to build in a circular way. They need clients who specifically demand circular ambitions. Everybuilding that is constructed in a non-circular way hinders high-value reuse of building materials in the future and slows the looping of the value chain. For the near future, instruments like spatial planning policy, land issue and regulations are indispensable.
- The biggest challenge in rendering the Construction chain more sustainable lies in the existing built environment. As such, the need to focus on an integrated approach in which energy, materials and health are taken into account arises.

Instruments \ Value Chain	Construction	Biomass & Food	Manufacturing	Plastics	Consumer Goods
Land issue	5	-	-	-	-
Spatial planning	4	-	-	1	-
Procurement	3	1	-	2	1
Education & information provision	3	2	2	-	-
Research	11	6	2	3	3
Networks & knowledge exchange	9	6	3	4	3
Legislation & Regulations	1	2	-	1	-
Business & Financial support	5	6	4	3	-

Evaluation of the value chain Biomass

- Within this chain there are several successful projects: sugar extraction from biomass in Biopark Havengebied; ammonia extraction from sewage water by Power to Protein; and phosphate extraction from urine at De Nieuwe Stroming. The municipality focuses mainly on research, networking and information exchange and, in some cases, offers financial support.
- The chain is often closed in a low-value manner, including the use of biomass for heat production. There is a need for scaling up initiatives that make high value reuse possible. In addition, logistics, financing and unclear or restrictive regulations are still obstacles for scaling up. There is a need for the deployment of spatial planning, business support, financing and regulations in order to achieve a successful upscaling of this chain.

SUMMARY

Evaluation of the value chains Manufacturing, Plastics, and Consumer goods

- *Amsterdam Circular* did not specifically focus on these three value chains. Nevertheless, various projects have been carried out within these chains through the connection with Construction and Biomass. The municipality has supported projects from renewable energy to 3D printing and from an internal marketplace for street furniture to repair cafés. In order to support these projects, knowledge tools and business support were also deployed.
- As a result of their traditional business models, there are conflicting interests between parties within these chains. Because of the highly urbanised character of the Amsterdam region, there are many opportunities for closing the loop in these chains, but a modification of the existing business models remains necessary.

Evaluation Land issue and spatial planning policy instruments

- These municipal instruments largely control the development of the construction chain. A lot of concrete projects have been carried out, among them four circular tenders on land issue and securing circular ambitions in the development strategy for the City-Port area. In addition to strategic decisions, these projects make it possible to scale up even more.
- For a successful application of these instruments, it is essential to involve all parties extensively in the entire implementation process. Taking Total Cost of Ownership as a starting point can make circular alternatives more competitive. In order to make future reuse of a high quality possible, it is important to take this into account in the development phase as well as in the user phase.

Evaluation Procurement instrument

- Procurement is the instrument par excellence that connects the municipality with physical products. It enables the municipality to create a market for circular products. In recent years, there have been a number of procurement processes in which circular principles have been applied, with circular procurement of office furniture as the best-known example.
- A further deployment of the procurement instrument can make a major contribution to the transition to a circular economy. This requires, among other things, a coordinating role of the lead buyers in the purchasing process, a different organisation of budgets and more functional questions.

Evaluation of knowledge tools (education & information provision, research and networks & knowledge exchange)

- With its knowledge tools, the municipality has both developed knowledge as well as shared it between market parties. Prominent examples are the City Deal Circular City, Amsterdam Smart City, Duurzaam020, and the PUMA research on the potential of urban mining. These instruments have helped to acquire knowledge on all value chains.
- The instruments have been used successfully to increase the level of knowledge in the city, both within the municipality and with market parties and consumers. Especially the Living Lab approach and the public-private-people partnerships stand out as successful. Therefore, the continued deployment of these instruments is important for all value chains.

Evaluation instrument of legislation and regulations

- The Quick Scan of the legal instruments for circular construction gives an overview of possible legal interventions by the municipality. The municipality has also laid down sustainability criteria in its events policy.
- In the field of legislation and regulations, the municipality has fewer possibilities because matters are often determined at an (inter-)national level. At the municipal level, it is important to safeguard circular ambitions in the new Environmental Vision and the Environmental Plan. Due to the postponement of the introduction of the Environment Act, it is important to include these ambitions in zoning plans, where possible.

Evaluation business support & financing tool

- The municipality has supported circular projects both on a programme - as well as at a project level. The Circular Innovation Programme and - at project level - an LCA scan for three companies in the port may serve as examples. The municipality has also provided financial support through the Subsidy Scheme for Sustainable Initiatives.
- Public financial support is often required to scale circular innovations to a commercially viable level. Think, for instance, of new (temporary) financing instruments that make it possible to finance high-risk corporate projects. In this way, innovators that have to bridge the higher risks and investment costs of circular business models are supported.

All parties are still at the beginning of the circular economy. The results of recent years enable us now to scale up to the next stage. In this evaluation, five action perspectives have been included for the next management period, providing concrete tools for upscaling.

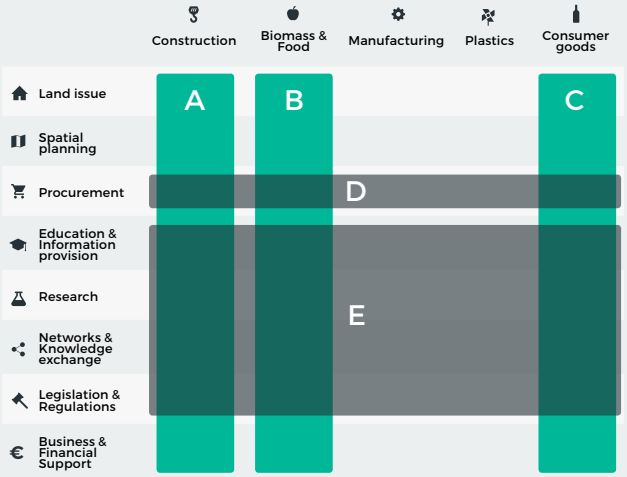
ACTION PERSPECTIVES FOR SCALING

The urban environment is the setting where complex societal challenges arise, where interaction between sectors takes place and where we can develop new solutions. The evaluation of 73 circular projects shows that the three value chains for Construction, Biomass & Food, and Consumer Goods are particularly promising for scaling up in the Amsterdam context. The municipality can make a big contribution to developing a new, circular standard in all these chains. In addition, the Procurement instrument and the Knowledge instruments (research, education & information provision, networks & knowledge exchange) show a great potential for accelerating the transition.

The three promising value chains and the two mentioned instruments, together, form five action perspectives. These action perspectives are based on what is needed to scale up to the next phase of the transition. This report describes both the role of market parties and the next steps for the municipality. We aim to continue the leading role of the municipality in an effective and realistic way. Thus, the action perspectives offer concrete tools for upscaling.

Upscaling of the construction value chain

In Amsterdam, the challenges in the construction sector are great: they are not restricted to new construction, they also include renovation/transformation, public space and infrastructure. Should these projects not be built in a circular way, renovation or disassembly becomes difficult, or even impossible. It hinders the future high-value reuse of building products. The construction sector can take big steps and quickly achieve visible results with a circular approach.



SUMMARY

The municipality of Amsterdam can accelerate the transition by a further deployment of the instruments of land issue, spatial planning and legislation & regulations. In order to realise circular projects in the short term and to guarantee circular performance in the long term, a good cooperation with market parties is essential. The *Roadmap Circular Land Issue* can play an important role in further upscaling.

These last years, Amsterdam's focus on circular construction has created a movement throughout the Netherlands. Amsterdam can support this movement by maintaining its focus on this value chain. In this way, the city can make a significant contribution to the further circularisation of the construction chain.

Upscaling of the value chain Biomass & Food

Biomass is a raw material for, among other things, food, cattle feed and building materials. Many biomass streams meet at a regional level. This chain has seen many activities in recent years, thanks to the *Circular Innovation programme* in particular. These innovative projects prove that there are many opportunities within this chain for high-value reuse.

A further deployment of the instruments of spatial planning and business support by the municipality offers the greatest contribution. After all, in this chain it is the private sector that have to take the largest steps, and these need support. The innovative cooperation between municipality and market, as designed in the *Circular Innovation program*, is a good starting point.

Continuing the commitment to the Biomass & Food chain ensures scaling up of innovations for high-value reuse. In this action perspective, for example, attention will be paid to activities that specifically focus on food and physical space in the city for decentralised solutions. The innovation developed in Amsterdam can then be applied elsewhere, which shows how important the role of Amsterdam is in accelerating the transition to a circular economy.

Upscaling of the value chain Consumer goods

As in any urban area, many consumer goods are being consumed in Amsterdam, such as: kitchen articles, furniture and clothing. With the continued growth of the city, the demand only increases further. Even more than transport and living, these consumer goods constitute the greatest environmental burden of households.

Continued focus on this value chain will mainly be in the fields of business support and information provision. The current emphasis on the end of the chain (waste phase) can be transformed into a structural approach for the entire chain. This leads to a lower environmental pressure. Effective cooperation with the greater metropolitan region is important. If we want to reach optimal results, we need to cooperate closely with the Amsterdam Metropolitan Area.

Expanding the Procurement instrument

Both at the European and the national level, procurement is seen as an important government tool to drive the circular economy. After all, for authorities, procurement is the main connection with physical products, and can involve significant volumes. An integral circular demand from the Municipality of Amsterdam drives suppliers to involve the complete chain.

The procurement instrument can be applied to all value chains. The greatest potential for municipalities, however, lies in the value chains of Construction (in the physical city) and Consumer goods (for own management). Structural circular procurement of Amsterdam creates an incentive for suppliers to produce circularly, and also offers them a secure market.

Expanding Research, Information provision and Networks

The transition to a circular economy shows, in many areas, a need for more knowledge and for sharing experiences. This does not only hold for technological knowledge, but also for knowledge on economic and financial incentives. In recent years, this focus of the municipality has proven to be successful in the chains of Construction and Biomass & Food. Together with market parties, the municipality started to create a learning environment, in which new initiatives were developed, applied and improved. This calls for an entrepreneurial and proactive civil service with a common knowledge on the circular economy and sustained awareness of the importance of cooperation.

These efforts should be taken to the next level in all value chains in the upcoming phase of the transition. By means of research, we should be able to chart technical and economic opportunities. Education & information provision should enable us to involve new stakeholders and organisations in the transition. Furthermore, The municipality should share knowledge and experiences in our networks, enabling all those involved to engage. In order for these instruments to be strong and effective, collaboration with Amsterdam-based knowledge institutes and market parties is essential.

Working together and learning by sharing

Stating that the transition to a circular economy is realistic and profitable, there is still a demand for many changes in as many areas. The importance of intensive cooperation should not be underestimated. This concerns both internal cooperation within the municipality (both within and between departments) and cooperation with external parties, including between the triple helix of government, business and science.

For this cooperation to be successful, an open attitude, transparency and a willingness to share knowledge and experiences are essential. Learning from each other not only entails sharing successful projects, but failures as well. Learning by doing and the formation of valuable networks are good first steps. However, we need to step up our efforts to make scaling up to the next phase possible. The philosophy of *Learning by Doing* could therefore be supplemented with *Learning by Sharing*.

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1 | INTRODUCTIE

The transition to a circular economy has accelerated over the past few years; the shift from a linear economy to a circular one is inevitable. While in a linear economy products are manufactured, sold and discarded after use, in a circular economy, products, parts and materials are reused to maintain their high value. Energy is produced entirely by renewable sources and sustainable principles are applied allround. All links in a value chain must cooperate to make this systemic transition possible. As such, the circular economy features high on the international, national and local agendas.

The entire Amsterdam Metropolitan Area is increasingly active to propel the transition to a circular economy, and a great number of innovative companies, start-ups and knowledge institutions here are already working on it. This is necessary because Amsterdam is not able to close many raw material cycles within the boundaries of the city. With an annual economic activity of € 106 billion, of which some € 47 billion in Amsterdam, possibilities are abound.[2]

In its Sustainability Agenda, the Municipality of Amsterdam announced its ambition to be the frontrunner in the transition towards a circular economy. In 2015, Amsterdam became the first city in the world to explicitly explore the opportunities of a circular economy. *Amsterdam Circular: Vision and Roadmap for city and region*[2] has become the (inter-)national leading research on the steps to take towards a city-wide circular economy. What is more, the circular economy is also a leading theme of the city's *Sustainability Agenda*.

The programmes *Amsterdam Circular: Learning by Doing and the Circular Innovation programme 2016-2018* are based on this roadmap. *Learning by Doing* engendered 20 circular projects for the municipality, including procurement and land development. Within the *Circular Innovation Program*, the municipality works closely with market parties and knowledge institutes on 30 innovative projects. The *Waste Implementation Plan* is approaching the transition from the end of the value chain and stimulates projects that address the way in which raw materials can be reused to maintain the high value. All projects are listed in Annex II.

The board of Mayor and Deputy Mayors has commissioned the evaluation of *Learning by Doing* and the *Circular Innovation Programme*. In this evaluation a total of 73 projects were assessed. These 73 projects include some relevant initiatives that did not belong to one of the programmes, as well as a number of projectsfrom the *Waste Implementation Programme*. A 'project' has been defined as an activity of the municipality or a market party realising circular ambitions. Therefore, not all projects are necessarily realised in the physical environment.

This research identifies the main lines of the project results and shows the lessons learned. Consequently, this report indicates which action perspectives are possible to further accelerate the transition to a circular economy.The central question of this research is; 'What is - in this phase of the transition - the role of the municipality and the role of the market parties?' The relation with the regional scale is important but falls - when it comes to closing material cycles - outside the scope of this research.

This report opens by presenting the current urban challenges that the circular economy strives to tackle and the questions that need to be addressed in the transition (Chapter 2). This chapter is followed by a short overview on the current state of the circular economy at the European, national and local context (Chapter 3). Next, we shall evaluate the three programmes – subdivided into five value chains and eight municipal instruments (Chapter 4). Based on the outlined context and the results of the evaluation, action perspectives to undertake the next steps are described in chapter 5.

According to the Circularity Gap Report published in January 2018, presenting the 'circular state of the world', at present, our world is only 9,1% circular.[1] Closing this circularity gap contributes to achieving the goals of the Paris Climate Agreement and the UN's Sustainable Development Goals. The report presents a snapshot of the current global use of materials, highlighting that over 90% of the materials that we extract from the Earth are thrown away after use. Finally, possible interventions for countries, cities, sectors and value chains are presented.

The circular economy as an integral approach

Over the past decades, urban regions, the world over, have been increasingly facing a number of major challenges; a pressure on available raw materials, energy transition, climate adaptation and dramatic rates of urbanisation. A large proportion of commonly used raw materials are becoming increasingly scarce worldwide.[3] In 2050, the Netherlands is aiming to become carbon-neutral, as far as energy supply is concerned (in 2050 100% CO2 reduction compared to 1990 and independent of natural gas).[4] The rise of global temperature must be limited to 2ºC, with a goal for 1,5ºC.[5] As a result of the inevitable impacts of climate change, adaptation measures are also necessary; creating a resilient urban environment in the face of extreme weather conditions. Further compounding these challenges, cities are also experiencing dramatic rates of urbanisation As a result of an increasing number of residents, more homes have to be built, both in the existing city as well as in new projects, further increasing pressure on the living environment. As a result of this growing population, the use of products and raw materials is set to increase in tandem.

With its integral approach, the circular economy is one of ways to tackle the challenges mentioned above, as well as others. As a result of this integral approach, the sustainable development and economic development of the city go hand in hand. A circular economy can save Europe an estimated $630 billion annually in raw material savings,[6] adding another $1200 billion of additional benefits.[7] Moreover, this results, among other things, in additional jobs for the maintenance, repair and return logistics of products and components. TNO has calculated that the circular potential for the Netherlands mounts to €7.3 billion,[8] the difference with the European figure being due to a closer focus.

At this moment, the transition to a circular economy finds itself in an initial phase.[9] For our energy supply, we mainly still rely on fossil fuels and the application of linear principles for product use (take, make, waste) are often still the standard. This early phase of the transition is also visible in the scan of many organisations; with the lack of one uniformly agreed definition of a circular economy[10] and the divergent types of 'circular' projects.[11]

The circular economy requires a system change

A complete transition from a linear to a circular economy is a complex task. All stakeholders within the economic system must participate in this change. This does not only mean forging new partnerships and collaborations throughout the entirety of the value chain, where this was currently not the case, but also cross-borders. As of yet, no one has a complete view of the consequences and which actions have to be taken in the long term.

Therefore, the circular economy requires a systemic change, surpasses changes simply on a technical level (e.g. the reuse of existing materials). To make these changes structurally possible, intensive forms of cooperation within all value chains are needed (e.g. the collection of products after the use phase). These can be boosted by new business models that internalise external costs and create long-term value (e.g. hiring a product instead owning it). The need for change on these three levels (technical, process and financial) is summarised in the model below.[12]

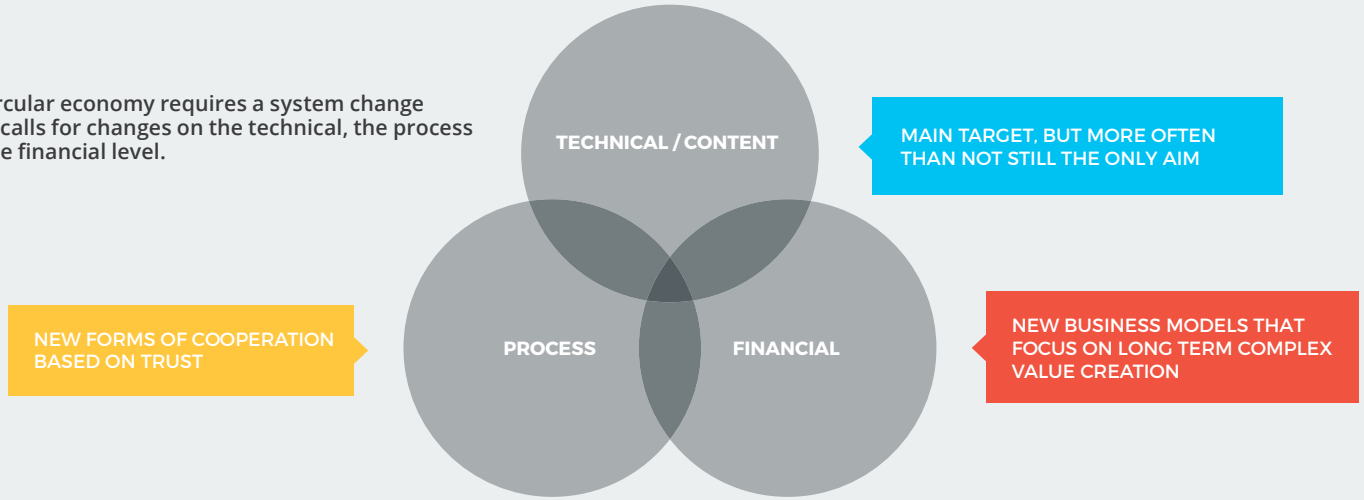
Consequences of a circular economy

Realising a circular economy is important for cities. First of all, the local economy is strengthened through the closure of product and material cycles on the smallest scale possible. This leads to more local transactions of products, parts and materials. Not only does does this lead to greater quantities of (high-value) materials within the region, but also increased employment. In addition, the circular economy will decrease the environmental impact of the city.

This extra employment also leads to a new view on the types of jobs needed. At a local level, there will be a call for jobs in the repair and maintenance of products in order to sustain their use on a high-value level. But also jobs that support these activities have an impact on local employment (e.g. jobs in return logistics). While, on the one hand, the circular economy will create many new employment opportunities , some jobs, on the other hand, will disappear or will change in character.

Finally, a circular economy will temporarily affect the available space of a city, partly as a result of the new infrastructure, such as smart grids, heat systems and new sanitation. For high quality reuse without large logistic movements, it is often necessary to (temporarily) store products and materials. After all, there is often a difference in time between the moment a material becomes available, and the moment that it can be reused. This applies to all materials and products. Amsterdam pays specific attention to building materials because of their significant volume in relation to other value chains.

The circular economy requires a system change which calls for changes on the technical, the process and the financial level.



▶▶▶ Digitale technologie als ondersteunende ontwikkeling

In the transition to a circular economy, digitisation, effective logistics and the financial sector can create a shift in the way the city functions. This has major consequences for both consumers and organisations. Four developments, which are reflected in the description of the action perspectives, are of particular importance:

- **Optimal use of materials –** Every day, digital platforms offer more opportunities for sharing products, lowering overall quantities required (e.g. car sharing platforms). Digitisation also increases transparency in design, materials used and maintenance (e.g. materials passports). This means that opportunities for high-value reuse after disassembly, for resource efficient production practices (e.g. 3D printing) and improvements in maintenance and repair are growing.
- **More knowledge and insights -** By collecting and analysing data that are already available ('open data'), digital technology can identify real-time challenges in the city. This includes the availability of materials, energy and water, as well as ways to optimise mobility. This makes urban challenges more visible and supports decision making towards a systemic solution.
- **Effective logistics -** Closing cycles on optimal scales requires the incorporation of other mobility flows and smart logistics, made possible by digital technology (e.g. self-driving vans and combined transport movements including returns). This growth in local, short transport movements is only possible when it is effectively embedded in multiple chains in the current urban logistics and spatial planning.

▶▶▶ Changing role of the financial sector

In the transition, an important role is reserved for the financial sector. Since the publication of Time for Transition,[13] banks and (public) investors are increasingly developing a responsible, integrally sustainable vision towards financing. For example, the financial sector now considers real estate with a high energy consumption as a high-risk property. This ultimately has consequences for investors' risk profiles, making such property undesirable, therefore, measures will be taken.

◀◀◀ Barriers for a system transition

There are important barriers in the systemic transition to a circular economy. Specific technical barriers do appear, but seem limited and are often not leading (e.g. multiple material composition of plastic hinders high-value reuse). The barriers are mainly economic, cultural (including cooperation) and legal (including tax and accounting rules) in nature. Literature[14, 15] offers the following six major barriers for the transition at the urban level:

- **Material consumption** is required for (positive) operating result - In most cases, product sales are the largest financial incentive for producers. Products breaking quickly lead to more profit for the producer and a higher GDP (positive), but also to more material consumption and a higher environmental impact (negative). The decoupling of profit and material, however, requires a fundamental change of the entire value chain, including sales strategy and suppliers' revenue models. Despite some good examples, there is still a world to win[16] (e.g. Schiphol purchases light as a service from Philips).
- **Focus on short-term value creation -** Many organisations lack a focus on long-term value creation (e.g. purchase on investment instead of lifetime costs). Low prices of virgin material are hardly an incentive for the recovery of residual value. The change to a circular business model often means higher investment costs and more financial uncertainty in the short term.[17]
- **Natural resistance to change –** A system transition requires behavioural change of each and every link in the chain. Due to routine or successful business management, many companies keep doing what they have always done. Resistance to change stands in the way of a system transition. For example (further elaborated in the evaluation of 'Legislation & Regulations'), the current resistance from distributors of printed materials to a yes/yes sticker is a result of a sector that wants to continue doing what it always did; distribute printed advertising material.
- **Lack of trust and transparency -** Right now, many organisations act as competitors. More sales for business A means less turnover for business B. In order to create circular revenue models around high-value reuse, products, parts and materials, other forms of cooperation, based on trust, are needed. Parties must be willing to share (competition-sensitive) data in order to make the desired system change possible.[18] This applies to parties in the chain as well as to the client-contractor relationship. Trust- and transparency based cooperation is essential for such long-term value creation for all parties involved.
- **Tax on labour instead of raw materials –** Low tax on new raw materials and relatively high tax on labour makes the repair and reuse of products, parts and materials financially less attractive. Today, new products are cheaper than repaired products. A tax shift from labour to raw materials is a solution to this problem. The publication of Ex'Tax (2014, with a focus on the Netherlands)[19] offers good tools for this. At the European level, Ex'Tax has developed concrete measures for a tax shift of €554 billion.[20]
- **Accounting rules -** Existing accounting rules are set for a linear economy (e.g. it is still mandatory for most products to be depreciated to a zero value). When we take into account risk assessments and taxes, selling products is still the most attractive alternative, fiscally speaking (e.g. in case of lease, products remain on the balance of the supplier). This calls for an international adjustment of accounting rules, allowing suppliers to make the transition from business models based on ownership to business models based on use.

Leading principles for Amsterdam

In order to make the transition to a circular economy, the municipality of Amsterdam formulated 7 guiding principles in its Sustainability Agenda:

- The circular economy has no **waste**. All materials enter an infinite technical or biological cycle.
- All energy comes from **renewable sources**.
- Raw materials are used to **create** (financial or other forms of) **value**.
- **Modular and flexible design** of products and production chains increase the adaptability of systems.
- The change from ownership to use requires **new business** models for production, distribution and consumption.
- The logistics system is changing. More **regional logistics and return logistics**.
- Human activities contribute to ecosystems and ecosystem services and the reconstruction of **natural capital.**

EUROPEAN UNION: SUPPORTING THE MARKET

The European Union is using its Circular Economy Package[21] to support the transition to a circular economy. Although many member states still have a limited understanding of what this transition means, laws, regulations and economic incentives on an EU level have a great impact. In addition to the Netherlands, Finland and France are strongly committed to the transition to a circular economy. On a sub-national level, Flanders and Scotland are very active.

The transition to a circular economy is one of the top ten priorities of the current European Commission, led by the Juncker Commission.[22] This movement has started in 2008 with the new Waste Management Directive.[23] For a number of member states, the prevailing motives to invest in the circular economy are improved waste management and compliance with European standards, laws and regulations in this area.[24]

In 2015, the Circular Economy Package was published, which, among other things, focuses on more commitment to stricter guidelines for EcoDesign and greater producer responsibility (extended producer responsibility). The concrete elaboration of these measures has yet to follow.

In the transition towards a circular economy, Europe especially relies on the initiative of the market and local authorities. That is why the European Investment Bank acts as co-financier of large circular initiatives[25] and why the European Commission focuses on sustainable[26] and circular procurement.[27] The European Joint Research Center collects and shares good examples[28] and the European Circular Economy Stakeholder Platform connects stakeholders with public and private backgrounds.[29] The EUROCITIES network, of which Amsterdam is the Chair of the Environment Forum and the Circular Economy Task Force, is one of the platforms where local governments share their knowledge.

In Europe, the Netherlands has taken on the role of frontrunner. Next to the Netherlands, Finland and France, are active for a circular economy on a national level. But other countries too, such as Luxembourg, Slovenia, Germany and Sweden, are active. Finland has the ambition to become a global leader and have published a national Roadmap to stimulate the transition.[30] France now guarantees the transition to a circular economy by introducing national legislation focusing on the transition to renewable energy.[31] The commitment of the Paris metropolitan area to the circular economy has generated national political support,[32] similar to that of Amsterdam in the Netherlands. At a sub-national level, Scotland (with a circular opportunity map)[33] and Flanders (with route maps on five sectors)[34] are active areas.

2008
European Waste Framework Directive
Publication

2015
Closing the Loop - An EU Action Plan for the Circular Economy
Publication

Januari 2017
European Strategy on Plastics in a Circular Economy
Publication

Maart 2017
European Circular Economy Stakeholder Platform
Publication

April 2017
Development of a Monitoring Framework for the Circular Economy
Publication

Oktober 2017
Public Procurement for a Circular Economy
Publication

The Netherlands: 100% Circular in 2050

In 2050, the Dutch economy should be fully circular, using 50% fewer primary raw materials by 2030. Those are the objectives of the current government, as stated in the Transition Agendas Circular Economy.[35] Over 325 parties have endorsed this ambition by signing the Resources Agreement. In five transition agendas, concrete measures have been worked out that contribute to the realisation of these ambitions. In addition to these Agendas, the Environmental law that takes effect in 2021 offers new opportunities for the realisation of circular ambitions.

The national transition towards a circular economy has started with advice from the Council for the Living Environment and Infrastructure in 2015. The core recommendation was to draw up a transition agenda with a common vision, common objectives and a clear division of tasks between different Ministries, based on the strengths of each stakeholder. This approach has led to the *Government-wide Circular Economy Programme*. In addition to this government-wide program, the Netherlands Environmental Assessment Agency (PBL) has formulated another four important policy options: (1) market and environmental pricing, (2) stimulating laws and regulations, (3) innovation policy, and (4) the government as a network partner.[36]

The *Government-wide Programme* describes six change pathways, five interventions and five priority value chains: Construction, Biomass & Food, Manufacturing, Consumer goods and Plastics. The two value chains that are mentioned in *Amsterdam Circular - Construction and Biomass & Food* – are mentioned explicitly in the Government-wide programme. This validates the Amsterdam choice for these two value chains in 2015.

By signing the Resources Agreement, over 325 parties have committed themselves to realising the circular economy. Next, the national and regional Government, and private sector stakeholders, together, developed transition agendas on the five chains mentioned. These Agendas appoint concrete objectives and actions, which include both social and financial aspects. The Municipality of Amsterdam has contributed to the agendas on Construction and Consumer Goods.

The Environment Act offers new opportunities for realising circular ambitions at the local level. The Act allows the municipality to form a vision in line with the national objective for 2050 and determine, together with all stakeholders involved, how this ambition can be realised within the city. The participative process also results in local stakeholders gaining ownership of the actions. Although the implementation of the Environmental Act (formerly 1 January 2019) has been postponed to 2021, the transition is already taking place. With the implementation, new issues will arise, however, this calls for an open attitude and a learning organisation.

Finally, the coalition agreement supports the transition to a circular economy. In addition to the strong commitment to CO2 reduction, it mentions the circular economy explicitly. The national government intends to implement the Transition Agendas, remove any obstacles as well as they can and share good examples. An extra tax on the incineration and landfilling of waste will also be implemented.

June 2015
Circular economy, from wish to reality
Publication

September 2016
Government-wide Circular Economy programme
Publication

January 2017
Resources Agreement
Signing

April 2017
Circular Economy: Policy Options
Signing

January 2018
Transition Agendas
Publication

Amsterdam: International Frontrunner

In 2015, Amsterdam was the first city in the world to develop a vision and a roadmap for the circular economy. A focus on two concrete value chains - Construction and Biomass & Food - rendered the concept tangible. Next, the programme Learning by Doing and the Circular Innovation Programme were published. By boosting the market, the activities that arise from these programmes play an important role in realising the circular economy.

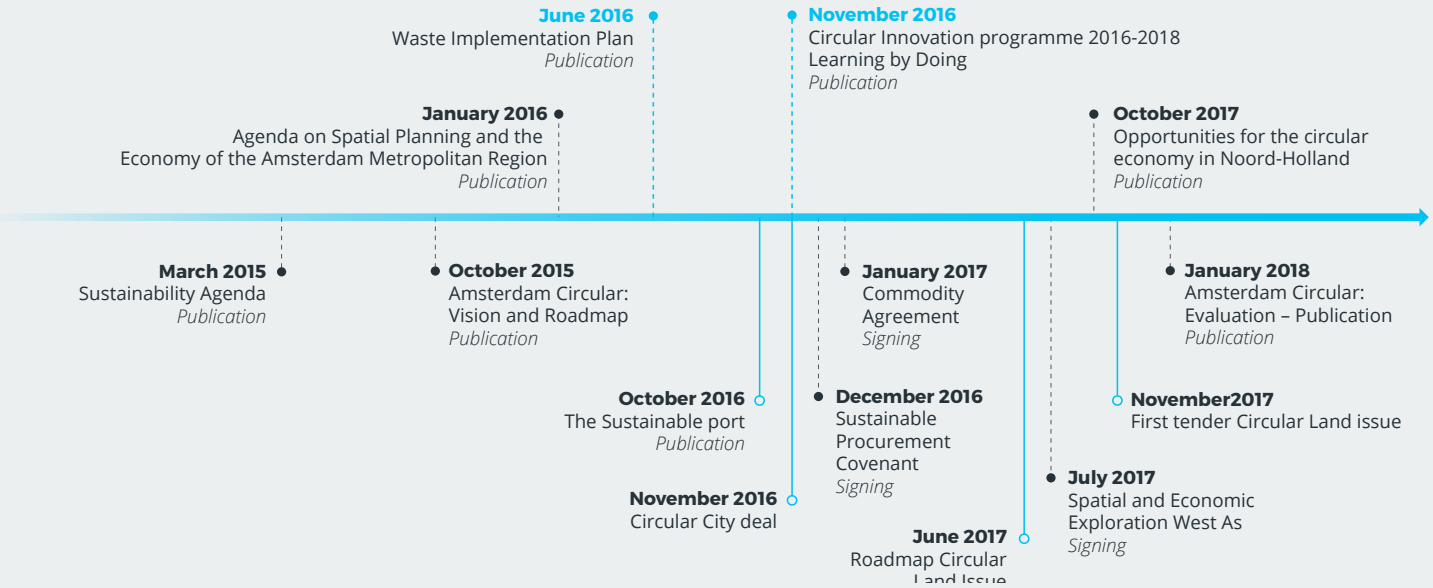
The publication of *Amsterdam Circular* proved to be an example for many other cities and regions that aspire to take steps towards a circular economy. This scan was the first study that practically translated the circular economy to an urban level. Quantifying the impact on jobs, emissions, economic value and raw material use showed that the circular economy not only leads to environmental gains, but also has positive socio-economic effects. The *Amsterdam Circular* roadmap not only gave focus and direction to the city itself, but also positioned Amsterdam as an international frontrunner.

Because the municipality actively indicates that 'circular' is the new perspective, businesses and knowledge institutions are anticipating future growth in this field. After all, they want to participate in the transition and see the efforts of Amsterdam as an opportunity to learn how to apply circular principles. For example: *The Roadmap Circular Land Issue*[37] and the research into the impact of circular construction[38] has resulted in various construction companies announcing that they would adjust their production processes to circular principles, with recognition to the demand for circular construction in Amsterdam.

The Amsterdam Metropolitan Area (AMA), as a whole, has increasingly committed itself to the transition to a circular economy. The Amsterdam Economic Board (AMEC) supports other local authorities and companies within the metropolitan area to take steps towards more circular operations. Many raw material flows do not remain within the city limits of Amsterdam. Ultimately, a far greater area than the Amsterdam Metropolitan Area is required to fully transition towards a circular economy (e.g. cycles of rare metals are closed at a European level).

Internationally, there is a wide interest for the experiences of Amsterdam. As a result of the practical implementation of projects from these programmes, these experiences and lessons learned are now available. In a C40 and EUROCITIES context, Amsterdam is often asked to support other cities in shaping their programmes on the circular economy by sharing its experiences.

The focus on the circular economy fits well with the wish of the Municipality of Amsterdam to position the city as *Innovation Capital*; the active climate for start-ups creates a breeding ground for innovations. Start-ups increasingly focus on the circular economy, as a result of various challenges around a theme (such as *Startup in Residence*) or the various breeding grounds where start-ups can develop (including ProDock).



4 | EVALUATION

During the past months, 73 projects have been evaluated. The project evaluations show that the transition to a circular economy is both realistic and profitable. The evaluation concerns the following projects: all 26 projects from *Learning by Doing*; all 30 projects from the *Circular Innovation Programme*, and 5 projects from the Waste Implementation Plan. 12 Projects were developed by the municipality separately (that is, not belonging to one of the programmes), these have been included due to their relevance. The projects from Learning by Doing are completed; the projects from the Circular Innovation programme are long-term projects and therefore interim results are given in this evaluation. Two projects have been delayed and will start next year and are therefore not part of the evaluation. A complete list of all 73 evaluated projects can be found in Annex II.

Implementation evaluation

The evaluation was performed qualitatively at a project level. Each project took place within one (or more) value chains and was supported by means of one (or more) instruments. The strategy *Learning by Doing* is bearing fruit. The research conducted as well as realised projects show that, as of yet, many lessons have been learned. A summary of all projects considered for each value chain as per instrument may be found in the matrix below. For each particular chain, the **impact** of the projects was also examined. For each instrument, the emphasis lies on the **effectiveness** of that instrument. The method of the evaluation is explained in Annex I.

Subdivision in value chains and instruments

Because an individual evaluation of the 73 projects would be difficult to read, the evaluation this divided by value chains and instruments. The value chains are the five national transition agendas: Construction, Biomass & Food, Plastics, Manufacturing and Consumer goods. The choice for classification of the instruments is based on the Policy Toolkit of the Ellen MacArthur Foundation.[39] This toolkit has been adjusted in order to cater the context of Amsterdam, in which eight instruments are distinguished: Land issue, Spatial planning, Procurement, Education & information provision, Research, Networks & Knowledge exchange, Business & financial support, and Legislation & regulations.

Many projects on Construction and Biomass & Food

The transition to a circular economy within the city shows that the various value chains find themselves in different phases of the transition. The majority of projects are located in the two chains that Amsterdam is actively involved in: Construction and Biomass & Food. A look at the instruments shows a clear focus on research, the creation of networks and business support.

Instruments \ Value Chain	Construction	Biomasss & Food	Manufacturing	Plastics	Consumer goods
Land issue	5	-	-	-	-
Spatial planning	4	-	-	1	-
Procurement	3	1	-	2	1
Education & Information provision	3	2	2	-	-
Research	11	6	2	3	3
Networking & Information exchange	9	6	3	4	3
Legislation & Regulations	1	2	-	1	-
Business & Financial support	5	6	4	3	-

Scale:
- Local
- Urban
- Regional
- National
- International

Developed in cooperation:
- Limited
- Unaltered
- Improved

Subdivision of the projects from *Learning by Doing*, the *Circular Innovation programme* and the *Waste Implementation Plan* into different value chains and instruments. Those projects that are in more than one chain, are counted likewise.

Rogers' innovation curve[40] expresses the extent to which organisations apply circular principles, distinguishing between five phases. The transition to a circular economy is still in its first phase. That applies to both the market and to the municipality of Amsterdam. After frontrunners (innovators) have taken the first steps, the vanguard (early adopters) follow close behind to learn the lessons from these frontrunners, and enlarge the market by joining the movement.

Chapter 4 (Evaluation) takes a look at the front-runners phase to identify what still needs to be done to get to the next, vanguard stage of early adopters. **Chapter 5 (Action Perspectives)** discusses what is needed to further the transition to the circular economy, focusing on the role that the market can play on the one hand, and activities the municipality can undertake on the other hand.

The following pages contain a summary of the main results per value chain and per instrument. Next, we discuss the lessons learned and determine what is necessary to enter the next phase. Moreover, the summary shows the number of projects carried out for each value chain and for each instrument, at which scale level they are located and the extent to which new collaborations have been entered into. For a further explanation of the methodology, see Annex I.

Lessons learned

The lessons learned summarise what barriers were identified; what worked and what did not; which support came from the municipality or which support was lacking; and what progress did the market make itself in the transition to the circular economy.

What is needed?

The lessons learned show us what is needed in the longer term (+/- 10 year) to realise the transition to a circular economy. Both the municipality and the private sector play a role in this.

Role market parties

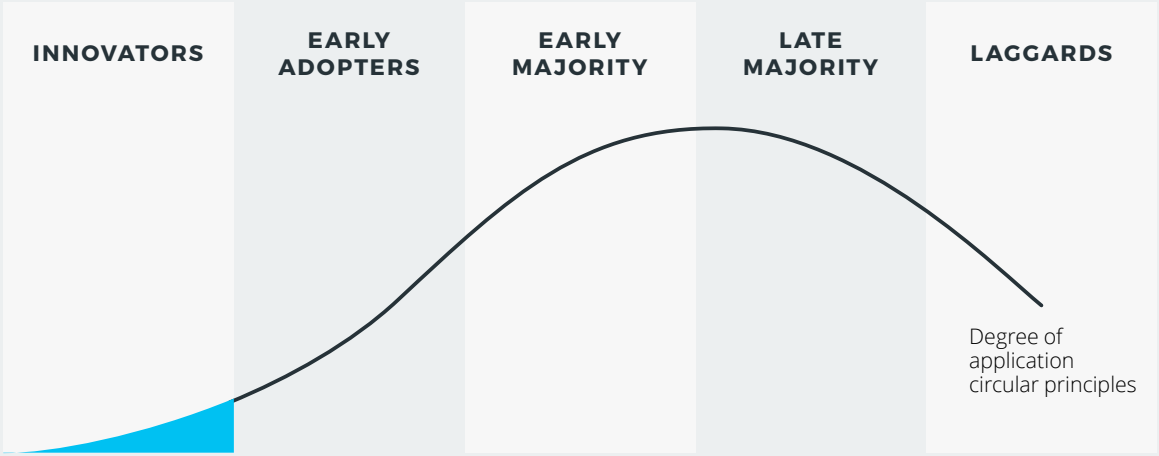
The private sector can take their own responsibilities in order to achieve what is needed to get to the next stage.

Activities municipality

In order to support the private sector, a number of concrete actions in the short to middle term (+/- 4 years) can be taken by the municipality.

4 | EVALUATION

5 | ACTION PERSPECTIVES



Scope *Under the Construction value chain, we recognise all activities related to demolition, renovation, transformation and new construction of buildings, civic and hydraulic engineering and the public space, within the municipal boundaries of Amsterdam. The chain of subcontractors also fall within scope, even if they are located outside Amsterdam.*

Chain status The construction chain is a large and diverse chain, which, despite some innovative frontrunners, is mainly organised in a traditional, linear way. Iconic circular projects have been created by innovative thinkers and organisations. Despite the fact that the application of circular principles is technically possible and occurs at a project level, non-circular construction remains the standard. When considering the reuse of construction waste, businesses commonly show a strong focus on low-grade reuse of demolition waste in their everyday practices (e.g. for reinforcement under new roads).

Project results In recent years, leading research has been conducted on circular construction in Amsterdam. The potency of urban mining (which, incidentally, does not apply to the construction chain only) for the city is determined for some specific materials (PUMA) and criteria for circular building have been formulated (*Roadmap Circular Land Issue*). A study on the costs and benefits of circular construction has been published and circular principles have been included in the development strategy for the Port-City Area (40,000 to 70,000 homes). At FabCity, a number of circular demo buildings were put up in the first half of 2016.

Circular criteria were included in four tenders for circular land issue: Buiksloterham, Centrumeiland, the Zuidas (all three of them housing) and Sloterdijk (retail trade). The tender for the Zuidas has already been awarded, and the tender for Buiksloterham has been published. The Municipality of Amsterdam expect to publish the remaining tenders sometime during the first six months of 2018. Moreover, *Amsterdam 1000 years* supports innovative processes towards circularity within the municipal organisation of Amsterdam. With metro and tram replacement projects, the city have been recycling steel for some time now. Circular principles were included by the Central Government Real Estate in the sale of the Bijlmerbajes.

In recent years, several networks have been set up in which knowledge on circular construction is exchanged. The municipality takes an active role in these networks. Amongst others, Cirkelstad (*Circle City*) brings parties from different parts of the construction chain together and developer OVG actively shares its knowledge on a circular transformation project in the South of Amsterdam. The Netwerk Betonketen (*Concrete Value Chain Network*) helps construction stakeholders to close the concrete cycle between projects (e.g. for some time, contractors have been adding granulated concrete to new concrete in metro and tram replacement projects). Finally, (large) contractors have attended a training on circular procurement and construction, organised with a financial contribution from the municipality of Amsterdam.

Research has been conducted into an (online) raw materials marketplace for construction waste and how cooperation can promote the exchange of building materials.[41] There appear to be various initiators of commodity marketplaces in the metropolitan area and there is a need for several in the region. However, the demand for marketplaces for circular building materials and products is lagging behind. To boost the demand, businesses see an active role for the municipality.

Roadmap Circular Land Issue

The Roadmap Circular Land Issue describes 32 criteria for incorporating circularity in a land issue process. These criteria cover five themes: materials, energy, water, ecosystems and resilience. When applying the roadmap, criteria are selected for the area in question, in line with local ambitions, area characteristics, and urban planning frameworks. From the day of publication, the Roadmap has proven to be authoritative in the Netherlands and is widely used to tender circular ambitions. Actual practice shows that some criteria could be fine-tuned and improvement in the application of the criteria is still possible. Therefore, it is important to continue testing the Roadmap, improve its criteria along the way and apply focus. The Roadmap will be evaluated after all four land issue tenders.

Lessons Learned	What is needed?
The market takes a positive attitude towards circular construction, despite the roadblocks (see Chapter 2). The private sector does need clients that actively demand circular ambitio ns and leaves them with maneuvering space	Circular ambitions in each land issue project Circular ambitions in each of the municipality's own real estate tenders, whether they concern new buildings, renovation or transformation Circular ambitions in each tender concerning civic and hydraulic engineering, transformation of the public space or utilities. Development of circular construction products
Every building that is not constructed in a circular way is not prepa red for circular demolition (in fact, disassembly). This hinders the high-value reuse of building materials and slows down the cycling of the value chain	Circular ambitions in the future Environmental Plan for Amsterdam, which would secure these ambitions for future developments. Developing buildings and parts that can be easily disassembled.
We find the greatest challenges for sustainability in the existing built environment. A focus on new buildings alone is too narrow	Circular ambitions in all projects concerning renovation and transformation of existing real estate, including (the transformation of) public space. In the elaboration of these circular ambitions, appropriate criteria can be formulated at a project level Circular ambitions in all projects concerning renovation and transformation of existing real estate owned by housing associations and investors. The size of their portfolio may create a demand in the market
Zoning plans limit the possibilities for new functions in a specific area, while the need for them may arise	More flexible zoning plans or zones with no, or only a few, restrictions A more proactive attitude at a local level in the setting of area-specific needs
Definitions of 'circular construction' are various, complex and hard to use. Despite dozens of definitions, parties are still trying to find out what is meant by 'circular construction'	More uniform definitions on circular construction. A clear guideline, safe-guarded at a national level, is called for. The Roadmap Circular Land Issue may be a starting point
Today, the prices for used materials are higher than for new ones	A shift in taxes from labour to materials in order to stimulate the reuse of materials
Tax reform in order to make circular construction more attractive. One way of achieving this is by connecting the property tax of a building to its environmental impact	Modification of the fiscal regime in order to stimulate the circular performance of buildings, by taxing non-circular performance
Focus on an integral process in each project concerning renovation and transformation on an integral process, taking demolition and disassembly into account. For this, timely planning is key	Focus on an integral process in each project concerning renovation and transformation , taking demolition and disassembly into account. For this, timely planning is key

Action Perspective A (page 32) describes the possibilities for upscaling the Construction chain >

4 | VALUE CHAIN **BIOMASS & FOOD**

24 PROJECTS INSTRUMENT SCALE COLLABORATION

Scope *Under the Biomass & Food value chain, we understand agricultural crops, algae, wood, grasses and residual streams from harvest to consumption and final processing. The value chain includes all activities of,*
amongst others, farmers, suppliers, retail, catering and consumers around organic flows within Amsterdam.

Chain status The Biomass & Food and chain comprises many different raw materials. Their value varies greatly: food has a relatively high value when compared to other forms of biomass. We are also confronted with dilemmas, such as the use of biomass as an energy source by means of combustion or fermentation, versus a more high-value application (e.g. the processing of residual wood in a table). In every step of recovering the highest value, the correct cascading of processes must be applied. Currently, waste streams are already being reused on a raw materials level. A fine example is the conversion of VFG waste to compost. Activities in this chain, therefore, primarily focus on the high-value recovering of specific raw materials.

Project results In recent years, several pilot projects have been executed. In *Biopark Havengebied* (an initiative by the Port of Amsterdam) an ecosystem is being created whereby lignin and sugars are refined from (woody) biomass. On an experimental scale, *Power to Protein* generates ammonia from a fermentation process of sewage for the production of high-value vegetable proteins. The *Nieuwe Stroming* is an initiative that extracts as much pure urine from Amsterdam festivals as possible, supplying it to Waternet for the recovery of phosphate. *Rainbeer* uses rainwater to brew beer. *SecretVillage* is an entrepreneurial initiative in the Regulierdwarsstraat, in which members compost their VFG waste to be put to use in local urban agriculture. *Waste to Aromatics* recover aromatics from waste for the production of plastics. Collaboration between businesses, knowledge institutions and public organisations such as Waternet and Staatsbosbeheer deliver new biocomposite products from biomass.

Furthermore, knowledge has been increased by performing various investigations, which provided further insight into the possibilities for decentralised processing of organic flows in the city (*RE-ORGANISE*) and solutions for a healthier, fairer and a more sustainable food system in the AMA (*Food Systems Design*). A collection pilot on Java island has shown that citizens are prepared to separate their VFG waste, the rigorous approach resulted in a participation of 50%, leading to a final response of 20%. Next year, a similar pilot will be set up at IJburg.

Power to Protein

Power to Protein creates high-value proteins in the form of Single Cell Protein, by a special bacterium that grows on hydrogen, carbon dioxide, ammonium and oxygen. Currently, ammonium is a waste material, which is present in different flows of wastewater treatment. A waste water purification plant also produces biogas. After combustion, biogas is converted into carbon dioxide, which can be used as a raw material for the production process of the proteins. Sewage water forms the basis for these high-value proteins.

At this moment, the initiative is still in the test phase and a few kilos of protein have been produced. The positive test results show the potential for upscaling. An advantage of this method of protein production is that the nitrogen cycle is more efficiently used than in a traditional process. In this way, the initiative contributes to local, high-value protein production, reduces the pressure on the food system and brings significant sustainability gains.

Lessons Learned	There is still uncertainty about the concepts of a circular Biomass & Food chain. Biomass and food are often mentioned together, but possess very different values and chains. In addition, the chain is still very fragmented; there are many initiatives, from bio-refining to counteracting food waste, but they are not necessarily connected to one another	The logistical organisation of the Biomass & Food chain remains problematic (e.g. the number of high-value flows is too small) and hinders, among other things, high-value recycling	The Biomass & Food chain are often still closed on a low-value level. This is partly due to restricting laws and regulations. For example: non-consumed food products must be treated as waste, which makes high-value application difficult	The high-value recovery of nutrients offers possibilities for profit in the water chain	A small number of specialised projects, such as Waste to Aromatics, are successful as a result of their small scale and specific focus in the high-value reuse of organic residual flows	In the start-up phase, innovative businesses need financial support because circular food products are not competitive with non-circular alternatives and negative costs are not calculated	Investments are lagging behind demand.This is because a regional strategy is current lacking and initiatives and up-scaling projects do not fit into an overall approach
What is needed?	A clear understanding of circularity in the Biomass & Food chain; how they can be realised and who is responsible	A regional strategy for high-value reuse of biomass, with a special focus on smart logistical connections	No restrictions in laws and regulations relating to high-value reuse of organic residual flows Knowledge about the correct cascading processes for optimal value retention through research into the technical and organisational possibilities and restrictions	Initiatives on a local level to reclaim high-value nutrients from water	Challenges in the Biomass & Food chain that can be scaled up Practical testing labs for the Biomass & Food chain	Account for external costs in the procurement of food products (see Chapter 2)	A regional strategy that ensures investments

Action perspective B (page 34) discusses the possibilities of upscaling of the Biomass & Food chain

4 | VALUE CHAIN **MANUFACTURING**

11 PROJECTS INSTRUMENT SCALE COLLABORATION

Scope *In accordance with the definition of the national Transition Agendas, we understand the Manufacturing value chain as the production of metal and plastics, the technology industry and smart industry, including suppliers. This value chain includes all activities in this area within the city of Amsterdam. In Amsterdam, a broader definition is generally used, but for reasons of unambiguousness, in this research we use the national definition.*

Chain status Although sufficiently present in the region (e.g. Tata Steel), relatively few producers in the metal, plastics and technology industry are located within the city of Amsterdam. The high-tech industry present is mainly situated in the Port (e.g. PPG). The municipality of Amsterdam has, therefore, not implemented any concrete projects in recent years, partly because the 2015 Amsterdam Circular roadmap did not focus on this chain.

Project results Despite this lower focus, a number of circular projects within the manufacturing industry have been executed. *City-zen* focuses on a change in the energy system in the city so that more local and renewable energy can be produced as well as used. The *Amsterdam Innovation ArenA* is working on innovative projects around the ArenA, where high-tech applications are also deployed. *Startup in Residence* also supports start-ups in the manufacturing industry. *Weeelectric* works together with the industry on the return logistics of electrical appliances.

Weeelectric

In May 2017 'Weeelectric' started in Amsterdam as a new test collection of small electrical appliances. This is a nice example of urban mining at product level. Residents in the Jordaan returned old and used electrical appliances to the package deliverer of PostNL. To date more than 750 devices have been returned.

Weeelectric is an easy way for people to recycle small electrical appliances. When the PostNL courier comes to deliver a package, citizens can return their old small appliances for free. These appliances do not have to be packaged; they only have to be clean, safe and easy to take away by the courier.

The project is an initiative of PostNL, Weee Nederland and Thuiswinkel.org in cooperation with the Municipality of Amsterdam, AEB Amsterdam and Amsterdam Smart City. More information can be found at www.weeelectric.nl, including the exact postal codes where Weeelectric is active.

Lessons Learned	Players in this high-tech value chain are often big international companies. Therefore, mostly European laws and regulation give direction for development to this chain. As of yet, this direction is inadequate	More knowledge and information about circularity in the manufacturing chain. What does 'circularity' mean in terms of quality, costs, design, guarantees and return agreements	Parties in the manufacturing industry have a need for high-value flows for their production. These, however, are often still not circularly (secondary) available because materials are often difficult to separate when applied in products	Conflicting interests ('split incentives', see chapter 2) prevent the transition to a circular manufacturing industry. On a local level, the municipality can act as a neutral partner
What is needed?	European laws and regulations stimulating the circular economy, such as a further expansion of extended producers responsibility (see chapter 2)	A concrete definition of 'circularity' for different groups of products	Extending the longevity of complex products (e.g. mobile phones) where circular principles are difficult to apply (design to last), resulting in fewer materials needed	Insight into the causes of conflicting interests in the production chain, and circular business models that prevent these conflicting interests

4 | VALUE CHAIN **PLASTICS**

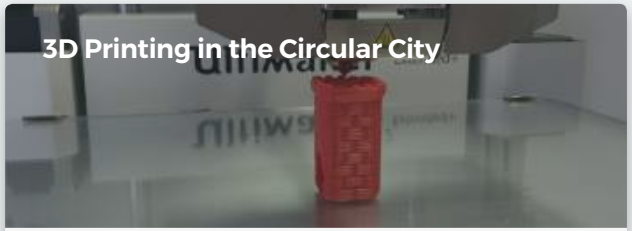
6 PROJECTS INSTRUMENT SCALE COLLABORATION

Scope *This chain concerns all types of plastics: from food packaging to its application in consumer products and buildings. This value chain consists of all plastics within the city of Amsterdam and the associated chain of suppliers.*

Chain status At the national level, it is evident that the closing of the Plastics chain, in current conditions, is reaching technical and economic limitations. Governments, businesses and waste collectors must take action to try to close the chain, both technically and economically.[42] With the current mix of plastics in separate waste collection, high-grade reuse is technically complex. Ultimately, this complexity severely impacts profit margins of plastic recycling. Therefore, it is necessary to focus on high-value mono-streams and bio-based materials.[43] In addition, recycling in its current form scarcely contributes to the reduction of the CO2 emissions.[44]

Project results The Municipality of Amsterdam has not been actively pursuing circularity in the Plastics chain. The number of concrete projects is therefore limited. The survey *3D Printing in the Circular City* shows that local secondary plastics can be converted to street furniture. In the context of the *Amsterdam Circular Challenge*, the *AUAS* explored for the Amsterdam Arena if and how plastic chairs could be 3D-printed. *VanPlestik* is a start-up that prints 3D products from plastic waste. *Waste to Aromatics* is in the test phase, trying to extract aromatics from waste for the production of plastics. *Plastic Whale* collects (plastic) waste from the Amsterdam canals, and uses it to make new boats.

For developments in this chain, Amsterdam is heavily dependent on national laws and regulations (e.g. the deposit system) or national financial incentives in the industry (e.g. waste fund packaging). At a local level, its action perspective, apart from the creation of more pure streams of plastic waste material, is limited. Amsterdam is committed to more source separation (and post-separation where this cannot be otherwise) and is working to increase the number of separate containers in the city. Source-separated plastics are processed by SUEZ in Rotterdam. In order to create purer flows, AEB Amsterdam established a post-separation plant at the end of 2017. This allows the recycling percentage of plastics (in addition to tin, drink cartons and an organic wet fraction) to be increased. It is too early to assess the results of this initiative. AEB works closely with the Packaging Fund, that aims at finding high-value applications for the recycled material against lower costs and extending the length of time within the value chain. In 2019 the post-sorted films and plastics can be upgraded to semi-finished products in a foil or plastic reprocessing installation and can be sold to the plastics industry to make new products out of them.



The research project 3D Printing in the Circular City, an initiative of AMS, shows us the possibilities of high-value reuse of plastics. Plastic waste from the city is separated and material with the desired composition is cleaned and reused as a raw material for 3D printers. These 3D printers can print large products that can be used in the public space, such as street furniture. Because the products are printed individually, residents can easily contribute to the design. Right now, it is being investigated how this cycle of collection, material processing and design input from residents can be made as efficient as possible as well as evaluating the overall impact.

Lessons learned

Recyclers need pure plastic flows in order to make economically competitive, new plastics from residual material. Although this a well-known problem, clean flows are (still) lacking

At the moment, the market for recycled plastics is limited.[42] Creating a demand for recycled plastics in procurement processes for new products can help to drive the market

What is needed?

A reduction in the quantity of plastics used, such as in packaging materials

Collection of pure plastic flows, in order to make high-value reuse possible

Plastic applications on the basis of recycled or bio-based plastic: both for the procurement of objects in the public space and durables and for packaging

4 | VALUE CHAIN **CONSUMER GOODS**

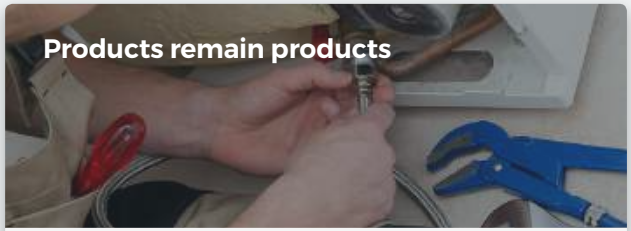
13 PROJECTS INSTRUMENT SCALE COLLABORATION

Scope *Under the Consumer goods value chain, we understand all products and packaging used by consumers (citizens as well as companies) used at home, at work and on the road. From coffee cups to clothing and from the packaging of soft drinks to vacuum cleaners and furniture. This value chain consists of the use-, application- and (high-value) reuse of these products, their parts and their materials in Amsterdam.*

Chain status Consumer goods is a collective name for huge variety of products, in a diverse market with many suppliers. The impact of consumer goods is large. When compared to travel or food consumption, consumer goods make the largest contribution to the annual environmental footprint of an individual.[45] In spite of the fact that the Municipality of Amsterdam has not focused on this value chain, progress has been made in the field of waste management (end phase chain) and the switch from ownership to use models (use phase) in the last couple of years. Little has been done by the private sector in the production of consumer goods (beginning phase chain). Initiatives, on both the national and the urban level, for collection and high-value reuse (by both public and private parties) are, at this moment, scattered and difficult to connect.[46]

Project results During the last few years Repair Cafés and second-hand shops were set up in the city. The municipality supports second-hand shops with a payment for the collection of specific products. Progress has also been made in the further development of municipal waste points to resource hubs. A spatial strategy is in the making, together with the AUAS, the municipality of Amsterdam are working on optimising logistics for this initiative. In addition, waste points De Pijp and Toetsenbordweg are in full preparation. The municipality is also critically examining the way in which textiles are being collected in the city (less pollution) and if by means of post-sorting a more valuable processing can be reached. Apart from municipal interventions, dozens of sharing platforms have been developed, which enable consumers to initiate a dramatic mentality shift; from valuing the possession of products, to using them.

The municipal organisation itself has also taken steps towards further closing the Consumer goods value chain. The municipality now has, to name only one example, established an internal market place for street furniture, which can be reused at one of their locations throughout the city. The municipality has also published a tender for circular furniture. Finally, in the context of the Waste Implementation Plan, research has been carried out into assessing the quantity of raw materials in industrial waste, and AUAS have looked into the possibilities of optimising waste logistics.



Products remain products

The campaign 'products remain products' continues to stimulate product reuse, repair and sharing of products amongst citizens.[47] The campaign, carried out in collaboration with Nature & Environment, aims to reduce the quantity of residual waste as well as raw material consumption for new products. On the basis of a study, six measures have been formulated for Amsterdam Oost: (i) improving the business model of local initiatives; (ii) increasing the awareness of local initiatives; (iii) increasing the number of local collection points, in collaboration with second-hand stores; (iv) higher-quality reuse of A-grade wood; (v) initiating pop-up stores; and (vi) more cooperation with retail. A script for an exchange party has also been made. Implementation takes place both by the municipality and those involved in the neighborhoods.

Lessons learned	Several parties in the chain have conflicting interests (see Chapter 2). Because companies need short-term sales, they can only solve this problem by making high investments	New financial models also require a change in the behaviour of consumers, not to mention suppliers. A transfer has to be made from owning products (that are sold) to using them	The municipality needs to communicate and create awareness for consumers to change their behaviour. This communication should offer information as well as show the municipality's good example	Primary education has an important role in creating this change in behaviour. The municipality should incorporate schools into its network approach
What is needed?	Break conflicting interests of consumer goods by, for example, the large-scale procurement of products in order to create win-win situations in the long- term		Awareness with consumers on the possibilities of sharing, renting and repairing products instead of buying and owning them	In order to reach a better understanding of circular principles with young children, schools should take initiatives in relation with the circular economy

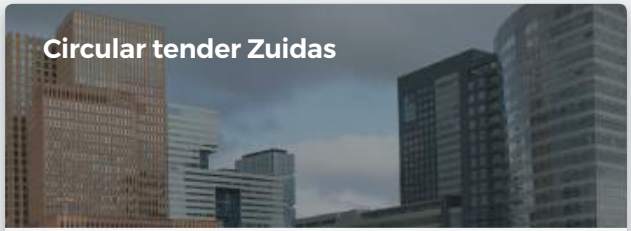
Action Perspective C (page 37) discusses the possibilities of upscaling the consumer goods chain

Description *Land issue is a long-term lease of land by means of, for example, a tender. The process is characterised by criteria (aspects on which the municipality challenges the market) that apply to a particular piece of land.*

Project results Most circular land issue projects are, according to planning, in the tender or the option phase. These are projects in Amsterdam Sloterdijk (part of the retail cluster), on the Centrumeiland, Buiksloterham and the Zuidas (all three residential buildings, Zuidas tender has been granted at the end 2017). Also the Bijlmerbajes, formerly owned by the Rijksvastgoedbedrijf, has been sold with a focus on circularity. This area will be redeveloped with 1350 homes. These last few years, the municipality of Amsterdam has made preparations as well as strategic choices as to their ambitions and criteria. Buiksloterham is an example of a successful development, as, since 2015, several circular initiatives have been started and circular ambitions have been implemented in residential areas, including De Ceuvel and SchoonShip.

The Roadmap Circular Land Issue, which was developed in close cooperation with local businesses, proposes criteria for circular land issue. The Roadmap, which is authoritative in the Netherlands, allows criteria to be allocated to focus areas in each issue. Because of the multitude of criteria, it is necessary to make choices in each project. Support from experts is necessary for the time being. The application of the roadmap will be evaluated after the completion of the first land issue projects.

Research has demonstrated that the initial construction and investment costs of a circular building are higher. However, in the longer term, large benefits will be possible through the residual value of parts and building adaptability.[38] The expectation is that with a growing demand for circular buildings, a decrease in the additional costs of circular buildings will occur.



Circular tender Zuidas

The first tender Circular Land Issue was completed on the Zuidas in December 2017. The tender was won by AM in collaboration with Team V Architects. With the 'Crossover' concept they combine more than 250 homes with offices, workspace for freelancers and space for creative start-ups. As far as circularity is concerned, AM and V Architects want to create flexibility between homes and offices, utilise a materials passport and adopt dry connection practices (example: bolt-screw, with a view to easy disassembly). This makes future reuse possible. Secondary materials are included in the partition walls (residual cast) and the facade (recycled bricks from StoneCycling). New materials are selected for their low environmental impact.

Lessons learned	What is needed?
The land issue policy in tenders, with a criterion of at least 30% sustainability, together with a number of other qualitative factors, can be used to stimulate circularity	Retaining structural attention for sustainability (and circularity) in selection criteria
Because of local characteristics, each land issue project is unique. Chances of success are highest when both generic and area-specific ambitions are formulated early in the process	Area-specific ambitions in the Environmental Plan and in Plaberum products (Planning and decision-making process for spatial measures)
It is important to create focus in the broad field of circularity on the urban, as well as on the project level. Businesses need this focus in order to formulate their own ambitions	Clarity about which stakeholder is realising which ambitions: the municipality at the regional level and the owner/developer at the building level Focus on a limited number of circular criteria, such as adaptability and use of materials, that can be easily understood
It can be complex for tender teams to make a choice between circular criteria in projects. They need ample time to do so. This may create tensions in large-scale circular procurement	A circular project asks for a different approach from the municipality as well as from businesses. The planning should allow more time for realising circular ambitions
The development of the public space must enable the application of circular principles	Implement circular principles in tenders for the construction and renovation of public space, as well as a link between an appropriate management and the budget allocated for maintenance
In order to prevent the future decrease in value, a long-term adaptability of buildings is highly recommendable. Prescribing functional tender criteria such as adaptability and modularity helps to prevent a future decrease in value	Flexibility of buildings – be they commercial, social real estate or homes – in order to make them adaptable for future functions
After land issue, businesses are responsible for the realisation of circular ambitions. Their motivations are, therefore, indispensable for a project to be successfully circular	Process criteria in land issue projects, supplementary to technical criteria, to make a match with an intrinsically motivated private sector possible
For circular demolition and disassembly, knowledge about the construction and the materials used is invaluable	Demolition and disassembly plans in tenders for homes and civil and hydraulic engineering A proactive approach from demolition companies in recovering value from residual materials in demolition projects

4 | INSTRUMENTS **SPATIAL PLANNING POLICY**

3 PROJECTS CHAIN SCALE COLLABORATION

Description *By means of spatial planning, the municipality divides and classifies the living space in a planned way. Therefore, spatial planning influences the amounts and types of space, what materials are used and what it looks like.*

Project results The past few years have seen circular ambitions firmly established in the development strategy of the Port-City area (40,000 up to 70,000 homes) and in a number of other strategy decisions for area development (10,000 homes). TNO has done a study on the circular potential of the Port-City area. Circularity is also guaranteed in the development strategy of the business park in Lutkemeer.

In November 2017, Cirkelstad and C-Creators launched the *Circular Construction programme* within the AMA. This programme aims at establishing connections between parties to accelerate circularity in the construction chain. This programme is partly due to the strategic choice for circularity in the construction chain of the city of Amsterdam. The municipality of Amsterdam is a partner in this programme.

Circular Homes Port-City

In the coming years, the municipality has a huge construction assignment. Circular principles will be applied to new neighborhoods. The Port-City project aims at the development of a new city district where (mainly after 2040) 40,000 to 70,000 new homes will be realised. The development strategy ensures that all these homes as well as the public space, will be developed in a circular way. Within the broad field of circularity, the focus lies on material use and adaptability. This creates demand for circularity, enabling market parties to respond to this demand. Next, circular ambitions can be translated into the spatial plan of the sub-areas of the Port-City area.

Lessons learned

- By safeguarding circular ambition in Spatial planning Policy, all parties concerned are forced to realise them
- By safeguarding circular ambitions in development strategies, circular construction will be organised full scale and continuously by means of spatial planning for the first time
- We need physical areas to close different value chains on a high-value level. The project 'From Waste (Point) to Resource (Hub)' shows that this applies for consumer goods in particular
- Parties in the construction chain express their need for areas for the temporary storage of (secondary) building materials. They are better equipped than the municipality to organise this effectively

What is needed?

- Circular goals in the Environmental Plan of Amsterdam
- Circular ambitions in all development strategies
- Physical localities on a neighborhood-level for the high-value reuse of products, energy and water
- Physical location for the temporary storage of secondary building materials in order to enable high-value reuse

4 | INSTRUMENTS **PROCUREMENT**

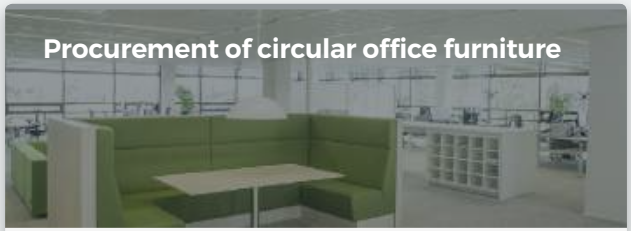
Description *Under the instrument procurement we understand all municipal expenses for buying products and services the municipality needs for her own operations and for public goods. By means of public procurement, the municipality can use her purchasing power to influence the market.*

Project results Procurement is one of the strongest government instruments to boost the circular economy.[48.49] The integral application of circular principles in procurement processes has a large spin-off to the market: to make a product circular, the entire chain of suppliers must change. The formulation of circular principles also leads to awareness within the municipal organisation. In the long-term, cost savings can be realised by making the move from purchase to (optimal) use. This not only concerns the procurement of consumer goods, but also the procurement of the design of public space, buildings or civil and hydraulic engineering.

At the same time, a balance has to be found in procurement between available budgets, solutions available in the market, the tasks to be performed by the municipality and the set (policy) goals. The procurement budgets should be spent in a lawful, effective, efficient and honest way.

In 2016, the Municipality of Amsterdam signed the National Manifesto on Responsible and Sustainable Procurement (RSP). The execution of this manifest is a task for the entire organisation: from manager and budget holder to buyer and contract manager. The municipality is currently working on an action plan, based on sub-plans of all relevant organisational divisions. These sub-plans identify opportunities, both around the theme of circularity, as around other themes within RSP. An example: The Traffic & Public Space department indicated in its RSP plan to purchase one circular project per year.

At the moment, a number of procurement projects where circular principles have been applied have been carried out: the tender of office furniture is the best-known example. There are a few projects in the public space as well: as of January 2018, the municipality will reuse old baked bricks for 100%. Project results often provide both a financial saving (based on long-term cost-benefit) as a material one. Additional internal knowledge is required for the further upscaling of responsible and sustainable procurement (and procuring it in a circular manner).



Procurement of circular office furniture

In 2016, the municipality purchased its office furniture in a circular way. In principle, no new furniture would be supplied if existing furniture was still satisfactory. When new furniture was indeed purchased, the supplier would take back the old furniture and assess - based on predefined criteria – if the furniture was still suitable for reuse, could be refurbished or had reached the end of its life cycle. Products that no longer met the criteria, were disassembled and parts would be reused for making new products (e.g. separation walls or lockers).

Lessons learned	Clients within the municipality still formulate no or insufficient circular ambitions and steer projects tightly on time and budget	Internal budget reservations often still use concepts as traditional purchase and depreciation. There are also often separate budgets for management and maintenance, separate from the purchasing budget. This does not benefit circular business models, that are based on the value of a product throughout its lifecycle	Circular projects need concepts like Total Cost of Ownership in order to arrive at a healthy business case	The municipality has insufficient knowledge on circular business models, as well as on criteria that can be applied in procurement processes of certain (circular) products	The supplier supplies what the client asks for. However, the supplier is the expert, not the client	Putting innovative circular products or services remains difficult
What is needed?	Lead Buyers should take a coordinating role in the procurement process in order to keep track of progress, formulated ambitions and contract management	Budgets and contract management should be rearranged, with a view to the optimisation of expenditure	Tenders on basis of Total Cost of Ownership, including the energy costs as well as residual value	Fitting criteria on finance, technical performance and process for each product group	Function-oriented tenders, rather than tenders driven by technical specifications	The municipality and affiliate organisations, could act as launching customers in order to optimise circular business models

Action Perspective D (page 39) describes the possibilities of expanding the Procurement instrument ›

4 | INSTRUMENT **EDUCATION & INFORMATION PROVISION**

4 PROJECTS CHAIN SCALE COLLABORATION

Description *Under education & information provision we understand education and educational programmes on the one hand, and making information and data available on the other. The municipality uses these instruments to promote the transfer of information and to raise awareness.*

Project results Despite that the evaluated projects hardly produced any results in the field of education & information provision, a lot has happened in recent years. The municipality organised Duurzaam020, an event in which both businesses and residents received practical support with their plans for sustainability. Finally, the campaign 'Amsterdam makes a difference' aimed at creating behavioural change among residents. This campaign presents successful examples and employees are asked to act as ambassadors.

Other parties in the city are also active. Within the AUAS *Urban Technology programme* lecturer-researchers often work together with students to realise tangible projects in the city. AMS actively disseminates knowledge gained in various studies. Some developers actively share their experiences as well as their knowledge on circular construction and demolition with the municipality. For a pilot of Weeelectric, the Municipality of Amsterdam supported communication by writing an introductory brochure: in this pilot, more than 750 devices have been collected.

Pakhuis de Zwijger has never been part of any of the municipal circular economy programmes. In spite of that, it has proved to be an important place for education on integral sustainability and circular economy for professionals. The municipality is one of the institutions that support Pakhuis De Zwijger financially: there is no admission fee, but visitors are asked to pay as they like. The event center attracts visitors from all over the Netherlands on topics relating to the circular economy as well as on others. Within the *Circular City program*, which has been running since 2014, 40 meetings have been organised to date.

Pakhuis De Zwijger

Pakhuis De Zwijger focuses as an independent platform fully on the sustainable development of the city. Thanks to 600 events per year, more than a hundred partners and an online community of over 125,000 members, Pakhuis De Zwijger plays a leading role in spreading knowledge about the future of cities. Especially since all events are free of charge, with a possibility to pay as you like. The content agenda brings both residents of the city as well as professionals from all over country together. This way, Pakhuis contributes to a better understanding of urban sustainability developments.

In 2016, Pakhuis De Zwijger opened 'FabCity' on Java Island. This was a temporary campus with fifty pavilions, workshops, installations and prototypes. More than 400 students, entrepreneurs, researchers, artists and designers lived and worked there for eleven weeks and conducted research into circular and sustainable solutions for the city of the future.

Lessons learned

www.data.amsterdam.nl offers a lot of open data. However, supply and demand could be coordinated in a better way

The best way to involve residents is by organising personal meetings and discussions

What is needed?

More open data on the (circular) achievements of the city

Initiatives on an urban as well as a neighborhood-level that involve the common man in the transition to a circular economy

Action Perspective 5E (page 41)discusses the possibilities of expanding the knowledge instrument ›

Description *The municipality can conduct research itself, or ask agencies, universities or other research institutions to do it on their behalf. Research increases the knowledge about processes and technologies.*

Projectresultaten In the past management period, the Amsterdam municipality actively involved in the development of knowledge, for example through the establishment of the Amsterdam Institute for Advanced Metropolitan Solutions (AMS). The Municipality has entered into a ten-year partnership with this research institute for the period 2014-2023.

These past few years, the municipality and knowledge institutions in Amsterdam have produced several nationally leading studies in the area of circularity. With these studies, the city took a leading role, both at the national and the international level, showing the possibilities in the field of circularity. Amsterdam focused on fundamental as well as applied research. This practice-oriented research is elaborated in the Living Lab approach,[50] putting 'system thinking' and 'innovative ecosystems' into practice.

Research has been done into Amsterdam's potential for urban mining in building materials (PUMA), and into the costs and benefits of circular construction as well. The successful *Roadmap Circular Land Issue* proves to be an important piece of research. Examples of research in the Biomass & Food value chain are *Re-organise* and *Evidence-Based Food Systems*: food flows have been mapped, and spatial and logistics solutions for a healthier, fairer and more sustainable food system have been explored. In the plastics value chain, a material study has been carried out on large-scale applications for 3D printing of plastic objects, such as couches. Also, a study of quality marks for the circular economy in the hotel and care sector was delivered. This study shows that existing quality marks often already contain circular elements, but that these are particularly relevant for technically proven measures. What is more, adapting quality marks is a lengthy process that is mainly decided on (inter-)national level(s).

In addition, a spatial economic exploration of the Westas has been published, with a number of sub-studies into raw material flows, steering instruments and spatial planning effects of the transition to a circular economy. The Project Book of the Amsterdam Logistics Board summarised the lessons learned.51 Metro and tram are running an inventory of the material flows in green tram infrastructure. They will also publish a circular vision for the future, containing various possibilities for its practical implementation.

PUMA: Prospecting the Urban Mines of Amsterdam

Prospecting the Urban Mines of Amsterdam is a research project on available materials (metals) in the Amsterdam built environment: steel, copper and aluminum. The commitment to circular construction created the need for a picture of future materials that will become available in demolition or renovation projects. The study provides both an overview of the potential of this 'urban mine', and ways of using it. The study is unique: no city anywhere has made their future material stock transparent. An important next step is further refining the models that estimate the amount of materials needed. In addition, it is important to structurally chart materials for new buildings, in connection with a digital building information systems such as BIM.

Lessons learned	The knowledge available about aspects of the circular economy within the municipality including circular procurement, circular construction, and high-value recycling of biomass improved thanks to the research carried out	Research and co-creation between research institutes, the municipality and market parties creates a connection with current trends and assignments, and delivers unique results	The AMS and AUAS Living Lab approach shows that public-private-people partnerships are essential for scaling up innovations. These living labs can only be put into practice in collaboration between citizens, government, companies and knowledge institutions.The involvement and decision power of the end user in particular ensure that innovations can be used in the right (most impactful) way. As the living lab approach sometimes demands flexible regulation, the role of the government is essential	Independent research projects are suitable to identify the roles of the municipality and market parties. Research may give the municipality more insight into control options and their limitations
What is needed?	Knowledge about the municipal instruments to boost the circular economy in all value chains Translation of research results into practical tools for the municipality	Optimal use of research potential, with a special focus on AMS and AUAS (AMS is enjoying a 10-year subsidy scheme)	A sequel to public-private-people partnerships (such as the Living Lab approach) with a special focus on the role of the municipality	A municipality that shows a proactive attitude

Action Perspective 5E (page 41) describes the possibilities for expanding the research Instruments >

Description *Networks and information exchange are online as well as offline platforms that facilitate the search for knowledge and partners, as well as the interaction between them. Possible manifestations are: a cooperation, working groups and digital platforms.*

Project results In recent years, many networks around the circular economy have been set up in Amsterdam, of which *Cirkelstad* is the most famous. The various municipal programmes have yielded networks, such as *Amsterdam Smart City* in the *Circular Innovation programme*. *ProDock* is building a network of startups working with biomass flows in the Port of Amsterdam. *Netwerk Betonketen Amsterdam* strives for sustainable construction projects by reducing CO2 and the reuse of concrete. Within *Amsterdam Smart City* and the online community platform public and private parties work together on innovative projects – such as the circular economy – in the physical environment. The *Products Remain Products* project works with citizens for higher-value reuse and for sharing products.

Together with eight other municipalities, three research institutions and the national government, the Municipality of Amsterdam participates in the *City Deal Circular City*. The municipality has set up a Sustainability Council to give advice on (parts of) the Sustainability Agenda. Amsterdam is also chairman of the circular economy task force of the European EUROCITIES network. In 2017 – partly on behalf of other Smart City cities in the Netherlands - Amsterdam presented the Dutch Circular Economy approach at the World Smart City Expo in Barcelona. On a regional level, there is a close cooperation both with the business community and with other regional authorities through the Amsterdam Economic Board. The business network of the Westas, too, is very important.

Eurocities and C40 are examples of international cooperation. This phase of the transition to the circular economy is characterised by the fact that many parties are still finding their way. Networks are focusing on sharing knowledge and are essential to allow parties to take the next steps faster. This exchange of knowledge creates opportunities in the form of insights, contacts and initiatives, but is difficult to measure.

Cirkelstad is a network of public and private parties that are committed to a city without waste. Several cities have a Circular City network, similar to Amsterdam. Cirkelstad was founded on the belief that if parties involved work together, they can potentially create a circular economy. The network meets every two months. Every meeting leads to the exchange of knowledge, new insights and new opportunities for cooperation. Partners have indicated to jointly focus on the implementation of their knowledge. Partly as a result of this, the circular Construction programme of the MRA has been developed.

Lessons learned	In order to bridge conflicting incentives, parties are needed that connect different market parties without personal stakes	Networks are accessible and informal and attending parties are able to find each other easily. Structural networks help in creating trust, which is important to jointly start initiatives in a later phase	In order to create value, networks should have a clear goal	In view of the fact that market parties do not necessarily work together, the connecting role of the municipality is invaluable	Profiling Amsterdam as a frontrunner in circularity, has proven to be successful in the Netherlands and in Europe. Cities abroad look at Amsterdam to take the lead and set the example
What is needed?	Impartial connecting party of market parties with an independent Chair	Support for existing networks, based on their needs, both from a content and a financial perspective (e.g. Pro Dock, Circle City and Netwerk Betonketen)	Different networks should formulate and delineate clear goals and operate effectively and efficiently	Continuation of the municipal role as connecting party	Retain the leading position by continuing to share knowledge Retain the leading position by continuing to attract private companies

4 | INSTRUMENTS **LEGISLATION & REGULATIONS**

3 PROJECTS CHAIN SCALE COLLABORATION

Description *Legislation & regulations are obligations that the municipality can formally impose on itself, the market, and the consumer in the form of, for example, minimum requirements, standards, or prohibitions. General strategies and policy agendas are also part of the legislative and regulatory instrument.*

Project results In November 2017 the municipality investigated its legal instruments to analyse what legal means are at the disposal of the municipality to drive changes in the fields of circular construction and demolition.[52] This research shows that especially from the moment the Environmental Act comes into force (probably in 2021), local governments will be able to set requirements for circular construction and demolition. The current possibilities are limited.

At present, it is legally not allowed to locally set requirements for construction and demolishing projects that surpass the requirements of the national Construction Act. One way to bypass this, is to appeal on the Crisis and Recovery law. The Port-City area has registered for this strategy and a zoning plan with broadened scope has been compiled for Sloterdijk Mediacollege. All major development areas in Amsterdam were registered for the Crisis and Recovery Law in November 2017.

The Quick Scan shows that it is wise to develop an unambiguous and executable standard for 'circular construction', which surpasses the current Environmental Building Performance (EBP). This new standard should consider aspects like disassembly, extension of the lifespan and functional adaptability. Apart from a new (circular) standard, BREEAM (Building Research Establishment Environmental Assessment Method) and the EBP are already used to tender or procure the sustainable performance of buildings. The DGBC (Dutch Green Building Council) will introduce criteria from the roadmap in the BREEAM system. The NEN is also working on a standard for circular construction.

The municipality has also laid down sustainability criteria for its events policy, apart from the construction chain. From the start of the event season in 2018, event-organisers must meet requirements in terms of energy, water, waste and the like in order to get a permit. These event criteria will also be laid down in the event subsidy grant as well as in the contracts for leasing public space. In cooperation with event-organisers Waternet will continue to work on the recovery of phosphate from urine. Organisers will have to comply. The municipality also reversed the rules for the door-to-door delivery of papers. They may only be delivered if the mailbox carries a yes/yes sticker.

Yes/Yes sticker

As of January 1 2018, the municipality of Amsterdam introduced a new system of mailbox stickers. From this date, it is only allowed to deliver unaddressed mail or newspapers if a resident's mailbox carries a yes/yes sticker. This may mean a cutback of 34 kilo of paper per household each year. This new policy turns around the delivery system: before 2018 it was allowed to deliver unaddressed mail or newspapers if mailboxes did not carry a sticker.

Lessons learned	It is important to safeguard circular ambitions in the new Environmental Vision and in the Environmental plan, which will be developed in the coming years on the basis of the new Environment Act (2021)	There is a need for an administrative set of ambitions with a clear and feasible standard for circular construction and demolition. This standard must surpass the existing EBP standard: they should not only include the environmental impact of materials, but also aspects such as disassembly, life extension and adaptability	Look for opportunities for local additions in support of laws and regulations (e.g. yes/yes-stickers for door-to-door distribution)
What is needed?	A principal level for circular construction to enable the large group of traditional construction companies to get started with circular construction	An administrative standard for circular construction and demolition, which is unambiguous and universally applicable, with both a basic level (in order to make traditional organisations reach higher) and space for frontrunners (to enable them to create innovative projects)	Ownership in all municipal departments for the circular ambitions of the municipality

Action Perspective C (page 37) discusses the possibilities of upscaling the Constructions chain >

4 | INSTRUMENTS **BUSINESS & FINANCIAL SUPPORT**

11 PROJECTS CHAIN SCALE COLLABORATION

Description *The Business & Financial support e tool supports companies with financial and non-financial resources such as grants, guarantees, and technical advice. The tool is often used to support small and medium-sized businesses with limited internal capacity and resources.*

Project results During the past few years, support has been given on a programmatic, as well as on project level. The *Circular Innovation programme* facilitates innovations of parties in the city by removing obstacles, making connections and involving the Municipality as a launching customer whenever we can.

What is more, a number of projects have been realised and have yielded concrete results with the help of funding from the European Commission. *City-zen* (Zero Energy) supports innovative entrepreneurs in their initiatives for CO2-neutral cities. The Municipality also contributed financially to an LCA scan for three companies in the port and for training five construction companies in 'Circular Procurement'. *startup in Residence* offers an annual incubation programme for startups and hosted its third edition in 2017/2018. Moreover, the *Amsterdam Circular Challenge* supported participants in the development of their startup business. Finally, a frontrunner group started up to support hotels that want to become more sustainable.

The subsidy scheme *Project preparation for sustainable initiatives* honored three applications that focused on making waste streams more circular in West and in Secret Village. The Sustainability fund also published a circular economy tender for which six parties sent in an application.53 At the end, only one application was honored, because the other five applications all concerned corporate financing. The fund only finances projects however, and not companies. Circular entrepreneurs need higher-risk financing, due to the fact that their projects are often innovative.

Meanwhile, the financial market seems to become more active in this segment. The *Subordinated Innovation Loans* from Rabobank may serve as an illustration. With these loans, Rabobank focuses on startups active in the circular economy, the food chain, renewable energy and vitality. The evaluation of the Sustainability Fund shows that it can be useful to have a separate financing instrument.

Parallel to this, the Amsterdam Climate and Energy Fund (AKEF) financed five circular projects: Bio Energy Netherlands (BEN), Urbee (e-bike sharing), GrowX (vertical farm), Aectual (3D-printed circular floors) and Chaincraft (making organic fatty acids on a large scale).

During the *Amsterdam Circular Challenge*, students and young professionals try to turn residual flows from companies into a profitable and scalable product. In 2016, residual flows from the renovation of the homes of Eigen Haard, the canals of Waternet, the waste from AEB Amsterdam and the Arena area were used for the challenge. The multidisciplinary teams actually made concrete products from these residual flows. One of the teams has become a successful startup, Planq. The concept of the challenge is now copied in Nijmegen and Venlo.

The financial support by Amsterdam companies, the Municipality of Amsterdam and Het Groene Brein/ Netherlands Circular was crucial for making this Public Private Partnership succeed. In 2018, the following edition will take place: a central location should increase cross-fertilisation.

Lessons learned	Training and courses focused on specific challenges in products and sectors may help entrepreneurs who want to become circular take their first concrete steps	In order to make circular ideas and innovations commercially viable, temporary financial support may help to bring them to the next level. Current financial instruments of several financial institutes are not always sufficient. This is due to risk calculations that are structured based on a linear economy	Collaboration between the Municipality and the private sector must be flexible: in case of changing market conditions, it should be possible to adapt the form of support to reality
What is needed?	In their approach companies should focus on training or research for specific target groups	New (temporary) financing instruments for entrepreneurs with a high-risk profile due to a different (circular) business model	Business support with a focus on impact, where (unnecessary) process-based requirements may not become obstacles

5 | ACTION PERSPECTIVES

5 | **ACTION PERSPECTIVES** HOW TO READ THEM

The transition to a circular economy is in full swing, particularly in urbanised areas where societal challenges arise and new solutions are tested. The five different value chains each find themselves in different stages of development. The next phase of the transition to a circular economy is all about scaling up: how can circular projects be scaled up and become a new standard?

From the evaluation of 73 circular projects and a validation with businesses, it becomes evident that three value chains and two instruments in particular are very promising to scale up. In these chains and with these instruments, the Municipality can make the biggest contributions. They are elaborated upon in five action perspectives that offer a concrete handhold for scaling up.

- **Scaling value chains:** For the value chains Construction, Biomass & Food and Consumer goods the potential impact for the Amsterdam context is high. In order to further boost the transition of these value chains, the current use of municipal instruments could be expanded or additional instruments could be used.
- **Expanding the deployment of instruments:** In recent years, the knowledge tools (Education & Information provision, Research and Networks & Knowledge exchange) have been applied effectively. The procurement instrument has a lot of potential that is currently underutilised. Both the Procurement instrument as well as the knowledge tools help to speed up the transition when they are applied in several value chains.

These action perspectives, both for the value chains and the instruments, have been translated into both a role for businesses and activities for the Municipality. These action perspectives indicate what is necessary to accelerate the transition to a circular economy during the next four years.

When we look at the application of circular principles according to the innovation curve, we see that amongst businesses, not just 'innovators' are involved, but that the 'early adopters' are also stepping in. The described roles of the private sector will therefore be mainly picked up by these 'early adopters'.

Lessons learned

The lessons learned summarise what barriers were identified; what worked and what did not; which support came from the Municipality or which support was lacking; and what progress did the market make itself in the transition to the circular economy.

What is needed?

The lessons learned show us what is needed in the longer term (+/- 10 year) to realise the transition to a circular economy. Both the Municipality and the private sector play a role in this.

Role of the private sector

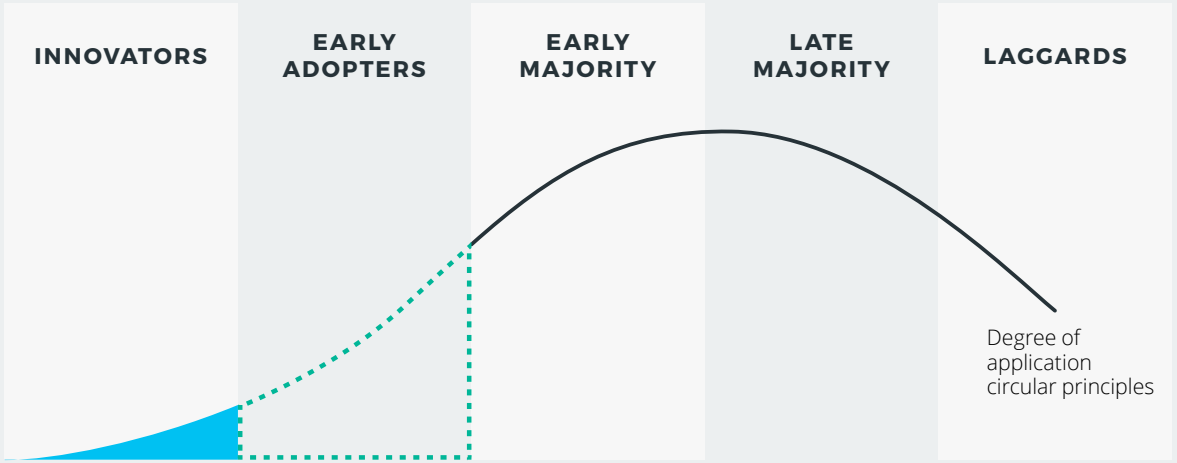
The private sector can take their own responsibilities in order to achieve what is needed to get to the next stage.

Activities Municipality

In order to support the private sector, a number of concrete actions in the short to middle term (+/- 4 years) can be taken by the Municipality.

4 | EVALUATION

5 | ACTION PERSPECTIVES



5 | FIVE **ACTION PERSPECTIVES**

For every action perspective, the strategic objectives from the five Transition Agendas of the National Raw Material Agreement are mentioned. Next, a number of opportunities for the specific combination of instrument and value chain is elaborated upon.

A - Upscaling the value chain Construction: These past years the municipally started up a number of activities related to circular construction. Thanks to the great commitment of Amsterdam, businesses have taken up more circular projects. By continuing to take the lead, Amsterdam can make a significant contribution in rendering the Construction chain more circular.

B - Upscaling the value chain Biomass & Food: Recent years have seen a number of activities in the field of Biomass & Food, especially from the *Circular Innovation programme*. This chain offers many opportunities for high-value reuse, focusing specifically on food-related activities. Continued effort by the Municipality of Amsterdam can also take this value chain to the next phase of the transition.

C - Upscaling the value chain Consumer goods: In urban areas, many consumer goods are used (e.g. electronic equipment, furniture, clothing). This offers a great number of opportunities. However, Amsterdam still focuses on the end of the chain (the waste phase). This focus can serve as a starting point for a more structural approach for the entire value chain.

D - Expanding the Procurement instrument: Procurement is often mentioned as an important instrument for local as well as national governments to boost the circular economy. After all, it forms the most direct connection between a government and physical products. Thanks to their large purchasing volume and their discretion and control over these purchases, the Municipality can act as a launching customer by creating considerable demand for circular products and services.

E - Expanding deployment of Research, Information provision and Networks: Creating new knowledge and sharing good experiences is essential for scaling up the transition to a circular economy. The instruments Research, Information provision and Networks have played an important role in these last few years. Because of their success, these instruments can also be used to effectively speed up the transition towards the next phase of the transition to the circular economy.

The commitment to these action perspectives does not preclude any activities within the other value chains or that no other instruments will be developed. However, for Amsterdam focus on these five action perspectives will prove to be the most effective way to make the transition: the value chains and instruments offer clear activities for the Municipality.

5A | UPSCALING OF THE **CONSTRUCTION CHAIN**

Circular construction means constructing buildings, carrying out civil engineering projects and organising public space in such a way that buildings and components are always used at a high-value level. In order to achieve this, a construction project can be designed in such a way that buildings are flexible and easily disassembled. What is more, only materials with the lowest possible impact on the climate should be used. High-quality reuse of the existing buildings is also part of circular construction: this concerns high-value reuse of components from the built environment.

In recent years, the Municipality of Amsterdam strongly focused on circular construction and has achieved considerable results: circular principles are included in multiple land issue projects and several research projects have been carried out. Despite this commitment, circular construction is not yet competitive with regular construction: this needs time. However, there is a sense of urgency to deal with energy, raw materials and water in a structurally different way.

At the same time, Amsterdam has created the preconditions to put circular construction into practice by formulating their ambitions for area development and knowledge creation. A circular ambition was included in the development strategy for the Port-City area and the *Roadmap Circular Land Issue* contains procurement criteria. Amsterdam's strong commitment to circular building can be setting new standards for the construction sector in the Netherlands and have an impact that is felt much broader than just in the city of Amsterdam. Given the strong expected growth of the metropolitan area, and the associated urban densification assignment, the coming decades will see a demand for 250,000 new homes. A focus on this chain, therefore, seems to be a logical choice, requiring special attention on direction within the construction chain.[54]

The energy performance of buildings in the built environment is a point of special attention in national legislation. Many buildings have to be isolated in the coming years. This requires a lot of materials. A focus on the disassembly of building components within this task can prevent wasting components and parts of (non-circular) buildings.

To give substance to this action perspective, the advice is to focus on five instruments: Spatial planning, Land issue, Legislation & Regulations, Procurement and Research. Based on the evaluation, these have proven to be the most effective tools within the Construction value chain. The focus on procurement is further explained in action perspective D (p. 39) and the focus on research in action perspective E (p. 41).

In the Integrated National Programme Netherlands Circular by 2050, the following strategic objectives are described for the Construction chain:

1. Use renewable resources for the construction of residential and non-residential construction as well as civil engineering projects.
2. The use of materials throughout the life of the construction is being optimised (value retention, less costs, more reuse and less environmental impact).
3. Construction should reduce as much as possible CO2 emissions, both in the production and construction phase and in the use phase.
4. Construction is an innovative sector that is proactive anticipates changes in society, the market and consumer demand.

SPATIAL PLANNING POLICY

Spatial planning policy allows Amsterdam to determine what functions to realise where. In recent years, many circular ambitions have already been formulated in strategy resolutions, and much more is possible in the coming years if the efforts are continued. The introduction of the Environment Act offers many opportunities in this respect.

What is needed?	Circular ambitions in the future Environmental Plan of Amsterdam, which will secure these ambitions for future developments	Region-specific ambitions in the Environmental plan and Plaberum (Plan and decision-making process spatial measures)	More flexibility in zoning plans, or zones with restricted regulation to limit the functional requirements of zoning plans	Realisation that materials in the infrastructure and in the public space are owned by the Municipality and that the city is an urban mine	Enforcement of circular performance of businesses in the realisation and exploitation phase	Physical places at the neighborhood level for the high-value reuse of products, energy and water
Role of the private sector	Setting ambitious objectives for own business operations, both in the use of recycled materials (in construction) and in high-value reuse (in the case of demolition). Translating these objectives to a project level		Indicating where zoning plans possibly hinder the further circular development of the city	Reusing materials from municipal property in other municipal projects	Making the application of circular principles transparent, for example, by using materials passports and disassembly plans	Developing physical spots in neighborhoods wherever this is possible and commercially feasible
Activiteiten gemeente	Including circular ambitions when drafting the new Environmental Plan. The earlier set of ambitions is the starting point. For each area, local priorities can be formulated. Involving local residents and users, and safeguarding their long-term interest: a healthy and pleasant living environment. A zoning plan with a broader scope can facilitate this		Developing flexibility at the neighbourhood level, or rendering zoning plans more flexible (later: Environmental plan), or creating a risk-free experimental area	In case of adjustments in the public space or infrastructure, making the opportunities for reuse of released material part of the request or procurement process: the city functions as an urban mine	Developing a monitor for the actually delivered circularity of area developments. Also looking at social and ecological aspects	Creating physical places at neighborhood level in the spatial planning policy that serve to store high-value construction products and materials for reuse by the construction sector

LAND ISSUE

Amsterdam owns a lot of land because of its leasehold system. Contrary to other municipalities, the Municipality of Amsterdam issues land on a regular basis. This land issue demands easily applicable circular criteria: only then can the upscaling towards all land issue projects actually take place.

What is needed?

- Circular ambitions in each land issue project
- Focus on a limited number of unambiguous criteria of, for example, adaptability and use of materials
- More uniformity in the definition of circular construction. An unambiguous guideline for circular construction, that is safeguarded nationally. The *Roadmap Circular Land Issue* may serve as a starting point
- Focus on a limited number of unambiguous and easy to understand circular criteria
- Process-related criteria for land issue projects, in addition to technical criteria, in order to find a match with an intrinsically motivated market party

Role of the private sector

- Proactive and project-related thinking with the Municipality about suitable circular ambitions for land issue projects
- Participating in the drafting of an unambiguous standard for circular construction. Looking for a connection with existing definitions such as BREEAM and EBP. Meanwhile (from January 2018 onwards) an EBP is mandatory for all new residential and commercial buildings
- Involving the entire chain of suppliers in realising circular ambitions, with a broader view than just the planned area. Part of this is an integral financial model, which includes both costs and long-term benefits for all parties

Activiteiten gemeente

- Designing a process and a (technical) starters package for every land issue project in order to involve businesses based their vision and circular ambitions
- Making circular ambitions in land issue projects area-specific, relevant and measurable
- Maintaining sustainability as a special selection criterion for at least 30% in all land issue projects, and exploring whether this can be extended to circularity
- Developing an unambiguous guideline for circular construction, so that both the client and the market can measure their circularity. Continuing the application of the *Circular Land Issue Roadmap*, and involving a national expertise center (e.g. the NEN) for future standardisation
- Including, next to technical criteria (in accordance with the *Roadmap Circular Land Issue*), also process-oriented criteria in land issue projects (e.g. a plan of approach on how to achieve circular ambitions)
- Evaluating the *Circular Land Issue Roadmap*, on, amongst other things, uniform applicability, potential for scaling up and regarding the cooperation side

LEGISLATION & REGULATIONS

In recent years, only a limited legal instruments have been deployed to further the circularisation of the Construction chain. Innovative businesses already start applying circular principles without legal incentive. A great number of laws and regulations concerning the construction sector have been adopted on the national level. With the introduction of the new Environmental Act (from 2021), however, more legal opportunities will arise locally. Currently, the Municipality may impose requirements that surpass the Construction Act, but they have to be included in a 'Zoning Plan with a broadened scope' after registering for the Crisis and Recovery Law.

What is needed?

- Circular ambitions in each tender of municipal real estate: be they new construction, renovation or transformation
- Adaptability of buildings (commercial real estate, municipal real estate as well as homes) to ensure that these will also be suitable for other functions in the future
- No obstructive laws and regulations for circular construction on a national level
- Shift of tax from labour to raw materials

Role of the private sector

- Proactively sharing knowledge about technical possibilities and the long-term consequences of circular construction: this is what it is all about both on available technology and on the long-term (financial and ecological) benefits of a circular construction
- Supporting the Municipality of Amsterdam in its efforts to demonstrate that the private sector is also demanding changes in laws and regulations

Activiteiten gemeente

- Requiring a materials passport and a disassembly plan (for example through BIM) for all new construction, transformation and renovation projects in Amsterdam. Securing these requirements in the zoning plan with a 'broadened scope' (later: Environmental plan)
- Taking flexibility as one of the criteria for all new construction and transformation projects. This is one of the topics from the *Roadmap Circular Land Issue*
- Intensifying the conversation with the national legislator on how to create a new standard for circular construction. Using practical experiences from Amsterdam as exemplary projects
- Intensifying the conversation with the national and international tax lawmakers to the shift of tax on labour towards raw materials. Connecting this with the efforts of Ex'Tax

5B | UPSCALING THE **BIOMASS & FOOD VALUE CHAIN**

What is a circular Biomass & Food value chain? *A circular Biomass & Food value chain is a value chain in which all biological residual flows are reused at high value. By means of cascading, valuable substances of high value can be used. Reuse sometimes involves creating a product from a residual stream (e.g. oyster mushrooms from coffee grounds) and sometimes to extract high-value raw materials from waste (e.g. basic chemicals from waste(water)). As a low-value - and therefore less desirable - option, energy can be produced by composting or incinerating organic residual streams.*

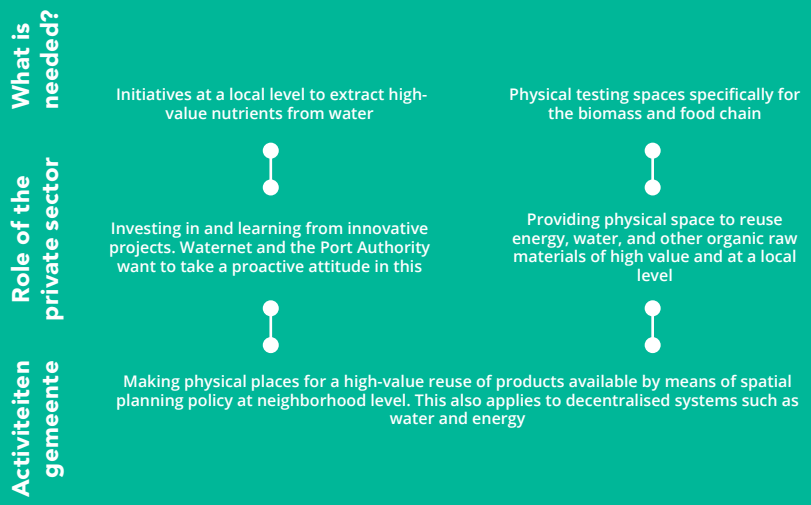
As a result of the Municipality's focus on the Biomass & Food chain, mainly small-scale innovative projects have been realised in recent years. On a larger scale, residual flows of this chain are still processed at al low value level into compost (e.g. VFG waste) or for the production of energy (through fermentation). However, the innovative projects of recent years prove that this chain offers many opportunities for high-value reuse. A continued focus on the Biomass & Food chain is highly recommended in order to scale up these for high-value reuse initiatives.

In order to both shift from low- to high-value reuse in the Biomass & Food chain and scale it up, it is recommended to focus on three instruments: Business & Financial support, Spatial planning and Legislation & Regulations. Just like the Construction chain, this value chain also requires research and the use of networks. This point will be further discussed in action perspective E (p. 41).

In the Integrated National Programme Netherlands Circular by 2050, the following strategic objectives for the Biomass & Food value chain are described:

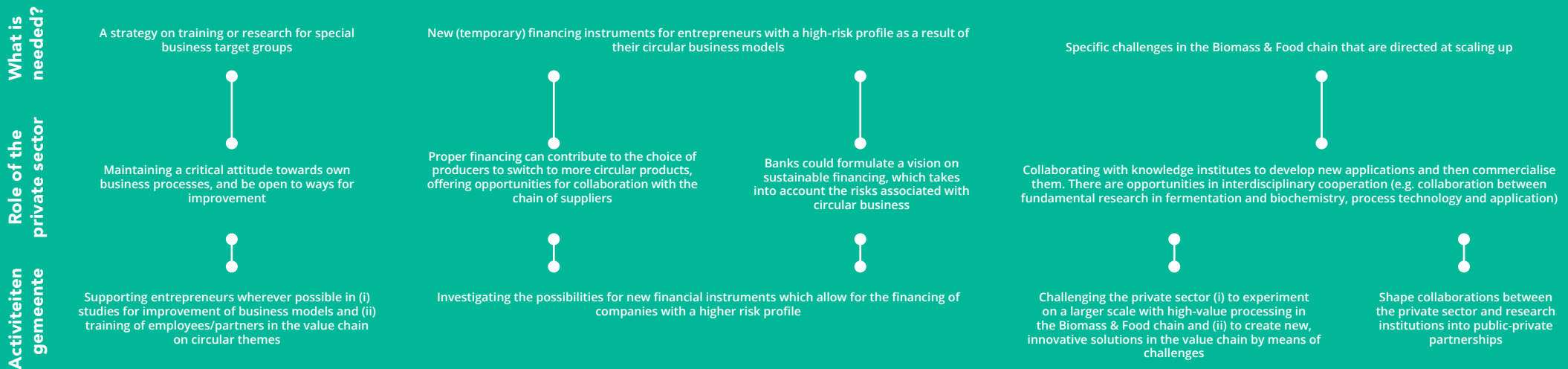
1. Sustainable production of sufficient biomass with extensive closing of nutrient cycles on a geographic scale that is as small as possible and as big as needed;
2. Optimal use of biomass and food by keeping raw materials and (half-) products in the chain at a high level for as long as possible.
3. Reduce the use of non-renewable resources and replace them by renewable raw materials;
4. Develop and introduce new ways of producing and consuming, which leads to improvements in the handling of biomass and food.

SPATIAL PLANNING POLICY



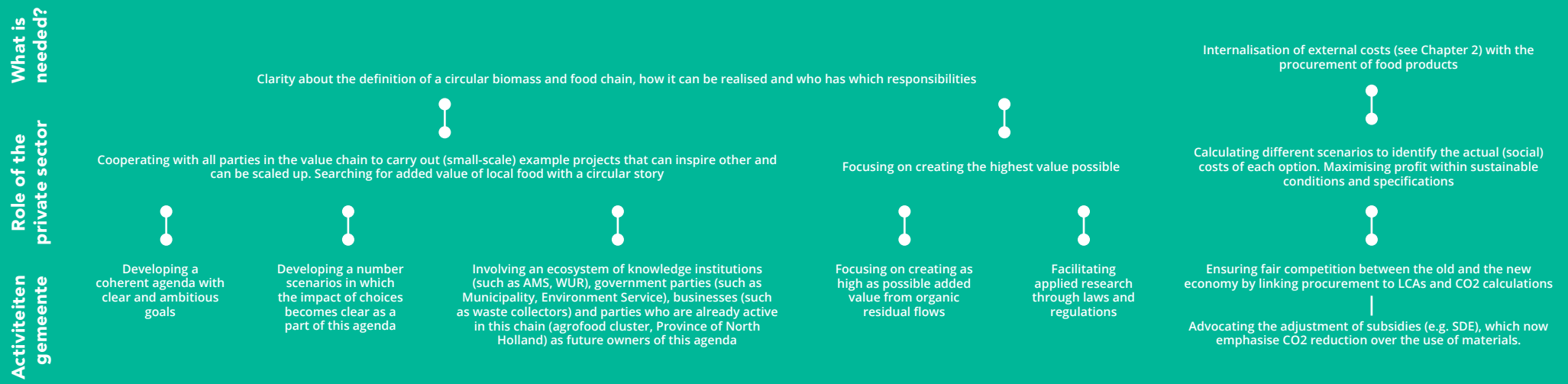
BUSINESS SUPPORT AND FINANCING

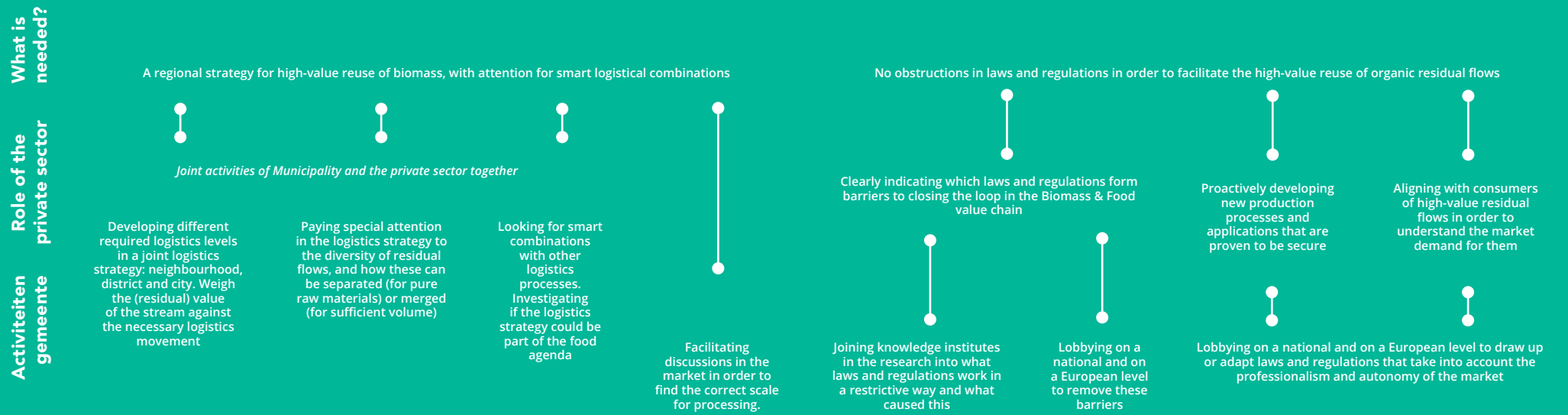
Many circular initiatives in the food or biomass chain are still at an early stage. This means, there is still a lot of unused potential for upscaling. The Municipality of Amsterdam also plays a part in this. The focus on business support & financing makes our part concrete.



LEGISLATION & REGULATIONS

The Legislation & Regulations instrument has the potential to counteract the fragmentation of the value chain, to improve current disappointing business cases and to adjust waste legislation more closely to making the Biomass & Food value chain circular.





5C | UPSCALING **CONSUMER GOODS**

What is a circular Consumer goods chain? *In a circular Consumer goods value chain, goods and associated packaging are kept in the value chain at as high a level of value as possible. Consumer goods are all relatively simple products that are used every day: from coffee cups to clothing and the packaging of soft drinks to vacuum cleaners and furniture. This value chain consists of the use, application and (high-value) reuse of these products, their parts and their materials.*

The focus of the Municipality of Amsterdam on the consumer goods chain is new compared to the earlier focus on Construction and Biomass & Food. The city offers many opportunities: due to a high density of the population, a lot of consumer goods are bought, used and discarded. Moreover, the growth of the city is accompanied by the growth of the use and discarding of consumer goods. There are many possibilities for high-value reuse through for example the sharing or repairing of products and parts. Scaling up this value chain, as well as Construction and Biomass & Food, then, seems logical.

What is more, consumer goods have the largest footprint, if compared to, for example, travel or food consumption. With a focus on this chain, much profit can be gained.[45]

In this sector, more and more suppliers are bringing circular products to the market (e.g. paying for the use of a product). However, in the short-term consumers only want to pay the lowest price for a product. This behaviour calls for a business model in which goods are sold in large quantities. This is a serious setback. Although this cannot be changed in Amsterdam at the macro-economic level, there is room for initiatives to be set up that promote high-value reuse and a decrease in waste. This focus on the end of the chain works in addition to the European focus on the start of the chain (design), for which EcoDesign guidelines have been developed.

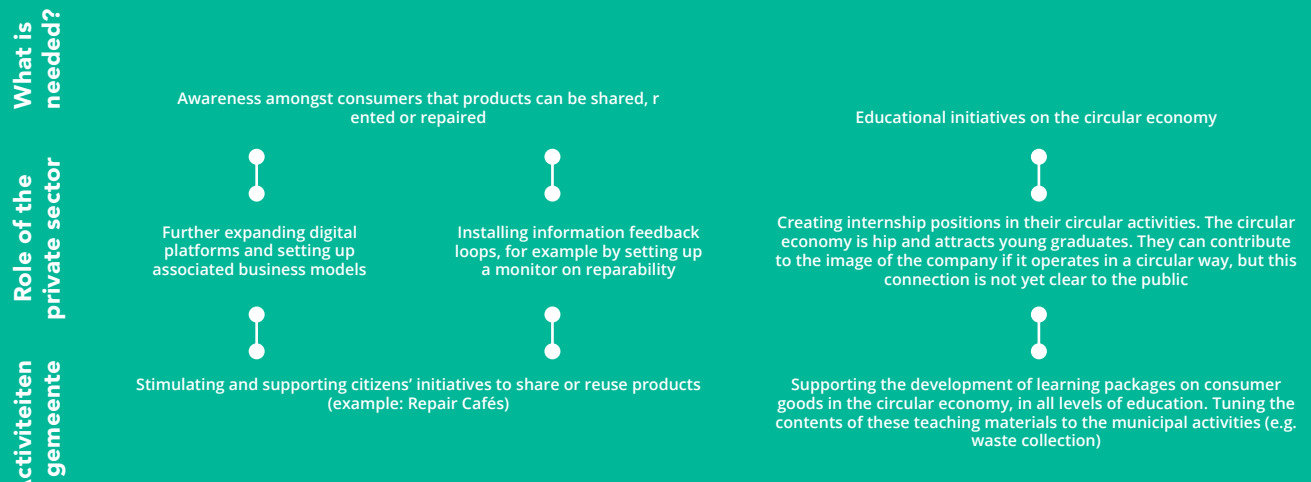
To give substance to this direction, it is advised to look more closely at two instruments: Business & Financial support and Education & Information provision. For this value chain too, a lot of additional research is needed, especially into the economic and financial incentives for production, use and processing of a product.

In the Integrated National Programme Netherlands Circular by 2050, three operational objectives are formulated for consumer goods:

1. The annual amount of household residual waste in 2020 is of 100 kg per person maximum, and reduced to 30 kg per person per year by 2030;
2. By 2022, the amount of residual waste from companies, organisations and governments that is similar to household residual waste has been halved (compared to 2012 figures);
3. By 2025, citizens and businesses will deal with consumer goods in such a way that they are kept in the value chain and leaving litter will no longer be the norm.

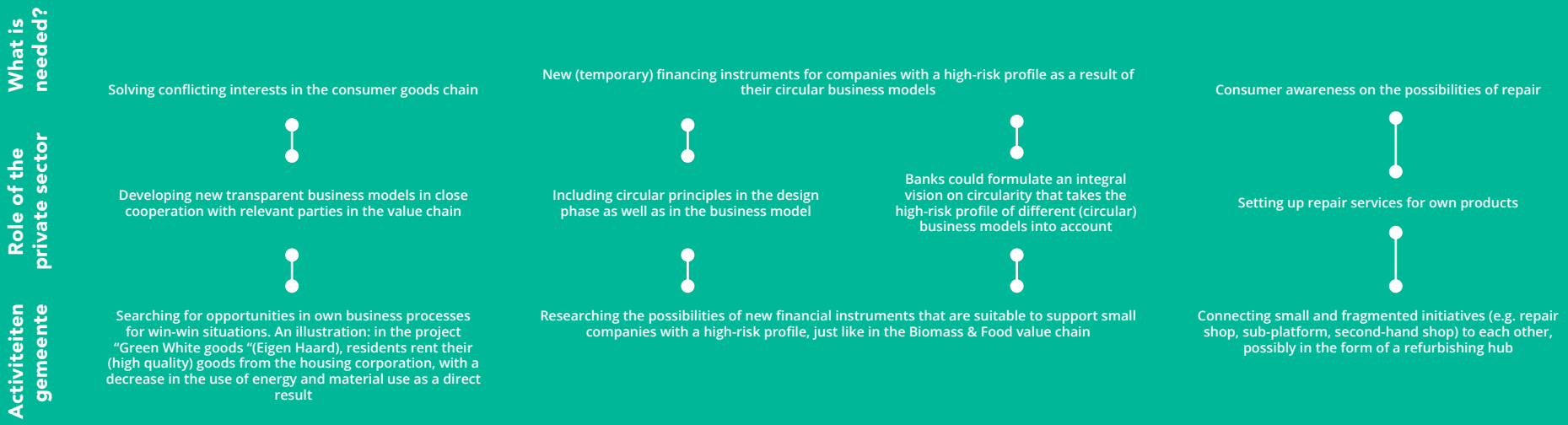
EDUCATION & INFORMATION PROVISION

Education & Information provision on the part of the Municipality increases consumer awareness and mainstreams the idea of circularity by also addressing the producers of tomorrow.



BUSINESS & FINANCIAL SUPPORT

With the Business & Financial support instrument, the Municipality can boost circular innovations by preparing them for the market. The instrument also improves the financial feasibility of circular consumer goods. The procurement tool is also suitable, but and is elaborated upon in Scenario D.



5D | EXPANDING **PROCUREMENT**

What is circular procurement? *Circular procurement is the buying or tendering of required products or services, with a view to optimally (re-)using products, parts and materials at the end of their lifetime. A more function-oriented procurement process is desirable, because this has the potential to influence the design of products. To arrive at long-term value creation, this calls for other forms of cooperation with the market and for other business models.*

Procurement is an important tool of governments for boosting the circular economy: it is one of the few connections with physical products, construction projects, and the furnishing of the public space. Adequate internal organisation of the Municipality is essential in order to effectively deploy the Procurement instrument. After all, the circular economy requires different agreements on budgets, business models and operating procedures. Sustainable and responsible procurement (with circular procurement as one of its elements) is therefore a task for the entire municipal organisation, and is not restricted to the procurement department.

The focus on procurement does not only affect products that are delivered to Amsterdam. An integral circular demand from the Municipality of Amsterdam influences the supplier directly, and the rest of the value chain by proxy for the supplier cannot realise the circular ambition alone. The maturity of the market, and with it the possibility for setting circular ambitions, varies per product group.

To encourage suppliers to produce circular products, it is advised to strongly focus on the procurement tool. Two value chains are of special importance here: Consumer goods (for use of the own organisation) and Construction (real estate owned + public space).

CIRCULAR PROCUREMENT IN THE CONSTRUCTION VALUE CHAIN

What is needed?	Circular ambitions in all renovations and transformations of existing real estate - including real estate of housing corporations and investors - and in the public space		Circular ambitions in every tender of civil engineering projects, (redevelopment of) the public space and the construction of utilities		Demolition and disassembly plans in tenders for buildings and civil and hydraulic engineering		Tenders based on Total Cost of Ownership, including energy costs and the valuation of residual materials		
Activiteiten gemeente	Expressing high circular ambitions in renovations and transformations of municipal real estate: commercial buildings, schools as well as community centers. Determine the relevant ambitions for each project. Demanding only existing methodologies (e.g. energy coefficients) is too limited, and gives businesses insufficient room for innovation. Challenging the private sector, amongst other things, on the maximum reuse of existing material	Collaborating with housing corporations in formulating circular ambitions in municipal requests to the market: both for demolition/new construction and in case of transformation and renovation. Here too, formulate specific ambitions per area or per construction period	Ensuring the right internal cooperation to come to a circular procurement request, that includes the realisation phase as well as multi-year maintenance. Introducing financial incentives that lead to long-term circular solutions	Working on further development of the Puccini method in order to enable the large-scale application of circular principles in the public space (e.g. technical specifications may hinder the application of reused building material)	In case of demolition/new construction, requiring high-value reuse of the materials in procurement requests or tenders. These materials can be reused both in the same location and elsewhere	Requiring (i) a materials passport and (ii) a disassembly plan in all tenders for new construction or transformation projects	Scoring offers based on the Total Cost of Ownership/Total Cost of Use. The Total Cost of Ownership should apply to all parties included, allowing them to allocate these costs between them		

CIRCULAR PROCUREMENT OF CONSUMER GOODS

What is needed?

A financial win-win situation for both the Municipality and the supplier

A coordinating role of the Lead Buyers in the procurement process, in order to survey progress, the realisation of ambitions and contract management

Activiteiten gemeente

Pushing circular ambitions forward as early on as possible (when a need arises) in all municipal procurement processes. This enables suppliers to produce products that are based on a circular business model

Asking a fair price in tenders, including all negative external costs

Developing internal incentives for all internal departments to work together and making department heads responsible for a shared optimal result during the period of usage

Establishing an interdisciplinary team across the municipal organisation to safeguard internal collaboration and enable the development of circular solutions for all departments. This internal collaboration includes an internal client, a budget holder, a policy maker, a lawyer and an end user. The lead buyer in this team figures as an impartial connecting party between all disciplines

Drawing up procurement schedules and category plans for all product groups, and identifying the product groups that are the most promising for realising circular ambitions. This creates (i) an overview of procurement product groups; (ii) insight into the budgets per product group and (iii) clarity on which product groups are promising in view of circularity

What is needed?

Flexible organisation of budgets and active contract management, aimed at optimising the expenses of the municipal organisation as a whole

Knowledge and experience of procurement officers and internal clients

Appropriate technical, financial and process criteria per product group

Procurement requests and tenders that focus on functional criteria, instead of technical specifications

Activiteiten gemeente

Making the costs during the entire lifespan (Total Cost of Ownership/Total Cost of Use) transparent for each product. Taking these costs as a maximum for a circular tender, with the aim of reducing them by smart agreements about optimal product use and residual value

Organising an internal training programme on sustainable and responsible procurement for all relevant stakeholders in the procurement process. Circular procurement forms an important part of this. Attendees go through the training programme on the basis of a self-initiated procurement pilot. The structure of the National Circular Purchasing Academy (an initiative by PIANOo) or regional knowledge networks such as the Community of Practice on circular procurement of the AMA can serve as inspiration

Determining for each product group suitable circular requirements (conditions) and criteria (possibilities for distinctive characterisation), paying attention to both technical and process-related aspects. This depends on the maturity of the market in a specific product group

Organising a market consultation may be useful. In addition, copy existing (international) standards and work together with other cities and municipalities to develop them further. This helps companies in streamlining and scaling their circular activities

5E | EXPANDING THE **KNOWLEDGE FUNCTION**

What is the knowledge function of Amsterdam? *The knowledge function of Amsterdam consists of both the development and dissemination of knowledge about the transition to a circular economy. Knowledge development is about research: both fundamental and practically applied research. Knowledge dissemination involves knowledge dissemination among businesses as well as among residents of the city.*

In the transition to a circular economy, there is a need for more knowledge and sharing experiences in a number of ways. This not only concerns knowledge on technology: there is certainly a need for knowledge about interactions between people and organisations, and for knowledge about economic and financial incentives.

By focusing on her knowledge function during recent years, the Municipality has already achieved a lot. The structural research by AMS contributed strongly to this, as well as the *Urban Technology Programme* of the AUAS. Effects of this research are especially visible in the two value chains Amsterdam focused on these last years: Construction and Biomass & Food. The knowledge developed in Amsterdam is also used elsewhere, again showing the broader influence of the city outside its urban boundaries.

The cooperation between the Municipality of Amsterdam, knowledge institutions, the private sector and residents is unique. Collectively, the city created a learning environment in which new initiatives can be developed, applied and improved. In the transition to a circular economy still ahead of us, this "transition arena" is essential. Strengthening the focus on the knowledge function of Amsterdam is therefore a next step with a high potential impact.

EDUCATION AND INFORMATION SUPPLY

Because the transition to a circular economy is still at such an early stage, information provision is essential. This means involving different target groups: residents, educational institutions and businesses. The role of the Municipality differs for each target group.

What is needed?	More available open data to support the realisation of circular ambitions		Retention of Amsterdam's frontrunner position by continuing to share knowledge actively	Educational initiatives about the circular economy in order to achieve better understanding of circular principles with young children	Cooperation with knowledge institutions to produce innovative teaching programmes for students on tender processes for buildings as well as civil and hydraulic engineering	More workers with secondary vocational education in the construction sector with an understanding of circular principles
Activiteiten gemeente	Looking within relevant knowledge institutions and within the internal organisation for relevant collaborations on producing, finding and publishing data through www.amsterdam.nl	Intensifying the collaboration with AMS, the AUAS and the UvA so that they are able to make use of the data available. The open data can be used for determining circular potential (such as: PUMA), or optimising existing processes (e.g. optimising waste collection logistics)	Organising structural knowledge exchange between the Municipality of Amsterdam and other municipalities in The Netherlands, to support them with their role in the transition to a circular economy. Cooperate in this with the Association of Netherlands Municipalities and the Dutch Smart Cities cities	Stimulating educational activities for (primary) education. There are already many initiatives eager to start in schools, but the match between educational institutions and other parties is often lacking. (Example: I Circulate for preparatory middle-level vocational education)	Continuing to act as launching customer of circular economy research at the AUAS | Supporting educational institute to invest in the development of skills that are relevant for the circular economy: computer-driven and data-driven thinking, system thinking and interdisciplinary thinking	Searching together with secondary vocational education Institutions for possibilities to make construction-related educational programmes more attractive to students. Then collaborating with these institutions to integrate circular principles into the curriculum

RESEARCH

Conducting both fundamental and applied research is important in the transition to a circular economy. Many developments are new and hence still involve uncertainties. Continuing the effort on research is therefore desirable.

What is needed?

- Additional research in all value chains to boost the circular economy
- Optimal use of the city's research potential, in particular AMS and AUAS (AMS is currently enjoying a 10-year subsidy scheme)
- Living Lab approach calling, with particular attention for the role of the Municipality
- Security for business investments

Activiteiten gemeente

- Strengthening the cooperation with relevant knowledge institutions, together prioritising groundbreaking research projects on the circular economy
- Actively sharing the findings and outcomes of these studies, and offer action perspectives for both the internal organisation and the private sector
- Continuing the living lab approach to gain more knowledge on the actual implementation of circular principles. Creating learning organisations and processes by means of 'managing, monitoring and measuring'. This increases professionalism and support for circular initiatives
- Initiating research into the impact of the different technologies through roadmaps. Scenario development can be an exploratory tool. This will bring more focus and security for business investment

NETWORKS AND INFORMATION EXCHANGE

A circular economy calls for more intensive forms of cooperation between value chain partners. The Municipality often plays a directing role, because it is the most important impartial player on the local level. It can proactively bring parties together around urgent issues. It is important for the Municipality to understand and safeguard the joint interests of stakeholders, keeping a clear focus on the bigger goal (sustainable development).

What is needed?

- Impartial connecting party of businesses and independent Chair with no interests
- Clear objectives for every network and an effective mode of operation with this
- Support for the existing networks according to their need, both from a content and a financial perspective
- Continued role of the Municipality as a ecosystem builder
- Sustained frontrunner position by actively sharing knowledge and by continuing to attract companies (e.g. as in Westas)

Activiteiten gemeente

- Strengthening contacts with startups in the city that have not found their way to the existing networks yet. Charting their needs can uncover opportunities for these startups
- Providing a clear overview of the circular economy-related networks and their focus areas. Establishing active and clear communication on the various municipal networks
- Continuing the search for opportunities for the participants of networks (e.g. ProDock)
- Continuing the financial support of networks (e.g. Cirkelstad) in order to optimise their operational processes
- Choosing membership of a limited number networks such as Cirkelstad. Matching the investment in networks to the value chain status to cater for the next phase of the transition
- Determining the needs of the different municipal networks, and using these insights to cater for them
- Use the decision power of organisations affiliated with the Municipality, such as Waternet, the Port Authority, AEB and Alliander and connect them with each other. This can lead to the major breakthroughs that are required to break with the current (linear) system
- Utilise the circular story in the city marketing campaigns by Amsterdam Marketing. This can further consolidate Amsterdam as a circular frontrunner

6 | CONCLUSIONS

The evaluation of the 73 projects and the market validation with about 100 businesses show that Amsterdam is seen (inter-) nationally as a frontrunner. There is proof that a circular economy is realistic and profitable. The current municipal approach to *Learning by Doing* and the choice to focus on the value chains Construction and Biomass & Food have been successful. However: all parties are still at the beginning of the transition to a circular economy.

The urban region is the location where societal challenges arise, where interaction takes place and where opportunities lie to find new solutions. Should policy remain unaltered, the use of materials - and therefore also the amount of household waste - within the municipal boundaries will increase as a result of the growth of the city. At the same time, the energy transition is causing an increase in the demand for materials, such as smart grids, heat networks and solar panels. In the coming years, a great number of new construction will be realised. If these are not built in a circular way, circular demolition, renovation or disassembly will hardly be possible. This hinders the future high-value reuse of construction products.

To enable upscaling to the next phase, a clear vision and direction from the Municipality on the priority value chains, the instruments to be used and proper partners is needed. By focusing on the transition to a circular economy, the Municipality supports the public interest of her residents: a healthy, sustainable and livable city.

Transition to the next stage

Amsterdam now need make the transition to the next stage: how can circular projects be scaled up and become the new standard? The aim is to be a completely circular city in 2050. To achieve this, there is still a lot to be done. It is fair to conclude that, as, yet there is (too) much room for business as usual: both the private sector and governments are still in the 'innovator' phase'. Non-circular products are still sold on a large scale, non-circular construction is still built in the 'regular' way, and non-circular value chains continue to use new raw materials and produce waste. The local Government has an important role for scaling up with the private sector and thus make the transition to the next phase.

Transparency in pricing negative external costs of products (see Chapter 2) is a point of attention in scaling up circular economy initiatives. As many project evaluations show, this transparency and sustainable price setting is currently insufficient. When fair pricing becomes the new standard, opportunities for circular growth will increase, because non-circular products become more expensive. The transition to the next phase of the circular economy requires the Municipality to act – where necessary – to give direction, to be involved as a network partner and to work together with various stakeholders, in value chains, in sectors and at various scales. The Municipality also has an active role as customer of circular business, for example in own procurement processes, (re) development of own real estate, and with the (re) design of public space. Finally, the Municipality can formulate conditions for the private sector to work in a circular way.

The evaluation of 73 circular projects shows that three value chains in particular are very promising for scaling up: in these value chains the Municipality can make the biggest contribution. These three value chains are: Construction, Biomass & Food and Consumer goods. These value chains are important to the metropolitan economy and have a high environmental impact. Moreover, there is already a lot of social energy present in these value chains to make the transition to a circular economy and they connect closely to the priorities of the European Commission, the State and the AMA.

Amsterdam can make the biggest impact in the next phase by focusing on the Procurement tool in particular and by expanding the various knowledge tools (Research, Education & Information provision and Networks & Knowledge exchange). The focus on these value chains and municipal instruments has been translated into five action perspectives. They offer concrete tools for next steps, with which the Municipality can continue its frontrunner role in an effective and realistic way.

Learning by sharing

Amsterdam has focused on learning by doing. After all: only by experimenting with new projects and processes can we learn how a circular economy really works. Knowledge exchange, amongst other things through the sharing of reports and involving project leaders in this evaluation, was the starting point. The next step includes the sharing of knowledge in a structural and proactive way as well as experiences and lessons learned and can further accelerate the transition to the circular economy. It is important to stimulate the sharing of knowledge within the municipal organisation (in and between departments) as well with research institutions and the private sector. Structural attention for evaluating projects, in which a positive basic attitude also allows the Municipality to look critically at its own organisation, can greatly contribute to this.

The importance of working together

The transition to a circular economy is vast and complex and requires changes on many different levels. Therefore, the importance of cooperation in the circular economy cannot be underestimated. This involves both working closely together within the municipal organisation, and with external parties, including the triple helix of government, business and research institutes.

Internal cooperation requires good coordination within and between the departments involved, as well as working in interdisciplinary teams. Such mode of operation optimises the provision of integral service to businesses. When the market develops a circular alternative, it often does not fit in the existing (linear) processes (e.g. an architect is encouraged to use recycled materials, but does not get permission from the welfare committee because they cannot deliver a final design on forehand). The current organisational structure therefore requires new and creative forms of cooperation, based on a common interest for the entire organisation.

It is important to look for possibilities for cooperation with external parties that also want to be a leader: science, education and businesses are included. The Municipality can act as an impartial party that brings stakeholder together on the basis of their common interest, taking into account the different individual stakes. This calls for an entrepreneurial and proactive civil service organisation, with a common understanding of the circular economy, craftsmanship and substantial expertise. To realise such an organisation, Amsterdam can build on the work that has already been done.

ANNEX I | METHODOLOGY

This evaluation – commissioned by the Municipality of Amsterdam - was carried out by Circle Economy and Copper8. Both Circle Economy and Copper8 are impact-driven organisations. Both parties do this from their own focus within the circular economy: Circle Economy starts activities through Circle Scans and regional implementation programmes; Copper8 is working on a project level by realising icon projects in the physical environment.

Based on this intrinsic motivation, the evaluation focuses on lessons learned and formulating concrete action perspectives based on them. In this methodology we mention the six steps which led to this report:

1. Establishing starting points & focus
2. Evaluating project results
3. Validation of the evaluation
4. Formulating action perspectives
5. Validation of action perspectives
6. Drafting the final report

1. Establishing starting points & focus

In consultation with the Municipality of Amsterdam, we formulated the starting points and focus areas for the evaluation and the action perspectives. The starting points are:

- The necessity of the transition to a circular economy is a fact: the urgency of the tasks is too great not to focus on them;
- Amsterdam has expressed the ambition to be a frontrunner and retain this position. A successful evaluation makes the continuation of this role a logical choice;
- The national Government and the European Commission are also working on the transition to a circular economy. Amsterdam takes on the role that fits her scale level: creating circular projects together with the private sector.

From this two focus points arise:

- Mapping the lessons learned (evaluation);
- Clarifying the (division of) roles between the Municipality and market (action perspectives).

2. Evaluating project results

In order to properly evaluate the municipal programmes and determine their effectiveness, we chose to evaluate separate projects and summarise the results. These project results have been retrieved with a digital survey sent to all involved project leaders. We achieved a 100% response rate: all requests were returned. As explained in the introduction, two projects have not been included. The complete list of evaluated projects may be found in Annex II.

Drafting survey questions
In the survey, there are a number of open questions (e.g. most important project results) and a number of closed questions (e.g. in what degree have follow-up steps been successful). As projects often did not contain quantitative targets (such as: reduction in raw material or energy consumption), we did not include quantitative questions in the survey. The survey existed of 20 questions in total: 11 open questions and 9 closed questions. The questions were validated by AMS before they were sent to the project managers.

Questions covered the following topics: value chain, scale level, obstacles, municipal support instrument, possible lack of support, project results, lessons learned and their possible application, identification and execution of follow-up steps, and the nature of partnerships and the development in these. These topics were chosen, because they (i) give a complete picture of the progress of the projects and (ii) show the relationship between these projects and the transition as a whole.

Retrieving survey results
To retrieve the data, we approached all project managers by email. We followed-up the emails by telephone calls. In case of incomplete surveys, individual project leaders were called for additional information.

Processing survey results
The survey results were classified according to the value chains they belong to and the municipal instruments they were supported by. As to the value chains, we chose to follow the classification used in the Netherlands Circular 2050. The value chains 'Construction' and 'Biomass & Food' are value chains Amsterdam – with Amsterdam Circular as a starting point - was already focusing on. For the instruments, we used the classification of the Ellen MacArthur Foundation,57 to which Land issue and Research have been added, as result of the active Amsterdam focus on these instruments. The policy tools mentioned in the Circular Innovation programme are not explicitly mentioned in this evaluation, but they are part of the categories mentioned.

The division into value chains provides insight into the progress of the transition to the circular economy of every value chain. The division into policy instruments makes visible to what extent and how effectively certain policy instruments have been deployed. In this way, it is possible to draw conclusions both per value chain and per policy instrument. These conclusions are substantiated with examples.

3. Validation of the evaluation

Next, the main lines of the digital evaluation were validated in a meeting with project leaders. In this meeting (November 2, 2017) project leaders from the municipal organisation as well as project leaders of the *Circular Innovation Programme* projects were present. During this meeting, the following issues were validated:

- The common thread + lessons learned per value chain
- The common thread + lessons learned per instrument

The results of the meeting were used to formulate the evaluations more precisely. The final version of the evaluations per instrument was validated once again by an official expert on the respective instruments.

4. Formulating action perspectives

In formulating action perspectives, we based ourselves on the results of the evaluation. To determine which value chains and which instruments should be focused on in future, we developed evaluation criteria based on the questions in the survey.

Preparing evaluation criteria
Two survey questions with an equal weighting, have been used as evaluation criteria. These questions represent the most important aspects in the transition to a circular economy: being open and having the courage to learn and wanting to work together in order to be able to realise more value in the long term.

- **Degree of applying the lessons learned**: at this stage of the transition, learning from each other and applying lessons learned is crucial for accelerating the upscaling.
- **Degree of cooperation between parties**: In order to realise the systems change, cooperation is indispensable. Stronger cooperation creates opportunities for an acceleration of the transition.
- **Degree of completion of projects**: when a project is completed, lessons can be learned and upscaling can start from there. The success or failure of the deployment of an instrument in a certain chain is the reason for expanding this instrument to other chains, or not.

Developing action perspectives
Based on the (i) the trends, (ii) the evaluation criteria and (iii) the expertise and practical experience of the consultancy firms involved, we then made a choice for the focus on certain value chains or use of specific instruments in other value chains:

- **Scaling up of value chains:** The potential impact in this chain is big. To boost the transition in the chain, multiple instruments can be used. In the action perspectives we have worked out various options. But other instruments too (which have not been described) offer possibilities.
- **Expanding the deployment instruments**: An instrument is effectively applied, and can have more impact if its application is broadened to other chains. In the action perspectives, we mention some important chains in which this instrument can be applied. This instrument can also be applied to other chains, but this needs further elaboration.

In the combinations of value chains and instruments, we defined possible roles for both the Municipality and the private sector. These roles are based on the lessons learned from the evaluation and the strategic objectives from the transition agendas for the Netherlands Circular 2050.

5. Validation of action perspectives

The action perspectives were validated in a meeting with +/- 80 attendees. Those present on this meeting (7 December 2017) mainly belonged to external parties: stakeholders of businesses from the various value chains, parties from the financial sector and local knowledge institutions. During this meeting the following aspects were discussed:

- Validating the lessons learned
- Retrieving information about the 'state of the market'
- Retrieving ideas about the role of the market (+ own validation findings)
- Retrieving ideas about the necessary activities by the Municipality (+ validation of own findings)

6. Drafting the final report

Based on the validation and the additional information retrieved from the meeting with businesses, the final action perspectives were drawn up. The final report was also read by those involved in the research programmes from AMS and the AUAS, and by the project leaders of the municipal programmes mentioned. Their comments have been included in this document.

Project team

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Copper8: Noor Huitema, Sybren Bosch

ANNEX II | PROJECT OVERVIEW

Circular Innovation Program

- Biopark Haven
- Nieuwe sanitatie
- Power to protein
- Waste2Aromatics
- Water governance
- Hemelswater
- Cross Chain Control Center
- Circular City research programme
- Energy Innovation Lab
- PUMA (Prospecting the Urban Mines of Amsterdam)
- Living Labs (Buiksloterham)
- Circular Amsterdam Challenge
- Startup in Residence
- Urban technology
- 3D printing with local residual products
- 3D printing in the circular city
- Amsterdam Reloaded
- Re-Organise
- Smart networks, City-zen breed
- Schaalsprong duurzame energie (Haven)
- Startup programma ProDock
- Secret Village Showcase
- Arena PL Circulair
- Smart city strategy & moonshots
- Smart City community
- Global Smart City coalition op thema Circulair
- Verduurzaming 100.000 woningen
- Living labs, governance, building principal investigator
- Weeelectric pilot in Jordaan
- Evidence Based Food System

Learning by Doing

- Circulair ontwikkelen Haven-Stad
- Input marktpartijen circulariteit in gebiedsontwikkeling Haven-Stad
- Quick scan en pilots juridisch instrumentarium circulair bouwen en slopen
- Circulaire tender gronduitgifte en projecten op gebied van transformatie, sloop en werkgebied
  - Circulaire tender Centrumeiland
  - Circulaire tender Buiksloterham
  - Circulaire tender Zuidas
  - Circulaire tender Sloterdijk
  - Algemene projectevaluatie circulaire sloop
  - Circulair bouwen
- Pilot Circulaire sloop en nieuwbouw
- Netwerk Betonketen
- Straat van de toekomst
- Hergebruik gebakken klinkers (weg als materiaaldepot)
- Westas werkplaats circulaire economie
- Circulair Business Park Amsterdam Osdorp
- City Deal Circulaire Stad
- Resultaatafspraken verduurzamen met aandacht voor circulair (MVI)
- Green Deal Cirkelstad Amsterdam en Amsterdamse standaarden
- Lobby bij het Rijk
- Circulaire economie zichtbaar maken voor de Amsterdammer
- Circulaire evenementen
- Circulair Buiksloterham
- Subsidieregeling 'Projectvoorbereiding collectieve duurzame initiatieven
- Pilot 'Product blijft product' .
- Bepalen kosten en baten van circulair bouwen
- Duurzaamheidskeurmerken

Waste Implementation Plan

- Aanpak Bedrijfsafval
- Uitvoering project GF inzameling op Java eiland
- Van afvalpunten naar recyclepunten
- Logistiek / meer waardecontainers
- Preventie

Other projects

- Routekaart Circulaire Gronduitgifte
- Cirkelstadkompas
- Training Circulair Inkopen Bouwbedrijven
- Bedrijvenscan Haven (LCA bij drie bedrijven)
- Circulaire aanpak en het werk van Circle Economy bij dienst Metro
- 1000 jaar Amsterdam
- Circulaire aanbesteding Bijlmer Bajes
- Circulaire hotels
- Circulair kantoormeubilair
- COP Circulair Bouwen
- Cartesius
- Herziening Puccini Methode

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