



The Circular Economy in the Urban Area: A case study of Nijmegen, the Netherlands



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Abstract

Cities in the Netherlands has made ambitious commitment to the pursuit of the circular economy. The role of cities is consistently emphasised in the circular economy policy discourse, yet it is not clear how stakeholders interact in socially oriented transition in the urban arena, particularly given the fact that the urban production-consumption system influenced by factors not only situated within but also beyond the city region. This research applies the multilevel perspective framework to investigate the interactions among circular niche actors and regime members in the plastic packaging value chain in Nijmegen in the Netherlands. The analysis shows that the strong environmental awareness and the European Green Capital Award contribute to the niche development in the city region. The circular niche actors are building local networks with the members of the regimes to prepare the activities within the framework of the European Green Capital. A trans-local niche-regime collaboration with plastic manufacturers is demanding, as redesigning is one of the crucial elements to realise the circular transition. This research echoes the multi-scalar perspective in the sustainability transition studies that actors constructed the scale of the networks which mostly meets their interests rather than fitting the administrative territories which are convenient for policy makers.

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1. Introduction

1.1 Context

Circular Economy (CE) gains much attention from policy-makers and businesses not only because of its potential to tackle environmental degradation and to facilitate sustainable development. The European Commission in 2015 adopts the ‘Circular Economy Package’, which consists of an action plan, a list of follow-up initiatives, and four relevant legislative proposals on waste¹ (European Commission, 2015a). Businesses, such as Philips and Dell, make commitments towards the pursuit of the circular model (Dell, 2017; Philips, 2014). The current ‘take-make-dispose’ model is seen as a system which fails to sustain the resources and the planet, since in such manner materials are extracted and exploited inefficiently (The Ellen MacArthur Foundation, 2012). In Europe, only around 40% of waste is recycled or recovered into energy (Eurostat, 2014b). The resources are consumed faster than the ability of nature to replenish. The current lifestyle of the average European inhabitant requires the equivalent resources from two and a half planets (WWF, 2014). The concept of CE proposes to change this entire system by closing the material loop through redesigning, reusing, repairing, and remanufacturing products (The Ellen MacArthur Foundation, 2012). Such alternative thinking is attractive to businesses, because companies may likely depend on less raw materials if they adopt such concept in the production process (Benton, Hazell, & Hill, 2014; Lacy & Rutqvist, 2015; Philips, 2014). The notion also attracts policy-makers as it provides a possible solution to alleviate the environmental deterioration which results from unsustainable development patterns (Dutch Ministry of Infrastructure and the Environment & Ministry of Economic Affairs, 2016; European Commission, 2015a).

Cities are the basic geographical unit and important seedbeds for the CE practices. In the European Union today, approximately 72% of the population live in urban areas, and the percentage is expected to reach 80% by 2020 (Nabielek, Hamers, & David, 2016). This significant number of inhabitants in the urban areas has put pressures on the regenerative capacity of nature. To sustain the inhabitants’ daily life, cities need materials, energy, water, and other resources. Cities have consumed 65% of global energy (IRENA, 2016); and by 2025,

¹ The four legislative proposals are the proposed Directive on Waste, the proposed Directive on Packaging Waste, the proposed Directive on Landfill, and the proposed Directive on Electrical and Electronic Waste, on End-of-life Vehicles, on Batteries and Accumulators and Waste Batteries and Accumulators.

the world's total annual municipal solid waste (MSW) is predicted to increase from 1.3 billion tons in 2012 to 2.2 billion tons (Hoornweg & Bhada-Tata, 2012). In some European cities, the annual amount of MSW per capita reaches 575 kilograms, which exceeds the global average (European Commission, 2016b). The current linear economic model has led to the scarcity of resources and the degradation of the environment (Circle Economy, 2016). To safeguard citizens' quality of life and to ensure urban sustainability, closing the material loop is one of the approaches to reach resource-efficiency (European Environment Agency, 2015b). Furthermore, cities are raring to position themselves as innovative leaders in order to attract entrepreneurs. The circular transition has been seen as a chance for cities to create opportunities for business innovation and development (Bacova et al., 2016). A large number of residents in the urban area could lay a foundation for businesses to test novel products and services, and the diverse range of urban stakeholders provides an occasion to build collaborative relationships (European Union Directorate-General for the Environment, 2014).

Within the past two years, some municipalities in the Netherlands demonstrate ambitious commitments to the CE transition (Gemeente Almere, 2016; Gemeente Rotterdam, 2016; Municipality of Amsterdam, 2015; Roemers, Galle, & Kennedy, 2017). Innovative initiatives are taken and experimented in different sectors. The Repair Café, for instance, is developed to encourage citizens to repair defective things instead of purchasing new products by utilising the tools and skills provided by local communities. Also, there is a start-up in Rotterdam aiming to heat the city with food waste from restaurants by 2020 (Scully, 2017), and there is an enterprise using the unwanted coffee ground to grow mushrooms. Several projects aiming to build new constructions with waste materials have experimented in Amsterdam, Rotterdam, Utrecht, and Amersfoort (Nederland Circulair, 2016). While these initiatives are inspiring, there is a question which has not been fully investigated. Raw materials are extracted by manufacturers outside the city territories, products are consumed by inhabitants within the urban areas, and waste is disposed beyond the city boundaries. As the material flows are affected by different players at different spatial scales, it is suggested to synergy these players for the pursuit of the circular transition (Bacova et al., 2016; European Environment Agency, 2015b). However, how do these players indeed interact in the process of the urban circular transition?

1.2 Societal relevance

Understanding different players' interactions in the urban circular transition could facilitate

knowledge diffusion and experiences sharing. Learning is one of the important factors which foster urban sustainability transition towards better development and day-to-day life (McFarlane, 2011). The social and environmental crises resulting from urbanisation trigger urban actors search solutions and borrow experiences from other cities (see also Kennedy, 2016). Stakeholders learn from others through sharing knowledge and best practices (Campbell, 2009), local authorities learn experiences from earlier adopters (Kennedy, 2016; Shipan & Volden, 2008), and grassroots also exchange knowledge with those similar communities located in different cities (Seyfang, Hielscher, Hargreaves, Martiskainen, & Smith, 2014).

Learning from other cities' transition experiences is not as simple as replicating the successful practices and policies. Urban actors may need to understand the way in which stakeholders' collaboration and the strategies taken by players to solve the conflicts. With regard to the urban circular transition, despite that the role of cities has been consistently emphasised (Bacova et al., 2016; European Environment Agency, 2015b), most CE case studies either focus on the businesses' initiatives (Basque Government, 2016; The Ellen MacArthur Foundation, Zero Waste Scotland, & Scottish Enterprise, 2015) or pay attention to the success of particular policy schemes (European Environment Agency, 2015a). These studies do provide fruitful information and good practices, while the interactions between stakeholders are still not comprehensively investigated.

1.3 Scientific relevance

Transitions occur when the society encounters pressures. The multi-level perspective (MLP) argues such pressures come from niches—the locus where actors support emerging radical innovations—and the external landscape—the wide context which cannot easily be changed within a short period (Geels, 2002, 2011; Smith, Stirling, & Berkhout, 2005). Innovations and external shocks aim to break through the stable regimes, which consist of solid routines and institutional arrangements. Once the incumbent regimes encounter the pressures, they then either embrace the innovations or lock in the traditional development path (Geels, 2005b). This MLP approach provides a straightforward conceptual framework to understand the complex transformation process in the production-consumption model (Smith, Voß, & Grin, 2010). It has been, however, criticised for its biased focus on technological innovations. The non-technical, socially oriented innovations, which emerge significantly in the real world, have been disregarded (Lachman, 2013; Witkamp, Raven, & Royakkers, 2011). Different from novel technologies, socially oriented innovations do not aim to create new tangible artefacts.

Social innovations could be a new way of operating businesses or a new contract between consumers and producers. The main purpose of these innovations is usually to fit social needs rather than to generate profits. Such differences make social innovations as an intriguing subject to investigate the transitions process under the MLP framework.

The emergence of the role of cities in the sustainability transitions provokes scholars' interests in the spatial dimension. The MLP studies tend to spatial-blind in a way that niche-regime-landscape is situated in the hierachal local-national-global structure. Niche refers to the protected spaces at the local level where innovations occur, the regime is situated in the context at the national scale, and the landscape refers to exogenous factors in the global context (Markard, Raven, & Truffer, 2012). As cities are becoming the key space for innovation and sustainability practices, the transitions in the urban context might be much more complex than what has been addressed in the traditional MLP studies. Urban actors in the innovation developing process may likely build networks with actors at other spatial scales; and actors in the regime may also collaborate with local communities. Such nuanced understanding of the spatial scale in the transition studies is conceptualised as multi-scalar perspective, which emphasises that the spatial scale is not only a hierachal and absolute scale but also a socio-spatial relational construction (Coenen, Benneworth, & Truffer, 2012). Also, the institutional particularities embedding in the urban area, such as the local norms and informal institutional configurations, have been recognised as one of the critical elements in the transitions process (Hansen & Coenen, 2015). These two aspects—multi-scalarity and the institutional embeddedness—lead to an intersection between the field of geography, the field of spatial planning, and the sustainability transition studies. Nevertheless, there are relatively limited empirical case studies conducted to explore how these aspects act in the urban arena, particularly in a socially oriented innovation transition. In the light of such research gap, this research attempts to apply the MLP approach through the lens of spatial perspective to investigate the urban circular transition.

1.4 The research scope

As the urban circular transition is a process in which different sectors may get involved and influenced, in order to specifically focus on players' interactions, this research centres on the plastic packaging value chain. There are three reasons for such focus: the dependency on plastic packaging in the urban life, the environmental impacts caused by plastic packaging, and its potential which has been recognised by the EC.

Plastic packaging has been widely used in the daily urban life. The feature of inexpensiveness and lightweight makes plastics distinctive from other packaging materials. Plastic packaging contributes to extending the life of food without increasing the cost of the food price. Since plastics does not significantly increase the weight of goods, the shipping cost could keep cheap and affordable. Plastic packaging also provides excellent protection to prevent goods from being contaminated and damaged. From our bathrooms to kitchens, there are plenty of plastic packaging on the shelves. The plastic packaging market is growing at the rate of 5% per year (The Ellen MacArthur Foundation, 2016). In 2013 there were 46.3 million tons of plastics demanded and utilised in Europe. Plastic packaging accounts for 39.6% of the total demand, which is the largest application of plastics (New_InnoNet, 2016). In the light of the intertwined relationship between day-to-day urban life and the usage of plastic packaging, it is noteworthy to explore the implications of the socially oriented circular innovation on the plastic packaging value chain.

Plastic packaging has significantly adverse impacts on the environment, in terms of material extraction in the production process and the end-of-life treatment. While in Europe merely 4% to 6% of the total consumption of oil and gas is utilised to produce plastics (PlasticsEurope, 2016), the amount is significant if one multiplies it by the total amount of consumption. Producers argue that 80% of the energy consumption of plastics occur at the use phase (PlasticsEurope, 2016). As most of such packaging is designed for a single-used purpose, the packaging is soon thrown into recycling bins after the containing products are being consumed. In Europe, over 50% of plastic packaging can be recycled (The Ellen MacArthur Foundation, 2016), yet the actual recycling rate is below 30% (PlasticsEurope, 2016). The majority of post-consumption plastics is treated through the waste-to-energy recovery process (39.5%) and landfill (30.8%). Furthermore, around 32% of plastic packaging has leaked into the natural environment and even flows into the ocean. By 2025, the total amount of plastic packaging in the ocean is expected to reach 250 million tons (The Ellen MacArthur Foundation, 2016). Such environmental impact makes the plastic packaging value chain would be a compelling research focus to investigate and experiment the circular transition.

Noticing the important role of plastic in the circular transition, the EC includes the plastics value chain in its action plan of the ‘Circular Economy Package’ and announces the roadmap for the circular strategy on plastics value chain (European Parliament, 2017). The strategic roadmap identifies three objectives which the EC attempt to achieve in the process of circular

transition in the plastic value chain: decoupling the plastic production from fossil fuels materials, facilitating the recycling and reusing market, and reducing the leakage of plastics into the ecosystem (European Parliament, 2017). Considering the commitment of the EC which aims to transform the entire plastic value chain circular and resource-efficient, it is intriguing to explore how the players in the value chain interact in the pursuit of the circular transition.

1.4 Research objectives and questions

In the light of the societal and scientific relevance mentioned in Section 1.2 and 1.3 and the importance of plastic packaging in the daily urban life, this paper aims to better understand the process of the CE transitions in the plastic packaging value chain in the urban context through the MLP framework combining with the lens of spatial perspective. The overarching research question, therefore, is framed as:

- How do the players in the plastic packaging value chain in the urban area interact to facilitate the urban circular transition, given that the urban production-consumption system is significantly influenced by several factors not only within but also beyond the city region?

The first research objective is to understand the players' perception of the CE, which has fruitful meanings and interrelated with different schools of thoughts. Furthermore, the research attempts to investigate how actors interpret the relationship between such concept and the plastic packaging value chain at the city level. This research objective is followed by a sub-research question:

(1) How do the players perceive the concept of the CE, and the relationship between such concept and the plastic packaging value chain in the urban arena?

The second research objective is to take a spatial perspective to explore the transition, particularly focusing on the interactions taken by stakeholders and the factors which may facilitate/impede the transition. This objective could be reached through the following two sub-research questions:

(2) Which actions have been taken and/or which practices will be taken in the future by the players to facilitate the CE transition in the plastic packaging value chain in the urban area?

(3) Which factors may likely facilitate and/or impede the CE transition in the plastic packaging value chain in the urban area?

1.5 Structure

This research is structured as follows. The next chapter firstly explores the notion of the CE and its relation to other schools of thoughts. Following insights from the socio-technical transitions studies, this chapter then reviews literature of the MLP approach and the urban sustainability transitions. Chapter 3 outlines the research strategy and methodologies. This research is a case study conducted through a qualitative and inductive approach. The details regarding research design and data collection are further explained in this chapter. The empirical results are presented in Chapter 4, which is followed by discussions and reflections in Chapter 5. This research will close with concluding remarks and recommendations.

2. Literature Review and the Conceptual Framework

Section 2.1 firstly reviews the notion of the CE and the relevant concepts. The two pillars of the CE—industrial ecology and cradle-to-cradle principle—are explored and introduced. Since the CE has been perceived as an approach to achieve sustainability, Section 2.2 reviews the sustainability transitions studies as well as the spatial perspective which is recently introduced to this field. Drawing on these studies, Section 2.3 provides the conceptual framework adopted in this research.

2.1 The evolution of the Circular Economy

While the terminology of the CE has incrementally received scholars' attention in recent years, the relevant discussion and implementation still focus on some particular industrial sectors, such as waste-to-energy recovery (Garg, Smith, Hill, Simms, & Pollard, 2007) and organic waste (Greben & Oelofse, 2009). It is still arguable that from which the origin of this concept firstly emerges (Andersen, 2007; Ghisellini, Cialani, & Ulgiati, 2016; Murray, Skene, & Haynes, 2015), and the interpretation is broad and diverse.

2.1.1 From waste recycling to products redesign

The CE evolves from different schools of thoughts in environmental economics and ecology (Geissdoerfer, Savaget, Bocken, & Hultink, 2017; Ghisellini et al., 2016; Murray et al., 2015). Viewing the earth as a 'single spaceship' which only has limited resources, Boulding (1966) firstly calls attention to the interactions between human beings and the 'cyclical ecological system'. The author argues that seeing the economy as a closed and circular system is the way to maintain human life without compromising the welfare of posterity. Stahel and Reday-Mulvey (1981) then conceptualise the notion of 'economy in loops', and sequentially identify two main strategies to enhance resource-efficiency particularly in the industrial economy: material recycling and product-life extension. It is suggested that by recycling materials the volume of waste can be reduced. Also, the amount of waste can further be prevented if one reuse products. These two strategies could further save businesses' costs and create jobs (see also Geissdoerfer et al., 2017). Based on such concept and the 'spaceship economy' introduced by Boulding (1966), Pearce and Turner (1990) firstly use the terminology of 'circular economy'. Considering the natural system and its interactions with the economy, the two scholars combine an economy system with closed materials flows and name such system as

‘the circular economy’. Different from the traditional perspective in economics which focuses on the productivity of raw resources, Pearce and Turner pay more attention to the implication of waste flows and the laws of thermodynamics on the economy (see also Ghisellini et al., 2016; see also Heshmati, 2015). The authors assert that the necessity of the co-existence of the economy and the environment is the prerequisite of the economic equilibrium. Such argument then raises further discussion about the interactions between the environment and the economy and the models which will enable the two systems to synergize (Hukkinen, 2003).

In addition to waste recycling, the concept of ‘economy in loops’ further stimulates scholars to reconsider the activities occurring at the beginning of the circle. McDonough and Braungart (2007; 2010) introduce the cradle-to-cradle principle and call for a second thought about the end-of-pipe recycling solution. The concept of eco-efficiency, which focuses on maximising economic benefits with minimising adverse impacts on the ecological system, is criticised by these two scholars. With the concept of eco-efficiency, materials are recycled. Nevertheless, they are recycled in a *downcycling manner*—the quality of materials is degraded, and functionality of recycled materials is lower than the original one. McDonough and Braungart (2007; 2010) argue that this *downcycling* begins with the ‘linear, cradle-to-grave’ thinking. Instead, the concept of eco-effectiveness is suggested, which proposes to generate a ‘cyclical and cradle-to-cradle’ system in which the products and processes are designed with the awareness of ‘turning materials into nutrients’ (Braungart et al., 2007). This cradle-to-cradle principle, together with diverse but similar thoughts such as the blue economy (Pauli, 2010), regenerative design (Lyle, 1996), biomimicry (Benyus, 1997), and industrial ecology (Lifset & Graedel, 2002), lay the foundation to the contemporary understanding of the CE.

2.1.2 Two pillars of the Circular Economy

The renowned definition of the CE might be the one which is framed by the Ellen MacArthur Foundation (EMF): ‘A circular economy is restorative and regenerative by design, and aims to keep products, components, and materials at their highest utility and values at all times (The Ellen MacArthur Foundation, n.d.).’ While other institutions and scholars have their interpretations which might be slightly different from the one introduced by the EMF (Deloitte, n.d.; Hislop & Hill, 2011; Preston, 2012; Rood, Mulwijk, & Westhoek, 2017), most of these are based on two concepts: industrial ecology and the cradle-to-cradle principle.

Firstly introduced by scholars in the environmental management field, industrial ecology

proposes that the industrial system should be seen as an ecosystem which is similar to the way the natural ecosystem functions (Erkman, 1997; Frosch, 1992; Jelinski, Graedel, Laudise, McCall, & Patel, 1992). Based on the analogy with the natural environment, in which organisms live interdependently in such a way that one's waste will be others' food, industrial ecology considers the industrial system is the web in which one's unwanted materials would be the inputs for others (Frosch, 1992). Recycling and reusing materials are the two practical strategies to mimic the biological ecosystem. The business cluster in Kalundborg demonstrates that the network of materials exchange can mutually benefit individual companies (Ehrenfeld & Gertler, 1997; see also Lifset & Graedel, 2002). In addition to the material flows within the economy and human activities, industrial ecology calls for attention to the interrelation between the industrial society and the natural ecosystem (Erkman, 1997; Lifset & Graedel, 2002), and two folds of applications are based on the thought of industrial ecology: eco-industrial parks and service economy (Erkman, 1997). The former has been widely developed all over the world since the early 2000s (see also Zhao, Zhao, & Guo, 2017), and the later which promotes selling intangible services instead of tangible goods also contributes to the development of the product-service system as well as the concept of the CE (The Ellen MacArthur Foundation, 2012; Tukker, 2015; Tukker & Tischner, 2006).

Some scholars argue that the contemporary concept of the CE is 'framed in an almost *identical* way' as the notion of industrial ecology, not only in the application of eco-industrial parks and the implication of cities metabolism but also in the recognition of the waste-resource loop within a single business (Geng & Doberstein, 2008; Murray et al., 2015). The CE does have roots in industrial ecology (Geissdoerfer et al., 2017; Ghisellini et al., 2016; Sauvé, Bernard, & Sloan, 2016). Yet this perspective, in which seeing these two concepts are identical, may focus too much on the aspect of material flows but neglects the dimension of *the economic system* of the concept of the CE. In addition to closing the material loops, the CE particularly highlights that the circular approach can benefit the economy in saving costs, mitigating risks, ensuring the resilience for growth, and creating employment (The Ellen MacArthur Foundation, 2012). Such impacts on the production-consumption system are seldom discussed in the industrial ecology studies. While the cost saving due to recycling has been addressed (Andersen, 2007; Côté & Cohen-Rosenthal, 1998; Frosch, 1992; Gibbs & Deutz, 2007), the spill-over benefit of innovations and employment did not gain too much attention from industrial ecology scholars. The contemporary CE concept has been even viewed as an economic development strategy which will create jobs in the shifting process, particularly in the discourse in China

(Yong, 2007; Yuan, Bi, & Moriguchi, 2006) and in Europe (de Man & Friege, 2016; Heshmati, 2015; The Ellen MacArthur Foundation, 2015a).

The second pillar of the CE is the cradle-to-cradle principle. The core tenet of this principle, as mentioned in Section 2.1.1, suggests that products should be designed in such a way that materials can stay in the closed system. They should also be designed with an intention that the products would not damage the environment when they are unwanted at the end of the lifespan (El Haggar, 2010; see also Glavić & Lukman, 2007). McDonough and Braungart (2007) categorise materials into two metabolisms—the biological and technical metabolisms, which are then entirely adopted in the CE concept (The Ellen MacArthur Foundation, 2012). Materials in the biological metabolism are those which could be broken down and formed into new resources within the biological cycle. They are extracted, manufactured, consumed and utilised, decomposed, and again transferred into resources in the system. On the other hand, the technical metabolism consists of manmade and synthesised material flows. For such products in the technical metabolism, in order to ensure the materials circulate within the closed system, McDonough and Braungart (2007; 2010) also suggest that these ‘products for service’ should be designed under the concept of functional economy—such as the leasing provision of televisions and washing machines.

The cradle-to-cradle principle and the CE concept to some extent share plenty of similarities, yet there is a subtle difference. Based on the idea that the industrial system and human society function as the biological ecosystem in which no waste exists, the cradle-to-cradle principle does not particularly emphasise the prolongation of the lifespan of products. If the materials can remain the status and quality as good as possible, products with a short-term lifespan are also encouraged (Braungart et al., 2007). From the perspective of McDonough and Braungart (2007), without the cradle-to-cradle design, extending products lifespan is nothing but extracting residual values until materials reach the lowest status of quality. In these circumstances, while the lifespan of products has been extended, the values of the materials are not retained in the loop. The CE concept attempts to complement the cradle-to-cradle principle and the lifespan extension. It argues that products should be designed ‘for remanufacturing, refurbishing, and recycling’ and the product life should be extended whenever it is possible by maintenance (The Ellen MacArthur Foundation, 2015c). In addition to remanufacturing and replenishing, the CE also takes other possible practices within the lifespan of products into consideration, including repair and refurbishing (see also Wever & Vogtländer, 2015).

2.2 Sustainability transitions and the role of cities

The relationship between the concept of circular economy and the terminology of sustainability (also known as sustainable development) is intricate and tortuous. Despite the lack of universal definition of sustainable development, the most-quoted interpretation is that it is a development model that ‘meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Commission, 1987).’ While the underlying principle covers resource-efficiency, the concept itself and the associated practices do not put great emphasis on material flows and the players’ interactions in the value chains in the production-consumption system. The CE, therefore, could provide a practical approach to realise sustainable development (Sauvé et al., 2016).

2.2.1 Sustainability transition studies and the multi-level perspective

Sustainability transition is a long-term, radical, and multi-dimensional transformation process through which the socio-technical systems shift from an unsustainable model towards a sustainable one (Coenen et al., 2012; Lachman, 2013; Markard et al., 2012). The socio-technical systems consist of actors (consumers, producers, organisations), knowledge, institutions (norms, property rights, regulations), markets and networks (Geels, 2004). Not only multiple actors and organisations but also different dimensions—technological, political, institutional, economic, cultural, and social aspects—are involved in the process of transformations (see also Geels & Schot, 2010; see also Rotmans, Kemp, & van Asselt, 2001). Thus, sustainability transition is usually complex and dynamic. From the multi-level perspective (MLP), which is one of the dominant approaches to analyse such socio-technical transition process, sustainability transition is the process that a historically predominant social-technical model shifts to a new configuration through the interactions among actors at three levels—the landscape, socio-technical regimes, and niches (Geels, 2002; see also Truffer & Coenen, 2012). [Figure 1](#) shows the interactions between these three levels.

The socio-technical regime consists of technologies and knowledge which are intertwined with institutions, practices, symbolic meanings, and other social embeddedness (Geels, 2002; see also Hodson & Marvin, 2010; see also Konrad, Truffer, & Voß, 2007; see also Markard et al., 2012). The core idea here is that technologies and knowledge shape and are shaped by society. Policies, regulations, consumption patterns, and market formations, together with technical structures, establish and stabilise the regime. It implies that a shift from an unsustainable to a

sustainable model does not easily occur only because of technology innovation (see also Hodson & Marvin, 2010). Institutional configurations and user preferences matter as well. The landscape refers to a broader context of the system, such as macroeconomic conditions, international political coalitions, and the environment quality. The landscape is hard to change and is seen as ‘external pressure’ to the socio-technical regimes and niches (Geels, 2002). Niches are defined as the ‘protected spaces’ and ‘incubation rooms’ for innovation and technologies (Geels, 2002, 2004). They are composed of a small group of actors who are keen to replace the existing regime with radical innovations (Geels, 2011; Hodson & Marvin, 2010). These actors secure the innovation and seek chances to break through the ‘window of opportunity’ at the level of socio-technical regimes and the landscape (Geels, 2002). Figure 1 shows the interaction amongst these three levels in the transition.

Regimes are stable but not static (Konrad et al., 2008; Smith et al., 2005). Regimes dynamically change when encountering external and bottom-up pressures. Environmental crisis at the landscape level, for instance, and innovation from niches can impose pressures to regimes (Coenen & Truffer, 2012). Regimes possess more or less capacity to respond to the selection pressures, which is defined as the adaptive capacity (Smith et al., 2005). The greater coordinating ability that actors in the regime have, the more adaptive the regime is. Based on the locus of resources utilised by the actors in the regime and the degree of coordination, Adrian Smith and his colleagues (2005) categorise four types of transitions: endogenous renewal, reorientation of trajectories, emergent transformation, and purposive transitions. The endogenous renewal refers to the situation that regime actors highly co-ordinately respond to the pressure. Regime actors clearly perceive the threat and utilise resources within the regime to react. The reorientation of trajectories, on the other hand, is the transition that actors experience a shock but fail to respond it in a coordinated way. Like actors in the endogenous renewal transition, actors in the reorientation of trajectories also respond with endogenous resources of the regime. The emergent transformation is characterised by actors’ uncoordinated responses and the need for resources outside the regime, while the purposive transition is that coordinating actors depend on outside resources to respond the pressure. Such typology provides an analytical framework for investigating the adjustments within the regime in the transition process. Geels and Schot (2007), however, question the classification which is based the degree of actors’ coordination and the origin of the resources. As transitions occur if and only if actors do reach an agreement on the collective goals, there might not be a transition which could be planned and coordinated ‘from the outset’. The two scholars argue that the

extent to which actors' planning and coordination should be explored and analysed rather than be assumed ex-ante.

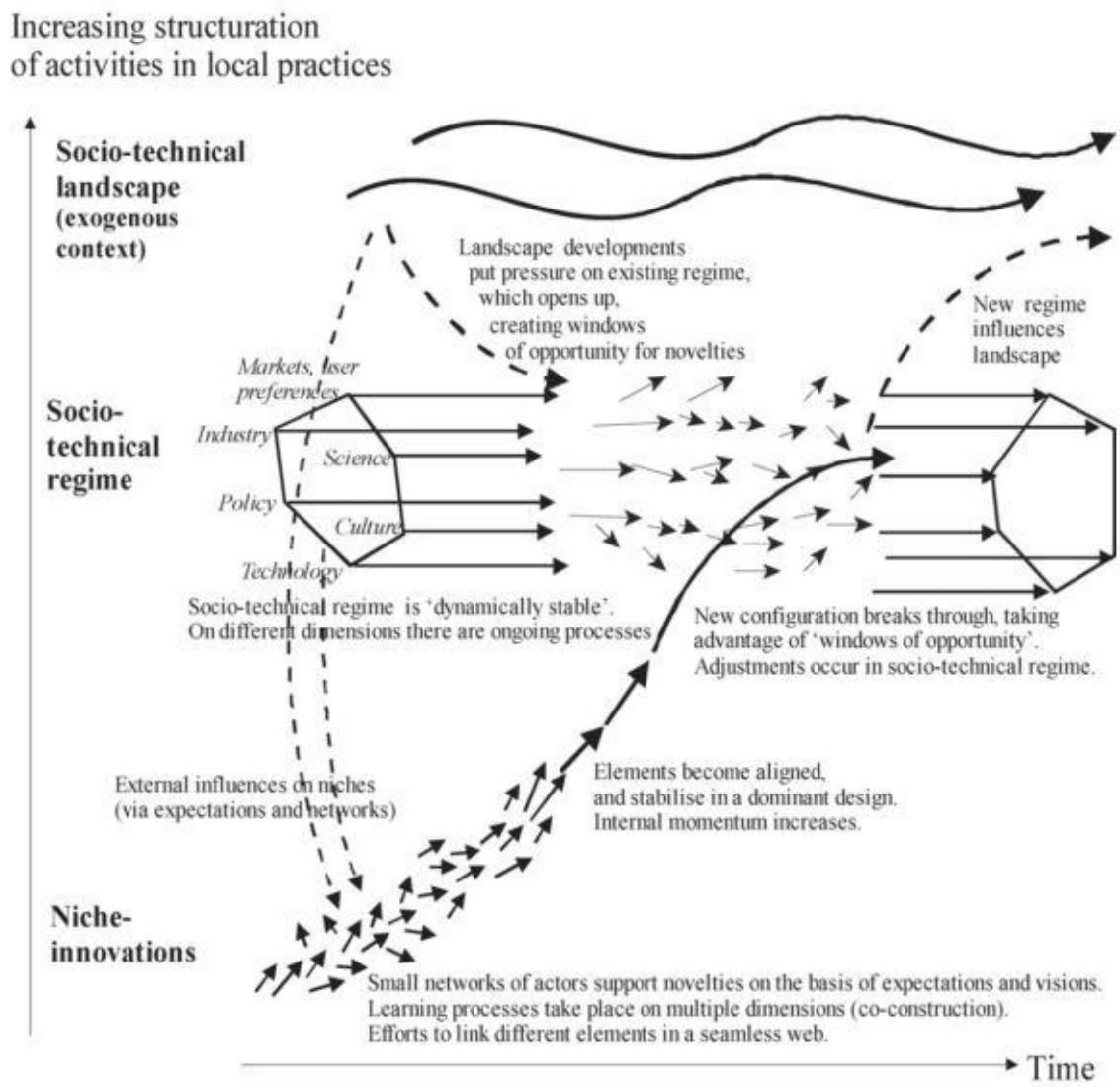


Figure 1. The MLP approach of transition and the interactions among three levels. Reprinted from Geels & Schot (2007), p.401.

Niches are the critical drivers to initiate the transitions; thus, it has been a research centre in the sustainable transition studies. The core tenet of the strategic niche management (SNM) approach is that the technological niches can be facilitated by the strategies which are designed to conquer the incumbent market, such as rearranging the regulation structures and supporting users' behaviour change (Schot & Geels, 2008). The SNM scholars are keen to investigate the reasons why some innovations successfully break through the regime while others fail. The SNM research focus on identifying the conditions and the processes which would benefit the niches development (Kemp, Schot, & Hoogma, 1998). Three elements are recognised as the

important factors: the expectation, social networks, and the learning processes. Niche actors' positive expectations would provide a climate for potential investors to sustain the innovation (Raven et al., 2012). Intensive social networks consisting of different types of actors in the niche could facilitate stakeholders' interactions and resources exchanging (Witkamp et al., 2011). The learning processes are particularly important to cultivate the niche. In addition to the information and expertise learning, the 'second-order learning' matters, which refers to the situation that the regime actors question the existing rules and norms embedded in the regime as they encounter the pressure from the niche (Seyfang & Haxeltine, 2012).

Both the MLP approach and the early SNM studies mainly focus on technological innovation niches but disregard the emerging socially oriented innovations in the sustainability transitions (Hargreaves, Longhurst, & Seyfang, 2013; Lachman, 2013; Seyfang & Longhurst, 2013). Technological innovations in the producer/supplier dimension have been widely analysed since Geels (2005b) firstly labels niches as 'technological niches'. The technical niches are usually related to physical artefacts innovations in some protected spaces and labs. Social innovation in sustainability does not build upon physical artefacts creation but propose new norms and values to satisfy the social unmet needs (Mulgan, Tucker, Ali, & Sanders, 2007; Witkamp et al., 2011; Wolfram, 2015). The differences lead scholars apply the MLP approach and the SNM perspective to investigate socially-oriented sustainability innovation and the interactions between social innovation niche and the regimes (Raven, Bosch, & Weterings, 2010; Seyfang & Haxeltine, 2012).

2.2.2 The spatial perspective and the role of cities in the transitions

The MLP approach and the SNM perspective implicitly address the role of the institutional configurations which are usually embedded in a certain place; thus, the role of cities and the local context are not completely disregarded in the discussion (Coenen et al., 2012). However, cities are often simplified as the place where niches situate and develop, and the regimes usually refer to the national context. There is an underlying presumption that the transition occurs when the innovations which are protected in the local area put pressure on the national regime (Hodson & Marvin, 2009; Truffer & Coenen, 2012). Hodson and Marvin (2010) challenge the traditional sustainability transitions studies through asking a simple question: where is the role of cities in the hierarchical level in the MLP framework? They argue that the territorial scale and context might demand a further clarification in the sustainability transitions studies. The transition in the urban arena is not only shaped by the coalitions between local actors but also

influenced by decisions and actions taken at the national and international levels (Hodson & Marvin, 2010). The interrelations between actors at different spatial scales make transitions in the urban context much more complicated than the one that traditional MLP scholars perceive.

Responding to Hodson and Marvin (2010), Coenen and his colleagues (2012; 2012) further specify two spatially-related conceptual frameworks which are conjointly shared in the regional literature and sustainability transitions studies—institutional embeddedness and the multi-scalar perspective. The institutional embeddedness has roots in economic geography and regional studies. The interdependency between institutional arrangements in a specific region explains the situation that some regions perform well in terms of innovation development while some lag behind (Coenen et al., 2012; Hansen & Coenen, 2015; see also Markard et al., 2012). It is arguable that formal (i.e. rules, regulations, laws, standards) and informal (i.e. norms, values, cultures) institutional configurations both play a critical role in the regional economic development. On the other hand, institutional embeddedness has also been discussed in the MLP studies. The institutional arrangements are viewed as the supportive factors embedded in the regime context to facilitate innovation and transformation (Truffer & Coenen, 2012). As empirical studies show that the regimes not only situate in the national context but also at different spatial scales (see also Hodson & Marvin, 2010), incorporating such perspective of spatial-related institutional embeddedness to the sustainability transitions studies might likely better understand the role of institutions in the transition process (Coenen et al., 2012).

Most of these studies, however, focus on the technical innovation, such as the solar photovoltaic system (Dewald & Truffer, 2011) and the energy system (Monstadt, 2007). The discussion regarding the institutional embeddedness in socially oriented transitions in the urban area is just emerging. Focusing on social innovations in the grassroots niches (i.e. new practices and ideas which are expected to satisfy the social needs and are driven and implemented by civil society actors), Wolfram (2016) investigates the process of grassroots niche formation and its relation with the institutional configurations. The scholar argues that the urban arena can be understood as a protected space for social innovations which usually emerge due to ‘institutionally and spatially embedded social struggles’. The social innovation in grassroots niches could, therefore, benefit from the local institutional thickness and the urban-specific cultures and values. The case study of the village community transition² in Seoul demonstrates

² The village community transition refers to a new practice to pursue the local autonomy and democracy

that the empowerment of civil society actors, the citizens' behaviour, governance structures, and the trust between niches innovators and regimes actors matter.

The other spatially-related concept is the multi-scalar perspective. Multi-scalarity argues that sustainability transitions should not only be analysed from a vertical-axis dimension (i.e. the MLP approach with nested and hierarchical levels: niche-local, regime-national, landscape-international) but also be understood from a holistic perspective across the geographical boundaries (Coenen et al., 2012). Such argument then leads to a discussion about the definition of a spatial scale. The MLP studies, though not explicitly, view spatial scales through the lens of territories and administrative boundaries, such as cities, regions, and nations. This point of view is named as an absolute spatial scale by Gibson et al. (2000). Local institutional embeddedness which is discussed above links to this absolute spatial scale perspective (see also Raven et al., 2012). On the other hand, the notion of space can also be understood from a relative proximity. That is, the proximity is not determined by the geographical boundaries but by the shared background and the interactions among actors (Coenen et al., 2012; Raven et al., 2012). Urban actors may seek to collaborate with the national government to lobby for a new market regulation, or international companies may build networks with local communities to experiment ideas. The administrative boundaries do not determine and constrain who the actors collaborate with and where the networks function. Such relational perspective contributes to unfolding the complex interactions between the actors in the niches and the members of the regimes in the transition process.

2.3 The conceptual framework in this research

This research adopts the MLP approach to answer the overarching research question: how do the players in the plastic packaging value chain in the urban area interact to facilitate the urban circular transition? The concept of the CE matches the characteristics of socially oriented sustainability innovation. The CE concept promotes to restore the life of products and to keep the value of materials in the loop (The Ellen MacArthur Foundation, 2012), which is indeed a new idea aiming to satisfy the social need to pursue resource-efficiency. This research, therefore, first adopts the MLP approach and the SNM studies to analyse this circular innovation niche, which consists of a small number of actors who support this social innovation

and aim to break through two social-technical regimes: the plastic production regime and the waste management regime. As the niche actors' shared vision is identified as one of the important factors for niche development (Kemp et al., 1998), this research applies the two pillars of the CE (see [Section 2.1.2](#)) to analyse the actors' interpretation and understanding about the circular transition in the plastic packaging value chain, which links to the first research sub-question (see [Section 1.4](#)).

This research then takes the spatial perspective introduced by Coenen and his colleagues (2012; 2012)—multi-scalarity and institutional embeddedness—to investigate the interactions between the circular niche actors and the members of the two regimes. The plastic production regime is intertwined with technologies, regulations, and user practices relevant to plastic packaging production and consumption; and the members of this regime are plastic packaging manufacturers, consumers and shops. The waste management regime is composed of the social-technical factors which are relevant to plastic waste management and treatment, and the actors in this regime are waste collecting and sorting companies, governments, and as well as consumers. Since the circular niche actors attempt to break through the way which the regimes function, to better understand the interactions between niche actors and the members of the regimes, this research adopts the multi-scalar perspective to analyse the actions taken by different players at different spatial scales in the process of the urban circular transition. This links to the second research sub-question which relates to activities and the practices taken by the players in the transition (see [Section 1.4](#)). The institutional embeddedness perspective, which argues that local institutional arrangement will have impacts on the transition (Coenen & Truffer, 2012), is adopted to explore the third research sub-question, which aims to identify the factors which may facilitate and/or impede the urban circular transition. [Figure 2](#) demonstrates the conceptual framework of this research.

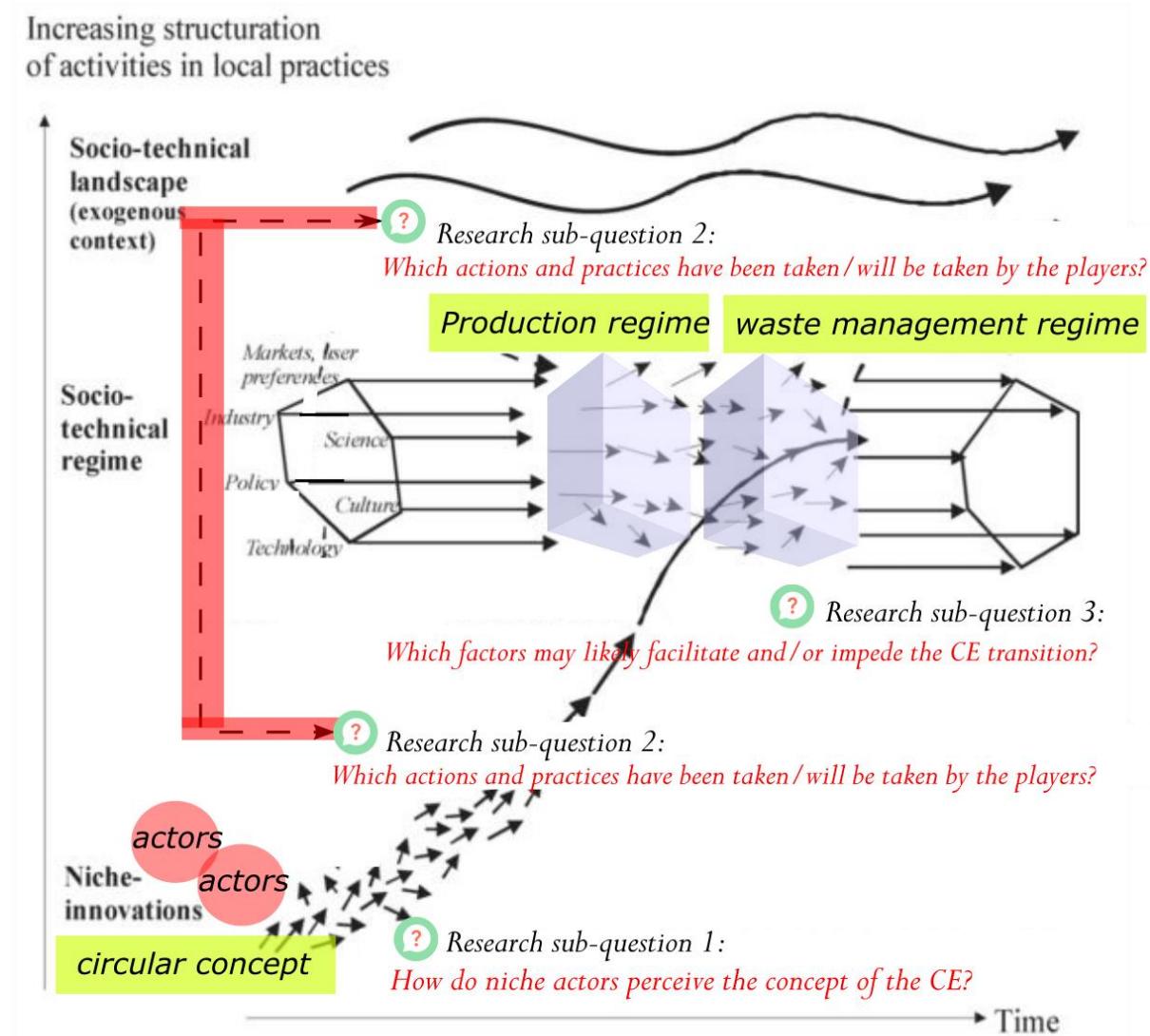


Figure 2. The research conceptual framework. Reproduced by the author on the basis of the figure from Geels & Schot (2007), p.401.

3. Research Design

This research is a qualitative, single case study conducted through the documentary analysis method and semi-structured interviews. Section 3.1 explains the ontological and epistemological foundations of this research, and Section 3.2 demonstrates the research strategies. Section 3.3 explains the reasons to select Nijmegen as the unit of analysis, and Section 3.4 provides details regarding the data collection process and the analysing methods.

3.1 The ontology and epistemology

This research takes an interpretive approach to explore the process of the CE transition. Interpretivist argues that society is different from the natural environment in such a way that the social world is constructed by inhabitants with their interpretations and day-to-day activities (Lewis-Beck, Bryman, & Liao, 2004). Understanding and interpreting, thus, are the two basic ways that people participate in society (Schwandt, 2007). This present paper considers that the CE transition is shaped by people, by the actions they take, and by the choices they make. To better understand the process of the circular transition, it is crucial to analyse the meanings embedded in people's actions, and the way they understand the concept (see also O'Reilly, 2009).

The ontological position of interpretivism taken in this research is relativism and constructivism. Relativism doubts about the stance of objectiveness, arguing that the social phenomena and people's judgements are based on individual's values and cultures (Lewis-Beck et al., 2004; Vogt & Johnson, 2005). Relativists assert human is also a part of the surrounding environment in which the ongoing development process is influenced by human action (Thorpe & Holt, 2008). In light of the complex interactions between human and the surrounding system, relativists further argue that the way that people make judgement and understand the world is bound with individual's values, cultures, preferences, and so on (Lewis-Beck et al., 2004). This present paper adopts this ontological position to analyse the circular transition process and players' interactions. There is no absolute right definition of the CE and there is no best development model regarding the plastic packaging value chain circular transition in the urban arena. The transition process not only is shaped by but also shapes stakeholders' knowledge and experiences; thus, the circular transition may differ from places to places. Such perspective is also relevant to constructivism, which argues that it is human beings' knowledge and subjective interpretations of the world that construct society (Coghlan

& Brydon-Miller, 2014).

3.2 Research strategy: an inductive and qualitative analysis

This research mainly applies the inductive approach to conduct a qualitative analysis. The MLP approach combining with local institutional embeddedness and multi-scalar perspective are adopted as the analytical framework of this research to investigate the circular transition in the plastic packaging value chain in the urban arena (see [Section 2.3](#)). Nevertheless, this research does not aim to *test* hypotheses which are directly derived from the MLP theory. Instead, this research takes an inductive approach which allow reflections on the theoretical framework emerge from the empirical data (O'Reilly, 2009). This empirical study is a qualitative research to answer the overarching research question: *How do the players in the plastic packaging value chain in the urban area interact to facilitate the urban circular transition?* As this research adopts interpretivism and relativism and specifically focuses on the actions that people take, a qualitative study fits the research purpose more than a quantitative one.

3.3 Research method: a case study

This research conducts a single-case study to explore the players' interactions in the urban circular transition, particularly in the plastic packaging value chain. Case study research is recognised as one of the research methodologies which can test hypotheses and investigate complicated causal relations among factors (George & Bennett, 2004). This methodology is widely utilised to analyse an individual, a group, or a phenomenon in the real-world context, particularly when the research focus and the context are intertwined with each other (Starman, 2013). The focus of this research, the players' interactions in the urban circular transition, is a complex phenomenon which is influenced by different stakeholders at different spatial scales. Urban actors' actions may be encouraged by policy-makers' decisions at the national level, and vice versa. The policies then may likely have influences on businesses strategies, which could alter the local consumers' consumption preferences. Case study research is, therefore, considered as an appropriate research method to investigate the transition.

Selection of the case

Nijmegen, a city in the Province of Gelderland in the east of the Netherlands, is selected as the case to investigate the circular transition. This city is chosen for two reasons: its ambition to be

sustainable and green, and the fact that it has been ignored by scholars in the Dutch city case studies. Nijmegen has applied three times for being the European Green Capital (hereafter: EGC). For the first two cycles, it was shortlisted in the semi-final competition but failed to win the final award. Instead of being knocked down, it learned from failures and finally won the competition to be the 2018 Green Capital. It is a rare case that a city continuously applies for the award and keeps being listed in the semi-final shortlist³, and it is noteworthy that its performance significantly improves within the three cycles⁴ (European Commission, 2015b, 2016a). In the pursuit of environmental sustainability, the concept of CE receives a great attention. Nijmegen performances significantly well in recycling and energy recovery⁵. The current recycling rate reaches 67%, which is the highest rate in the Netherlands (European Commission, 2016a). The city consistently seeks to boost the eco-innovation economy under the CE framework (European Commission, 2015b). Such ambitious and persistent commitment towards sustainability and the circular transition makes Nijmegen be an intriguing subject to investigate the transition process.

While Nijmegen demonstrates its significant environmental commitment, it receives little notice from sustainability researchers and scholars, compared to other cities in the Netherlands such as Amsterdam and Rotterdam⁶. The overwhelming focus on large cities in the west of the Netherlands might neglect the diversity within the national territory. Nijmegen is a relatively smaller city, regarding the inhabitants and the area administrated by the local authority⁷. It is expected that the capacity of the municipality and the distance between actors are likely

³ Since the first 2010/2011 cycle to the eighth 2019 cycle, at least twenty cities have applied for the award more than once: Antwerp (2012/2013, 2014), Bristol (2010/2011, 2014, 2015), Brussels (2014, 2015), Espoo (2010/2011, 2012/2013), Essen (2016, 2017), Ghent (2014, 2018), Glasgow (2012/2013, 2015), Lodz (2010/2011, 2012/2013), Ljubljana (2012/2013, 2014, 2015, 2016), Malmo (2010/2011, 2012/2013), Murcia (2010/2011, 2012/2013), Nijmegen (2016, 2017, 2018), Oslo (2010/2011, 2016), Rotterdam (2010/2011, 2014), ‘s-Hertogenbosch (2017, 2018), Torun (2010/2011, 2012/2013), Umea (2016, 2017, 2018), Vienna (2010/2011, 2014), Vitoria-Gasteiz (2010/2011, 2012/2013), Zaragoza (2010/2011, 2014, 2016). However, the majority has not been shortlisted more than twice in the semi-final competition, except Bristol, Ljubljana, Essen, ‘s-Hertogenbosch, Oslo, Umea, and Nijmegen. Among these twenty cities, Vitoria-Gasteiz was awarded as the 2012 European Green Capital, Bristol is the 2015 Green Capital, Ljubljana won the 2016 cycle, Essen wins the 2017 cycle, and Nijmegen will be the 2018 Green Capital.

⁴ Nijmegen was respectively ranked fourth in the 2016 cycle, second in the 2017 cycle, and first in the 2018 cycle.

⁵ It is still arguable if energy recovery is one of the practices of the circular concept, according to the interview outcome in this case study (see [Section 4.2.1](#)).

⁶ The author of this research retrieves the peer-reviewed articles reported in the Scopus database (www.scopus.com). There are 26 articles labelling either ‘sustainability’ and ‘Amsterdam’ or ‘sustainable development’ and ‘Amsterdam’ as the key words; there are 21 articles labelling either ‘sustainability’ and ‘Rotterdam’ or ‘sustainable development’ and ‘Rotterdam’ as the key words; and there are only 3 articles labelling either ‘sustainability’ and ‘Nijmegen’ or ‘sustainable development’ and ‘Nijmegen’ as the key words.

⁷ Nijmegen has around 170,774 inhabitants (in 2015), while Amsterdam has 813,562 inhabitants and Rotterdam has around 633,471 inhabitants.

different from those in the mega-urban areas. Such differences, together with its great ambition, make it appealing to analyse how the circular transition would occur and develop in the urban arena.

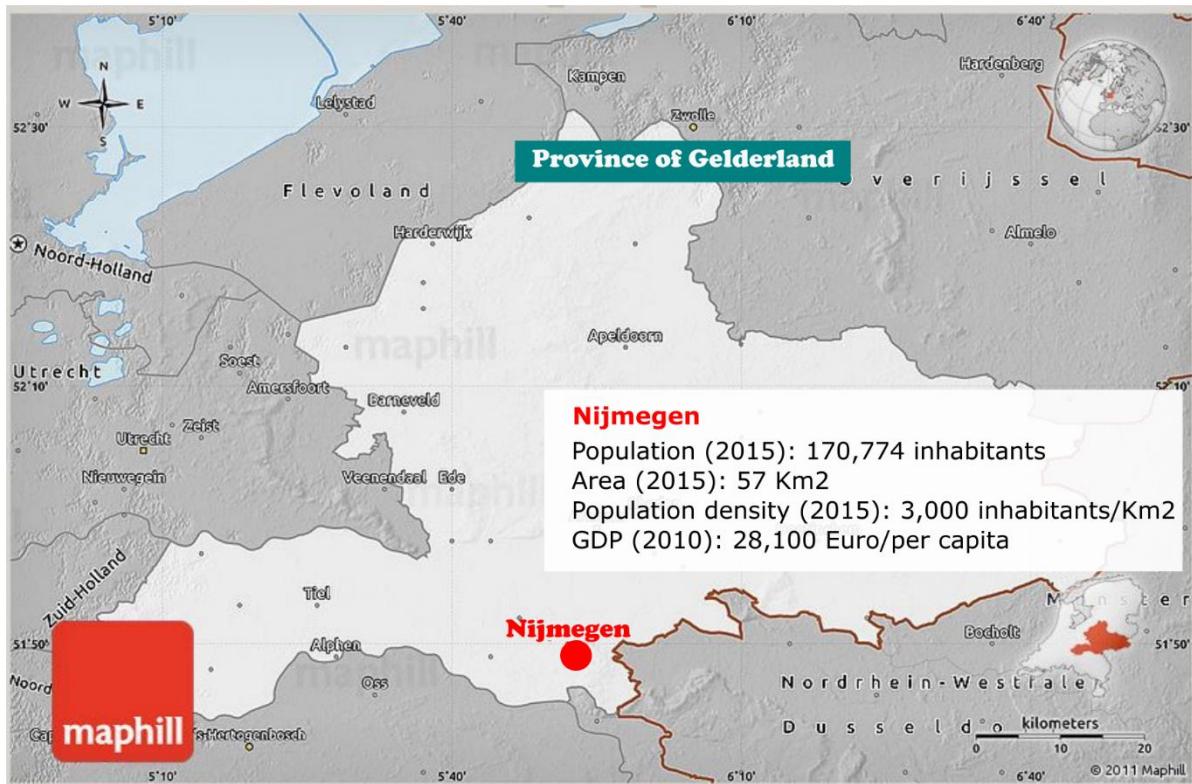


Figure 3. The location of Nijmegen. Map retrieved from Maphill (<http://www.maphill.com>) and adapted by the author; statistic data retrieved from European Commission (2016a), p.15.

The design of the case study

This case study is conducted through a three-stage process which is suggested by Yin (2009): defining and designing, preparing and collecting, and analysing and concluding. At the first stage, by reviewing literature on the concept of CE and sustainability transition studies, this research builds an analytical framework (see [Section 2.3](#)) to investigate the case—Nijmegen’s circular transition in the plastic packaging value chain. At the second stage, this research applies the desk-based document analysis method (see details in [Section 3.4.1](#)) and semi-structured interviews (see details in [Section 3.4.2](#)) to collect empirical data. At the third stage, the conclusions are drawn from the data analysis as well as reflections on the theoretical framework of the MLP approach. [Figure 4](#) displays the three-stage process.

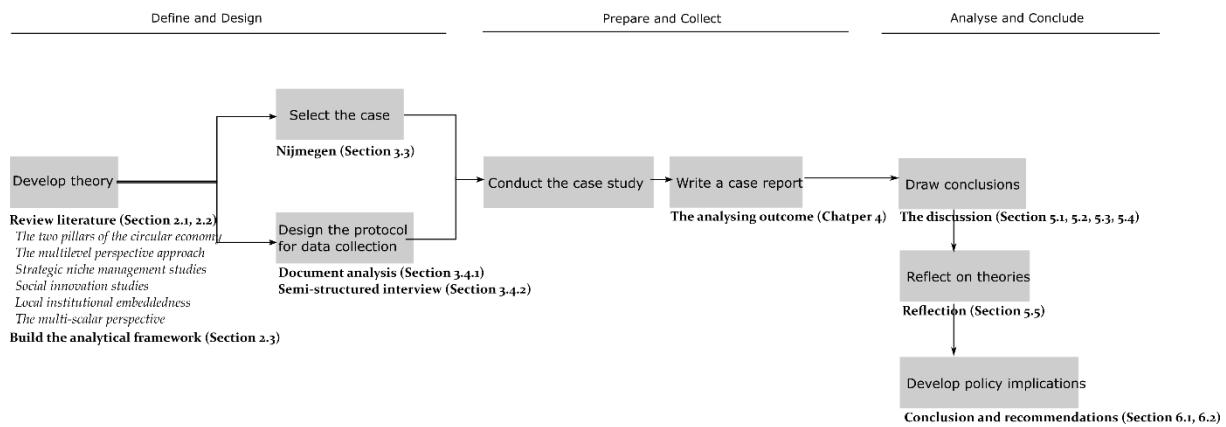


Figure 4. The three-stage research process. Retrieved from Yin (2009), p. 57 and adapted by the author.

3.4 Data collection and analysis

This research applies two methods to collect the empirical data: the desk-based document analysis for the secondary data and the semi-structured interview for the primary data. Document analysis is often used for triangulation in qualitative research (Bloor & Wood, 2006; Bowen, 2009). Analysing documents is a cost-effective approach to assist researchers in identifying data that need to be investigated further (Ahmed, 2010). Semi-structured interview method is the main research approach in this study. Such method is often used in qualitative studies, as it provides a great degree of flexibility for both the interviewers and the interviewees.

3.4.1 Desk-based document analysis

The desk-based document analysis method has been recognised as one of the crucial methods for data collection and investigation in the social science studies (McCulloch, 2004; Mogalakwe, 2006), as documents are the dominant tools for information delivery. This research adopts this method to investigate the policies and legal frameworks regarding Nijmegen's circular transition, since these data may contain information which may influence stakeholders' interactions. Also, the local news reports are also analysed, in order to triangulate the players' practices and actions which may facilitate the transition. All the analysed documents are publicly accessible and the date and sources are clearly declared, in order to ensure materials meet the criteria of authenticity and representativeness (Bryman, 2004).

3.4.2 Semi-structured interviews

To explore urban players' thoughts about the urban circular transition and their actions, this research conducts nine semi-structured interviews. Compared to structured interviews, a semi-structured interview allows the researcher to pursue topics which are most interesting and relevant in the process of interviewing. Interviewees have space to freely respond without following rigid outlines. On the other hand, the researcher has more control on the themes and topics in a semi-structured interview than in an unstructured one (Given, 2008).

Sampling

This research applies two sampling strategies to select the interview subjects: purposive sampling and snowball sampling. The purposive sampling approach is commonly used in a single-case study (Robinson, 2014). It is usually conducted when researchers attempt to interview people who are familiar with the research topics (Bryman, 2004). This approach is adopted with an intention that the researcher aims to find the sample which/who can systematically reflect the research themes rather than a random sample. The other strategy, the snowball sampling approach, takes advantage of the social networks of the interviewees. In the social science field, researchers often utilise this strategy to have a contact with hard-to-find groups (Lewis-Beck et al., 2004). On the basis of these two strategies, this present research then sets two criteria to select interview subjects:

- (1) *The interviewees in this research must have a basic level of understanding of the notion of the CE and the situation of the selected case of the circular transition in the plastic packaging value chain.*
- (2) *The interviewees in this research have engaged and/or are engaging in any activities, campaigns, or actions which are relevant to the circular transition in the plastic packaging value chain, either on behalf of organisations or as individuals.*

[Table 1](#) provides details about these interviewees, and [Figure 5](#) demonstrates the position of the interviewees in the plastic packaging value chain.

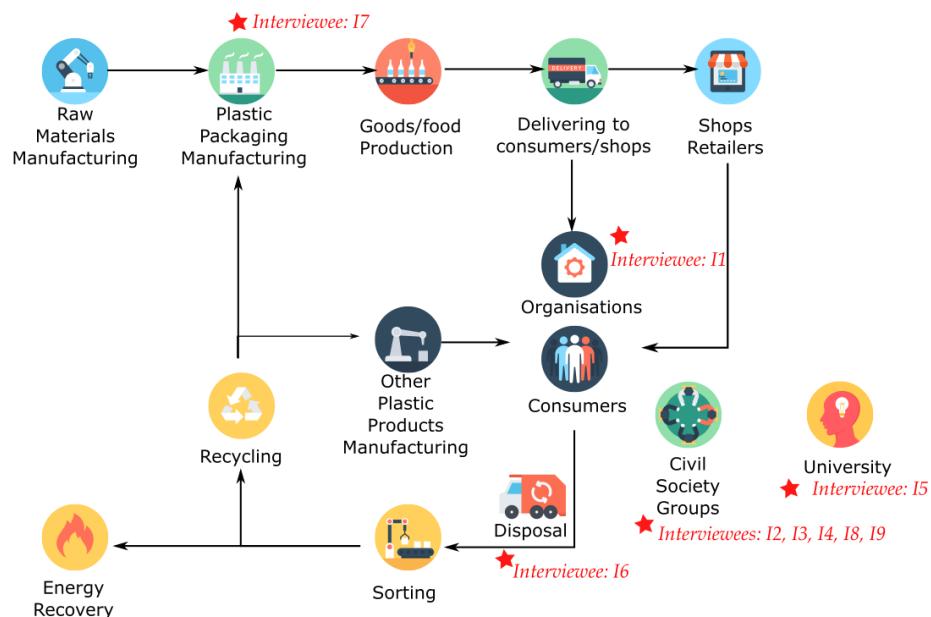
Thematic analysis

The semi-structured interviews are proceeded under the guiding questions (see [Appendix 1](#)),

and the results are investigated through the thematic analysis approach. The thematic analysis method is widely used in the social science fields in order to understand ‘what’ has been said (Bryman, 2004). It is the ‘themes’ that researchers aim to identify from the collected data (Clarke & Braun, 2013), thus the transcripts are coded based on the themes identified by the researcher (see [Appendix 2](#)).

Table 1. The list of the interviewees

Reference Number	Affiliation	Role
I1	Department of Health and Safety, Radboudumc (In English: Radboud University Nijmegen Medical Centre)	Staff
I2	The Lions Club Nijmegen	Fundraiser member
I3	De Nijmegen Afval Challenge (In English: The Nijmegen Waste Challenge)	Organiser
I4	The sub-group of waste theme, the Green Capital Challenge Group	Organiser
I5	Radboud University Nijmegen	Researcher
I6	Dar N.V.	Director secretary
I7	Be-O	Founder
I8	Het Groene Brein (In English: The Green Brain)	Entrepreneurial fellow
I9	De Nijmegen Afval Challenge (In English: The Nijmegen Waste Challenge)	Initiator



Icons made by Flaticon Basic License from www.flaticon.com

Figure 5. The nine interviewees in the plastic packaging value chain

4. The Case Study of Nijmegen

4.1 Background

Being the oldest city in the Netherlands, Nijmegen has been identified as a city with ‘a high performing waste management system’ (European Commission, 2015b). The city commits to be sustainable and circular. In 2014, the recycling rate of the municipality solid waste reached 67% (European Commission, 2016a), which is far above the national average (Dijkgraaf & Gradus, 2016). By 2020, Nijmegen aims to increase the number to 75% and to reach the target that the annual amount of residual waste per inhabitant is less than 100 kilograms (European Commission, 2016a). The city aims to be a waste-free area by 2035(Rob Jaspers, 2017). Such commitments closely align with the national goals and objectives (See [Section 4.1.2](#)). In addition, the regional bus system is national-wide recognised because it is completely fuelled by the gas generated from organic waste decomposition.

4.1.1 The vision and approaches toward the Circular Economy

The city’s visions and approaches towards the CE are to some extent aligning with policies and decisions made at different levels of the hierarchical governmental structure, including the province of Gelderland, the government of the Netherlands, and the EC. The EC in 2015 adopts the ‘Circular Economy Package’, which consists of four legislative proposals on waste and plastic packaging⁸ (European Parliament, 2017). The EC argues that the circular transition is a critical approach to develop a sustainable society and competitive economy of Europe (European Commission, 2015a) . To facilitate the transition, the EC identifies five value chains in the action plan: biomass and bio-based products, food waste, critical raw materials, construction and demolition, and last but not least, plastics. The EC particularly prioritises three strategies to accelerate the circular transition in the plastic value chain: to encourage eco-design, to facilitate recycling plastic packaging, and to boost the recyclable plastics trading system (European Commission, 2015a).

In 2016, the government of the Netherlands introduced the national-wide CE programme ‘Netherlands Circular in 2050’, though the concept of CE has been embedded in other

⁸ The four legislative proposals are the proposed Directive on Waste, the proposed Directive on Packaging Waste, the proposed Directive on Landfill, and the proposed Directive on Electrical and Electronic Waste, on End-of-life Vehicles, on Batteries and Accumulators and Waste Batteries and Accumulators.

programmes as well (see [Section 4.1.2](#)). The CE is interpreted as a solution to alleviate the threat of the material deficit. The circular concept could, on the one hand, lead the Netherlands to depend on fewer raw materials, and on the other hand, will provide economic opportunities (Dutch Ministry of Infrastructure and the Environment & Ministry of Economic Affairs, 2016). The Dutch government explicitly declares that its vision is to build the CE in the Netherlands by 2050, and the interim objective is to reduce 50% of the consumption of primary raw materials by 2030 (Dutch Ministry of Infrastructure and the Environment & Ministry of Economic Affairs, 2016). Three strategic approaches are identified to reach such ambitious commitment: efficiently utilising the existing raw materials, replacing the non-sustainable raw materials to renewable sources, and developing innovative production methods and promoting new consumption manners (Dutch Ministry of Infrastructure and the Environment & Ministry of Economic Affairs, 2017). Also, plastics are selected as one of the prioritised value chains, together with biomass and food, manufacturing industry, construction, and consumer goods (Dutch Ministry of Infrastructure and the Environment & Ministry of Economic Affairs, 2017). The Dutch government's vision is that in 2050 all plastics would be 100% renewable. Plastic products will be designed with the circular concept and be produced without depending on fossil fuel materials. To realise this vision, the Dutch government sets three strategic goals: designing plastic products with the attempt to be reused and recycled after being discarded, utilising plastics efficiently in order to reduce the use of raw materials and to prevent the leakage, and scaling up the use of recycled, bio-based, and bio-degradable plastics⁹ (Dutch Ministry of Infrastructure and the Environment & Ministry of Economic Affairs, 2016).

Responding to the nation-wide commitment, the province of Gelderland also sets an ambitious goal: Gelderland will be the first waste-free economy in the Netherlands (Provincie Gelderland, 2016). In regards to the interim objective, the province aims to reduce 10% of the consumption of energy and raw materials by 2020, and it is expected that over 50% of the businesses in Gelderland will adopt the circular concept (Provincie Gelderland, 2016). The plastics value chain once again is identified by the government of the province of Gelderland as the crucial system in the circular transition, though limited information about the transition policy scheme

⁹ There are debates about the sustainability of the bio-based and/or bio-degradable plastics (also called bioplastics). As most of the bioplastic products are made from sugarcane, wheat, and other crops, the concern centres on the competition between food resources and such packaging and containers. However, such discussion is beyond the scope of this research.

have been declared (Provincie Gelderland, 2016).

The municipality of Nijmegen, together with Milieusamenwerking en Afvalverwerking Regio Nijmegen (In English: Environmental and waste affair Regio Nijmegen), ARN BV¹⁰ and Dar NV¹¹, have formed a steering committee to facilitate the CE transition. The committee in 2017 issued 'Notitie Rijk van Nijmegen Circulair (In English: Abundance from Nijmegen Circular)', in which the future of the CE is envisaged and the implementation strategies are identified. The CE is interpreted by the committee as an economy in which the raw materials can be kept in the loop, the system is built on renewable energy, and the activities are based on new forms of cooperation (Roemers et al., 2017). The objective of the CE is to maintain and increase biodiversity and people's welfare, so that the social and natural capital will eventually create values to benefit economic activities (Roemers et al., 2017). Considering the local specialities of Nijmegen, four value chains are then prioritised: healthcare, construction, manufacturing, and waste. While the plastics value chain is not explicitly addressed in the latest report, it is embedded in projects in the healthcare sector and waste management. The actors in healthcare sector, for instance, are currently investigating the feasibility of returning the reusable packaging back to the suppliers. Since plastics are viewed as resources rather than waste by the players in waste management sector, there is an attempt to connect the waste processing companies with the plastics industry in order to better manage the material flows (Roemers et al., 2017).

4.1.2 The visions and policies regarding waste-to-resource

In regards to adopting the circular concept in the plastics value chain, Nijmegen particularly focuses on the process of turning plastics from waste to resources. The municipality's vision and implementation strategies are significantly influenced by policies and regulations at the national level (also see [Section 4.2.3](#)). It is arguable that these policies might also influence and be affected by relevant regulations and legislation set by the EC; however, such discussion is beyond the scope of this research.

The nation-wide programme 'Van Afval naar Grondstof (In English: From waste to resource;

¹⁰ ARN BV is a waste-to-energy company located in the Arnhem-Nijmegen region. The company generates 160,000 MWh of electricity annually from around 550,000 tons of waste.

¹¹ DAR NV is a waste collection and waste management company located in Nijmegen. The Municipality of Nijmegen and other five municipalities around Nijmegen are the shareholders of this company.

hereafter: VANG)' and the implementation plan 'VANG Huishoudelijk Afval (In English: From waste to resource household waste)' are the two guidelines for municipalities in the Netherlands to reduce waste and to reach resource-efficiency. With the attempt to become more circular, the Dutch government adopts VANG programme much earlier than other circular policies (also see [Section 4.1.1](#)). This programme shifts the traditional waste policy from a passive manner which focuses on diminishing the adverse environmental impact towards an active approach in which waste is treated as resource. The government of the Netherlands, on the one hand, aims to reach 75% of the recycling rate of the municipal solid waste, and on the other hand, targets to reduce the amount of household residual waste to 100 kilograms per inhabitant per year by 2020 (Rijksoverheid, VNG, & NVRD, 2014). Since municipalities are responsible for waste management in the local area, this programme encourages local authorities to set their own ambitious goals and to invent innovative financial instruments (Rijksoverheid et al., 2014).

The waste management system in Nijmegen is functioned under the collaboration between private companies and the municipality of Nijmegen. The municipality is also one of the shareholders of the major waste collection company in the region. To foster waste separation and recycling, the local authority adopts the 'pay-as-you-throw' policy in such a way that inhabitants are requested to pay for bags which are particularly used for residual waste collection (European Commission, 2016a). For recyclable materials, such as plastics and cans, citizens can ask for free bags from local grocery shops. Through increasing citizens' financial costs and the inconvenience of dealing with the residual waste, the authority attempts to encourage inhabitants not only to separate resources from waste but also to reduce the amount of residual waste.

4.2 Outcomes of the interviews

This research conducts nine semi-structured interviews to analyse the overarching research question: *How do the players in the plastic packaging value chain in the urban area interact to facilitate the urban circular transition?* These nine interviews are carried out through the following three thematic guidelines.

The first theme centres on the interviewees' perceptions about the CE and the practices in the plastic packaging value chain. This topic links to the first research sub-question: *How do the players perceive the concept of the CE, and the relationship between such concept and the*

plastic packaging value chain in the urban arena? This research explores how the interviewees interpret the concept of CE and to what extent the concept is relevant to the plastic packaging value chain. The result is demonstrated in Section 4.2.1.

The second topic relates to the interviewees' perceptions about the practices of the circular concept in the plastic packaging in Nijmegen and the actors' interactions. This theme reflects the second research sub-question: *Which actions have been taken and/or which practices will be taken in the future by the players to facilitate the CE transition in the plastic packaging value chain in the urban area?* The results are demonstrated in Section 4.2.2 and Section 4.2.3. The former section focuses on the activities taken by the circular niche actors, and the latter presents the practices taken by stakeholders from a wide range of backgrounds at different spatial scales in the transition process. Also, Section 4.2.6 presents the actions which the interviewees will take in order to facilitate the urban circular transition.

The third theme focuses on the supports and resources which may likely influence the development of the circular concept in the plastic packaging value chain in the urban arena. This mirrors to the third research sub-question: *Which factors may likely facilitate and/or impede the CE transition in the plastic packaging value chain in the urban area?* Such results are presented in Section 4.2.4 and Section 4.2.5. The former section shows the networks among actors, and the latter centres on the local institutional infrastructures which are relevant to the transition process.

4.2.1 The circular concept in the plastic packaging value chain

While interviewees have a wide range of interpretations of the CE, there are four elements in common. First, the CE is perceived as a concept that products should not only be recycled at the end of its lifespan but also be redesigned by producers at the beginning stage (**I1; I3; I4; I8**). Recycling is essential, yet it has been seen as a relatively narrow and traditional concept, which co-exists with the take-use-dispose linear model (**I1**). The key which makes the CE different from the linear model is that it emphasises producers' responsibilities and takes the design stage into account (**I1**). It is expected that the CE is a system in which products will be redesigned in such a way that no extra raw resources will be extracted (**I3; I8**) and resources which are taken from nature can be returned to the ecosystem (**I7; I8**). Second, the circular concept concerns the reuse of materials both within and after their lifespans (**I3; I4; I6; I7; I9**). The core tenet of the CE is that the product lifecycle could be extended so that the value of

materials could be retained as long as possible (**I4; I7**). Once consumers attempt to get rid of the products for any reason, in the circular model, the materials can be utilised again for other purposes (**I3; I6; I7; I9**) rather than being incinerated or landfilled. Third, interviewees agree that ‘waste’ plays a critical role in the circular system (**I1; I2; I5; I6**), while they provide a broad range of perspectives on the way in which such ‘waste’ is treated. One of the interviewee argues that the current waste-to-energy solution is still based on a linear thinking (**I1**). Since waste-to-energy companies demand a large amount of waste in order to generate energy and profit, such fact might implicitly contradict to the origin idea of the CE which aims to efficiently utilise materials and reduce waste. Some interviewees claim that the CE is a system in which the material loop will be closed (**I5; I6**). In other words, all materials are resources. Someone’s ‘waste’ could be others’ resources (**I6; I9**). The loss of resources would be minimised. Last but not least, several interviewees claim that the CE is a broad concept (**I2; I5; I9**), so that it is ‘not yet very clear what people mean by it (**I1**)’. In addition to these four commonplaces, it is noteworthy that two out of the nine interviewees particularly mention social cohesion (**I4; I8**). The CE also refers to an inclusive society in which the talents of individuals are respected and the wealth is more evenly distributed.

Because of the prolonged impacts of plastics on the environment (**I1; I5; I8**) and the production process highly depending on raw materials (**I7; I8**), the plastic packaging value chain has been recognised as a critical segment in the circular transition. Nowadays, most of the plastic packaging still cannot be degraded by the ecosystem, which may cause environmental problems if they are not treated well (**I1**). Once the plastic packaging is not properly treated after disposal, the adverse environmental effects can even affect someone who live a million miles away (**I5**). In the light of the concern about the environmental impacts resulting from plastics packaging, interviewees imply that the pursuit of the CE in the plastic packaging value chain could likely alleviate such issue. Also, since there is still a significant amount of plastic packaging made from crude oil, such production process is considered as a linear model which needs to be changed if the society aims to be sustainable (**I8; I9**). Though plastic products are widely recycled, manufactures of plastic packaging prefer to utilise raw materials due to low price and the myth that recycled materials have lower quality (**I7**).

Three practices are identified to realise the circular transition in the plastic packaging value chain: to redesign, to reduce, and to recycle plastic packaging (**I1; I2; I3; I4; I6**). Echoing the influential role of producers in the circular system, interviewees state that it is worthy to

reconsider the necessity of plastic packaging when designing products (**I3; I4**). Plastic packaging makes our day-to-day life convenient, yet it has been somewhat overused. However, producers are not the only actors to drive the change of plastic packaging design and the way that products packaged. The way that products packaged interrelates to consumers' preferences; thus, such redesign would succeed if and only if consumers also change their consumption pattern and behaviour (**I3; I4; I9**). Considering the overuse of plastic packaging, some interviewees consequently argue that to reduce the usage of plastics is a critical step to facilitate the circular transition (**I1; I4; I9**). In addition, the treatment of plastic packaging at the end-of-life stage receives significant attention from the interviewees. Separating and recycling plastic packaging are seen as an important practice (**I1; I2; I4; I6**). Recycling is a small but important step, as the circular concept refers to closing the material loop. One of the interviewees, nevertheless, does highlight an important issue regarding recycling—not all plastic packaging materials could be recycled under the current facilities (**I9**).

4.2.2 The circular niche development in Nijmegen

It is acknowledged that the significant environmental awareness of citizens in Nijmegen and the local political spectrum have laid the foundation for the city's circular transition (**I1; I2; I3; I4; I6**). The interviewees claim that citizens in Nijmegen are aware of the environment degradation (**I1; I3**), and they welcome changes and innovative ideas (**I2; I6**). Such awareness of the environment and the willingness to change towards sustainability could be a good starting point for the CE niche development (**I9**). In addition, the stance of local politicians may contribute to nourishing the circular concept. The so-called 'left-wing' government is perceived as one of the important factors to the city's transition, as the local authority demonstrates its supportive attitude towards socially-oriented sustainability innovation as well as waste separation pilot projects (**I2; I3; I5; I6**). Nevertheless, though there is a consciousness that sustainability and environmental quality are essential, such understanding has not yet made citizens see the CE transition as an opportunity rather than costs and inconvenience (**I3**).

The honour of being awarded as the 2018 EGC is perceived as a one-of-a-kind opportunity to facilitate the CE transition in the plastic packaging value chain in Nijmegen (**I2; I4; I5**). Initiatives and campaigns aiming to make the city ready for the forthcoming year have been either organised by several civil society groups which consist of citizens from a wide range of background—including representatives from businesses, government officers, students, and so on. The interviewees claim that these small campaigns regarding waste and plastics reduction

are crucial steps towards the circular transition (**I2; I4**). Such movement may trigger shops and producers to rethink the necessity of plastics. They might adjust the strategy of the provision of plastic packaging once they notice that consumers' preference has changed (**I4**). Also, one of the interviewee believes that the award would likely attract more investors and businesses which embrace the circular concept to situate in Nijmegen (**I5**).

Two challenges in the circular transition are identified: one is the way in which chain stores operate (**I3; I4**), the other is the way in which plastic packaging is designed (**I4; I6**). The pursuit of an entirely circular system in the urban area is almost impossible if there is no external support (**I3**). Different from products which are sold in the local shops, those in the chain stores and supermarkets are usually processed and packaged in other cities before being shipped to Nijmegen. These products, however, may be overpacked with unnecessary plastic packaging. Consumers have limited choices when purchasing groceries in supermarkets: either buy a cucumber wrapped in the plastic foil or leave it on the shelves. They are not offered an opportunity to buy an unwrapped cucumber. As long as there is no significant number of consumers to turn down the overpackaged products, chain stores and producers may have little incentive to change the production process and the current pattern of operation (**I4**). Also, the fact that plastic packaging is designed under the linear thinking may hinder the circular transition (**I4; I6**). One of the interviewees demonstrates his concern about the plastic packaging which is 'made for throw away after use (**I4**)', such as the single-use food trays. Also, there is a certain amount of plastic packaging could not be appropriately recycled (**I6; I9**). The end-of-life treatment is not considered when the packaging and products are designed, which makes it difficult for waste sorting companies to recycle them (**I6**). These two challenges imply that there is a limitation to realise the circular concept within the urban area. Yet one of the interviewees emphasises that local shops and local manufacturers could be the frontrunner to break through the barriers (**I3**).

4.2.3 The interactions among actors

There are at least three kinds of practices taken by actors in the plastic packaging value chain to facilitate the circular transition: the attempt to *redesign* the shipping process and packaging products (**I1; I7**), actions for better separation and *recycling* (**I1; I6; I8**), and activities to raise citizens' awareness about the adverse environmental impacts of plastics (**I2; I3; I9**). Firstly, to reduce the amounts of plastic packaging for disposal, one of the interviewees discloses the effort he had put to persuade the courier company to take the plastic packaging back for a

second use (**I1**). Such negotiation has not yet succeeded, as the ambiguous and unidentified ownership of the packaging impedes the progress. The courier company, as a third party in the market transition between the seller and the consumer, show limited willingness and capacity to deal with such packaging. This company considers itself as a temporary owner of the packaging in the shipping process, and has no responsibility for it after the parcel is well-received by the consumer (**I1**). To redesign the shipping process in order to extend the lifespan of the plastic packaging, the interviewee states that there is a need to ‘reframe the concept of ownership (**I1**)’. Also, in Nijmegen, at least one entrepreneur incorporates the circular concept into the plastic packaging design (**I7**). With the aim of changing the current linear model which is nowadays embedded in the plastic industry, the founder of this start-up designs water bottles with an intention that such bottles can be fully recycled once they are unwanted. Since the products are made from renewable biomass sources rather than fossil fuels, the founder argues that the bottles could possibly be carbon neutral as well.

It is recognised that the city’s plastic packaging separation and recycling scheme is well-organised (see [Section 4.1](#)), and some interviewees see such scheme as a critical step towards the circular transition (**I2; I6**). The key players in waste management sector has shifted from end-of-pipeline solutions toward circular practices (**I5; I6; I8**). One of the interviewees, who has plenty of experience of waste collection management, attributes the success to the tight collaboration between the municipality of Nijmegen and the city’s major waste collection company (**I6**), as the municipality is one of the shareholders of this company. The municipality and the company, therefore, have an aligned vision and a consensus on the circular future of the city: separating plastic packaging from residual waste as much as possible. In addition to the city-wide level, there are also initiatives occurring at the organisation-based level. In order to encourage faculties and students to separate plastic packaging, several waste bins with special design are placed in the Radboud University (**I1**). Also, in the Hogeschool van Arnhem en Nijmegen (In English: the HAN University of Applied Science), there is an experiment about replacing bins in order to foster recycling (**I2**).

Several activities and campaigns focusing on raising citizens’ awareness of the negative environmental impacts of plastic packaging were held or are ongoing in the city region. The two exhibitions which were held in the Museum Het Valkhof (see [Section 4.1](#)) and the campaign named ‘De Nijmegen Afval Challenge (In English: the Nijmegen waste challenge; hereafter: NAC)’ have been continuously emphasised by the interviewees (**I2; I3**). Though the

interviewees state that citizens in Nijmegen are aware of the environmental issues and are keen to accept changes (see [Section 4.2.2](#)), there are others assert that such awareness is still at the basic level (**I3; I4**). The majority of inhabitants may have not yet transferred the awareness into behaviour change (**I4**).

4.2.4 The networks and resources nourishing the circular niche

Some interviewees attribute the diffusion of the circular concept to the support from local communities and inhabitants. The initiator of the NAC campaign expresses that she is significantly encouraged by residents, people working in academia, and grassroots (**I9**). Such support makes this activity upscale from a personal lifestyle change to a city-wide campaign. It has launched its third round and recruited at least over one hundred participants¹². The municipality of Nijmegen also participates in this campaign in such a way that the relevant information is shared in the intranet platform (**I3**). One of the interviewees from the Radboud University also tells his experience about sharing tips with his colleagues (**I1**). Some local shops respond to participants' requests for unpacked products by offering alternatives for consumers (**I4; I9**). Though there is resistance and objection, as such campaign aims to change the behaviour and lifestyle which people get used to (**I9**), most citizens in Nijmegen are keen to participate in activities which are related to environmental sustainability (**I2; I3; I6**). In addition, faculties and students in the universities are open-minded to embrace changes and to experiment innovative circular ideas. One of the interviewees claims that testing novel ideas through small-scale projects could contribute to the development of the circular concept (**I4**). Regarding plastic packaging recycling and waste separation, one of the interviewees states that households and citizens are willing to collaborate with the municipality for the new collection scheme (**I6**), which requests citizens to pay for particular bags for their residual waste and reduces the collection frequency of residual waste (also see [Section 4.1.2](#)).

A wide range of networks between stakeholders from different background is developing. The interviews show that the municipality of Nijmegen, businesses, and citizens collaborate in the strategic civil society group which is established to prepare for the EGC in 2018 (**I3; I6; I7**) (also see [Section 4.2.2](#)). Representatives from waste collection businesses and the local

¹² Since the campaign is volunteer-based and participants do not be requested to sign a form for participation, it is difficult to calculate the exact number of participants. The number presented in this paper is based on the number of 'likes' on the fanpage of this campaign, which is the main platform for information exchanging among the participants.

authority are eager to share knowledge and information in such groups with other participants, while they might tend to act as a supporter rather than an initiator (**I6**). One of the interviewees from a bio-plastic start-up shares his experience about building connections with potential business customers within such group (**I7**). However, such collaboration and other activities related to the EGC Award is considered by another interviewee as an exclusive and privileged alliance (**I8**). Also, there are several local networks focusing on information changing between businesses which have interests in adopting the circular concept (**I5**). Trans-local organisations, such as Het Groene Brein (In English: the green brain) and Metabolic, are mentioned by the interviewee (**I5**), while it is not clear which roles such organisations play in these networks. Two of the nine interviewees name several bilateral and multi-lateral collaboration between businesses in the city region (**I5; I8**), particularly focusing on material flow information exchanging (**I4; I5**). The role of the municipality of Nijmegen in such networks is recognised, as the local authority usually is the initiator to organise and holds the events and networks (**I5**). On the other hand, the networks in waste management is relatively narrow but more mature. In addition to the partnership between the municipality of Nijmegen and the waste collection company, as mentioned above, the main waste collection company in the region also cooperates and exchanges information with a nation-wide independent organisation named Milieacentraal and through a platform named NVRD (**I6**).

The activities and campaigns raised in Nijmegen somewhat influenced by projects and actions taken in other cities. One of the interviewees takes the exhibition named ‘Plastic Soep (In English: plastic soup)’ as an example. This exhibition was in fact inspired by one similar project which had been held in Belgium and was received knowledge support from organisations located in Amsterdam (**I2**). The exhibition in Nijmegen was held through the collaboration between the Museum Het Valkhof and the Lions Club Nijmegen, in order to raise the environmental awareness regarding the use of plastic packaging. One of the interviewees, who is also the organiser of the NAC campaign, shares her experience of being inspired by Thomas Rau¹³, an architect who advocates that it is the function of goods should be focused and promoted rather than the ownership of products (**I3**). Such idea reflects the cradle-to-cradle principle and the concept of functional economy (also see [Section 2.1.2](#)).

¹³ Thomas Rau was invited to Nijmegen in 2016 for a lecture which is held by the duurzaamheidscafe (In English: sustainability café), though the interviewee was aware of the idea which promoted by Thomas Rau before he visited Nijmegen.

4.2.5 The institutional structures

Compared to the knowledge and intellectual resources, the financial schemes in Nijmegen are relatively inadequate for the circular niche development. The interviewees state that the activities and projects which they engage only receive limited financial support (**I1; I2; I4; I8**), and most of the time such support is material-based (**I2**). However, the circular practices could be expensive sometimes (**I1; I6**). The interviewees show different attitudes towards the lack of structured financial scheme. One of the interviewees is optimistic (**I4**), while another interviewee concern that the situation will lead to a brain drain (**I8**). On the other hand, in order to encourage businesses to adopt the circular concept into their operation model, it is highly suggested to establish an investment fund and to introduce much more subsidies (**I5**). The current subsidy schemes might be too complicated for start-ups to understand (**I7**). Also, two out of the nine interviewees argue that the way which financial institutions operate may require a systematic transformation, yet they do not explain the how in detail (**I1; I4**).

The interviewees also point out the insufficient competency (**I8**) and unorganised leadership of the municipality of Nijmegen (**I2; I9**). One of the interviewees has experienced a time-consuming negotiation with the local authority because there was no one could make a final decision about the project she would like to launch (**I2**). Two out of the nine interviewees share their disappointment about the relatively passive role of the local government in the process of preparing activities related to the EGC as well as the pursuit of the circular concept. The municipality of Nijmegen tends to be a supporter rather than a co-initiator who collaborate and conjoin with citizens (**I9**). Most of the time activities are initiated by the citizens themselves (**I9**), and there is limited support from the local authority (**I8**). Such lack of competency and leadership would possibly trigger these talents to move from Nijmegen to other cities for better opportunities (**I8**).

Regarding circular-oriented policies, most of the interviewees highlight the effects of the hierarchical waste management structure in Europe (**I3; I5; I6**). The municipality of Nijmegen is perceived as a policy taker that mainly follows the frameworks which are established at the national and European levels (**I3; I6**). Such frameworks, particularly the national-wide VANG programme (see [Section 4.1.2](#)), provide a guideline for municipalities to pursue the collective goal with different approaches which take the local specialities into account (**I3; I5; I6**). One of the interviewees also emphasises the significant effectiveness of the ‘polluter pays principle’ scheme, which requests plastics manufacturers pay for collection and treatment (**I6**), as this

scheme lays a solid financial foundation for a city to implement waste separation and recycling.

In addition to waste management, some interviewees argue that much stricter legislation regarding the reduction of plastic packaging could be helpful in terms of cultivating the circular concept (**I1; I3; I9**). Yet it is difficult to implement and enforce in the city region because the proposal may unlikely be consented by all citizens and shops in Nijmegen (**I3**). On the other hand, other interviewees would like to have relatively flexible regulations in order to encourage campaigners and businesses to launch more experiments and collaboration (**I2; I5**). The feasibility of establishing a particular zone in which activities are only regulated by some necessary rules, therefore, is mentioned by one of the interviewees (**I5**).

4.2.6 The future development towards a circular Nijmegen

Most of the interviewees take a positive attitude towards the future of the circular transition in the plastic packaging value chain in Nijmegen, yet being an entirely circular city might be somewhat impossible for now (**I1; I3; I5; I9**). It is impossible because the material flows in the city region are intertwined with materials from other cities. This interdependency makes it difficult to comprehensively realise the circular concept in the entire value chain, particularly if there is no support from actors at other spatial scales. Under such circumstances, the interviewees assert that local consumers and shops could be the essential gear to drive the transition in the urban area (**I1; I3; I9**). This perspective links to the situation that most of the interviewees would like to continue making the effort to raise citizens' environmental awareness in the following future (**I1; I2; I3**).

On the other hand, the role of businesses in the circular transition is as important as the consumers (**I3; I5; I6; I9**). The interviewees are expected that actors on the supply side would embrace the circular concept and take it into account when designing the products as well as the logistic process (**I1; I4; I5; I6**). However, since the circular concept is 'context-specific' (**I5**), businesses might require special assistance in technologies and knowledge. A circular business model which functions well in one sector may not be replicated in another sector. For instance, two of the interviewees takes the 'Light as a Service', which introduced by a Dutch light company named Philips, as an example (**I1; I5**). In this case, consumers who request the lighting service would no longer purchase lighting bulbs; instead, they could purchase the service from the company. Since the company possesses the ownership of the lighting facilities, there is an incentive for this company to produce and maintain the bulbs in a good condition.

Such business model might hardly be applied in the plastic packaging value chain; therefore, one of the interviewees suggests that the local authority could consider the feasibility of establishing a special consulting group to support businesses to be circular (**I5**).

It is noteworthy that there is a huge difference between interviewees' opinion on the role of elders and youth in the circular transition process. Two out of the nine interviewees highlight that young people plays a crucial role to facilitate the transformation, as they possess new ideas and innovative thoughts (**I7; I8**). These interviewees argue that most of the civil society groups in the city region are functioned by the elders who may likely make the transition progress slow and not radical enough. On the other hand, one of the interviewees emphasises the importance of better utilising the talents and knowledge which is possessed by elders (**I4**). It is considered as a practice of the 'waste is resources' concept in the social dimension.

5. Discussion and reflection

This research originated from the phenomenon that several cities in the Netherlands make commitments to the circular transition with ambitious goals and objectives. The role of cities has been continuously highlighted, yet it is not clear how the stakeholders interact in the urban circular transition, given that the urban production-consumption system is significantly influenced by actors not only within but also beyond the city region. This chapter adopts the conceptual framework drawn on sustainability transition studies (see [Section 2.3](#)) to further analyse the interviews outcomes (see [Section 4.2](#)).

This chapter is structured as follows. Section 5.1 and Section 5.2 adopt the tenets of the two major pillars of the CE concepts (i.e. industrial ecology and the cradle-to-cradle principle, see [Section 2.1](#)) to investigate the interviewees' interpretations of the CE and the practices in the plastic packaging value chain. Section 5.3 discusses the impact of local institutional configurations on the circular niche development in Nijmegen. Section 5.4 then investigates the stakeholders' interactions through the lens of multi-scalar perspective. Section 5.5 wraps up this chapter with a reflection on the MLP theoretical framework.

5.1 The circular concept is more than closing the loop

In the Nijmegen case, the interpretation of the circular concept and the practices in the plastic packaging value chain (see [Section 4.2.1](#); see also [Appendix 2](#)) closely reflects the two core pillars of the CE: the cradle-to-cradle principle and industrial ecology (see [Section 2.1.2](#)). Redesign has been pointed out by the interviewees as the essence of the circular concept and one of the crucial applications in the plastic packaging value chain. The interpretation of redesign, which refers to design products with the intention that materials can be utilised in the loop, identically matches the core tenet of the cradle-to-cradle principle, yet there are two subtle differences between the interpretation of the interviewees and the cradle-to-cradle principle. First, in the Nijmegen case, the interviewees explicitly point out the overuse of plastic packaging in the current production regime. Such overuse implies inefficiency and waste. In order to utilise material efficiently and realise the circular concept, there is a need to change this pattern. This argument mirrors the Dutch government's goal of utilising plastics efficiently (Dutch Ministry of Infrastructure and the Environment & Ministry of Economic Affairs, 2016, 2017; see also [Section 4.1.1](#)). Second, the interviewees emphasise the important role of consumers in the redesign application. Only when consumers change their consumption

preferences and have sympathy with producers' change of design can the concept of redesign be successfully transferred from ideas into actions. As the cradle-to-cradle principle emphasises on producers' role in generating the cyclical material metabolisms, the overuse of materials and the role of consumers in the production-consumption system does not receive much attention (Braungart et al., 2007; see also [Section 2.1.2](#)).

The overuse of plastic packaging links to the practice of reducing the use of plastic packaging. It is different from reusing materials within and after their lifespan, which has been explicitly embedded in the most renowned definition of the CE (The Ellen MacArthur Foundation, 2012; see also [Section 2.1.2](#)). One possible reason is that the application of the circular concept is 'context-specific', as mentioned by one of the interviewees (see [Section 4.2.4](#)). Most of the plastic packaging is hardly reused because it has been contacted or contaminated by raw food, such as the plastic wrap outside a cucumber and the plastic tray for raw meat. In the light of such characteristic, reducing the unnecessary plastic packaging might be more feasible than reusing the packaging in terms of adopting the circular concept in the value chain.

The other important aspect identified by the interviewees, recycling, echoes the notion of industrial ecology. Emphasising one's unwanted materials would be others' inputs, both the interviewees and industrial ecology scholars assert that recycling is an important practice to retain the value of materials in the loop (Frosch, 1992; O'Rourke et al., 1996; see also [Section 4.2.1](#)). This application is indeed interconnected with the practice of redesign. The interviewees point out that there is a need to better design the materials of plastic packaging so that they could be easily recycled in the present waste management scheme. Such perspective implies that the decisions of plastic manufacturers and the actions of practitioners in waste management are interdependent and intertwined in the circular transition.

5.2 The absence of the economic perspective

Most of the interviewees highlight the material aspect and keep silent to the economic dimension of the circular *economy*, particularly the two elements which have been emphasised by the European Union in the CE discourse: strengthening local economies and creating local jobs (Bacova et al., 2016; European Commission, 2015a). One of the possible explanations may be the significant environmental awareness embedded in the city (see [Section 4.2.2](#) and [Section 5.3](#)). Such concern about the environment could also be spotted when the interviewees explain the reason why the plastic packaging value chain is highly relevant to the circular

concept (see [Section 4.2.1](#)). Due to the dominating awareness of the environmental issues, the interviewees might tend to understand and interpret the concept of CE through the lens of environmental sustainability rather than emphasising on the potential economic benefit. Such ‘bias’ may also link to the fact that the origin intention of the circular concept mainly targets to solve the environmental problems generated from the current linear model (The Ellen MacArthur Foundation, 2012; see also [Section 2.1.2](#)). Nevertheless, it may likely lead to a similar situation which the sustainability niche encounters before; that is, the niche actors are criticised by other players outside the niche for the neglection of the economic aspect (Renn, Reichel, & Bauer, 2012).

The other explanation may link to the city’s steady economic development and the characteristic of the economic structure. The gross domestic product (GDP) at current market prices per inhabitant in Nijmegen and Arnhem region remains at the same level in the period from 2009 to 2011¹⁴ (Eurostat, 2014a). The growth rate of GDP of the province of Gelderland in the period from 2012 to 2016 improves significantly, from -1.7% in 2012 to 2.3% in 2016¹⁵ (Statistics Netherlands, 2017). Such stable economic development might lead to the situation that there is no urgent demand to particularly frame the circular concept with an emphasise on the economic benefit. One could also find a similar context in the latest policy document published by the municipality of Nijmegen (Roemers et al., 2017; see also [Section 4.1.1](#)). In addition, the plastic packaging manufacturing sector is not the main business sector in Nijmegen, compared to healthcare and logistics¹⁶. While the practices of circular concept may generate economic benefits in the plastic packaging value chain, yet these benefits would probably realise in other cities and have relatively slight impacts on Nijmegen’s economy.

5.3 The local institutional embeddedness

One could explicitly notice from the interview outcomes that in the case of Nijmegen citizens’ environmental awareness and the EGC Award have significant impacts on the circular niche development (see [Section 4.2.2](#); see also [Appendix 2](#)). Citizens have a consciousness that being

¹⁴ The latest data is updated in 2014. In the period from 2009 to 2011, the GDP at current market prices per inhabitant in Nijmegen and Arnhem region remains 29,700 euro per inhabitant.

¹⁵ The growth rate of GDP of the province of Gelderland in the period from 2012 to 2016 is respectively -1.7% in 2012, -1.3% in 2013, 1.6% in 2014, 2.4% in 2015, and 2.3% in 2016.

¹⁶ According to the website of the Municipality of Nijmegen, logistics and transport are the two main service industries of the city. Also, the city lies in the healthy valley, which is a cluster in the east of the Netherlands. Several private and public organisations in Nijmegen focus on healthcare innovation.

sustainable is the direction that the city should take, and they are willing to take actions. The survey shows that in 2017 approximately 90% of Nijmegen residents always separate recyclable materials from the residual waste (Gemeente Nijmegen, 2017). Also, almost 60% of the inhabitants reports that they often extend the lifespan of products because of the concern of the environment (Gemeente Nijmegen, 2017). As mentioned by the interviewees, most of the initiatives receive a broad range of support from inhabitants, and citizens are keen to participate and share information (see [Section 4.2.4](#)). As participation has been identified as one of the important factors in promoting social innovation at the local level (Neumeier, 2017), such pattern of thoughts and the norms embedded in the city might contribute to laying a foundation for the circular niche development. This thickness of environmental awareness may also shape the formal institutional configuration in the waste management regime. The local authority, which is perceived by the interviewees as the so-called ‘left-wing’ government¹⁷, demonstrates its interests and commitment to set a pilot site for the waste separation project (see [Section 4.2.2](#)). Though the waste management policies are mainly constructed under the multi-level governance structure (see [Section 4.1.2](#)), Nijmegen is different from other cities in the way that it embraces the circular concept at the very early stage (**I6**). Also, the EGC Award provides a special opportunity for the circular niche cultivation. Several campaigns related to realising the circular concept are launched in order to make the city ready for 2018 (N1.nl, 2017; Nieuws uit Nijmegen, 2017; Nijmegenleeft, 2017). The case in Nijmegen shows that the local norms and the urban-specific culture matter in the sustainability transition, which reflects the perspective that local institutional configuration contribute to ‘shaping the transition spaces’ (Coenen et al., 2012; Coenen & Truffer, 2012; see also [Section 2.2.2](#)).

Despite the significant awareness of the environmental issues which is embedded in the local area and the political spectrum, in the Nijmegen case, formal institutional infrastructure somewhat lag behind. The empirical analysis shows that limited financial schemes have been established at the city level (see [Section 4.2.5](#)) to facilitate the pursuit of the urban circular transition in the plastic packaging value chain. On the other hand, while the waste management

¹⁷ In 2017, SP and GroenLinks are the two major parties which have a majority of the seats in city council of Nijmegen. The former supports waste separation and recycling, but they propose to lower the price of the bag for the residual waste and to implement post-separation collection (more information: <https://nijmegen.sp.nl/>). The latter embraces the circular concept and considers waste is reusable resource (more information: <https://nijmegen.groenlinks.nl/>). The third biggest party is D66, which has 7 seats in the city council of Nijmegen. Regarding sustainability, D66 pays much more attention on renewable energy development, particularly in favour of solar power. The fourth biggest party is PvdA with 4 seats in the council. PvdA also focuses more on renewable energy and climate change issues, particularly in favour of wind energy.

scheme co-evolves with the circular concept, it is mainly constructed under the hierarchical, nested multi-level governance structure. According to the interview outcomes, the municipality of Nijmegen acts as a policy-taker to implement the policies decided at the national level. The local authority also shows inadequate competency in collaborating with civil society groups (see [Section 4.2.5](#)). The absence of local-specific policies and financial schemes raises an intriguing question about the extent to which cities could determine their destinies. Both technical and social innovation transition studies have acknowledged that local policies play a crucial role in the niche development as well as in the transition process. The way in which the local policies are formulated is highly influenced by the power competition among actors in different sectors at different spatial scales (Audet, Lefèvre, Brisebois, & El-Jed, 2017; Hansen & Coenen, 2015; Lutz & Schachinger, 2013; Truffer & Coenen, 2012) and the managerial capacity of the organisation (Wang, Hawkins, Lebredo, & Berman, 2012). However, it is still unclear in the Nijmegen case to which extent the power competition and the local government's capacity result in this absence.

5.4 The multi-level and multi-scalar circular transition

Local niche—regimes interactions

The empirical study shows that the circular niche actors are developing local connections with members of the production regime and waste management regime. On the one hand, the ongoing negotiation with the courier company (see [Section 4.2.3](#)) aims to break through the existing ‘rules of the game’ in the production regime. As only a small number of niche actors put the pressure on the members of the regime, it has not yet effectively influenced the way in which the regime operates. On the other hand, the interactions between the circular niche actors and the players in waste management system are active and relatively mature. The hierachal VANG programme (see [Section 4.1.2](#), [Section 4.2.3](#)) contributes to injecting the circular concept into the regime. The tight partnership between the municipality and the local waste collection company may lead to the effectiveness of waste separation and the high recycling rate (European Commission, 2016a). The interaction not only occurs at the macro-level but also takes place at the micro-level. Small-scale actions, such as specially design waste bins, are introduced to enhance inhabitants, who are also the players in both production and waste management regimes, to take actions on separating and recycling plastic packaging. The red arrows in [Figure 6](#) indicate the relationship between niche actors and regimes players at the local level.

Local circular niche—trans-local production regime—local waste management regime

The Nijmegen case shows that a scale-up inclusive collaboration between the local circular niche actors and the players in the production regime at the national and international levels may likely be a crucial prerequisite to foster the circular transition. The interviewees argue that the way that chain stores operate, such as supermarkets, could be the potential obstacle to pursue the urban circular transition (see [Section 4.2.2](#)). The municipality of Nijmegen may have little authority to get involved in the production processes outside the city region, and the pressure from consumers has not strong enough to change the overuse of plastic packaging in these stores. The niche actors are comprehensively aware of this critical situation and the demand of a multi-scalar cooperation with players in the production regime (see [Section 4.2.6](#)), though limited strategy have been developed and experimented. Such collaboration is also critical for the actors in the local waste management regime. To tackle the issue resulting from non-recyclable plastic packaging, the waste collection company in Nijmegen calls for manufacturers' action to redesign packaging and products (see [Section 4.2.6](#)). These demanding cross-scale networks reflect one of the elements of the multi-scalarity perspective: actors constructed the scale of the networks which mostly meets their interests rather than fitting the administrative territories which are convenient for policy makers (Coenen et al., 2012). Such phenomenon is also significant in other sustainability-oriented social innovation cases, such as the seasonal food markets in Montreal in Canada (Audet et al., 2017) and the SpeiseLokal local food hub in Maria Anzbach in Austria (Lutz & Schachinger, 2013). The blue arrows in [Figure 6](#) indicate such expected cross-scale relationship between niche actors and regimes players.

Local niche networks

The internal and external circular niche networks in Nijmegen are active and continuously developing. The empirical data show that the internal circular niche networks build on the projects and initiatives which are relevant to the circular concept, such as the NAC campaign and the pilots launched by the circulaire economie (In English: circular economy) team under the framework of the EGC Challenge (Ginneken, 2017; see also [Section 4.2.4](#)). The preparation of the 2018 EGC is served as a collective goal for niche actors to collaborate, though this short-term goal is so dominant that actors have less capacity to consider action plans for a long-term vision (**I2; I3**). These EGC-related activities motivate niche actors to strengthen connections with stakeholders from a wide range of background in order to build external networks. Not

only citizens and government officers but also business representatives and students are being part of the networks (Green Capital Challenges Nijmegen 2018, 2017; see also [Section 4.2.4](#)). The interwoven and complex connections may likely facilitate knowledge exchanging and information sharing, as indicated by some interviewees (**I6; I7**).

The circular niche development in Nijmegen follows the internal niche processes which are labelled by SNM scholars (Raven et al., 2010; Seyfang & Longhurst, 2013). The first process, shaping expectations, is particularly important when an innovation is in the early stage of development. As the collective goal of being sustainable and circular for the 2018 EGC is shared by the niche actors in Nijmegen, the case meets the criterion that the process functions well if the same expectations are shared by a great number of actors (Raven et al., 2010). The second one, building social networks, indicates that niches require new actors from different dimensions and backgrounds to strengthen the connections with stakeholders (Raven et al., 2010; Seyfang & Longhurst, 2013). While the project-based networks tend to embrace different players, it is still considered by one of the interviewee as an exclusive circle which functions by a certain group of people (**I8**). The green arrows in [Figure 6](#) indicate the actors' interactions which facilitate the circular niche development.

Trans-local niche networks

In the Nijmegen case, there is limited evidence showing that the circular niche actors have built or plan to build connections with those at the national (e.g. the Netherlands circular hotspot campaign) and international levels (e.g. the Ellen MacArthur Foundation). Such phenomenon is rarely spotted in the process of social innovation niche development, according to those cases which have been investigated (Seyfang & Haxeltine, 2012; Seyfang et al., 2014). One of the possible explanations for this situation may link to the four-phases pattern of knowledge flows introduced by Geels and Deuten (2006). They argue that the process of technological knowledge diffusion follows the four sequential phases: the local, inter-local, trans-local, and global stages. In the first stage, innovations emerge through isolated initiatives. The innovative ideas mainly focus on solving local problems, and local actors have little intention to share knowledge and collaboration. Innovators tend to build links and alliances with other producers in the second stage when the ideas are more mature, but the know-how remains within the networks. This stage is then followed by the third, trans-local phase, in which knowledge is developed with an intention to be widely applied. In the global phase, the globally technological societies have treated such initiatives as a general and standard practice. While

such conceptual framework is introduced to analyse technical innovation development, it might help to explain the Nijmegen case. Though the circular concept is not new, it is until the recent two years that practices are taken in Nijmegen. Also, the initiatives are mainly constructed with the intention of the pursuit of the EGC Award, which leads to a localisation-oriented development of the circular niche. Most of the actors do not consider building trans-local networks with other niche actors beyond the city region as a priority but enhance the empowerment of the city and the awareness (see [Section 4.2.3](#)).

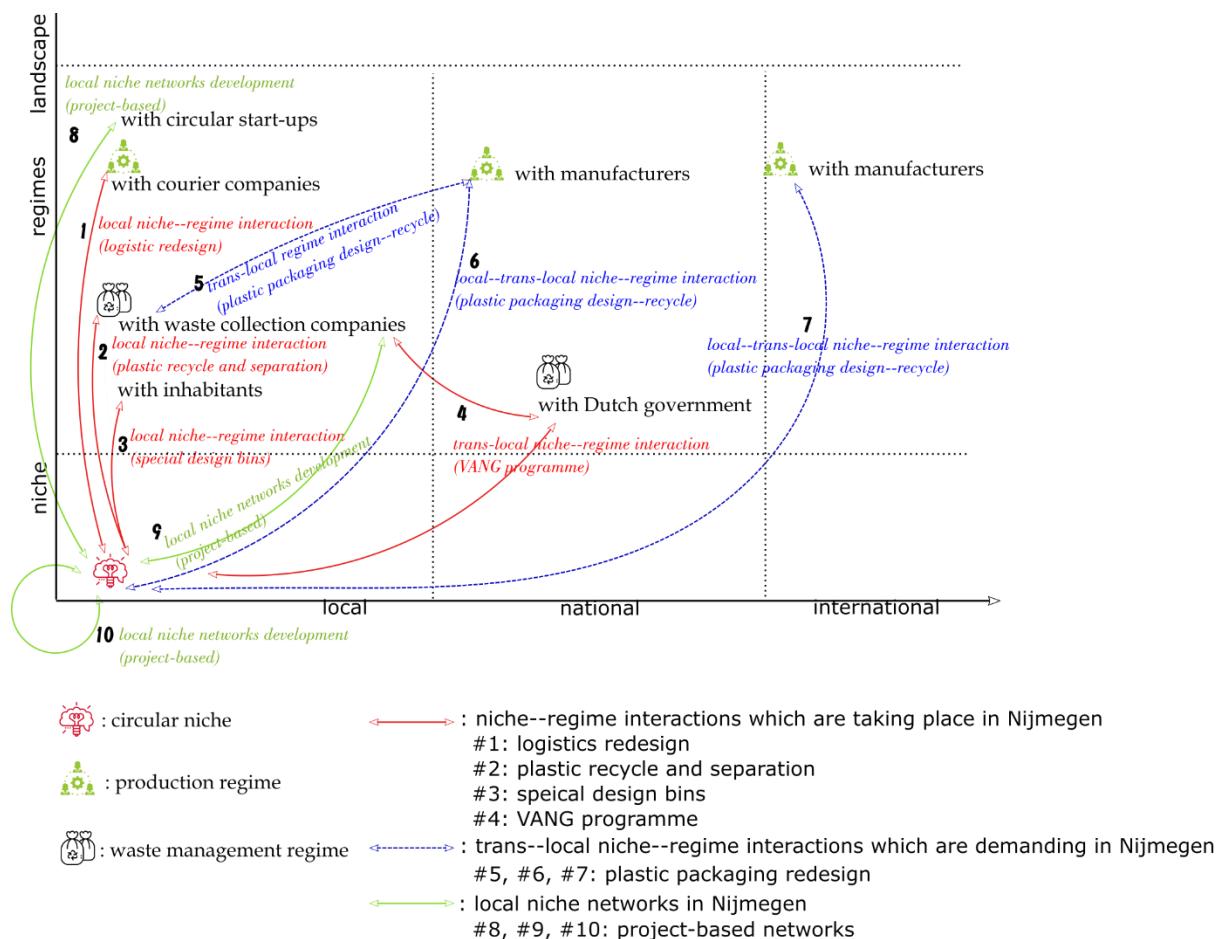


Figure 6. The multi-level, multi-scalar circular transition in Nijmegen

5.5 Reflections on the MLP approach

Within the multi-level and multi-scalar MLP conceptual framework, this research argues that there are two different types of transition in the Nijmegen case. First, the interactions between actors in the circular niche and the waste management regime could refer to an *endogenous transition*; that is, the regime actors respond to the pressure with coordinated responses through internal resources in the regime (Smith et al., 2005; see also [Section 2.2.1](#)). The waste collection companies and the local authority in Nijmegen consistently collaborates under the VANG scheme through the multi-level governance structure, when they encounter the incrementally increasing pressure from the circular niche actors. Secondly, the interactions between actors in the circular niche and the plastic packaging production regime more likely fit the *re-orientation of trajectories* transition (Smith et al., 2005; see [Section 2.2.1](#)); that is, the regime actors react to the pressure with uncoordinated responses and internal resources. One could notice that limited financial schemes are introduced to facilitate the circular transition (see [Section 4.2.5](#) and [Section 5.3](#)), even though the local and national authorities have prioritised plastics sector for the transition (see [Section 4.1.1](#)).

The Nijmegen case shows that there could be a sharing point between niche actors and members of the regimes, which may blur the distinguish between these two levels. The traditional MLP studies argue that actors in the regimes act according to the regime rules, such as the lifestyle and the shared belief, and such rules are reflectively shaped by actors' daily actions. The niche aims to replace the existing rules and introduces a new innovation (Geels, 2011). This empirical study observes that in Nijmegen the strong environmental awareness is not only embraced by the niche actors but also shared by members of the regimes; for instance, inhabitants quickly accept the circular concept and voluntarily participate in initiatives. Some local shops also quickly shift to provide cotton bags to meet consumers' needs for non-plastic packaging (**I4**). The niche actors may likely utilise this shared norm rather than replace it in order to facilitate the transition, yet further research is suggested to investigate the details.

In light of such shared environmental awareness and the local networks between niche actors and members of the regime (see [Section 5.4](#) and [Figure 6](#)), this research argues that it would be the norms to distinguish niches and regimes when analysing social innovation transition. Niches are usually considered as 'protected spaces' in which innovations could keep away from the mainstream regime (Geels, 2002; Geels & Schot, 2010; see also [Section 2.2.1](#)). The difference between niches and regimes is that the niche networks are much weaker and actors

have limited agreement on rules of game (Geels & Schot, 2007). In social innovation transition, niches and regimes may likely interdepend on each other rather than evolve separately. One could notice that in Nijmegen some actors in the regime adopts the circular concept easily and quickly, and the niche relies on these regime actors for further development. Such co-evolving interrelationship is also observed in socially oriented local food initiative cases (Audet et al., 2017; Lutz & Schachinger, 2013).

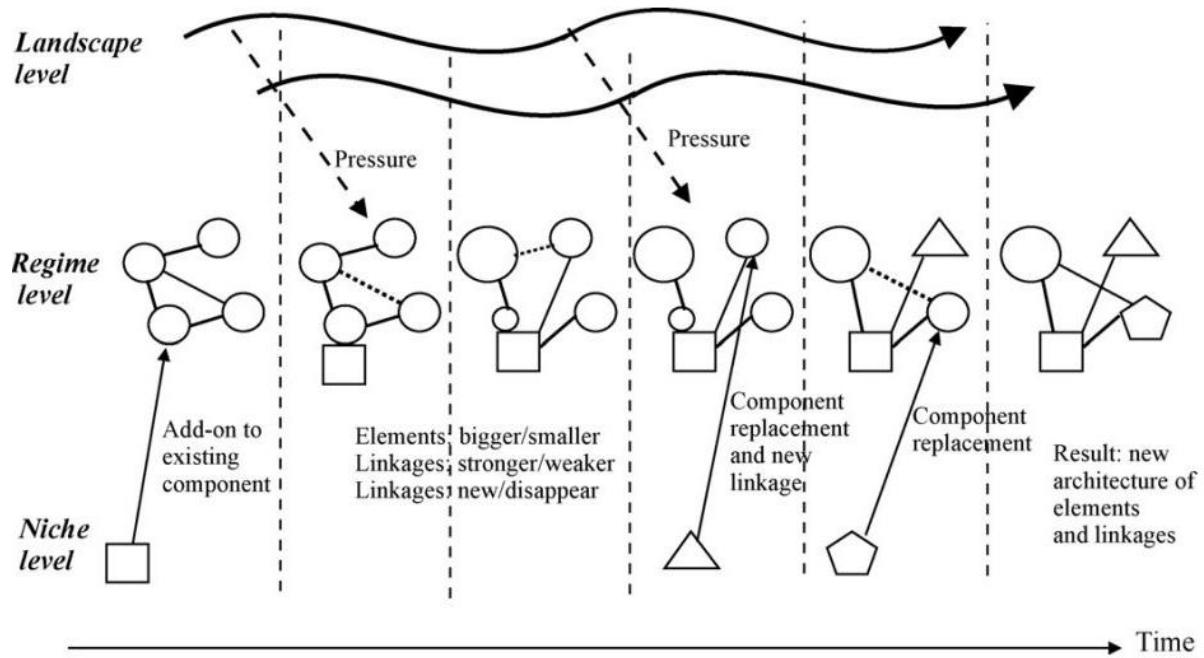


Figure 7. Reconfiguration pathway transition. Retrieved from Geels & Schot (2007), p. 412.

While Geels and Schot (2007) label the situation in which innovative technical artefact are adopted by the regimes in the early stage as a ‘reconfiguration pathway transition’ (see also [Figure 7](#)), it is the fundamental difference between technical and social innovation trigger scholars to question the criteria of distinguishing niches and regimes rather than adopting the framework of ‘reconfiguration pathway transition’ in the social innovation transition analysis (Audet et al., 2017). Social innovations must interact with the regime when the innovative ideas are developing. It is different from the ‘reconfiguration pathway transition’, in which the minor innovation (e.g. performance improvement) is firstly well developed in the niche and then further being adopted by the regime actors. In this Nijmegen case, it would be more appropriate

to differentiate the circular niche and regimes through the extent to which the actors embrace the circular concept. For instance, those have strong interconnections and embrace the circular concept, such as some local shops in Nijmegen, would be identified as the circular niche actors rather than members of the production regimes. The transition would be understood as the process in which those share circular belief to break through the regime consisting of actors who do not adopt the circular concept. [Table 2](#) shows the differences between the criteria to distinguish niches and regimes in the technical innovation transition and the ones likely appropriate for social innovation transition.

Table 2. The criteria to distinguish niches and regimes in the social innovation transition

Technical innovation transition			Social innovation transition		
	Criteria Networks	Example	Criteria Networks	Belief	Example (in Nijmegen case)
regime	+	Water supply regime (Geels, 2005a), national energy system (Raven et al., 2012)	-	-	Plastic packaging manufacturers utilising raw materials to produce packaging
					Consumers who do not accept the circular concept
niche	-	Piped water system (Geels, 2005a), biomass gasification (Raven et al., 2012)	-	+	Waste collection companies and the municipality of Nijmegen
					Campaigners and advocates of the circular concept

Note: '+' stands for strong networks/belief; and '-' stands for weak networks/belief.

6. Conclusions, Recommendations, and Research Limitations

This research initiates from the phenomenon that cities in the Netherlands make ambitious commitments to shift from a linear economy to a circular model. To investigate how stakeholders interact in such transition process in the urban arena, this research undertakes an in-depth case study of the city, Nijmegen, on the circular transition in the plastic packaging value chain. Section 6.1 answers the overarching research question and the following three research sub-questions. Section 6.2 provides recommendations for Nijmegen's circular transition in the future, and Section 6.3 offers suggestions for future research. The research limitations is explained in Section 6.4.

6.1 Concluding remarks

This research conducts a qualitative, single-case study to investigate the urban circular transition in the plastic packaging value chain. Adopting the conceptual framework drawn on the MLP approach and multi-scalar perspective, this research aims to answer the overarching question: *How do the players in the plastic packaging value chain in the urban area interact to facilitate the urban circular transition, given that the urban production-consumption system is significantly influenced by several factors not only within but also beyond the city region?* This overarching question could be analysed through the following three research sub-questions and the answers to these sub-questions.

(1) *How do the players perceive the concept of the CE, and the relationship between such concept and the plastic packaging value chain in the urban arena?*

The empirical analysis shows that niche actors perceive the CE as a system that producers take the responsibility to *redesign* products so that materials can be *reused* within and after the lifespan. Only limited waste exists in this circular system because *ones' unwanted materials can be others' resources*. Such interpretation reflects two school of thoughts: the cradle-to-cradle principle and industrial ecology (see [Section 2.1.2](#), [Section 4.2.1](#), and [Section 5.1](#)). In regards to the application of redesign in the plastic packaging value chain, the Nijmegen case shows that actors emphasise the overuse of plastic packaging and the role of consumers. These two elements, however, are not explicitly addressed in either the cradle-to-crackle principle or industrial ecology studies. In addition to highlighting the importance of making materials be retained in the loop through redesign, the actors in Nijmegen argue that the plastic packaging

should be redesigned to reduce the unnecessary use of materials. Such practice will be successful if consumers also embrace the circular concept and change their consumption behaviour. Furthermore, the Nijmegen case shows that the circular transition is ‘context-specific’. As reusing plastic packaging somewhat is difficult, reducing the use of packaging is a more feasible practice to facilitate the urban circular transition.

The economic dimension of the circular *economy* is received little attention from actors in the Nijmegen case, particularly the two dimensions which are often addressed in the policy discourse of the European Union: strengthening local economies and creating local jobs. This research argues that this situation may result from the actors’ significantly strong environmental awareness and the city’s economic structure (see [Section 4.2.2](#), [Section 5.2](#) and [Section 5.3](#)). The actors tend to understand the circular transition in the plastic packaging value chain from an environmental sustainability perspective (see [Section 4.2.1](#)). It is the adverse environmental impacts of plastic packaging makes the circular transition in the value chain crucial. In addition, as plastic packaging manufacturing is not the main economic sector in Nijmegen, the economic benefit resulting from adopting the circular concept in the value chain may likely not occur in the city region.

(2) Which actions have been taken and/or which practices will be taken in the future by the players to facilitate the CE transition in the plastic packaging value chain in the urban area?

In the Nijmegen case, three types of practices are undertaken in the urban area: the action to redesign of the logistic process, the scheme of plastic packaging separation and recycling, and the campaigns to raise consumers’ awareness of the negative environmental impact resulting from the use of plastics (see [Section 4.2.3](#)). These initiatives are mainly developed through collaboration at the local level, including local niche-regime interactions and local niche networks (see [Section 5.4](#)). The circular niche actors are negotiating with courier companies in the plastic packaging production regime in order to foster the second use of plastic packaging. In addition, the partnership between municipality and the local waste collection company facilitates the plastic packaging recycle scheme, and actors are keen to implement strategies to further increase the recycling rate. The circular niche actors in Nijmegen build networks with a wide range of stakeholders on the basis of the preparation projects of the 2018 EGC. The NAC campaign, which challenges citizens to reduce plastics and residual waste as much as possible within thirty days, has gained a significant support not only from the municipality and

people in the academia but also from the inhabitants.

The empirical data shows that a trans-local niche-regime interaction is demanding to facilitate the transition (see [Section 4.2.2](#), [Section 4.2.6](#) and [Section 5.4](#)). As products are designed and packaged before being shipped to the city region, the niche actors call for producers' action to embrace the circular concept in the production process beyond the urban area. The local waste collection company in the waste management regime also expects producers to better design the products so that plastics could be fully recycled in the city region. While limited strategies are adopted to foster such collaboration, the niche and the regime actors' need for trans-local and cross-level cooperation echoes the multi-scalar perspective, which argues that the actors constructed the scale of the networks fitting their interests rather than following the administrative territories which are convenient for policy makers (see [Section 2.2.2](#)).

(3) Which factors may likely facilitate and/or impede the CE transition in the plastic packaging value chain in the urban area?

The significant environmental awareness embedded in the city region lays a foundation to develop the circular niche. Campaigns and activities receive support from actors in the regime, including participation from consumers and local shops. The political spectrum of the composition of the local authority lead to the fact that the city pilots city-wide plastic separation and recycle scheme at the early stage and further implements well (see [Section 4.2.2](#), [Section 4.2.4](#), and [Section 5.3](#)). As Nijmegen is awarded as the 2018 EGC, it contributes to align actors' visions to demonstrate the city is circular and sustainable. This is also an one-of-a-kind opportunity for circular niche actors to build external networks with stakeholders in the city region and to strengthen internal connections with civil society groups and practitioners (see [Section 4.2.4](#) and [Section 5.4](#)).

The lack of financial scheme and the municipality's supportive but not active stance may likely slow the speed of the urban circular transition (see [Section 4.2.5](#)). For regime actors, adopting the circular concept sometimes generates financial burden, as it may require a systematic redesign on the production process or a comprehensive change of operation scheme. Such finical barrier could hinder the transition, even if the players in the regime sympathise with the circular niche. In addition, while the local authority backs up the circular niche and their campaigns, the niche actors expect the municipality to be a co-initiator who possess adequate competency. The transition may likely be accelerated if the municipality collaborate rather than

cooperating with the niche actors.

6.2 Recommendations for urban circular transition in Nijmegen

For the circular niche actors, it is suggested to build trans-local internal connections with players who work in the similar niches. Drawing on the perspective from strategic niche management (see [Section 2.2.1](#)), this research argues that trans-local internal networks of niche actors could enhance information sharing and experience exchanging. Social innovation niche actors usually build intense internal links at the very early stage, particularly with actors in the similar niches at the national and global levels (Seyfang & Haxeltine, 2012; Seyfang & Longhurst, 2013). On the one hand, as the niche actors in Nijmegen show limited capacity when negotiating with courier companies, the trans-local internal networks may likely provide platforms for these actors learn from other niche players. On the other hand, though the actors in Nijmegen call for producers' action to adopt the circular concept in the design of packaging, very limited strategies have been introduced to facilitate the collaboration between the niche and the regime. It is suggested to form an alliance with actors in the similar niches beyond the city region in order to enhance the pressure on the regimes.

For the local authority, it is recommended to reinforce the financial scheme and to actively collaborate with the niche actors. The players of the regimes may encounter extra costs at the early stage when shifting from a linear model to a circular one. A set of well-structured and supportive financial instruments, such investment funds and low-interest loans, may foster the transition as well as attract new investors. Considering the local authority has limited resources, this research suggests the municipality of Nijmegen could better utilise the commitment of the circular transition made by the European Union and the Dutch government in order to leverage more support. In addition, while the citizens' strong environmental awareness and initiatives launched by the niche actors have laid a foundation for the urban circular transition, one should not neglect the crucial role of local policies in the sustainability transition (Hansen & Coenen, 2015). This research recommends the municipality not only cooperates but also collaborates with the niche actors to establish a clear and long-term vision of Nijmegen's circular future.

6.3 Recommendations for further research

It is suggested that researchers conduct a multiple case study analysis method to compare stakeholders' interactions in the process of circular transition, in order to better understand the

impact of the local embedded institutional configuration on the sustainability transition. This present research demonstrates that citizens' environmental awareness and the EGC contribute to the circular niche development and the interactions between the niche and regimes. However, as it is a single case study, it is difficult to further evaluate the extent to which such elements are locally specific and facilitate the transition. That is, if the circular transition does not occur in a city which also receives the EGC and the citizens possess strong environmental awareness as well, then there might be other determinant factors in the urban circular transition.

It is recommended to distinguish niches and regimes by the extent to which the actors embrace the circular concept. As social innovations do not develop in a 'protected space' but co-evolve with the regimes, the criteria which are widely used in the technical innovation transition studies to differentiate niches and regimes might not match the case in the socially oriented transition. Drawing on social innovation transition studies (Audet et al., 2017), this research proposes to define circular niche as a system in which actors adopt and share the circular concept no matter they have strong or weak networks. The transition occurs when these actors attempt to influence the rules of the game of the regimes in which members do not embrace the circular practices.

6.4 Research reliability and validity

The reliability of this research is influenced by the interview method and the rapid development of the circular concept. A piece of reliable analysis is that one could reach identical or at least similar results under the same research procedure (Coghlan & Brydon-Miller, 2014). This empirical case study is mainly conducted through semi-structured interviews. Since the interview questions may alter on the basis of the interviewees' answers, it might be difficult to replicate the entire interview process and then to reach the identical results. Even though similar interviewing questions are inquired, the interviewees might provide different answers and change their perspectives, particularly in light of the rapid and dynamic development of the circular concept in recent two years. Furthermore, as the interview transcripts are analysed by thematic analysis method, which highly depends on the researcher's objective judgement, different researchers might have different interpretations on the same transcription.

This in-depth case study somewhat ensures internal validity. Internal validity refers to the extent to which the research results demonstrate the social phenomena (Bush, 2013). The primary data are provided by the interviewees who are familiar with the plastic packaging value

chain as well as the development of the circular concept in Nijmegen. Their experiences may likely demonstrate the circular transition which is currently happening in the city region. While this single case study may be difficult to generalise across cultures, values, places, and so on, this is exact the core intention to adopt the spatial perspective in this research. That is, there are spatially specific factors in every single case which are worthy of better understanding when researchers analyse the circular transition in the urban arena.

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Appendix 1: The Semi-Structured Interview Guide Questions**Perception about CE**

- 01.** Could you give your interpretation of the concept of ‘circular economy’?
- 02.** What’s your opinion about the relationship between plastic packaging system and the concept of CE?
- 03.** From your experience, do you think it is difficult to become circular in plastic packaging system in Nijmegen?

Response to the CE

- 04.** Do you launch activities about plastic packaging?
- 05.** How do you respond to the CE advocacy in plastic packaging? (what actions, who work with)
- 06.** From your previous experiences, have you ever received resources/support from others to help your projects and activities? (knowledge, technologies, funding, etc) (within the city region or outside the city?)
- 07.** From your perspective, what’s the most difficult part to work on projects?

Coordination and networks

- 08.** Have you worked with civil society groups in Nijmegen? Could you talk about your experience? (atmosphere, people)
- 09.** Have you worked with the municipality of Nijmegen? Could you talk about your experience?

Future of the CE

- 10.** What would like to see about Nijmegen’s future regarding plastic packaging and circular economy?
- 11.** What are the supports/resources you would like to have in the future to facilitate the activity?

Appendix 2: The Thematic Coding

	Main themes	Subthemes			
1	Circular economy concept	1-1 Circular Economy interpretation	Redesign, producers' responsibility		
			Reuse		
			Waste	Waste-to-energy	
				Recycle	
			Social aspect		
			Broad concept, not clear		
			Economic aspect		
		1-2 Circular Economy and the plastic packaging value chain	Importance	Environmental impacts	
				Raw materials dependency	
			Practices	Redesign	Products
					logistics
				Reduce	
	2 Actor's actions	2-1 Niche actors' interactions	Reuse		
			Recycle		
			With/in the production regime		
		2-2 Niche actors' networks	With/in the waste management regime		
			Awareness raising		
			Local	With governmental bodies	
				With academic institutions	
				With businesses	
				With communities	
			Trans-local	With non-governmental organisations	
				With semi-governmental groups/platforms	

	Main themes	Subthemes		
		2-3	Actors' expectation	Awareness raising Recycle and separation enhancing Producers collaboration Legislation Financial schemes Ownership issue Active government Businesses revenue model, knowledge support
3	Niche development	3-1	Niche development	Environmental awareness European Green Capital Challenges
				Citizens Politics spectrum
				Chain stores Packaging design Financial difficulties Role of consumers
				Policies/competency of the local government
				Financial resources
				Funding for projects Subsidies Investment fund Financial institutes

Theme 1-1: Circular Economy interpretation

	Redesign, producers' responsibility	Reuse	Waste		Social aspect	Broad concept, not clear	Economic aspect
			Waste-to-energy	Recycle			
I1	<i>But the decision you take before that moment.</i>	<i>But if you take the concept broader, it means the new thing about it is that you just, don't just buy stuff and then use it and discard it, or recycle it, or reuse it again.</i>	<i>Sometimes people say it's also part of circular economy to produce waste, and then burn it. And produce electricity or heat. I don't think that's the right way.</i>	<i>And sometimes people use this concept and they mean, well, just recycling. Not just, they mean recycling. It's still an important issue, recycling. But recycling it's a concept twenty, thirty years ago.</i>		<i>It's not yet very clear what people mean by it.</i>	
	<i>So the producers they have to do new things with that production lines, production process.</i>		<i>it means that there is no incentive to reduce waste. Because the company that uses wastes to produce energy.</i>				
	<i>Because the concept is with the circular economy, that means a lot of companies have to cooperate things.</i>						
I2				<i>I start with the waste, instead of the whole</i>		<i>my opinion is that every citizen in the world can do little</i>	

	Redesign, producers' responsibility	Reuse	Waste		Social aspect	Broad concept, not clear	Economic aspect
			Waste-to-energy	Recycle			
				package.		steps to make the difference. Mostly, I think people take the whole package. That's so difficult to start with something.	
I3	<i>we don't take new ones from that, from it. So everything we have now, we have to redesign.</i>			<i>And I think talking about circular economy, most people think at the end of the circle, so recycle</i>		<i>when you talk about reducing your packaging, everyone knows what you're talking about. When you're talking about circular economy, I am not sure if everyone knows what you're talking about. I think a lot of people don't know what the concept of circular economy is.</i>	
	<i>I think that really, the, the real thing is in the beginning. So redesign your products. Design your products in such a way that in the end when you don't want them anymore, or when they are getting old, you can take them apart, and</i>						

	Redesign, producers' responsibility	Reuse	Waste		Social aspect	Broad concept, not clear	Economic aspect
			Waste-to-energy	Recycle			
	<i>reuse the different objects, and make something new out of it.</i>						
I4		<i>keeping everything what is worthwhile as long as possible in a chain or in a system</i>			<i>It's about the talent. It's about social cohesion, like relations everything.</i>		
					<i>in my opinion, the talent of people.</i>		
					<i>So it's abuse. It's try not to abuse your soil, your raw materials, your people, your talents.</i>		
					<i>these talented, talents, they are still here. But they are in the, relatively old people. So use these talents.</i>		
					<i>I think circular economy is also combining things</i>		
I5	<i>I believe the trigger to</i>			<i>return the plastic</i>		<i>it's such a broad</i>	<i>it's basically an economy</i>

	Redesign, producers' responsibility	Reuse	Waste		Social aspect	Broad concept, not clear	Economic aspect
			Waste-to-energy	Recycle			
	<i>be in the companies, not in the people itself</i>			<i>and receive like money for it</i>		<i>concept</i>	<i>which also benefit the environment. So it just like not really minimising, environmental damage but also contributing to the environment.</i>
	<i>Like we only have to have, to offer them, hmm, the sustainable product. So that it is not possible for them to be, to pollute like the earth like.</i>					<i>it basically like an umbrella term, which pretty much covers, transition towards green energy, hmm, so what's closing the loop, like closing the material flows. So it is really broad and so far.</i>	
	<i>I believe it has to come from the companies.</i>					<i>umbrella term, which covers all sustainability practices or something</i>	
16	<i>in our point of view, are the producers of the packaging. Because they should take that responsibility, the producers' responsibility. And they have to think about design for recycling.</i>	<i>we, make clearly that things should be in a circular movement. We should use our resources many times. Try to, no lost of resources.</i>		<i>There is waste, rest, when we come in action. We want to go back in this chain. So we want also make people aware of, hmm, they should not be waste. They should be a</i>			

	Redesign, producers' responsibility	Reuse	Waste		Social aspect	Broad concept, not clear	Economic aspect
			Waste-to-energy	Recycle			
				<i>circular use of, sources.</i>			
				<i>waste is resources</i>			
I7		<i>when the life cycle is almost over for products, try to make it that you can use it again.</i>					

Note: I8 and I9 interviews are confidential so that the transcripts and coding process will not be disclosed in this appendix.

Theme 1-2: Circular Economy and the plastic packaging value chain

	Importance		Practices				
	Environmental impacts	Raw materials dependency	Redesign		Reduce	Reuse	Recycle
			Products	logistics			
I1	<i>I think the plastic packaging is a very relevant issue. Because plastic doesn't biodegrade, and you see the plastic coming everywhere in the oceans. And there are a lot of birds die from eating the plastic or suffocated in plastic things.</i>			<i>we don't want this stuff. We don't need it. It's just packaging material. So we are trying to let the company that delivers stuff these stuff, take it back.</i>	<i>So the, the university, hmm, wants to reduce, the whole community, the whole society wants to reduce the plastic use.</i>		<i>But if you use them, try to recycle them. So that's a better way of, handing the waste.</i>
					<i>first of all, don't use the plastics.</i>		<i>so we try to recycle it.</i>
I2						<i>What should we do to plastic bottle? You can take, with, reused thing, with another plastic bottle.</i>	<i>the little things in the whole circle is the plastic packaging. And we can start to separate it and recycle it.</i>
							<i>it's only a little, subject. That's the, the waste. So we, we try to do a little steps to make it better. At the front and at</i>

	Importance		Practices				
	Environmental impacts	Raw materials dependency	Redesign		Reduce	Reuse	Recycle
			Products	logistics			
							<i>the back, just recycle or, reuse things.</i>
I3			<i>So, packaging is in a lot of cases something we just don't need. So why should we use it? In the beginning of the process, it shouldn't be in our designing idea.</i>		<i>I think that a part of circular economy is the thing we don't need, we should not use.</i>		
I4	<i>it's like a Wembley Stadium full, and then four times, which is floating in the ocean.</i>		<i>you have to change the system, in a, in very fundamental way. But now we are, err, making products. So they can, as.. For example, as chips, to the Cokey, Lays. This is, aluminium with plastic. And it's very hard to recycle this.</i>	<i>And that was like, combining, err, bring new goods to the shops and factories combine that with, with, err, the first logistic.</i>		<i>there is a lot of good things going on of, of making more, err, things of plastic which are can longer be hold</i>	<i>Or make a concept when it's comes back in a model recycling.</i>
			<i>you have to think, rethink about is this plastic necessary</i>				
I5	<i>Plastic is one of the main problem, of course, for the environment</i>				<i>And we also have a lot of festivals. And that produces a huge amount of</i>		

	Importance		Practices				
	Environmental impacts	Raw materials dependency	Redesign		Reduce	Reuse	Recycle
			Products	logistics			
					<i>plastic. If there is like a way, what this can be reduced, that will be a huge, step forward, definitely.</i>		
	<i>Plastic is being used everywhere, of course. It's kind of like, universal product, I would say. It's not really, you might also able to apply the results on the other side of the world</i>						
I6							<i>there will also be a moment when this packaging becomes waste. Or maybe can become, hmm, a source, a very new source for a new packaging.</i>
							<i>plastics, when it's separated effectively, you can also have a good renewable products</i>
							<i>DAR together</i>

	Importance		Practices				
	Environmental impacts	Raw materials dependency	Redesign		Reduce	Reuse	Recycle
			Products	logistics			
							<i>with the city of Nijmegen think it's very important to do this separate collection.</i>
I7		<i>when I found out how much oil we use for plastics, that was for me a wake-up call. Then I found 311 million tones of plastics which we produce every year, we only recycle 4%. And on the others, we just use virgin material, so that's oil, again.</i>	<i>And then I found out that there is an alternative, called bio-plastics, and a lot of different, alternatives within bio-plastics. And then I started to look for the best solution.</i>				
		<i>The plastics. I have a lot of experiences with plastics, and what I experienced from, within the plastic industry, that we don't use recycled materials. So we never have, we never use recycled material.</i>	<i>you can recycle it 100%, because the recycling companies they don't even see the difference between the polyethylene and bio-polyethylene. So, then I found this material, and then I told to myself, okay, this is the best option so far. I will choose</i>				

Environmental impacts	Importance		Practices			
	Raw materials dependency	Redesign		Reduce	Reuse	Recycle
		Products	logistics			
		<i>this material, and probably it's a different.</i>				
		<i>companies, who sell it to consumers, they say, we don't want recycle plastics because it can be harmful, or the quality could be bad. In that way we can't use. It loses our market share. So if those kind of company say to the producer, we don't want recycle plastics, then the producer doesn't use recycle plastics.</i>				

Note: I8 and I9 interviews are confidential so that the transcripts and coding process will not be disclosed in this appendix.

Theme 2-1: The circular niche actors' actions

	With/in the production regime	With/in the waste management regime	Awareness raising
I1	<i>In Dutch call it Peip, Peipschuim. That can't be recycled, in this moment. We don't need it. It's just packaging material. So we are trying to, let the company that delivers stuff these stuff, take it back. But they are not too keen on that.</i>	We try to get waste cans.	
	<i>Ask nicely, but this doesn't seem to work good enough</i>	<i>Specially for plastic, to get it recycled. That's not everywhere. So in the faculty of science they have, they do it more.</i>	
I2	<i>We spoke to the, the people who have the catering it. The food, and we have just get another supplier for our food. We go to do together is to take of the waste to reduce the waste here in the HAN. At the front, less waste, hmm, less plastic in the food shops. So, yeah. We, we, we talked a lot of suppliers for this sort of things.</i>		<i>we focus on plastic. And we did three things with Lions Group Nijmegen. We have, also our target is to make the citizens of Nijmegen aware of the problem from the plastic soup.</i>
	<i>All the places here on this, this floor, we have bins like that. Just not the separation. So we like to take them out. And only have one bin at the end. So they can separate the waste, there. And another step is maybe here to have some art bins also.</i>		<i>The second action we did is to introduce the, the people in, the, the primary schools and the secondary schools.</i>
			<i>And the third is walk of waste.</i>
			<i>We hope people are, get more awareness,</i>
I3			<i>from there I started the challenge, the Nijmegen's afval challenge, where we try to reduce our waste in thirty days.</i>
I4			<i>I think when you make small steps at the sixty percent. You have more effectiveness.</i>
I5	<i>There are also a lot of repair companies here in Nijmegen. Hmm, this basically produce local goods, like local products, chairs, tables, which are built by</i>	<i>the main waste processing company, hmm, is DAR, D-A-R, and A-R-N, especially ARN, and what is actually this two companies are really like ahead in</i>	

	With/in the production regime	With/in the waste management regime	Awareness raising
	<i>local resources, so based on local resources.</i>	<i>the circular economy, and especially on the national scales. For example, ARN uses their waste which is being processed, and use it to generate energy, green energy, so to say. DAR is really ahead like the separation of waste.</i>	
	<i>I know this small start-up which is also about plastic actually. He is planning on producing biological degradable plastic, so he intends to make bottles for like water and stuff, which are completely biological degradable.</i>		
	<i>You know of course all companies like produce waste, which might be the potential resource for another one. The trickiest question like how do you bring these two companies together to ensure that they are aware of each other existence, so to say. What these companies do is basically provide a market place.</i>		
I6			<i>we try to make the household aware of the importance of separate collection and recycling.</i>
			<i>the main strategy is just explain why, and how people should separate the waste</i>
I7	<i>This is BE-O. The vision is that we are gonna use only natural, bio-plastic for all our products in the future. Our mission is to accelerate transition from, hmm, fossil material plastics to bio-plastics. We gonna design reusable products made from bio-plastics, which are 100% recyclable</i>	<i>And I look around Nijmegen, I see a lot of, a lot of big businesses, focusing on sustainable matters, like ARN and DAR</i>	

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Theme 2-2: The circular niche actors' networks

	Local				Trans-local	
	With governmental bodies	With academic institutions	With businesses	With communities	With non-governmental organisations	With semi-governmental groups/platforms
I1	<i>because the Gemeente Nijmegen can participate in, Nijmegen Green Capital next year. That's also good stakeholder for us.</i>	<i>there are changes from this Nijmegen Green Capital... I am trying to introduce that here, in the university.</i>	<i>we tried to get contact with the stakeholders. So that's the companies that delivers stuff. That's one. Also with the company that takes our waste.</i>			
I2		<i>So we start now think how must we get this spread out, And, I told with a lot of people, and I asked them to join us. So I hope that's will be good. We are now, busy with the, the beleid, the policy about, what do we want as HAN for the waste.</i>	<i>We spoke to the, the people who have the catering it. The food, and we have just get another supplier for our food. And one of the things we go to do together is to take of the waste to reduce the waste here in the HAN. At the front, less waste, hmm, less plastic in the food shops. We talked a lot of suppliers for this sort of things.</i>	<i>all the volunteers who pick them up, but also spoke to the people who, who walk there, and to do the same.</i>	<i>one of our members have seen this exhibition, exhibition, three four years ago in Belgium.</i>	
					<i>We have spoken to the</i>	

	Local				Trans-local	
	With governmental bodies	With academic institutions	With businesses	With communities	With non-governmental organisations	With semi-governmental groups/platforms
					<i>plastic soup foundation in Amsterdam, and we have, did a lot of research on internet.</i>	
					<i>So, we talked with the man, the plastic soup sever, and we make connection.</i>	
I3	<i>I received not that much support from the government. I think that, that the companies are, are, further than the government is.</i>			<i>I started because I started as a volunteer at Duurzaamheidscafe. And there I knew people who were even more involved. And that's how I came involved at Green Capital Challenges.</i>	<i>I received support from the NGO where I was writing about circular economy.</i>	
	<i>The government is, sometimes is even too slow.</i>			<i>I got support from the people from Nijmegen, because people are enthusiastic about like the Nijmegen, also challenge, and some people are really like keen to us afterwards</i>		
	<i>they are related in our projects that we do. They are also related, they are involved, I mean, involve, in the circular economy project. There is always one person from the government seating</i>					

	Local				Trans-local	
	With governmental bodies	With academic institutions	With businesses	With communities	With non-governmental organisations	With semi-governmental groups/platforms
	<i>there.</i>					
	<i>the local government offers to put it on their website, like their internal website, where all the people that work there are go to in the morning when they like sign and start up. So we had, I think, the thirty people from the gemeente involved in the first round, the first challenge.</i>					
I4		<i>from the new business models, this, this, Jon Jonker.. That's also what he writes and what he investigates it's very, inspiring.</i>	<i>what's going on in the 3D printing</i>	<i>there is an afval challenge.</i>		
		<i>there is a psychology here in the university. We are thinking about, making testing and experimenting, on the sustainability or waste subject with this knowledge.</i>	<i>and now this bakery, sells these bags to customers. So it's a slow change.</i>			
I5			<i>I joint a project in Venlo, which was</i>			<i>And another start-up you are, of course, like the</i>

	Local				Trans-local	
	With governmental bodies	With academic institutions	With businesses	With communities	With non-governmental organisations	With semi-governmental groups/platforms
			<i>called Venlo Circular Challenge. We basically competed in groups of a three, four actually. We had a business case. And we were just asked to create a circular solution for this business case.</i>			<i>Groene Brein, I am not sure if you heard of them. They also like semi-public organisation, And they are also like, the major promoter of the circular economy in Nijmegen at least.</i>
				<i>There are more local initiatives, Lokaliteiten Kabinet, which are also about waste of course.</i>	<i>And of course Metabolic, they are really like cooperate, and they really approach the companies and just try to, tackle their problems, like the problems they face right now, in the overall transition.</i>	<i>You have like some main players in the Nijmegen, and het Groene Brein</i>
			<i>there is a lot of initiatives to, hmm, make more like, efficient use of networks.</i>			
	<i>So the key is, especially for the government, they have to organise events. You have to organise events so that people can meet, share their experiences, and just cooperate.</i>		<i>Because you know the circular economy is all about being inclusive, like the companies have to be inclusive, have to cooperate. Because</i>			

	Local				Trans-local	
	With governmental bodies	With academic institutions	With businesses	With communities	With non-governmental organisations	With semi-governmental groups/platforms
			<i>you need each other, in this overall transition</i>			
I6	<i>we are daily dealing with this problem, so we know very much. And more even than the municipalities. And, therefore, we are also the adviser for the municipalities. We support the municipalities thinking out the policies.</i>			<i>I know there are about fifteen challenges going on this moment. I know that we, at least four of them, we are involved.</i>	<i>we, rely sometimes on them. There's a, one organisation in Holland. It's called Milieucentraal.</i>	<i>we have an, a branch, hmm, organisation, the NVRD, which is very important for us. Because all the public, hmm, organisation who deal with household waste collection, and hmm, but even also the, all the, the municipality, they can be member of this branch. And we share a lot of knowledge, and share a lot of, hmm, things we have in common. We share there. And that's our reliable partner for us.</i>
	<i>we have a good cooperation.</i>			<i>when we can support them, we will do. But we have on this, particular actions, we have said we will, we supporting, but not, we are not the ones who should trigger or should be the, be the puller.</i>		
	<i>DAR was, in early days we were one, hmm, we</i>			<i>we support by, hmm, giving knowledge, hmm, by</i>		

	Local				Trans-local	
	With governmental bodies	With academic institutions	With businesses	With communities	With non-governmental organisations	With semi-governmental groups/platforms
	were..Nijmegen was our own boss, our owner. In 2000, we were separated from the organisation of Nijmegen. We were, became one, hmm, company.			participating in discussions.		
	<i>the municipalities. It was for us very important to know, hmm, what the municipalities expect from us. Because when you try to organise circular economy, and, at this start, it can be possible that things become more expensive. WWe had a long discussion with the municipalities to be sure that they want to do as what we are doing now.</i>					
17		I've a conversation with the RadboudUMC, and also HAN, the hogeschool.	I am trying to get a conversation with ARN as well. But I need more companies who will willing to buy this product, so that this	Well, I've been to the green, hmm, how do you call it? Nijmegen won the green capital award, right? Yeah, I went to the first meeting. So I have a lot of conversation with a lot of		

	Local				Trans-local	
	With governmental bodies	With academic institutions	With businesses	With communities	With non-governmental organisations	With semi-governmental groups/platforms
			<i>product can be really success in the future</i>	<i>people over there.</i>		
	<i>also province Gelderland</i>		<i>I did find a chance to have a conversation with LUX, the cinema,</i>			

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Theme 2-3: The circular actors' expectation for the future

	Awareness raising	Recycle and separation enhancing	Producers collaboration	Legislation	Financial schemes	Ownership issue	Active government	Businesses revenue model, knowledge support
I1		try to get more plastic to be recycled.	of course, the, the, go more into contact with the company that deliver us the, the plastic. And, trying to convince people not to use more plastic.	we need better legislation. That's not a popular subject, but.., strict legislation. Just not allow to use plastic bags.	(The financial institutes) They have to invest in companies.	let's say, ownership. Ownership, that's, that's very complicated concept.		
			It's in the hospital. Plastic. Patients get, err.., infusion? And they are used only once. They can't be recycled very good, because it consists different kinds of plastic.	And the law needs to be sharp.		So what we want is that the deliverer remains the owner of these plastic things around the bottle. But the deliverer says, no, I sold you this. This all yours now.		
			So we should enter the discussion with the deliveries, delivered companies. But they are very big, multi-companies, that deliver these things, all over the			That's, very important to, err, to re-frame the concept of ownership.		

	Awareness raising	Recycle and separation enhancing	Producers collaboration	Legislation	Financial schemes	Ownership issue	Active government	Businesses revenue model, knowledge support
			<i>world. So, it's quite a challenge to get them to produce different kinds of these bags.</i>					
			<i>We need the deliverers to change the processes. So that's the factories.</i>					
			<i>The companies would deliver things to us, as have a better, err, production process.</i>					
			<i>get more people involved. That's what we can do.</i>					
I2	<i>That awareness I want to all my employees, err, to have all, think about that. People, can make difference.</i>			<i>I think you may need space from the policy. You have to do your own projects. And they must, hmm, support you instead of all rules.</i>				
I3	<i>I keep doing. Nijmegen afval</i>			<i>Strict policies, yes, please. But</i>				

	Awareness raising	Recycle and separation enhancing	Producers collaboration	Legislation	Financial schemes	Ownership issue	Active government	Businesses revenue model, knowledge support
	<i>challenges until 2018.</i>			<i>I think strict policies for only Nijmegen in packaging, is difficult.</i>				
I4	--	--	--	--	--	--	--	--
I5				<i>So maybe have like, hmm, if it's possible, but again it's probably not from the legal perspective. Maybe like zones, in which becomes easier for companies to actually experiment in this transition.</i>	<i>I, personally, believe the government has to introduce an investment fund.</i>		<i>What I hope we need is for the government to be more active</i>	<i>we need models of revenue for the companies to make it financially attractive.</i>
					<i>you have to introduce more, subsidies. That's basically not yet.</i>			<i>if we have these models of revenue, which actually make it on the whole term more attractive to make the transition to the circular</i>

	Awareness raising	Recycle and separation enhancing	Producers collaboration	Legislation	Financial schemes	Ownership issue	Active government	Businesses revenue model, knowledge support
								economy
								<i>To actively help the companies to look for new models of revenue.</i>
I6			<i>the big change then comes to plastic recycling have to come from the producers. Hmm, and I hope there will come some change, the way that the producers will use more, well-defined plastics.</i>					
			<i>The producers should see it, take that responsibility, and try to design for recycling, and try to make packaging not only recyclable but maybe also reusable.</i>					
I7			<i>And if I could talk with them, explain</i>		<i>for the short term, subsidies</i>			

	Awareness raising	Recycle and separation enhancing	Producers collaboration	Legislation	Financial schemes	Ownership issue	Active government	Businesses revenue model, knowledge support
			<i>them what I am doing, for Nijmegen as well, maybe then I can get support. First, I have to find the, those people. I have to cooperate with them.</i>					

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Theme 3-1: The circular niche development

	Environmental awareness		European Green Capital	Challenges			
	Citizens	Politics spectrum		Chain stores	Packaging design	Financial difficulties	Role of consumers
I1	<i>environmental issues, everybody knows about them at a certain level, in all the Holland. We all know about, waste, about energy problem, etc., about plastic.</i>						
	<i>People ask us: why can't we get those waste bins like in the library. People want this.</i>						
	<i>So there is always people who think, ohh, what a nonsense. But the majority, I think, wants to cooperate with this, and think it's a good idea. And that's not only the employees but also the students.</i>						
	<i>Awareness, there is enough awareness. I am sure that.</i>						
I2	<i>Everybody who spoke to us, they like the project. Everyone knows it's a problem, and you can do it. Err, you can help for</i>	<i>All the policies in Nijmegen, they, they are aware of this. We have a left, left wing, in the Nijmegen, so that</i>	<i>in Nijmegen there is a, a, big chance now, the European Green Capital is coming next year. And, the,</i>			<i>Yeah, for the walk of waste, we have a little, little, hmm, funding for Nijmegen.... The</i>	

	Environmental awareness		European Green Capital	Challenges			
	Citizens	Politics spectrum		Chain stores	Packaging design	Financial difficulties	Role of consumers
	<i>yourself.</i>	<i>helps. They are more aware of the, of the environment and the meier and sort of things.</i>	<i>the, the mayor and the board of Nijmegen, they do a lot of, try to inspire a lot of citizens in Nijmegen to do something.</i>			<i>city of Nijmegen, they paid in material not in money.</i>	
	<i>I think in Hollands everybody is aware of the problem.</i>		<i>there is a great opportunity in Nijmegen for the European Green Capital. You see a lot of citizens are activated by this.</i>			<i>And not, err, not the funding out of Nederlands. No. We tried, but it's difficult.</i>	
						<i>a big ocean, but there are a lot of fish. They want money. That's more, it's difficult.</i>	
I3	<i>People are aware of the problem, not everyone but at least a few.</i>	<i>I think that Nijmegen is quite a left-wing city, which makes people open and influenced by environmental reasons.</i>		<i>But then the problem is, I think, for example, supermarkets, they are not from Nijmegen.</i>			<i>small companies that work with circular economy products. But people have to buy it. Because otherwise those stores will like not</i>

	Environmental awareness		European Green Capital	Challenges			
	Citizens	Politics spectrum		Chain stores	Packaging design	Financial difficulties	Role of consumers
							<i>sell, and have to close eventually.</i>
	<i>Some people have the awareness, but it's far away... There is a long distance. Yeah. I think that's one of the, that's, that's a problem. Because in the end, like circular economy and everything, why do, why we want that? Because the earth is, like, slowly dying. You see that, people, people need to make that link.</i>			<i>They are everywhere. So just one supermarket, I mean, maybe they can look at what they buy, but it's, it's already decided what they have there.</i>			<i>People need to start thinking. So, maybe if you give them like two options, they have to think.</i>
	<i>I think that the citizens of Nijmegen, at this moment, don't see that it can bring them something. They more look like it's kind of costing me something.</i>			<i>For only specific to packaging, I think we can do a lot, but still Just a big company which is in every city. And we can ask local, we can ask local shops.</i>			
	<i>I think they have an environmental awareness. But on a basic level, more than the.. For example, the countryside.</i>						
I4	<i>And I see when I go to the market at Saturday</i>			<i>but in the large supermarkets, it's a,</i>			

	Environmental awareness		European Green Capital	Challenges			
	Citizens	Politics spectrum		Chain stores	Packaging design	Financial difficulties	Role of consumers
	<i>morning to buy food and vegetables, that's more and more people bring their own bags for the guy.</i>			<i>it's a, it's a long way to make some change.</i>			
				<i>They say that's what the consumer wants. The consumers want cucumbers in plastic, consumers want cookies three times packaged.</i>			
I5		<i>we just mentioned, err, the area here is really pro-green.</i>	<i>especially from the perspective of marketing, I would say. It's, it's, of course really good, because you can actively like profile Nijmegen as being green. You know, to the Europe, which might in turn attract green investors, to Nijmegen.</i>				
I6	<i>Nijmegen and the region about, we are keen to participate in this pilots.</i>	<i>The colour of our policies. How do you call this? The, hmm, there is a, at least, in Nijmegen, hmm, all awareness of,</i>	<i>2008 Nijmegen is green capital of Europe. There are a lot of initiatives on this moment to make Nijmegen at that, in</i>		<i>there are many problems not solved yet. The little trays, where are the, hmm, the, trays for meat, for</i>		

	Environmental awareness		European Green Capital	Challenges			
	Citizens	Politics spectrum		Chain stores	Packaging design	Financial difficulties	Role of consumers
		environmental problems, in the, hmm, the citizens, but therefore also in the, in the government.	this year, very, hmm, make clear that Nijmegen has a lot to do with circular economy.		example. They are difficult to be recycled. So they don't have way, they are still looking for a way to recycle this.		
	then you can see there are both a lot, a long time awareness, we have to do something in this.				they are co-layers, those like that. The co-layers are very bad, because they cannot be separated from them.		
	Nijmegen and the region were very keen to do this. There are other cities and other regions in Holland, which waited, and waited, and waited long time. You know in this region, we were make good, good steps, and we came further and further, while other regions still, still waiting.						
I7	--	--	--	--	--	--	--

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Theme 3-2: The institutional structures

	Policies/competency of the local government	Financial resources			
		Funding for projects	Subsidies	Investment fund	Financial institutes
I1		<i>But they are expensive. It's eight hundred euros for one (special bins).</i>			<i>very different kinds of people are aware of the problem. Not only the activists. Now it is more people, also financial people, also people from the government.</i>
		<i>No, there is no real funding. Hmm, so these waste bins, eight hundred euros, there is no funding for that.</i>			
I2	<i>I did a lot of talking to the city of Nijmegen. A lot of people, that a lot of different people to, err, get them attention about walk of waste. It costs me one year, I think. The city could be more, err, cooperate and faster to the citizen, I think.</i>				
	<i>Because they said what you want to do, no, we must first think what we do about the Waal. What we want to do there, stop with this. That costs a lot of efforts to convince them that's a good idea. So, that's, it's, hmm, yeah. How do you call that? Err, bureaucratic?</i>				
	<i>they have a lot of rules. Because you go first, and, and, oh, I am not the people, the person. You</i>				

	Policies/competency of the local government	Financial resources			
		Funding for projects	Subsidies	Investment fund	Financial institutes
	<i>must talking, talk to this, a lot of, hmm, people who.. Not only one who can make a decision.</i>				
I3	<i>we have the VANG, from waste to resources.</i>				
	<i>This is from the national government. But, so the local government gonna have to like, kind of things.. The national government has a programme in which they trying to help the companies.</i>				
	<i>Nijmegen has a really green vision</i>				
I4		<i>They have idea competition, for instance. So there is no place for your idea, or something like that. So, yeah, then I, oh, yeah, too bad. And I go further.</i>			<i>but banks they don't, err.., it's terrible how they act now.</i>
I5				<i>I, personally, believe the government has to introduce an investment fund, which companies can safe from, which company can use. Well, that's basically not happening so far.</i>	
I6	<i>but the local legislation is just following the national. It's not, we cannot say that this region,</i>				

	Policies/competency of the local government	Financial resources			
		Funding for projects	Subsidies	Investment fund	Financial institutes
	<i>or anywhere else in Holland, the legislation on the local, hmm, the local legislation will go further, more consequences, then the national.</i>				
	<i>the national government has also, to take actions and this legislation, which helps us to do what we are doing, and even also European.</i>				
	<i>the national government has claim that the municipalities should reach the point 100 kilo per inhabitant waste, in 2020 or 2025. This region we are already on this point. Almost. But still it's support us. When you come this point, the, what they called VANG, doelstellingen, they are the goals for the VANG</i>				
	<i>When the national government has claimed this, this goals, hmm, it's supporting us to go on the way we are going.</i>				
I7			<i>It's so difficult to find it, because there are so many different websites.</i>		

Note: I8 and I9 interviews are confidential so that the transcripts and coding process will not be disclosed in this appendix.