

The Hague, 25 February 2014

# ***Facilitating space for innovation***

SHIFTING COALITIONS, CHANGING FRAMES AND FACILITATING INNOVATION  
PROCESSES IN THREE BIOPOLYMER PACKAGING INNOVATION CASES



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Name student: Koen van Swam  
Student number: 880513-818-080  
E-mail: [koen.vanswam@wur.nl](mailto:koen.vanswam@wur.nl)  
Telephone: +31 (0) 65 352 60 89

MSc Thesis Communication and Innovation Studies  
Knowledge, Technology and Innovation Chair Group  
Wageningen University Social Sciences Group

**Supervisors Wageningen UR:**

Prof. Dr. Ir. Cees Leeuwis  
Chair holder of Knowledge, Technology and Innovation Chair Group  
Wageningen University Social Sciences

Ir. Christiaan Bolck  
Programme Manager Biobased Performance Materials  
Wageningen UR Food & Biobased Research

**Supervisors Schuttelaar & Partners:**

Hylke Brunt MSc  
Advisor Technology & Society

Alexander Duyndam PhD  
Senior Advisor Technology & Society

Schuttelaar & Partners  
[www.schuttelaar.nl](http://www.schuttelaar.nl)

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## **Abstract**

Increasing demand for natural resources, depletion of fossil fuel sources, and increased pollution are problems that require new ways of thinking and acting. The biobased economy is a concept that uses resources as building blocks for renewable materials and energy sources. Innovation is the driving force behind this development. Communicative strategies can be used to enhance innovation processes for improved results. This study strives to contribute to effective innovation processes as a part of working towards the biobased economy.

The goal of this research was to study how facilitation strategies contribute to effective innovation. The aim was to analyze how facilitation strategies are currently being used to enhance innovation processes. This research analyzed three cross sector innovation cases related to biobased packaging with different sizes, compositions and phase of innovation. Multiple semi-structured interviews were performed to reconstruct the three innovation process histories. The study firstly looked at dynamics in network composition and frames. Secondly the research analyzed the role of facilitation strategies in those dynamics. Thirdly the three cases were compared with each other.

The research showed that the networks, groups and coalitions in the three cases were not static entities. The frames of players in the cases changed within each phase of innovation. In many cases facilitation strategies were (not deliberately) applied during critical moments. Multiple cases displayed the influence of facilitation strategies on coalition formation and frames.

This means that the (deliberate) performance of facilitation strategies influenced both network composition and frames. It served as an important dimension of innovation, deliberately organized or not. From this study it can be concluded that facilitation strategies can be a meaningful instrument to contribute to effective innovation.

The research recommends innovation parties to put efforts in deliberate facilitation of innovation processes and also to further enhance reflexivity by commissioning an (external) monitor as part of the group.

**Keywords:** biopolymers; biobased economy; innovation processes; network coalitions; framing; facilitation strategies; communication; monitoring.



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# 1. Introduction

*This chapter describes a brief history and context in which the research takes place. It presents the concept of 'biobased economy' and the potential for biopolymer packaging materials related to this new green economy in the Netherlands.*

*In the second chapter processes are analyzed regarding the biobased economy and innovation of the packaging value chain, the chapter ends with a problem statement. Chapter 3 outlines the theoretical framework that will be used to tackle the problem stated. In chapter 4 the methodology is described and the research questions are formulated. In chapter 5, 6 and 7 the cases are reconstructed and analyzed, followed by a comparative analysis and discussion in chapter 8. The conclusions, recommendations and reflections are presented in chapter 9.*

## 1.1. New problems and new solutions

Increased demand for natural resources, decreased fossil fuel sources, pollution and indirect land use are problematic issues. The increased CO<sub>2</sub> and NO<sub>x</sub> concentrations in the atmosphere result in climate change. Conflicts lead to radical stock changes in oil. A growing amount of waste on land and in oceans places a burden on generations to come. The amount of stakeholders involved in these issues: farmers, governments, companies, consumers, etcetera and the disagreement between them makes the problems increasingly complex. These wicked problems have a cause-effect relation that is difficult if not impossible to define and require collective action (Dentoni, Hospes et al. 2012). New technologies, concepts and perceptions are crucial for facilitating change processes and transitions (Dewulf and Bouwen 2012). Working towards a biobased economy is one example of a transition. Steps are made in the production biobased plastics for packaging materials, but some of these innovation receive harsh criticism by environmental organizations (Resch and Elander 2011) and have difficulty landing in market places. So, it's not only the technical component but also the social and communicative component that can make the difference in these types of innovations. These challenges require new problem solving methods for production and consumption habits (van Mierlo, Arkesteijn et al. 2010). The way institutions, companies and citizens deal with these problems and create solutions is important to realize effective change.

## 1.2. The biobased economy

The biobased economy is a concept that uses renewable resources as building blocks for materials and energy. The environmental benefits of this economy are currently debated. The biobased economy competes with the current petro-chemical economy which uses (non-renewable) crude oil for building blocks. In the biobased economy recycling, re-using and

zero-waste are exemplary concepts that upgrade waste to input for production. Renewable products can replace fossil and chemical materials. Four main drivers can be classified for the biobased economy. Those are environmental, commercial, social and political drivers. Consumers are becoming more aware of sustainability. Recycling and valorizing (former) waste to new building blocks lowers the environmental burden. Commercial drivers are branding, corporate social responsibility and sales. Social drivers are the attitude of citizens-consumers on sustainability and the importance of transparency and specifications of biobased materials. Political drivers relate to energy independence during times of conflict and existing interests in the oil and energy sector. Creating a biobased economy is a transition towards a more sustainable economy. This is done through innovation, and to improve innovation processes there is a need to facilitate space for innovation.

### 1.3. Packaging

Product safety, conservation, transport, disposal and recycling are important considerations of packaging. In the biobased economy, production materials are renewable and (green) waste is valorized to input material. The packaging of (non-)food products is an exemplary industry that can contribute in the transition to the biobased economy. The packaging industry is not a stand-alone sector, but has interdependencies with resource supplies (oil, paper or plant materials), product design and safety, transport, retail and consumer demand. This interconnectedness makes innovation related biobased packaging a multi-stakeholder affair. Multiple sectors and organizations need to work together (producers, brand owners, waste disposal, etc.). And therefore innovation of packaging products requires a multi-stakeholder approach for a successful transition. New biopolymer production processes using starch and lactic acids outline only a few possibilities that are utilized at the moment (Bolck, Ravenstijn et al. 2012). Waste disposal and production companies join value chains, biobased materials are added, moving towards the biobased economy. So, the renewable biopolymer value chain exists in a diversity of aspects and is depending on a multitude of sectors and levels (from local to international), see figure 1.

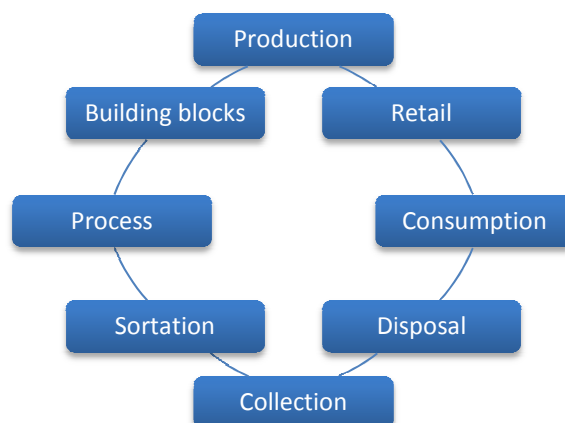


Figure 1: Simplified value chain of renewable biopolymers (Adapted from: van Raak 2013)

#### 1.4. Biobased packaging: an emerging market

From 2009 to 2016 the production of bioplastics based on starch, sugar and cellulose is predicted to increase 600%. A trend which should result in a yearly increase of 75% (VNCI 2009). Starting from 23 metric tons of bioplastics in 2009 the worldwide volume is expected to rise to more than 5,000 metric tons in 2016 (European Bioplastics 2012, AMRO 2013).

In 2010, the materials that are used for packaging, mostly paper, cardboard and plastic have a market volume of 400 million tons of paper and cardboard and 250 million tons of plastics (Bolck, Ravenstijn et al. 2012). The potential for substitution by biobased materials is around 85 and 90% (Bolck, Ravenstijn et al. 2012). Biobased packaging solutions have already been created using PLA (poly lactic acid), biobased poly ethylene (Bio PE), Poly ethylene furan carboxylic acid (PEF) and cardboard (Bolck, Ravenstijn et al. 2012).

Mostly large brand owners, such as Danone, Heinz and Coca-Cola, seem willing to pay higher prices for environmental friendly packaging (Bolck, Ravenstijn et al. 2012). Expectations are that retailers shall also decrease their focus on packaging product functionality (e.g. user friendly dosage system) and expand their views towards the production process and materials (AMRO 2013). Together, these trends, the increased consumption and the development of 1-bite snacks in the Netherlands will increase production of packaging materials (AMRO 2013).

The described possibilities and expected dynamics of the (biobased) packaging market outline legitimate opportunities for stakeholders in the field of packaging to take steps towards the biobased economy by using innovations in the production, use and waste disposal of packaging materials.

#### 1.5. Biobased packaging innovations

In the Netherlands, packaging is making steps towards the transition to the biobased economy. In the last five years several technologies have been developed. A public private partnerships is the project of technology foundation STW that has made bioplastic from industrial (chocolate) waste water (Rasenberg 2013). This project functions with significant (financial) support of the Dutch government because of their research focus. Together with the use of innovation intermediaries (Klerkx and Leeuwis 2008, Klerkx and Leeuwis 2009, Klerkx, Aarts et al. 2010, Klerkx, Schut et al. 2012), such as technology



Figure 2: Infographic Plant Bottle of Coca-Cola (TCCC 2011)

foundation STW, the Dutch government is aiming to facilitate innovation processes.

Companies are developing new products or creating new markets by collaborating with other companies or institutions in the packaging value chain. Global brand owner Coca-Cola and Dutch technology company Avantium are working together to research the possibilities of PEF as a building block for plastic bottles (Avantium 2011). Previous steps of the beverage giant was the Plant Bottle with 22% of renewable input (also see Figure 2).

These initiatives have the intention to innovate the existing value chain. Not all projects are successful in taking the obstacles (sustainability, safety, supply, etc.). The ability to perform effective cooperation is essential in taking steps towards the biobased economy. This ability is not present in all innovation cases. One reason for this is the changing of roles of companies in the value chain.

## 2. Problem statement

*Networks with diverse compositions are innovating towards a more sustainable packaging value chain. During innovation processes networks meet several challenges. Biobased packaging is competing with the existing oil based types of packaging. External obstacles arise such as legislation and the market preferences. Also internal challenges need to be tackled by actors in the networks such as problem articulation and trust. The role of communication is essential -connect players, translate technology and share ideas- to take opportunities. The problem statement and preliminary research question result from this analysis.*

### 2.1. The communicative challenges in innovation processes

To innovate towards a biobased economy is a complex challenge. The envisioned innovation is not just a product but it consists of a complete (new) value chain. Successfully working towards this type of innovation requires capacities related to technology, finance, logistics and process management. Working together with different types of actors is seen as key to successful innovation (Klerkx and Leeuwis 2009). This is also visible in the different innovation groups of biobased packaging (brand owners, producers and knowledge institutions). The compositions of biobased packaging networks are divers. It seems that there is no standard composition. Another important aspect of these networks is the lead position (Klerkx and Aarts 2013). Composition of innovation coalitions are the starting point for innovation to enable biobased packaging. Leeuwis (2013) also refers to this social and compositional aspect as follows:

*“innovation is in many ways a social struggle, whereby the success of initiatives for change depends on in part on the social strength of the support network or coalition that proponents of particular technical and socio-institutional solutions manage to forge.” (Leeuwis 2013, p. 18).*

The activities that networks perform are important to reach their goal of biobased packaging. Biobased packaging networks can perform several strategies to communicate during the innovation process. In the agricultural sector many research has been done which concluded that three strategies to facilitate communication are essential: articulation of problems and possibilities, network building and support of social learning and negotiation (Klerkx, Schut et al. 2012). Klerkx, Schut et al. (2012) clearly state that these strategies are relevant for other multi-disciplinary innovation networks. This means that biobased initiatives can learn from this knowledge. Facilitation strategies are used -deliberately or not- by networks to enhance

innovation processes. This is done through communication that in turn helps to avoid obstacles or tackle them, creating space for innovation.

Actors look upon problems, solutions and relationships in certain ways. If there is internal controversy about what the problem is that these groups want to solve, it can be difficult to keep moving forward. Sharing, adjusting and developing these perceptions between actors can create more space to align goals and perceptions and to tackle obstacles.

*If and how networks facilitate innovation processes is not clear,  
also the results of these strategies are unclear.*

Researching the influence of facilitation strategies on the innovation processes, can show biobased packaging networks what the results of their practices are. This research wants to improve the results innovation processes and deliver new empirical case studies for scientific research. The preliminary research question of this thesis is:

*What is the relation between (the use) of facilitation strategies and the  
influence on the development of innovation processes?*

The first step is to reconstruct the innovation processes and analyze whether facilitation strategies are used. This is followed by the analysis if strategies are enhancing innovation processes regarding biobased packaging for a biobased economy. The problem and question stated above are translated into a theoretical and analytical framework in the following chapter.



### 3. Theoretical framework

*This chapter elaborates the theories and concepts using a multi-level perspective. Three theories related to network composition, facilitation strategies and frames are central, followed by the concepts. The perspective, theories and concepts are then integrated into a new analytical framework. The framework represents -the role of communication in- the innovation process, by researching the relation between network composition, facilitation strategies and frames.*

#### 3.1. Multi-level perspective and system innovation

The biobased packaging innovation networks are collaborations between a diversity of players who find themselves in a complex setting of social, economical, technological and physical arrangements. They aim to transform the current packaging value chain into a new and more sustainable biobased value chain, thereby competing with existing value chains and practices.

Geels (2002, 2004) uses a multi-level perspective to define analytical distinctions between systems and actors involved in those systems. He describes three levels within a system: niche, regime and landscape. Most innovations arise from technologies in the micro niche level created by niche players. Niches can be seen as incubator spaces for technologies and inventions. These technologies follow challenging paths from niche level to regime level, such as the transition from sail to steamboats described by Geels (2002). Other innovations are performed by actors present in the regime level, larger players with practices that are - already- aligned with other social, technological or institutional players. These regime players can also connect with niche players to create hybrid or new value chains. To cooperate effectively variety of meanings -goals and visions- should be reduced through negotiation which leads to coalition building (Geels and Schot 2007). These network coalitions can put items on the agenda (Negro and Hekkert 2008). The interactions within these networks can affect positions and relationships (Geels 2004) (e.g. abstention or drive of a player in the network). If networks have negotiated their visions and goals one can speak of 'coalition of the willing' (Leeuwis and Aarts 2011). Landscape dynamics can open and close windows of opportunities for innovation. These are related to e.g. sustainable consumer preferences, which has developed over a long time (15-30 years) (Geels 2002). Also, government legislation can be seen as landscape dynamics if it involves a large change in thinking or doing. The packaging market can be seen as a stable market which has existed for over 30 years.

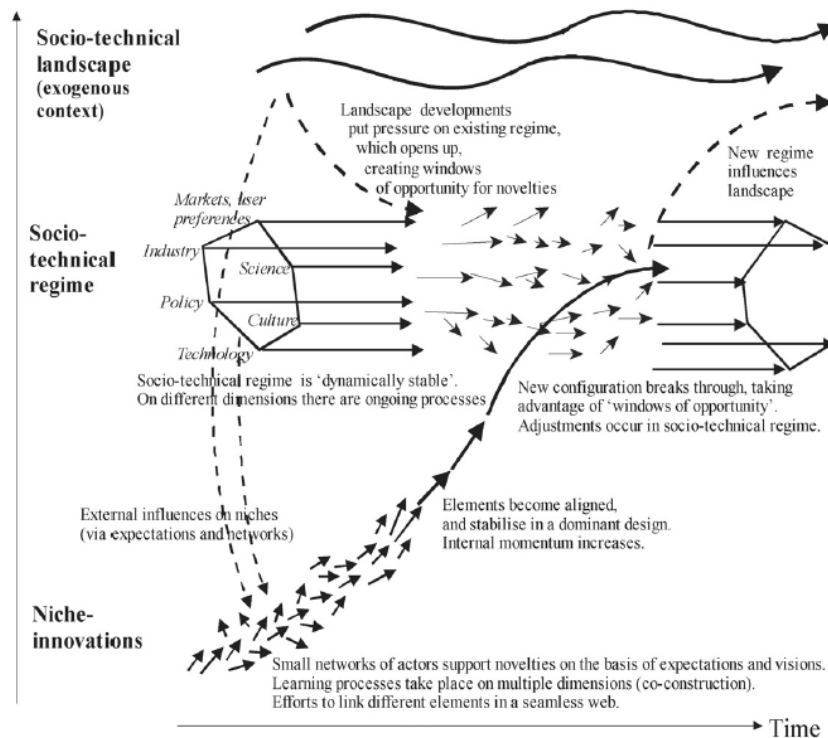


Figure 3: Multi level perspective on system innovation (Geels and Schot, 2007). From the low Niche level new technologies arise and are taken up to the middle regime level when elements (e.g. beliefs or physical characteristics) are aligned. The high Landscape dynamics put pressure on the existing regime and open up space for technological niches.

The types of paths of innovation within a system can arise or be intertwining with different levels. Also competing firms -with conflicting views or goals- on a regime level or new firms create different types of paths (Geels and Schot 2007). Sustainability is a major obstacle which isn't simple to tackle. CO<sub>2</sub>-footprints are difficult to research for new (pilot) technologies. Biobased production input can compete with food or has negative indirect landuse. Food security issues and certification is not yet present. These issues cannot be solved or framed without controversy (Dentoni, Hospes et al. 2012). This makes it difficult for new (bio)technologies to break through to those higher market levels (Geels 2002). The overthrowing of regimes is not only technological but also socially constructed (Geels and Schot 2007). Smith, Voß et al. (2010) refer to these socio-technical processes as system innovation:

*“the renewal of a whole set of networked supply chains, patterns of use and consumption, infrastructures, regulations, etc.”* (Smith, Voß et al. 2010, p. 439).

Biobased packaging networks want to achieve system innovation and cooperation is essential to tackle the challenging obstacles that come along with the innovation process.

### **3.2. Innovation networks: network coalitions**

Biobased packaging innovation networks have diverse compositions relating to numbers of actors, types of actors and governance. The composition of networks is conditional for system innovation, because the actors use strategies and perform activities to create space for innovation. The number of actors is straightforward, the other two aspects will be elaborated in this paragraph. As mentioned in the previous paragraph, these networks are dynamic coalitions with sometimes conflicting goals and views. So actors, their positions and the governance type can also change.

System innovation is a multi-organizational process in which actors can have different roles. Three different types of actors can be present in innovation trajectories according Klerkx and Aarts (2013): input/output stakeholders, enabling stakeholders and facilitating stakeholder. The first relates to actors which are producing the innovation as supplier or manufacturer. Enabling stakeholders represent actors which have influence related to policy, regulatory or advocacy. The third types of actors participate to enhance innovation activities (Weber and Rohracher 2012), such as the government intermediary Transforum (example see: (Klerkx, Hall et al. 2009, Klerkx and Leeuwis 2009). The interdependencies and (standardized) interaction patterns can constrain or facilitate innovation (Leeuwis and Aarts 2011).

The management of innovation trajectories is referred to as leadership, network governance or orchestration (Provan and Kenis 2008, Klerkx and Aarts 2013). Three types of governance are described by Klerkx and Aarts as: participant governed, one lead organization and a separate independent (network administrative) organization. Participant governed is a shared leadership position by all participants in the network. If an actor has a central role this is a lead organization. The third modality is an independent organization which is impartial. The three types are not mutually exclusive, so subsets can be present in networks. Three dimensions can be described, horizontal and vertical relationships, centralized and decentralized organization/interaction and formal and informal positions (Provan and Kenis 2008).

### **3.3. Enhancing innovation processes through communication: facilitation strategies**

Networks can enhance innovation processes through communication and organizing activities. Networks can use facilitation strategies to perform such activities. Facilitation strategies regarding three innovation processes are essential for change and innovation: articulation of problems and possibilities, network building and support social learning and negotiation (Leeuwis and Aarts 2011, Klerkx, Schut et al. 2012, Sol, Beers et al. 2013). In table 1 an overview is given of innovation processes and examples of related activities.

Articulation of problems and possibilities	Network building	Dealing with power and conflict: social learning and negotiation
Demonstrate and visualize interdependencies among stakeholder practices	Make an inventory of existing initiatives, complemented with stakeholder analysis	Identify and propose process facilitators who are credible and trusted by the stakeholders involved
Explore and exchange stakeholder perspectives (values, problems, aspirations, context, etc.) through discussion, role playing, dramatization, visits, filmed interviews, informality, humor, fun, etc.	Build on existing initiatives for change and the networks around them  Arrange contact between disconnected networks who may have compatible interests (e.g. consumers and producers)	Work towards process agreements including dealing with media, mandates, etc.  Probe to explicate the interests and fears that underlie mobilized arguments and counter-arguments
Visualize invisible biophysical processes with the help of discovery learning tools, or situation	Work towards 'coalitions of the willing' and exclude actors who do not feel independent	Steer collaborative research activities to questions relevant to less resourceful stakeholders
Explore past and current trends and likely futures if nothing changes		Make stakeholders talk in term of proposals and counter-proposals
Use visioning tools and scenario analysis to imagine (and find common ground on) possible futures		Ensure regular communication with constituents to take them along in the process
Discuss institutional and other influences that reinforce existing patterns/problems		Translate agreed-upon problems and solutions into storylines and symbols that are likely to resonate in society
Organize contact with others who have encountered and managed similar problems		Use media and lobby tactics to influence societal agendas and advocate solutions (with the help of storylines/symbols)
Elicit uncertainties that hinder change, and design collaborative investigation and experimentation to develop common starting points		Use practical actions and experiments as source of reflection and learning rather than organizing discussion and reflection only
Articulate knowledge and resource needs (e.g. funding, lobbying support) as well as where to get knowledge and resources		Organize regular reflection on process dynamics and satisfaction with outcomes

Table 1: Innovation processes and attributed facilitation strategies (adapted from: Klerkx, Schut et al. 2012, p. 54). The first row describes the innovation processes. The belonging columns show examples of facilitation

The first process relates to the exchange of perceptions and expectations of actors regarding problems and solutions. The second process is seen as the (re-)configuration of network relationships (Leeuwis and Aarts 2011) and actors own role within the network. The last process can be seen as a reflexive process that focuses on difference in power and dynamics of trust. Social learning is referred to according to the definition of Sol et al (2013):

*“an interactive and dynamic process in a multi-actor setting where knowledge is exchanged and where actors learn by interaction and co-create new knowledge in on-going interaction”* (Sol, Beers et al. 2013, p. 37).

Negotiation is related to the concept of power (who has knowledge?, what resources can be used?, what network connections do players have in a network?) and aligning the perceptions relating them by developing common goals and interests for the players of the innovation networks. Also conflicting views can be tackled through social learning or negotiation.

### **3.4. Building blocks to create space for innovation: frames**

Interaction between actors are micro-dynamics that are facilitated and framed (Weber and Rohracher 2012). Framing is a concept used in a wide array of disciplines such as sociology, psychology, communication and management. There are two main approaches to framing: cognitive frames are representations and schemes of how actors deal or perceive certain issues, relationships and interactions (Dewulf, Gray et al. 2009) and an interactional approach that sees frames as alignment of communication, which is negotiated, produced and reproduced in on-going interaction (Dewulf et al., 2009). The networks consist of actors that have interpersonal contacts. This relates to the quick and agile interactional approach, but the actors in innovation processes are also representatives of (larger) organizations that can work with long term strategies or policies. This makes perceptions of processes or specific issues more stable than perceived in the interactional approach to framing. Relating to this research uses a cognitive approach on framing.

Cognitive frames are not static. These frames can change with new insight or experiences. In turn, facilitation strategies can influence these frames. Changes in actors' perceptions of issues, relationships or trust can develop into dynamics in network coalitions. Actors can frame issues, identity and relationships and the process (Dewulf, Gray et al. 2009, Dewulf and Bouwen 2012). A distinction between the focus of the three types of frames is made in a range of literature. Issue frames refer to agenda items, events, problems or goals. Potential gain or loss can be attributed to one or more issues, these attributions can conflict with other's ethical standard or values. Sharing or negotiating perceptions of issues help to form coalitions (Geels 2004, Dewulf and Bouwen 2012). Identity and relationship frames refer to oneself and the relation with counterparts. Changes in the relationship

frames can also have impact on the network composition (Geels and Schot 2007, Sol, Beers et al. 2013). Process frames refer to interaction (meetings or discussions) (Geels 2004, Geels and Schot 2007, Schot and Geels 2008, Dewulf, Gray et al. 2009, Weber and Rohrer 2012, Sol, Beers et al. 2013). Process frames relate to how an actor perceives and deals with certain situations (e.g. conflicts) and plans (e.g. resolution or meetings). Power and trust have an important role in this. If an actor perceives another party as very powerful, the actor can adapt his interaction or approach to a certain process. Also trust can influence actors representation of a process or relation.

### 3.5. Analytical framework

The analytical framework consists of three aspects that influence each other in a dynamic manner. Depending on the type of governance, actors in the network can perform facilitation strategies. Second, facilitation strategies are activities that enhance innovation processes and change actors frames. Third and last are frames that are perceptions of issues, identity, relationships and processes. The frames can develop into dynamics of the network's composition.

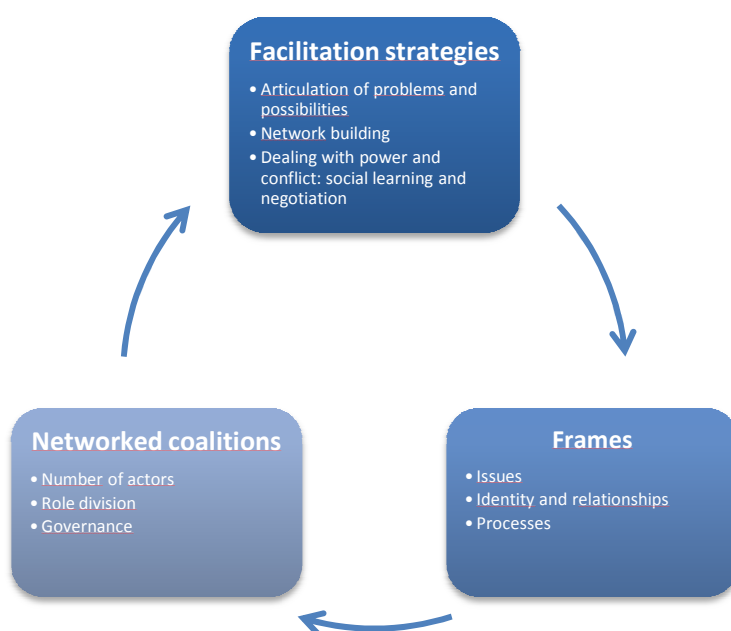


Figure 4: Analytical framework; network coalitions perform facilitation strategies, facilitation strategies (and belonging communication activities) impact frames, changes in frames have impact on coalitions.

#### A hypothetical example:

*Two friends want to go on a cycling holiday. The two friends would like to go with three persons because it would solve their package issues. The two friends ask their best friend, but the friend has a negative perception of cycling holidays. The two friends shoot a short movie that portrays their vision of a cycling holiday and what it contains. The best friend sees the movie and receives new information about what a cycling holiday is and what it entails. The best friend now would like to join the two others on a cycling holiday.*

The theories and concepts described are added to formulate the following research question and sub questions:

*How are facilitation strategies performed and enhancing innovation processes regarding biobased packaging?*

- How are biobased packaging innovation networks composed?
- How are actors framing issues, identity and relationships and processes?
- How are these networks performing facilitation strategies?
- How are facilitation strategies influencing network composition and frames?

## 4. Methodology

*This chapter explains the research methodology. First, the strategy, sample and unit of analysis is described. Second, the data collection is performed through a document analysis and interviews. Last, the development of the networks innovation process is analyzed to look at the role of communication. Although the methodology is presented in a linear way, the process is executed iterative.*

### 4.1. Strategy

The objective of the methodology is to gather qualitative data useful for analyzing the relationship between network composition, facilitation strategies and frames, through an interpretative multi-case study. The reason for a multi-case approach is comparability of the innovation processes. There is one main research question that is divided into five sub questions. To analyze and connect the three different components, multiple types of analysis are used. Networks are coalitions with three building blocks: number of actors, role division and type of governance. These will be investigated with a system analysis (Klerkx, Aarts et al. 2010, van Mierlo, Arkesteijn et al. 2010, Klerkx and Aarts 2013). Facilitation strategies are activities which are performed by networks to enhance innovation processes. These activities (e.g. agenda or brainstorm) will be determined through a document analysis. The results of those activities is interpretable using a frame analysis. The main research question shall be answered using the information and analyses of the five sub question through a comparative analysis.

### 4.2. Sample

A combination of a judgment sampling, where the most productive sample to answer a research questions is actively chosen (with the use of supervisors), and a theoretical sampling, where the sample is chosen iteratively to fit the research. The unit of analysis is the dynamic of a networks innovation process. Three elements will be observed: the network, the facilitation strategies and frames. The goal is to compare dynamics and the influence of facilitation strategies. Three distinct projects are approached to function as data source. All of the cases have been working on several phases of biobased packaging innovations. The three networks are chosen to be diverse: by size, effectiveness and place in the value chain. One case focused on technological development, a second works with a developed material and a third works with parallel development of technology and market mainstreaming. The projects have three different sizes, small (pilot plant), medium (retailer-market) and large (international-value chain) scale. All cases work with multiple organizations and are building towards the biobased economy. The projects are at least active since 2008. Together this makes the cases diverse and comparable to answer the research question.



#### 4.2.1. *Case 1: Biopolymer Food Packaging*

Bio4Pack is a bioplastics producer that is retailer focused on compostable and sustainable packaging. Their production chain is internally organized through collaboration with mother- daughter and sister organizations. Since 2009 Bio4Pack can be seen as a full service bioplastic company with ten years of experience. Current steps focus on creating relations with large retailers. One of their partners is the PLA producer NatureWorks. NatureWorks is one of the larger bioplastic producers in the world. The company works in cooperation with large brand owners, convertors and retailers.

#### 4.2.2. *Case 2: Plant Bottle of Coca-Cola*

Coca Cola is a large and well known brand owner that is working together with their own R&D department or independent research companies such as Avantium to develop biobased packaging innovations. One product, with relation to supply, production and demand, is the Plant Bottle of Coca-Cola. The Plant Bottle uses up to 30% of plant material for biological ethylene building blocks. In the future Coca-Cola wants a Plant Bottle 2.0 that is completely made from PEF. This material is made from renewable materials and developed by partners such as R&D company Avantium.

#### 4.2.3. *Case 3: From Waste to Biobased*

Waste disposal company Attero has recently stated that it wants to produce bioplastics (DVHN 2013). Next year Attero will start together with Paques and TU Delft using a pilot installation, with the prospect of commercialization within three to four years. The reason for their steps are new fermentation techniques that make it possible to use organic waste for the production of bioplastics and recycling. The three companies have expanded the project with back end partner, Novamont and Gemeente Venlo. Recently, they signed a Green Deal with the Dutch government to present their project.

### 4.3. **Data collection**

Two types of data collection are used to gather primary data: document analysis and semi-structured interviews. The thesis uses the document analysis to establish a base for activities performed in the networks (meetings, discussions, brainstorm). These documents are also used to retrieve composition details of the innovation networks. This will be done through the analysis of internal and external documents (websites, tweets, agendas, reports, etc).

The semi-structured interviews are used to attain data on the networks, activities and frames related to issues, identity and the process. Semi-structured interviews are used to compare themes and understand the context as well. A structured interview would give limited space to do this and an unstructured interview doesn't allow to compare cases properly. Through semi-structured interview it is possible to guide the interviewees to these themes. Next to this, semi-structured interviews increase the comparability of the



## 5. Case 1: Biopolymer Food Packaging

*The following three chapters (5, 6, and 7) describe each case. Each chapter will begin with a introduction of the players of the case, followed by a process history. The process history is divided into multiple episodes around critical events deducted from the interviews. After this part an analysis of the case is performed in more detail according to the analytical framework.*

*The Biopolymer Food Packaging case is the reconstruction of the development of a biopolymer food packaging material. Producers, compounders, a global food company, a retailer and technical companies play a role in the development of this innovation process. In this case Bio4Pack and NatureWorks are interviewed. The names of the retailers, food companies and technical companies are made anonymous to ensure privacy.*

### 5.1. Introducing the players

The Biopolymer Food Packaging case consists of seven key players. Bio4Pack is a small/medium size enterprise specialized in full service biopolymer packaging. Bio4Pack doesn't produce their own materials, it is a compounder with broad experience in the biopolymer packaging field. In this case Bio4Pack works with the PLA material of NatureWorks. NatureWorks is a large international producer of bioplastics. The company covers the production of biopolymer granulates and sheets. NatureWorks serves multiple markets, one of these consist of large brand owners. NatureWorks does support companies such as Bio4Pack in their business processes with food companies, retailers and smaller customers. The global food company in this case wanted to change their biological segment from an oil based packaging material to a renewable packaging material. The global food company has multiple clients to whom they sell their products. One of those clients is also a player in this case, the Dutch retailer. This player is positioned close to the end consumer and fits into the business-consumer segment. Next to the global food company, there is also an ECO food company. This company is focused on different types of retailers and customers compared to the global company. There is also an international NGO involved in this case. The NGO is approached to put their label on the biopolymer food packaging. The last players in this case are the technical companies. In this case there is a multitude of technical (additive) companies present, but in the process description they are described as one player, because they play a similar role.

Organization	Organizational background	Role
Bio4Pack	Small 'one stop shop' for sustainable packaging, through several partnerships with mother and sister organizations, Bio4Pack enables companies to be more sustainable using compostable bioplastic packaging materials.	Enabling stakeholder and Input/output stakeholder

NatureWorks	Large producer of renewable plastics. The company works in cooperation with large brand owners, converters and retailers.	Input / output stakeholder
Global Food Company	Large Food Company that works internationally, both working with 'non-biological' food products and biological food products.	Input / output stakeholder
Dutch Retailer	Retailer with partial ownership of packaging supply chain, retailer also functions as a brand owner for many of its products.	Input / output stakeholder
ECO food company	Medium size food company / retailer with focus on biological and ECO products.	Input / output stakeholder
NGO	International NGO that sometimes functions as Third Party Approval for products or projects.	Enabling stakeholder
Technical companies with bioplastic specialty	Companies related to technical aspects in the production chain of bioplastics, these are companies that build machines, deliver laminates, impact modifiers, etcetera.	Enabling stakeholder

Table 1: Description of the relevant organizations, backgrounds and roles of the Biopolymer Food Packaging case

## 5.2. Process history

The process begins with a small bioplastic producer/packaging company and a large international food company that find each other in their goal to realize biobased packaging. The interviews suggest that the global food company had the intention to use bioplastic instead of oil based plastic for their biological food packaging. Bio4Pack stated that it being a small company that works with biopolymers has a large business network. The two companies came together and first they set a goal: develop a renewable food packaging. Following this Bio4Pack started the development process. The interviewee mentioned that a completely new packaging had to be created. Bio4Pack used the PLA material of NatureWorks to work with. The packaging existed of three parts: a container, a foil and pad (to collect moist). Bio4Pack started developing the container using sheets of PLA. It was possible to make a container, but in the production process the material slivered. Bio4Pack stated that it brought this problem to NatureWorks, the producer of PLA. NatureWorks stated that the material itself wasn't easy to alter so adaptation needed to be made using additives. Bio4Pack went to a technical company to ask if they had additives Bio4Pack could use. The interviews suggest that the technical company didn't have an additive available, so it also needed to be developed. As stated by Bio4Pack the volume of material in this case wasn't enough to be profitable for the technical company. So it is suggested that it became for the technical company a matter of putting their confidence in the potential of the case. The technical company made the decision to develop the additive. According to the interviewees a second generation of containers was developed that met expectations. When the container was developed, Bio4Pack started developing the foil.

Bio4Pack stated that it came to the insight that the method that was used to make a foil was too expensive. It is suggested that this was the reason that the project was put on hold for some years. According to Bio4Pack it was possible to make a less expensive foil that could be used in the project at a later moment. In 2011, the last part of the packaging, the pad, was developed because a standard pad wouldn't fit the renewable aspects for the packaging. Bio4Pack went back to the technical company and they developed a pad that would meet the criteria. Now that all of the components were developed they needed to be brought together to form the complete packaging. The interviewee of Bio4Pack stated that this didn't happen overnight. Bio4Pack needed to research where problems came from, because there was a problem with the connection between the foil and the container. Bio4Pack went back to the technical company to ask for a new additive that would solve the problem. With the new additive added the problem was solved and the renewable packaging was finished.

So with the packaging finished Bio4Pack was ready to close the deal with the global food company. According to the interviewees, during the development process four of five partners of the global food company Bio4Pack was working with changed or left the company. Around 2012, the global food company organized a meeting to talk about the project with Bio4Pack. According to Bio4Pack they said that they wanted to completely change to the renewable packaging, instead of only their biological products segment. The volume of the biological products was too small to build a factory. So now, the global food company wanted to know what the costs would be of a complete switch. With this switch, it was now possible to add an extruder and other production adjustments that would make it more cost efficient. Also a label ('kiemplant logo') could be added to the material. Bio4Pack stated that it was now possible to make packaging cost neutral compared to the old process. The global food company would have exclusive rights to the process and material. Internal and external tests were performed to check everything for the last time. During this phase the food company had some financial difficulties. When Bio4Pack asked for a volume guarantee for a loan related to the project, the food company wasn't able to give this. The two companies went to the Dutch retailer to discuss if they wanted to use the renewable packaging. According to Bio4Pack the retailer said: "it sounded too good to be true" and thought that Bio4Pack was holding information back. In return Bio4Pack said that the contract with their current packagers would have to change to just one supplier and one supply chain. The retailer mentioned that they didn't have a sustainability strategy related to packaging. The interviews suggest that this was an important reason not to change to biopolymer packaging. Later the retailer asked Bio4Pack to provide the material with a Third Party Approval (TPA). Together with NatureWorks, the two made three appointments with a NGO. According to the interviews NatureWorks and Bio4Pack weren't able to have constructive contact because the issue wasn't relevant for the NGO at that time. So, it was not possible to have the NGO as TPA. Parallel to this, the food company stated that they would use the renewable packaging for their clients, and traded the rights of exclusivity with the volume guarantee with Bio4Pack. Sometime later, before

a meeting where Bio4Pack wanted to close the deal with the global food company, the company called. In this phone call, the global food company said they stepped out of the deal and the project. Interviews suggest that this came as a complete surprise for Bio4Pack. After the phone call, Bio4Pack contacted clients of the food company to make an inventory about what happened and why. Bio4Pack also discussed the possibilities of direct contract with those clients, but the packaging volumes would be too low to have an efficient packaging process.

Bio4Pack continued to have conversations with an ECO-retailer. The retailer wanted to have their plant based products in plant based packaging material. According to Bio4Pack, price wasn't a problem for the company, so volume wasn't a problem for Bio4Pack. Currently, the final touches are being made in the production process of packaging for the biological food company.

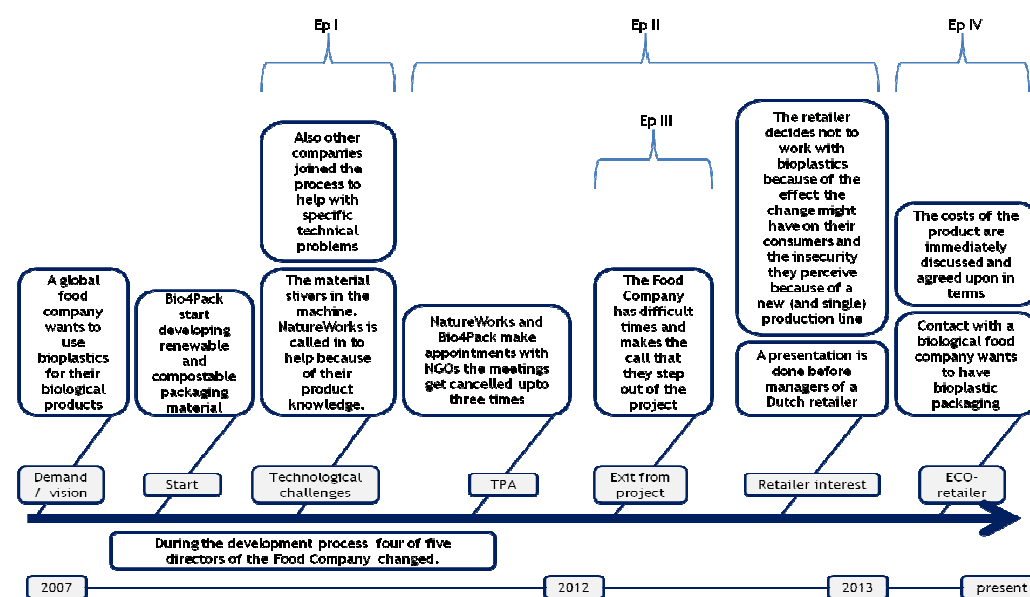


Figure 6: Timeline of Biopolymer Food Packaging case. Critical moments are described (grey fields) with short overview (white fields).

### 5.3. Episode I: Technological challenges

The first episode of this case describes the development of the food packaging product. The episode focuses on the critical moment 'Technological challenges'. The package is developed in three parts: first the container, second the foil and lastly the pad.

#### 5.3.1. Network coalitions

In this case companies worked together to develop a biobased food packaging. Bio4Pack had a leading role in the process and used its network to tackle challenges such as a missing additive for the development of the biopolymer container. The other companies join the effort when they were asked by Bio4Pack. The relations were already present between the companies, but the companies weren't constantly working together. This means it is not really possible to talk about a coalition as such. The relations can be seen

as a business network in which companies support each other in a development process that can lead to business opportunities.

### **5.3.2. Frames**

Technological issues and lack of knowledge are important issues in the development of the biopolymer packaging. With the development of the container Bio4Pack needed knowledge about the material to make further steps. The company attained this knowledge by asking NatureWorks for support. When Bio4Pack understood that the PLA material which they are working with needed an additive, the company went to a technical company that helped Bio4Pack with this. In the case of developing the foil, the process came to a halt because technology wasn't available or was too expensive.

Bio4Pack and NatureWorks had a specific business relation. Bio4Pack used the material of NatureWorks and NatureWorks supported Bio4Pack when it came to technical specifications of the PLA material. Bio4Pack framed the relation as being a partnership and NatureWorks framed it as being a normal relation. The relation between the global food company and the other two parties was mainly organized by Bio4Pack as a type of 'main contractor'. Bio4Pack presented itself as a connector and a facilitator of the development process. The role of the food company was to purchase the product once it had been developed.

### **5.3.3. Facilitation strategies**

In this episode Bio4Pack and the global food company shared their goals and interests in the start of the project. The problems encountered during development weren't explored by Bio4Pack or the global food company. When obstacles were encountered, Bio4Pack organized ad hoc contacts with other companies that knew more about the problem or had resources to solve this. In this way Bio4Pack was able to tackle issues by using his network.

## **5.4. Episode II: TPA - Retailer interest**

As a part of closing the deal, the retailer asked for a third party approval. Episode II describes the attempt by Bio4Pack and NatureWorks to get TPA of an international NGO.

### **5.4.1. Network coalitions**

Although the retailer asked for TPA, they didn't join Bio4Pack and NatureWorks in the effort to make an appointment with the NGO. Both Bio4Pack and NatureWorks wanted to close the deal with the retailer. To do so, the two companies needed a TPA and approached a NGO. In contradiction with the technical companies and the way how they were contacted, the NGO was not present in the network of Bio4Pack. The data of the interviews suggest that this made approaching the NGO successfully more difficult.

#### 5.4.2. Frames

The retailer mentioned that they don't had a strategy related to sustainable packaging. It can therefore be presumed that this wasn't an issue for the retailer. Later on the retailer asked Bio4Pack if it is possible to get TPA for the product. The retailer stated that it sounded too good to be true in which NatureWorks underlined the importance of honesty in this issue.

*"I believe that you should always stay honest, because people will always find out. So, keep it with lower CO<sub>2</sub> emission or the replacement of fossil fuels. Those are honest arguments."* NatureWorks (1:1)

When Bio4Pack and NatureWorks approached the NGO. The NGO stated that biobased packaging wasn't an issue for them at moment. Especially for Bio4Pack this changed the way how they looked at the NGO from positive and possible party to a more negative connotation related to the NGO. This moment shows how frames change between critical moments.

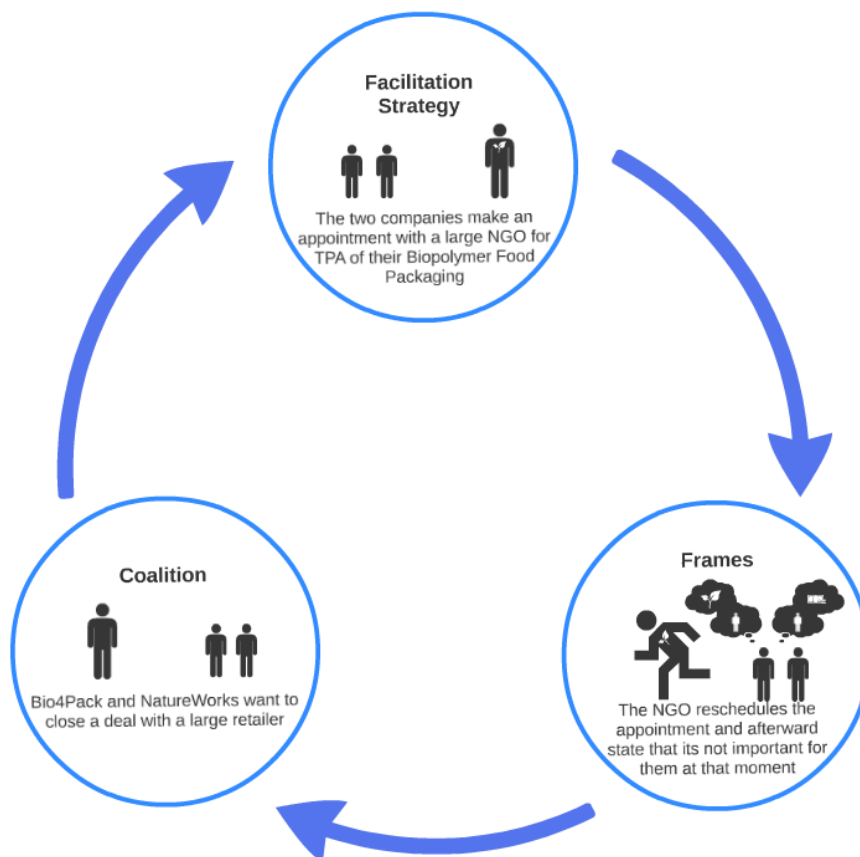


Figure 7: Visualization of episode II. Coalition formation, the use of facilitation strategies and frames are influenced by each other during a critical moment in the Biopolymer Food Packaging case (starting from coalition).



### 5.1.1. Facilitation strategies

The retailer asked for a TPA, their question can be interpreted as a type of counterproposal in the negotiation process of closing the deal Bio4Pack. As Bio4Pack and NatureWorks approached the NGO, they didn't perform an inventory which specific NGOs could help them with a TPA. Both parties only approached one NGO without effective results.

## 5.2. Episode III: Exit from project

The third episode describes the critical moments related to the global food company that exited the project.

### 5.2.1. Network coalitions

During this third episode there were internal changes at the global food company. As four of the five members working on the project changed, that also changed the dynamic of the process. The food company came with alterations relating to the deal earlier made with Bio4Pack. The food company wanted to change completely to renewable packaging instead of just its biological segment. The retailer came into the picture of Bio4Pack. The completion of the development of the packaging changed the business network that focused on technical companies to a focus on market parties.

### 5.2.2. Frames

The biobased package was developed and ready to be produced on a larger scale. As the global food company organized a meeting with Bio4Pack to discuss the project, the strategy of the global food company changed from just biological products to change all of

*"Something new always has to be explained, something new needs things to be explained. If you're making steps to become more sustainable, I mean, 60% of consumers doesn't even know that plastic is oil based, so how can you convince consumers what the advantages of bioplastic are? And even if, actually what you are saying then is that all the other [packaging] products that you have, aren't sustainable." Bio4Pack (2:12)*

their products to biopolymer packaging.

The frames of Bio4Pack related to the process also changed from technical development of a new product to creating a contract and closing the deal. This change brought up other issues. Entry to market needed to be discussed with both food company and retailer. This wasn't covered in the first two episodes.

### 5.2.3. Facilitation strategies

The global food company organized a meeting to discuss changes in their strategy. This was followed by a joint meeting of the food company, Bio4Pack and the retailer. During these meetings multiple proposals to facilitate a deal were made. In this episode the global food company took the lead by organizing meetings aimed to express problems and to deal with conflict.

## 5.3. Episode IV: ECO-retailer

The last episode in the case describes the realization of a new project of Bio4Pack and an ECO-retailer.

### 5.3.1. Network coalitions

The global food company has left the process. The material of NatureWorks isn't being used in the material for the ECO-retailer, so the relation between NatureWorks and Bio4Pack changed again. With the new project Bio4Pack has a new process with new players. According to Bio4Pack the goals of Bio4Pack and the ECO-retailer are strongly focused on being -or becoming- more sustainable. This has made Bio4Pack and the ECO-retailer more than just a companies working together.

### 5.3.2. Frames

In this episode a big change happens when the global food company -already 5 year a partner of Bio4Pack in the project- stopped. Bio4Pack realized that the way this project is executed should be different next time. The way how Bio4Pack framed the innovation process changed.

*"Can we agree on a price, yes or no? What we did in the past: develop, develop, develop, ready. And then the price comes up and it costs too much." Bio4Pack (2:21)*

### 5.3.3. Facilitation strategies

The efforts of Bio4Pack to come to an agreement with the global food retailer were ineffective. This process became a learning moment as Bio4Pack recalled in the interview that the company reflected on what had happened. In the next project Bio4Pack with the ECO-retailer, the company brought his learnings to practice with by discussing and making agreements on costs from the start. The partnership between ECO-retailer and Bio4Pack can also be seen as example of a group willing to change and innovate.

## 6. Case 2: The Plant Bottle of Coca-Cola

*The Plant Bottle of Coca-Cola case is the reconstruction of the development of a 100% biopolymer material for Coca-Cola's Plant Bottle related to their 2020 Vision. Multiple R&D companies and brand owners are related to the project, as well parties that function as a Third Party Approval. In this case Coca-Cola is interviewed and a document analysis on Avantium is described.*

### 6.1. Introducing the players

In the Plant Bottle case exists of three different groups that are involved in (1) technology development, (2) feedstock transparency and (3) consumer attitude and market positioning. The technology group is the Plant PET Technology Collaboration (PPC) that consists of Coca-Cola, Ford Motor Company, H.J. Heinz Company, NIKE Inc. and Procter&Gamble. These five companies finance three technology companies to research a 100% renewable PET/PEF solutions. One of those research companies is Avantium. The second group, the Bioplastic Feedstock Alliance (BFA), is focused on the transparency and sustainability of the feedstock,. The coalition consists of eight partners including the ones that are part of the PPC. The World Wide Fund for Nature (WWF) holds the secretariat of the BFA and also functions as Third Party Approval. The group related to consumer attitude and market positioning are the organizations currently working with Plant Bottle (material), such as H.J. Heinz Company and Danone, WWF also has a TPA function in this coalition. Together these three groups take part to realize the goal of Coca-Cola stated in the 2020 Vision. This means that there are two versions of Plant Bottle material, the currently used Plant Bottle with up to 30% renewable material (version 1.0), and the future PEF bottle which uses a sustainable and renewable feedstock for its supply chain (version 2.0) which is planned to be commercialized between 2016 and 2018.

Organization	Organizational background	Role
The Coca-Cola Company	Beverage company with the goal to increase sales with 50% and decrease emissions with 50%. The Plant Bottle is a packaging solution which should make this sustainable growth possible.	Input/output stakeholder and facilitating stakeholder (lead)
Avantium	R&D company with high throughput technology. Researching PEF material for packaging solutions.	Enabling stakeholder
Ford	Partner of Coca-Cola in developing bioplastic materials for automotive industry.	Input/output stakeholder
Heinz	Partner of Coca-Cola in Plant bottle initiative. They have used the plant bottle for ketchup bottles.	Input/output stakeholder
World Wildlife Fund	NGO that works as a Third Party Approval for the Plant bottle, it	Enabling stakeholder

also holds the secretariat of BFA		
<b>Plant PET Technology Collaboration</b>	Collaboration that focuses on development of replacement of PET technologies, with large users of plastic materials.	Enabling stakeholder
<b>Bioplastic Feedstock Alliance</b>	Alliance between (non-)competitive parties to realize and research the possibilities for a sustainable feedstock to produce renewable bioplastics	Enabling stakeholder

Table 2: Description of the relevant organizations, backgrounds and roles of the Plant Bottle of Coca-Cola case.

## 6.2. Process history

The process started in 2002 with Coca-Cola's first experience with bioplastic during the 2002 Winter Olympics. Around this time Coca-Cola was also developing their 2020 vision. The vision included two goals: 50% higher sales and 50% less carbon. The pathway to these goals was characterized by sustainable growth. Three elements were labeled as important by Coca-Cola: cost, trust and love. Cost related to supply chain and procurement, trust related to the feedstock and transparency and love as the emotional connection with the products. According to Coca-Cola, their PET packaging was able to fulfill expectations and wishes of consumer, but when it comes to costs and sustainability (trust) there still was room for improvement. For Coca-Cola this was a cue to start with the development of a new type of packaging. A cross functional team was created, consisting of persons from the following departments: procurement, supply chain, quality, R&D, marketing and legal. The interview suggest that the main reason for a cross functional team was to make different functions talk with each other and thereby seeing new opportunities. The interviewee stated that the team had routine based meetings, a holistic view and was led by one central person. The first activities of the team were related to researching possible development pathways and limitations. According to Coca-Cola, procurement and environment team members immediately focused on end-of-life solutions. It was concluded that recycling or re-use was essential. Also the quality team member stated that it was not possible to make compromises when it came to quality aspects. According to Coca-Cola existing biopolymers couldn't meet current quality standards. This led to the reoccurrence of PET material in their discussions again and again. The interviewee stated that this was followed by much laughs in the team that they went from 'outside of the box' thinking to 'inside of the bottle' thinking. According to the interviewee the positive effect of this thinking was that it was less disruptive (room for conflict in the value chain by changing interests and markets) and the promise to be more cost competitive. Coca-Cola's thought was that keeping a good supply chain, proper end of life solution and highly refillable material would have to tackle the oil based front end of the bottle. During an offsite meeting in a park in Atlanta the team believed they only had one option: to use a biopolymer with lacking specifications. During that same meeting, the polymer scientist (also present in the team) received a valuable insight which he shared with the rest of the team. He recalled that a core ingredient of PET could be made from renewable material. It

wasn't currently being used for PET composition but it was an option. According to the interviewee this started two things for the Plant Bottle process: first, the team had a compelling case for change and second, the team saw that their cross functional collaboration was critical for making these steps. Following this, the team started with the development of a pathway that would be cost competitive and how this could be communicated. The technology to develop a partial renewable PET material was present, so the focus was on extending production and to create sustainable feedstock. The results were presented to an internal operating committee of Coca-Cola. Plant Bottle version 1.0 was brought to the market for commercial learning in the beginning of 2011. According to the interview, preparation of the partnerships and marketing lasted for one complete year. Document analysis showed that in the end of 2011 Avantium visited Coca-Cola with their new PEF material. Next to this, Coca-Cola knew that suppliers of a new material couldn't be dependent of one supplier. The interview suggests this led to the idea to forge a coalition with non-competitors. As Coca-Cola puts it, they were rethinking sustainable innovation. Winning for Coca-Cola would be first to market and showing leadership. The next step was to persuade Coca-Cola's executives. The team stated that things were going great, consumers were starting to get the idea and that they had to keep moving fast. The proposed to accelerate the process by letting other companies join the development process. The interviewee referred to this as that: *"Coca-Cola would be commoditizing technology"*. Coca-Cola thought this approach was useful for R&D companies such as Avantium, so they could have a clear project and focus. The technology would be advanced through the Plant PET Technology Collaboration (PPC). The collaboration consisted of the four companies described in the previous paragraph. It served to showcase brand owners preparedness to develop and market new technologies and materials. Related to the trust part, Coca-Cola developed the Bioplastic Feedstock Alliance (BFA) to research sustainable feedstock for bioplastic production. Eight partners in total are part formed this alliance, including members of the PPC. Coca-Cola knew that they couldn't do this alone and asked multiple organizations for providing Third Party Approval. The organizations include three universities and the WWF who also holds the secretariat of the BFA. Documents showed that a sequence of accusations by NGOs in Germany and Denmark preceded the official start of the BFA. The accusations were that Coca-Cola was green washing their practices relating the Plant Bottle 1.0. According to the interview Plant Bottle 1.0 was a learning instrument relating marketing and communication. The interviewee stated that Coca-Cola's next steps would be to develop the Plant Bottle 2.0 (PEF), realize a sustainable supply chain and inform stakeholders at a local level.

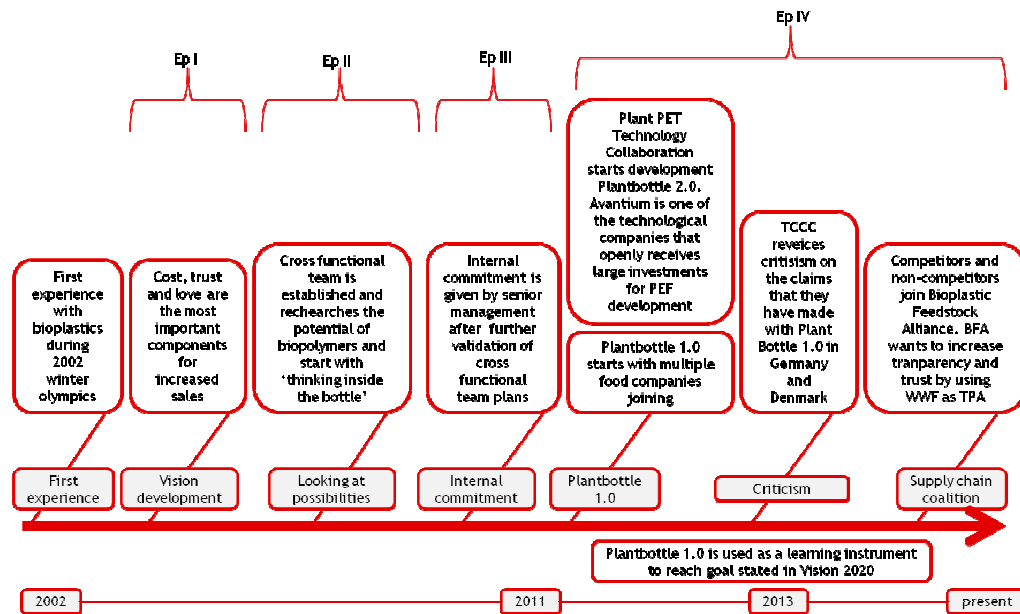


Figure 8: Timeline of Plantbottle of Coca-Cola case. Critical moments are described (grey fields) with short overview (white fields).

### 6.3. Episode I: Vision development

The first episode deals with the development of Coca-Cola's Vision 2020 which led to the Plantbottle project.

#### 6.3.1. Network coalitions

At this moment it is not possible to speak of a coalition. Coca-Cola was internally deliberating what their strategy and vision is. An important stakeholder that Coca-Cola mentioned was the consumer. But there weren't any stakeholder involved in the process during this episode.

#### 6.3.2. Frames

Coca-Cola developed three important guidelines to achieve their goals of 50% less CO<sub>2</sub> emission and 50% more sales. These were cost, trust and love. Coca-Cola perceived these aspects to be important to reach their goal. The interview suggest that these aspect are considered to be important issues of aspects of the process to reach their 50:50 goal. When it comes to the process, Coca-Cola wanted to meet the expectations of their consumers. This is a important starting point of the process. The development of the vision also led to creating a platform to develop new businesses and technologies, as the quote of Coca-Cola describes.

*“A lot of people think that it [Plant Bottle] originated solely from an environmental or sustainability agenda. And it didn’t, it really goes back to the long term planning of our business.” Coca-Cola (3:3)*

### 6.3.3. Facilitation strategies

The first experience of Coca-Cola served as an initial thought to do something with bioplastics. This can be seen as a strategy to orientate the market and possibilities. The development of the 2020 vision facilitated innovation by serving as a clear goal for the company and the cross-functional team.

## 6.4. Episode II: Looking at possibilities

The second episode runs from the moment that the 2020 vision was ready to the moment that the cross-functional team had a clear plan and went looking for internal commitment in episode III.

### 6.4.1. Network coalitions

After episode I a cross-functional team was established to bring different disciplines together. The group working on the project still consisted only of people working at Coca-Cola. But the way the internal group dealt with the project was like a coalition for change inside Coca-Cola.

### 6.4.2. Frames

During the park meeting that the central leading person organized, a critical moment arose. New information provided by the polymer scientist gave the team a new perception on how to approach the project and realize the expectations of procurement and quality assurance.

*“We can put our finger around the moment when the idea easily came up, and it was a team process, and that got us good.” Coca-Cola 3:10*

As the development of the Plantbottle continued, it is possible to see a clear change how Coca-Cola perceived their innovation process: from disruptive change in a complete system of suppliers, producers, etcetera, their perception changed to small adaptations (less disruptive) of the current PET bottle which later became Plant Bottle 1.0.

### 6.4.3. Facilitation strategies

The establishment of the cross-functional team brought different types of knowledge together. The team had the challenge to reach the 50:50 goal of the 2020 Vision. Next to the team, the role and function of the manager was strongly related to making connections

*"I often joke that I'm really like a match.com, a dating service that is about making sure that procurement is talking with marketing, and marketing is talking with supply chain, to be able to identify risk, obviously to the platform, but more importantly be able to see opportunities." Coca-Cola (3:2)*

within the group and facilitating reflection moments.

The informal setting that was created by park meetings facilitated space for new ideas. Also the routine based way the team comes together can be perceived as a deliberate strategy to enhance their effectiveness of their project.

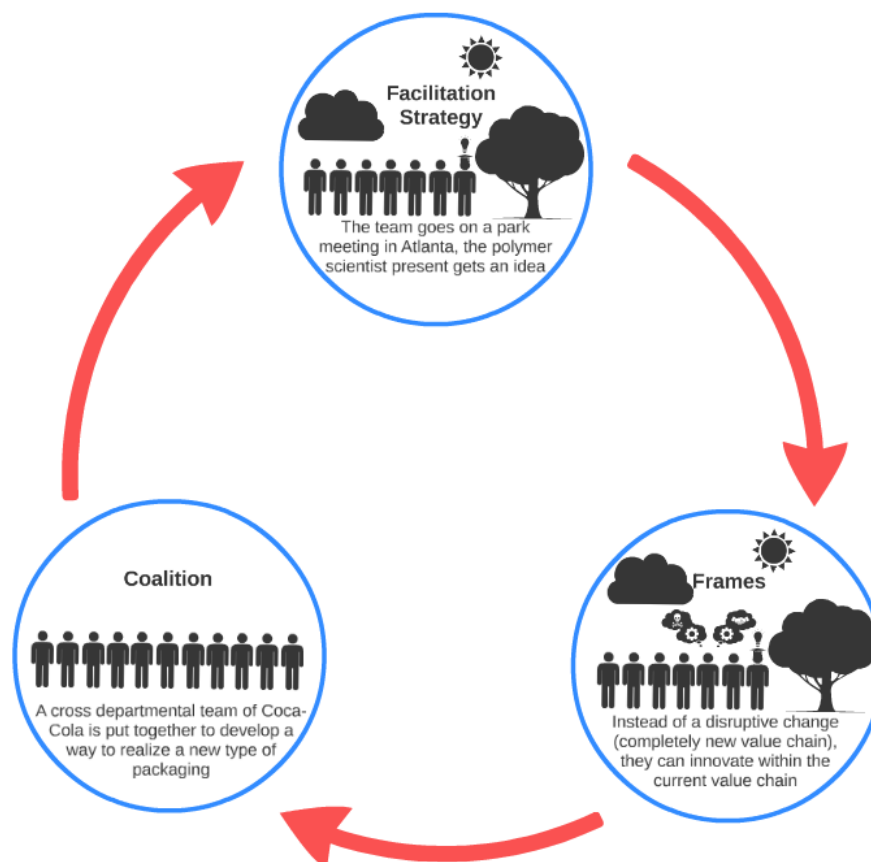


Figure 9: Visualization of episode II. Visualization of episode II. Coalition formation, the use of facilitation strategies and frames are influenced by each other during a critical moment in the Plantbottle case (starting from coalition).



## 6.5. Episode III: Internal commitment

The third episode shows how internal commitment was reached. The cross-functional team shared their strategy and ideas with multiple committees up to Coca-Cola's executive board.

### 6.5.1. Network coalitions

Also in the third episode there weren't any external stakeholder involved in the process. The internal 'coalition of the willing' (cross-functional team) wanted to attain commitment with senior level and the companies leadership to make new steps and reach the goal of a 100% renewable bottle.

### 6.5.2. Frames

One of the questions that Coca-Cola mentioned when talking to its leaders was how they

*"If it's truly going to be changing the world, can an individual company keep it to themselves? So that's where we had to rethink what is winning within sustainable innovation?" Coca-Cola (3:16)*

looked at winning and sustainable innovation.

The question directed change in the perception of the process. Later on Coca-Cola also referred to this as 'commoditizing technology'. This was a difference compared to framing a good process as making instant profit changing from a closed innovation process to a collaborative innovation process.

### 6.5.3. Facilitation strategies

The cross functional team used multiple presentations to convince others to change their perceptions. Also showcasing the Plant Bottle 1.0 worked as a facilitation strategy to show Coca-Cola's leadership in the market and to internally provide Coca-Cola with a positive vibe.

## 6.6. Episode IV: Forging coalitions

The fourth and last episode shows the steps made in bringing multiple companies together to support and further develop the Plantbottle from version 1.0 with 30% to Plantbottle 2.0 with PEF that is 100% renewable.

### 6.6.1. Network coalitions

In this episode multiple food companies and companies from other markets such as clothing and automotive industry were brought together to ‘hold hands’ throughout this innovation process. There was a group that put Plant Bottle material on the market, a group that invested in the technology through financial arrangements with companies such as Avantium.

*“Coca-Cola was being flooded by companies claiming to have a solution for a 100% sustainable bottle, they thought our technology was interesting, but we didn’t had a bottle.” Avantium (8:2)*

Another group worked together to research the feedstock for the sustainable production of bioplastics. Almost every player in the three groups was a large multinational and hadn’t a core business related to (bio)plastic production. The groups functioned as a coalition in how they stood together to propel the innovation of bioplastic forward.

### 6.6.2. Frames

After the leadership of Coca-Cola had agreed on forging coalitions and to develop the Plantbottle further, the internal position of the cross functional team fell into the background. Instead of a small group in the company, it was now the entity of Coca-Cola that was working on the innovation. In that time many companies were approaching Coca-Cola to show new technologies for a sustainable bottle. By investing in some of the technical companies, Coca-Cola transformed their relation with these mainly much smaller companies.

*“What was interesting is, we kept running into similar companies that were interested in exploring this stage. Well one thing you could say is let’s keep them out of it, but another thing is, well, it takes the attention away from companies like Avantium” Coca-Cola (3:16)*

Coca-Cola also received multiple accusations by several NGO’s on green washing. Coca-Cola referred to this in describing how they approach the innovation process (see quote 3:30)

*“One of the questions we’ve had, and that goes back to that NGO discussion was: do you want us to wait, till we actually have all the answers on the feedstock to invest in future technologies on being able to make the ingredient or can we do this work in parallel?” Coca-Cola (3:30)*

#### 6.6.3. Facilitation strategies

Coca-Cola showed leadership by showcasing Plantbottle 1.0 and how they continued to develop Plantbottle 2.0. The goal was to show suppliers that companies wanted to make the change to bioplastics and actually already were changing. When it came to the consumers, Coca-Cola invested in creating more transparency in the supply chain and researching this with help of WWF as a TPA. These activities showed Coca-Cola actions on facilitating the innovation process by investing in building a network with trust and dealing with conflict related to transparency and the claims Coca-Cola made.

## 7. Case 3: From Waste to Biobased

*The third case deals with the ‘From Waste to Biobased’ project. The group exists of Attero, Paques, TU Delft, Novamont, Municipality Venlo and Government. This case is in the earliest phase of innovation compared to the other cases. Attero, Paques, Novamont and Municipality Venlo were interviewed.*

### 7.1. Introducing the players

The From Waste to Biobased case consists of Attero, Paques, TU Delft, Novamont, Gemeente Venlo and the Dutch Government. Attero is a waste disposal company, their business model is to retrieve valuable materials or energy from waste. One of their own projects is a two phase digester that produces fatty acids, this facility is located in Venlo. Paques develops and builds biotechnical processes to clean industrial water. Preceding the ‘From Waste to Biobased’ case, they built a pilot plant for Mars that produces PHA (poly hydroxy-alkanoates). TU Delft is a technical university that performs research related to micro bacterial production of biopolymers with more than ten years experience. Paques and TU Delft already had a relation when it comes to performing research together. Novamont is a producer and compounder of bioplastics. A few years ago, they performed a research on the processing of bioplastics in waste plants for Attero. Gemeente Venlo is a municipality in the South of the Netherlands (also the location of Attero’s two phase digester). The municipality has a strong focus on sustainability and the biobased economy. The person representing Gemeente Venlo is a municipal officer working on the waste theme. The Dutch government is also part of the case as facilitator of the Green Deal and deals with legislation and financial support.

Organization	Organizational background	Role
Attero	Waste disposal; Energy and materials are made from waste	Input/output stakeholder (lead)
Paques	Water technology; industrial water is cleaned by technology	Input/output stakeholder
TU Delft	Technical University; perform research for water technologies	Enabling stakeholder
Novamont	Bioplastic company; produce, compound and process bioplastic	Input/output stakeholder
Gemeente Venlo (Municipality)	Municipality with focus on cradle-to-cradle, next to this Venlo is location of Attero’s pilot plant	Enabling stakeholder
Government	Ministry of Environment organizes ‘green deals’ to smoothen innovation processes related to sustainability	Enabling stakeholder

Table 3: Description of the relevant organizations, backgrounds and roles of the From Waste to Biobased case.

## 7.2. Process history

The process starts in 2011 when Attero, Paques and TU Delft started a research project on the possibility of bioplastic production using Attero's fatty acid stream coming from their two phase digester plant in Venlo. The years before 2011 TU Delft was already active in performing research on micro bacterial production of biopolymers. TU Delft also worked with Paques and researched aspects of the realization of a PHA plant for Mars at Veghel. In 2011 the pilot plant was realized at Veghel. In the years preceding the case Attero was active in developing new businesses to valorize (green) waste. One of the outputs of these development projects was their two phase digester, the fatty acids that they were now producing could be used more effectively than compost creating or biogas. Following the build of the plant, Attero performed an inventory of new innovations; a market exploration of bioplastics and organized multiple meetings with possible partners. Attero had a colleague with contacts at TU Delft. Paques was contacted because of their experience in the Mars project. A series of lab test was performed by TU Delft. The interviewees of the interviews stated that when the results were positive, Paques became more involved. The interviewees of both Attero and Paques said that together a goal was stated to create a pilot plant in Venlo. Attero was the main financier, TU Delft researched micro bacterial production of PHA and the hydrolysis water and Paques looked at the plant processes and design.

The interviews showed that Attero was also working on the back end of the process, to make sure that the produced material could be sold. During the time of research, interviewees state that the group didn't meet regularly, only when 'important' information needed to be shared. Interviews suggest that Paques was in the lead in this part of process. In practice the group met every three or four months. However by phone and e-mail there was more contact. When Attero, Paques and TU Delft had a meeting to present the results of the research, the interview shows that the results were not as expected for Attero. Against their expectations more research was needed to to continue with the process and make new steps. According to Attero this occurrence was discussed with the other two parties. Paques stated in the interview that researchers of the group experienced the meeting differently and called the results encouraging. Attero, Paques, and TU Delft decided to share more information preceding such meetings and to make notice when results weren't as expected. Following these first moments of research, Attero focused on the possibility of doing investments. Attero saw it as important to share interests of the current three parties as a good starting point. The next step from Attero was to apply for a subsidy. For Paques this application came sooner than expected and wasn't able to join the effort as strong as Attero. The interview suggest that this was because of a CEO change at Paques the exact moment of applying for subsidy. The interviewees also stated that Paques increased the communication with Attero, to keep them updated about the internal process and possibilities to join the application. In the end, it wasn't possible for Paques at

that moment to join Attero. In the meanwhile Attero was increasing their external communication by providing some news articles on the process with Paques and TU Delft to produce bioplastics. According to Attero and documents this led to much contacts, interesting conversations and possible buyers, although the pilot plant wasn't even build. Attero was active to involve backend players and had a meeting with Novamont, an existing relation of theirs. Novamont shared their vision on the market and agreed to perform the necessary research on the produced bioplastics. According to Attero Novamont would also buy the material -if quality was ok-. This material would then be used to produce waste bags. Following the meeting with Novamont, Attero had also contacted Gemeente Venlo to purchase these waste bags. Concluding all parties stated that all of the parts of the value chain are present and together perfectly represent the biobased economy. The interviewees mentioned that Attero and Paques see their roles changing in the future. Novamont also mentioned that their actual role is much broader than their role as compounder in this case. Nonetheless, the parties realized a Green Deal with the Dutch government in which their roles were prescribed and visualized. Interviews suggest that the Green Deal was a moment to create internal commitment between the five companies: Attero, Paques, TU Delft, Novamont and Gemeente Venlo. The story of the case was a strong story, green waste collected in material produced from collected green waste. Next to the Green Deal all companies also see that in the future other connections with other markets and partners can be made. Especially when the government develops legislation that makes it better possible to use green waste as a production material for biopolymers.

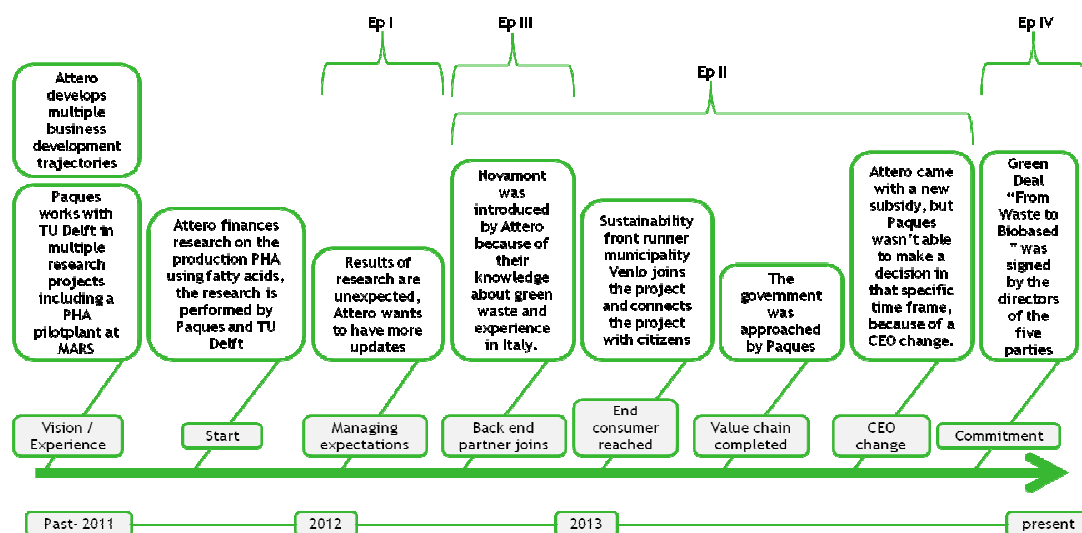


Figure 10: Timeline of From Waste to Biobased case. Critical moments are described (grey fields) with short overview (white fields).

### 7.3. Episode I: Managing expectations

Attero, Paques and TU Delft had agreed on researching the possibility of using Attero's fatty acids stream for the production of PHA. This episode describes the first tests and how the group was their managing expectations.

### 7.3.1. Network coalitions

Paques and TU Delft began working together with Attero. Preceding this project, Paques and TU Delft were committing another research project in Veghel with Mars. Because of this experience Attero approached TU Delft and Paques. Paques and TU Delft were now able to continue their research and build another pilot plant.

### 7.3.2. Frames

The group performed research to gain more knowledge about the possible production of bioplastics. Technological knowledge was framed as an important issue by both Attero and

*“Each link has an added value and we should see that value back in the project. If someone doesn’t see this value back, no one will make the effort and the whole project would fall into pieces. Now, it was clear. Right away it was clear that we are all pulling in one direction. We really have a drive.”*

Attero (4:5)

Paques.

Next to this the companies and university all had a clear focus and specific role in the research. Both Paques and Attero referred to similar positions and relations which suggests that the relationship frames were aligned between the group members. Contradicting this is the technical knowledge levels of the persons present in the group. Not all persons needed to have the knowledge level, but after a presentation of results, changes were made in the way of sharing information.

### 7.3.3. Facilitation strategies

Attero performed a market research and made a list of innovations relevant for their business. When Attero found existing initiatives that could be followed up, they found partners in TU Delft and Paques. This showed how Attero was actively facilitating network building for a successful innovation process. When the partners were found, they shared their companies interests and stated that they saw a clear match. This activity worked as a strategy to facilitate innovation. The meeting of the research results wasn’t perceived by all parties as successful. Paques and TU Delft saw promising results but Attero stated that the results of the meeting weren’t as expected. Attero wanted to be better informed by the two researching parties. Attero evaluated the process with the two other parties and together it was decided to change and improve information sharing.

## 7.4. Episode II: Back end partners join - CEO change

The second episode describes the moments related to a subsidy application and a CEO change of Paques well underway.

### 7.4.1. Network coalitions

The constitution of the group has changed in this episode, but internal dynamics at Paques were more important. When Paques wasn't able to receive internal commitment for a subsidy application Attero asked for, The group wasn't able to make steps and applicate for the subsidy. This showed the importance of internal commitment, even if persons (executives) are not present in the project group.

### 7.4.2. Frames

The subsidy application of Attero came quite suddenly as Paques mentioned. The rate in which the subsidy needed to be signed was difficult to manage for Paques as they were in middle of a CEO change.

*"Because they [Attero] also have to deal with internal commitment. They reacted very understanding. And actually, it has not slowed us down, we are at the same pace with Attero." Paques (7:18)*

Both parties state that the openness they showed to each other during this episode was very important for the process. Both Attero and Paques appreciated these approach to the process from each other.

### 7.4.3. Facilitation strategies

Paques reacted proactive on the subsidy application of Attero, by taking it up with the executives of the organization and directly communicating this with Attero. The increased amount of contact that they had helped the process not to fail. Related to this Paques also stated that it hadn't slowed them down.

## 7.5. Episode III: Back end partners join

As the front end was (being) developed, Attero went looking for partners in the back end of the process. They wanted to create partnerships with parties that could buy and use the produced bioplastic.

### 7.5.1. Network coalitions

Novamont joined the group first. At a later moment Gemeente Venlo joins. When the group represented all elements of a biobased value chain, the Dutch government is approached



by Attero. The back end partners, Novamont and Gemeente Venlo, had other roles than Paques and TU Delft. Novamont and Gemeente Venlo had certain conditions in which the project would become relevant. This moment was reached when a product of good product was produced. Novamont -also producer of bioplastics- only had a role as compounder in this project.

#### 7.5.2. *Frames*

As the 'From Waste to Biobased' project continued and the technical process was being developed, the focus of Attero was moving towards the back end of the value chain. New issues came up: the quality of the material and also legislative aspects of the biopolymer production. The first step in this back end development was to create waste bags as a type of showcase, this could later be followed by other products.

*"At one point we were like, okay, it might be something for Novamont, to use the materials [PHA] in our products. But that's only useful if you're going to sell such products and develop the market. For example, organic waste bags for households in flats." Novamont (6:3)*

#### 7.5.3. *Facilitation strategies*

Attero approached multiple parties that could have compatible interests in the "From Waste to Biobased" project. This was a strategy to build their network. Another aspect that came back in the interviews was that the back end partner only met with the entire group one or two times. So there only was little contact between the parties if one compares it with the contact between Paques and Attero in episodes I and II.

### 7.6. **Episode IV: Commitment**

The last episode of the 'From Waste to Biobased' project shows the developments that occur when the group was preparing and signing a Green Deal with each other and the Dutch Government.

#### 7.6.1. *Network coalitions*

The Green Deal was used to showcase the groups project, media attention was also an important aspect of this. The presence of high representatives of the organizations working on the projects also resulted into internal commitment.

*“As for us, to communicate on this not only prepares you externally but also internally. It is a way of saying, hey, we are working on this. Our directors also become involved in what is happening here.” Attero (4:26)*

### 7.6.2. Frames

The relations and roles of Attero, Paques, TU Delft, Novamont and Gemeente Venlo were clearly defined in the Green Deal. This is a change to how Attero and Paques talked about the innovation process in the start of the project (open roles).

### 7.6.3. Facilitation strategies

The way how the group saw themselves as a representation of the circular economy was a strong symbol that they were communicating with the Green Deal. The use of media in this, was a activity to reach future consumers and show the group’s leadership.

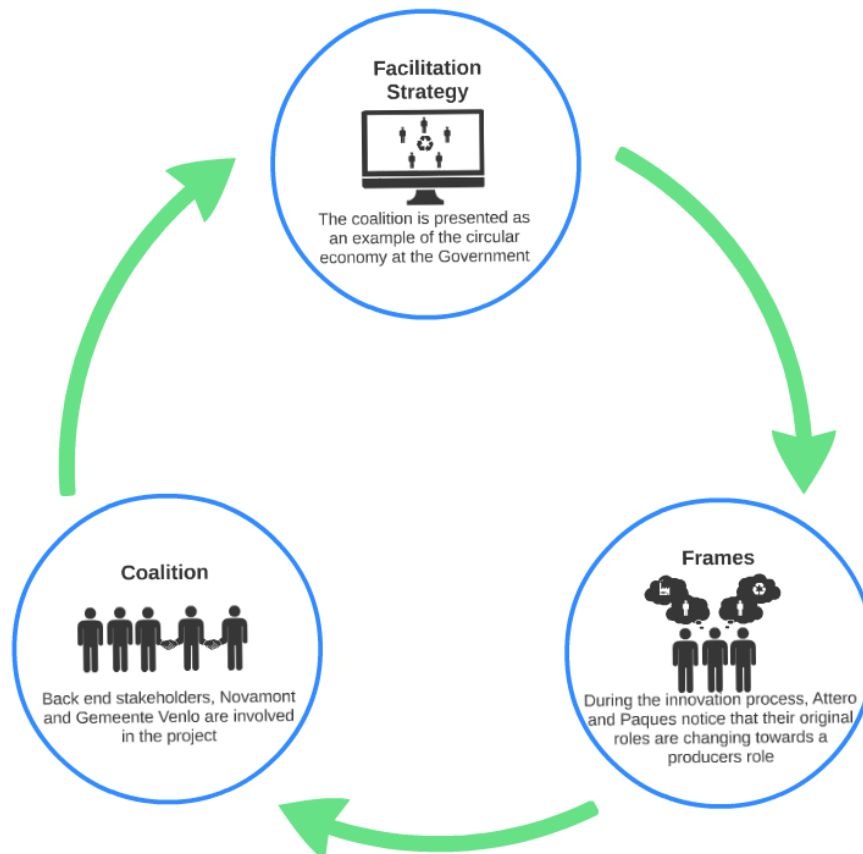


Figure 11: Visualization of episodes III and IV. Coalition formation, the use of facilitation strategies and frames are influenced by each other throughout critical moments in the ‘From Waste to Biobased’ case (starting from frames).

## 8. Comparative analysis and discussion

*Following the findings and analyses in the previous three chapters, this chapter compares the different innovation cases and enumerates significant differences and resemblances relating network composition, frames and the use of facilitation strategies.*

### 8.1. Custom made innovation processes?

The Biopolymer Food Packaging, Plant Bottle of Coca-Cola and ‘From Waste to Biobased’ cases all have their own unique characteristics. The theoretical concepts that have been described in chapter 3, related to network composition, frames and facilitation strategies, are used for the comparative analysis. The table below describes the findings related to each concept in each case. In the following paragraphs similarities, differences and striking aspects will be discussed in more detail.

	Biopolymer Food Packaging	Plant Bottle of Coca-Cola	From Waste to Biobased
<b>Roles in coalition</b>	Bio4Pack has a central and leading role, the roles of NatureWorks and the Global Food Company change with the phase of innovation and project.	Coca-Cola has a leading role in the development of the process. It forged multiple coalitions in which other companies support Coca-Cola's efforts.	Attero is the leading parties but during specific parts of the project other parties take the lead; in the research phase Paques is in the lead and it was suggested that when bioplastic is being produced Novamont and Gemeente Venlo will attain a more leading position.
<b>Coalition formation</b>	Ad hoc conversations and contracts with different parties present in the business network of Bio4Pack.	Coca-Cola first developed a strategy, second non-competitors and competitors are asked to join the coalitions to showcase market leadership and willingness to change.	First Attero and Paques asked existing relations to be a partner. Later on in the process exact roles are fixed in the Green Deal.
<b>Third Party Approval</b>	No TPA present because Bio4Pack and NatureWorks weren't able to make an appointment as a biopolymer food packaging wasn't an issue at that time for the NGO they wanted to speak with.	A TPA is present. One of the coalitions working on a sustainable feedstock is led by the WWF. Multiple international universities perform the researches.	All of the parties that were interviewed stated that they hadn't thought about TPA. They suggested the product they are developing has no direct need for TPA. They also stated that they will look into this in the future.
<b>Issue frames</b>	Depending on the phase of innovation the issues relevant for the parties were product characteristics, price and	Depending on the phase of innovation the issues relevant for the parties were technological possibilities, transparency and product	Depending on the phase of innovation the issues relevant for the parties were technological knowledge (Paques and TU Delft) later

	consumers perceptions/attitude.	characteristics. Cost, trust and love can also be interpreted as guiding issues.	followed by product characteristics (Novamont and Gemeente Venlo) and consumers perceptions/attitude.
<b>Identity and relationships frames</b>	Bio4Pack and NatureWorks both state that it is important to be honest and transparent in a business relationship.	Coca-Cola stated that a company has to work with products and technologies that are available. Transparency and honesty about the process and in an relationship is essential.	Parties need to work together for value chain innovation. Flexible roles can help during this process, instead of rigid contracts.
<b>Process frames</b>	Bio4Pack learned during the process that it needed to discuss the issue of costs at the start of a collaboration instead of first start developing. Conservative producers have a very strong (financial) position with retailers and brand owners	Coalition formation to showcase the supply chain that companies are willing, a non-disruptive process was important to not frustrate the current regime.	Size of coalition (value chain) creates a stable front against externalities. It started open and ended as a closed process. The coalition was then used to showcase the project.
<b>Methods of articulation of problems and possibilities</b>	Meetings and presentations.	Market research, regular meetings, presentations and (informal) park meetings.	Meetings, presentations and market research.
<b>Network building</b>	Business relations that support each other.	Coalition formation with both non-competitors and competitors.	Coalition formation through existing relations to complete the value chain.
<b>Dealing with conflict and power: learning and negotiation</b>	Pragmatic business approach, reflection when things go wrong or don't work.	Coalition formation as a method to deal with current regime. Reflection is organized by team leader.	Step by step process, reflection when things go wrong or don't work.

Table 4: Overview of the theoretical concepts comparing the three cases

## 8.2. Similarities

The three cases show resemblances with regard to the issues at stake. The 'From Waste to Biobased' project focuses on technology in the beginning of the project. As the project continues a technology is developed and this issue's importance declines. Later on in the project the partners increase their focus on publicity and showcase the project. The goal has changed from technology development to creating a good market entry position. The other cases also see this development or evolution of issues happening throughout the innovation process.

Players in all cases are dealing with innovation. Coca-Cola prepares one complete year for the market entry of a new product. A Dutch retailer mentions that their consumers don't like change. Gemeente Venlo first wanted a finished product before it approaches their citizens. Innovation was mostly framed as a difficult issue or process. Innovation implies

improvement thus suggesting that the former wasn't as good or even problematic. Another time innovation means that consumers need knowledge to understand what it means for them and if they need to adapt.

In all cases moments occurred in which problems and possibilities were articulated. Avantium walked into a meeting with Coca-Cola and presented a new type of material. Novamont shared their perspective on the bioplastic market. Bio4Pack presented the possibilities of their packaging material in front of a retailer. When new parties came together, they talked about their visions to approach these problems and possibilities. Almost all critical moments contained an aspect of sharing information, problems and possibilities.

Plastic bottles, food packaging and waste bags were the products developed in the three cases. A variety of stakeholders throughout the value chain was involved in each of those products. One missing link in the value chain of the biobased economy was the consumer. Coca-Cola worked with WWF for TPA. Gemeente Venlo joined the 'From Waste to Biobased' project as was referred to as a type of consumer. But none of the cases involved consumers in the innovation process.

### 8.3. Differences

The three cases also displayed several differences between them. The moment when the global food company called Bio4Pack to tell the company to step out of the project was the cue to start reflecting on the process and think about new strategies. The manager of the cross functional team of Coca-Cola holds reflected each year and raised questions on the teams practices. Between the cases there were different ways of organizing reflection. Only Coca-Cola organized reflection moments deliberately, in the other two cases there were no moments present that reflection was deliberately organized.

The composition of the groups in each case was strongly different referring to position in the value chain, mandates and type of relation. In the Plant Bottle case only brand owners were present in the coalitions. There were no retailers or bioplastic producers part of those partnerships. In the same case there were different coalitions that all had their own 'mandate' related to the innovation process. One coalition dealt with R&D and another with a supply chain sustainability and transparency. Similarly, the 'From Waste to Biobased' case also had companies involved in technology and others were more related to the market. But in this case its presented as one group. The same group also works with long lasting relations in the group. In the Biopolymer Food Packaging case technical companies contributed on technical matters but were never a (constant) participant in the development of the biobased packaging.

The way how companies dealt with their roles throughout the innovation processes also shows differences. Attero and Paques mentioned that their roles were changing with the development of this new technology. Coca-Cola stayed at their core business by opening the innovation process for non-competitors and competitors. For Avantium the Plant Bottle

case changed their role from high speed throughput service provider R&D to build the pilot plant for PEF production. This suggests that innovation processes creates new spaces with new roles to be fulfilled. The cases also show that there are multiple ways to deal with this.

#### 8.4. Striking aspects

Next to similarities and differences, the cases showed aspects that demanded further elaboration. Openness, transparency and trust were referred to by all parties. This was in relation to their own identity, part of a relationship or an essential aspect of the process they were in. The question is: how important are openness, transparency and trust for innovation processes? And how do these aspects come to practice in the cases? In the 'From Waste to Biobased' case companies talked about openness. The interview shows that they had only met with all parties one or two times. Few contact moments can create situations in which parties aren't up to date and it can become more difficult to meet expectations. Only in the Coca-Cola case regular meetings are organized with the cross-functional team. In the Plant Bottle case transparency was referred to as important and an integral part of their vision (cost, trust/transparency and love). But documents showed that the Bioplastic Feedstock Alliance (related to transparency) officially started in November 2013. This was almost two years after the introduction of Plantbottle 1.0 and months after accusations from multiple NGO's.

In the Plant Bottle case and the 'From Waste to Biobased' case the number of player that were part of the coalitions or group grew and the networks expanded. In the Biopolymer Food Packaging case the contact between Bio4Pack and NatureWorks seemed to stagnate or even decline. This could have to do with the business relations that exist in this case with Bio4Pack and NatureWorks. Related to these relations, it should be noted that Coca-Cola and also Attero had performed market research to get an overview of relevant players, talked with them and either decided to continue with them or not.

It was striking to see the reasoning related to consumer involvement in the three innovation processes. Coca-Cola worked with WWF on Plant Bottle 1.0 and also in the Bioplastic Feedstock Alliance. Universities were also functioning as TPA. In the 'From Waste to Biobased' case Gemeente Venlo functioned as a type of end user and connection to the citizen/consumer. Although the companies present in these cases argued that it served the goal, the argument needed to be made that consumers weren't directly involved. Plant Bottle version 1.0 also had TPA but still received wide criticism. A more extensive consultation or eventual direct involvement of consumers could lower the risk of failure at market introduction.

## 9. Conclusions

Innovation means change. In this paper three dimensions of the innovation process are analyzed: coalition formation, framing and facilitation strategies. This research analyzed three biobased packaging innovation cases with different sizes and in different phases of innovation. The following four paragraphs each answer the research questions described in chapter 3:

1. *How are biobased packaging innovation networks composed?*
2. *How are actors framing issues, identity and relationships and processes?*
3. *How are these networks performing facilitation strategies?*
4. *How are facilitation strategies influencing network composition and frames?*

### 9.1. Network composition

The three cases showed three different networks in each project: the Biopolymer Food Packaging case showed a strong business support network, the Plant Bottle case consisted out of three different coalitions that focused on specific parts of the project and the 'From Waste to Biobased' case consisted of a front-end coalition and a back-end network. Another aspect that wasn't a focus of this research but resulted to be an important aspect in all cases was internal commitment. Klerkx and Aarts (2013) referred to the importance of champions in an innovation system. The conclusion of this research is that a network, coalition or group is composed contingent to the phase of innovation. The composition is always incomplete and demands constant network building and destruction to cope with the dynamics and developments of the innovation process.

### 9.2. Frames

The issue frames in all three cases evolved during the innovation process. In the technical development phase of innovation a genetically modified ingredient isn't framed as an issue, but when a product arrives in the market it evolves and is framed to be a big issue. This is shown in the Danone Yoghurt PLA cup case of NatureWorks. It can be concluded that there are several issues: technology, knowledge, costs, consumer attitude, sourcing etcetera which are always present but have different importance attributed to them with each phase of innovation.

Whether players framed certain aspects of a process or relationship to be important doesn't mean that frames represented the existing situation. In the 'From Waste to Biobased' case players framed openness as an important aspect of the relationship and the process. Although the presence of this frame, there were critical moments in which openness (sharing information, updates, etc.) wasn't put into practice and became an issue. Also in the Biopolymer Food Packaging case the story about the biopolymer packaging sounded 'too good to be true' to the retailer. Novamont and Bio4Pack stated

that honesty was very important in their relations with others, but that this was a challenge because it was (according to NatureWorks) such a *“difficult story”*.

### 9.3. Facilitation strategies

In the innovation process facilitation strategies fulfill a role between network composition and frames that enhance results. The research showed multiple occasions in which facilitation strategies had an important role in frame changes and shifting coalitions. In all cases players performed activities related to the innovation process: articulation of problems and possibilities. In most cases this was not done deliberately. Similar to this were the activities organized to facilitate network building. Market analyses were executed in multiple cases, but this didn't led to new partners or expansion of players' networks. In most cases existing relations were used during the innovation process to tackle problems or cover issues. The three networks all showed different ways how they dealt with conflict and negotiation. Most parties used proposals and counter proposals as a strategy to deal with negotiation. Another important aspects relating this innovation process was reflection. If things went wrong then players organized reflection activities. Only Coca-Cola had regular reflection meetings. In some of the cases it can interpreted that reflection moments were lacking and stagnated the innovation process. Related to this aspect, it can be concluded that only in the Coca-Cola case a certain type of monitor role was practiced. In none of the cases players had an external monitor within their project team.

### 9.4. Enhanced innovation processes

It can be concluded that the networks, groups and coalitions in the three cases aren't static entities. Also, frames change throughout the innovation process. In many cases facilitation strategies are not deliberately applied during critical moments. The research showed that facilitation strategies can enhance the innovation process. Organizing reflection activities can help the development processes to be more focused than in the Biopolymer Food Packaging case. Organizing regular meetings can enhance transparency and help to avoid feeling not up to date as in the 'From Waste to Biobased' case. Facilitation strategies have also been performed with positive results. Ideas that came up during an informal park meeting at Coca-Cola. The story and visual representation of a circular value chain when applying for a green deal was a successful output of a facilitation strategy and boosted the innovation process. This research concluded that the (deliberate) performance of facilitation strategies influenced both network composition and frames. It serves as an important dimension of innovation, deliberately organized or not. The research also concluded that companies can use these theories to apply facilitation more deliberately, also with the help of an (external) monitor. In this way more space for innovation can be facilitated and thus created to work towards a biobased economy.



## 9.5. Recommendations

### 9.5.1. Research

This interpretative research was difficult -if not impossible- to generalize. Further statistical research could help to create more substantial results relating if facilitation strategies were practiced and whether they enhance innovation processes. A quantitative research with indicators relating facilitation strategies (type and number of activities organized) could achieve this. The role of framing, frame changes and frame alignment have potential with regard to researching the micro dynamics in innovation processes and the facilitative aspect that they have in these processes. An increased of focus on championing (as used in Klerkx and Aarts, 2013) might help dealing better with external group dynamics during research.

### 9.5.2. Companies

The companies involved in the cases could enhance reflexivity by assigning a(n) (external) monitor. Also bringing more structure into the process, by setting regular meetings and timely reflection moments, can help projects to be more efficient. To accommodate research managers who have made it this far reading this thesis some key questions that companies should ask themselves can be found in the table on the next page.

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#### Key questions for research managers

How have you shared your vision on the product and process with partners and other (future) stakeholders? Are your interests (e.g. sustainability) and breaking points (e.g. costs) clear with partners and are you aware of theirs?

Do you know if your product is aligned with consumer needs and is there societal support? Do you have a Third Party Approval of a NGO or other objective organization (e.g. university)?

How have you organized the communication of your process? Are partners feeling up to date? And how are other (future) stakeholders informed about the process? What are the storylines and symbols that you use?

How do you reflect on process and external dynamics and the satisfaction with outcomes? Have you selected a person or organization whose role it is to monitor these processes objectively?

How are you organizing (informal) contacts within the group?

What is the energy level in the group? Is it still fun?

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Table 5: Key questions for research managers to gain insights on innovation processes

### 9.5.3. *Non Governmental Organizations*

Another type of party that can be important for a successful innovation and which is difficult to involve are NGOs. Framing of issues is an important aspect of their business. NGOs can give Third Party Approval for products or innovation processes, such as WWF in the Plant Bottle case. The other two cases either want to be in contact with NGOs, but the NGOs don't relate to their issues or the group doesn't see the benefits of a NGO and sees their own product and process as impeccable. The role of public framing (or agenda setting) is important for NGOs. If bioplastic becomes a big issue in the eye of the public, NGOs can become more involved in these issues either constructively (working towards) or destructively (working against). This also relates to landscape developments during innovation processes. The role that NGOs play might increase the chance of success at the later stages. There are NGOs who know how these issues are framed by the public or consumers. Working together instead of against innovations could help NGOs in achieving the goals they pursue.

### 9.5.4. *Government*

Another aspect outside of the scope of the research but interesting to biobased innovation processes is the inclusion of citizens through participation or proactive communication. The role of the Dutch government in the From Waste to Biobased case has an enabling role in legislation and sometimes also finance. But it would be interesting for the Dutch government to expand their role to facilitate citizen interaction with the innovation process or make it mandatory for subsidies. This can change Dutch policy focus from invention (just technological) to innovation (societal). The role of citizen participation in innovation processes is difficult, especially with bulk materials such as plastics (consumers don't see the difference with bioplastics). But frames relating bioplastics are important and can become breaking points later in the innovation process (e.g. PLA yoghurt cup of Danone in Germany). Research relating to public acceptance, issue framing and participation in innovation processes could help to solve these difficult aspects of biobased innovation.

## 9.6. **Reflection**

### 9.6.1. *Theoretical framework*

The theoretical framework used in this research was able to comprehend the cases, but clearly other aspects such as internal commitment and framing versus acting were present. These aspects were an important part in the dynamics of innovation processes and in the ways to enhance them. The focus of this research was on the micro dynamics in inter-organizational innovation processes, reconstructing the development of the process to see how players forge a coalition, frame issues and perform facilitation strategies. It would be logical to extend the focus on framing in the research to better comply to those micro dynamics.

### 9.6.2. *Methodology*

Next to this theoretical part, the research would be improved if we could observe the actual dynamics of critical moments during meetings of the innovation coalitions. This would provide the researcher with objective data compared to interviews. This would also imply a longitudinal method that would follow developments as they happened. Action research would be able to achieve this although the actions performed by the researchers could alter events, meaning that there should be a control group.

### 9.6.3. *Interviewees*

An important aspect to deal with is trust between the researcher and the interviewees. During the research multiple organizations were feeling uneasy talking about their practices. A six months thesis is maybe not the best time frame, although interviewees also could feel more comfortable talking to a student than to a professor. In this research, the problem was tackled by allowing multiple persons present at one interview. This created a comfortable atmosphere for the interviewees. If the research would be repeated, the learnings of this method would be that an informal relation with the interviewee should be started earlier so that from early on a relation can be built.

### 9.6.4. *Research process*

The research process is divided into three parts, two months literature research, two months data collection and two months analysis and writing. Although time flew by, it is possible to perform a thesis research in this time. In the perception of this researcher planning is an important capability to perform scientific research, as time is an integral part of the methodology (planning interview, external of internal developments during an innovation process, etc). The strong phasing of the research provided positive outputs, such as clear deadlines and proper time division for a theoretical framework and interviews. An improvement would be to apply a type of contingency approach or hybrid form where writing a proposal and performing the interviews are combined in one phase. This would create a feedback loop that would improve both the relevance of the theoretical framework as the data collection.

### 9.6.5. *Facilitating the research process*

As this research has submerged itself in facilitation strategies, the researcher has learned that using an external monitor (outside the scientific research) can help with keeping focused on the research process. Next to a supervisor, an external monitor can help to overcome obstacles through increasing reflexivity. Also the organization of creative activities were helpful to look at the theoretical framework in a completely new way. Multiple presentations and visualizations helped to give new impulses to the research.

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