

# **Study on investment climate in bio-based industries in the Netherlands**

**Final Report**

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# 1 Introduction and executive summary

This study presents the results of a short study that investigated the barriers faced by small companies active in bio-based economy when they want to acquire investment for their businesses. The study was conducted from January to May 2014 in the form of 13 interviews with start-ups or other SMEs in the Netherlands, Germany, France and Belgium and was complemented by selected literature. The literature was used to check some statements made by interview partners and to place them before the background of current political, economic and academic debates. The focus was exclusively on bio-based chemicals and materials, not on food, feed or energy produced from biomass.

The objective of this study was to assess the investment climate for bio-based industries in the Netherlands in comparison to other countries. The main research questions were: Which reasons move investors to provide money for bio-based entrepreneurs? What are the advantages of the Netherlands as a location for bio-based industries? Which hurdles might prevent investors from placing their funds in the Netherlands and which conditions make other locations potentially more attractive for investing?

Since start-ups and small companies regularly face the challenges of obtaining funding in order to implement and expand their businesses, such companies were selected for the interviews. In order to get a more comprehensive picture and due to the political realities of the European Union, not only industries in the Netherlands were examined, but also companies from surrounding countries: Germany, Belgium and France. The perspective during the interviews was global, taking into account also developments in Asia or the Americas.

The interviews highlighted several issues that make investors insecure about the new bio-based industries and therefore constitute barriers for companies producing bio-based materials that need to acquire funding for their businesses.

The strongest point of criticism was the structure of public funding programmes. Existing public funding schemes were positively mentioned by many interview partners mainly for research and development, but many lamented a lack of public support for the following stages, namely pilot and demonstration as well as commercialization. Existing mechanisms were also criticized for complexity and slowness as well as the dominating requirement of including big universities or companies in consortia in order to obtain grants.

Concerning the acquisition of funds other than public support, three options became apparent: Bank loans, investment from risk capital or investment from strategic partners, i.e. other companies interested in a cooperation or in using the bio-based materials for their own products. Several participants stated that the bank system fails innovative entrepreneurs completely. Even with government guaranteeing for 50% of the risk as is done by some public programmes, most banks still shy away from the investment. This is a massive problem for European entrepreneurs. Concerning risk capital, several interview partners complained about a generally bad investment climate in Europe, but others said that the lack of investment is a specific problem of the bio-based sector. Here, lack of investors' knowledge about the new industries paired with an insecurity stemming from a lack of political will and priorities for these new industries is a key component that needs to be addressed in order to facilitate the acquisition of funds for small innovative businesses. The latter aspect, missing political commitment to the new bio-based economy

was not identified as a barrier per se, but seen as an underlying factor for many hurdles that exist in the market today.

For many companies, finding a partner from the industry in order to form a strategic partnership was the ideal solution to getting money for their business activity. However, sometimes the management of intellectual property can be a difficult issue in such an arrangement, which makes it also dangerous for some small firms to take big industrial partners on board.

Other aspects, such as lack of tax incentives for innovation, missing standard of bio-based products, labelling, GMO regulations and infrastructure are listed and discussed in the main section of the report. The last parts address strengths and weaknesses of the Netherlands as a location for bio-based industries, the level playing field and then derive recommendations, mainly focussing on political will and clear measures that can support the infrastructure of bio-based industries, create market demand and give security to investors.

## 2 Objective and methodology

Lack of innovation investment currently is a widely debated topic in Europe. Many stakeholders observe that research and development is often carried out and supported with large public funding in Europe, but that the next step of pilot facilities or commercialization is more and more realized in the Americas or Asia. The following graph underlines this finding for the bio-based polymers sector, shifting more and more to South America and Asia:

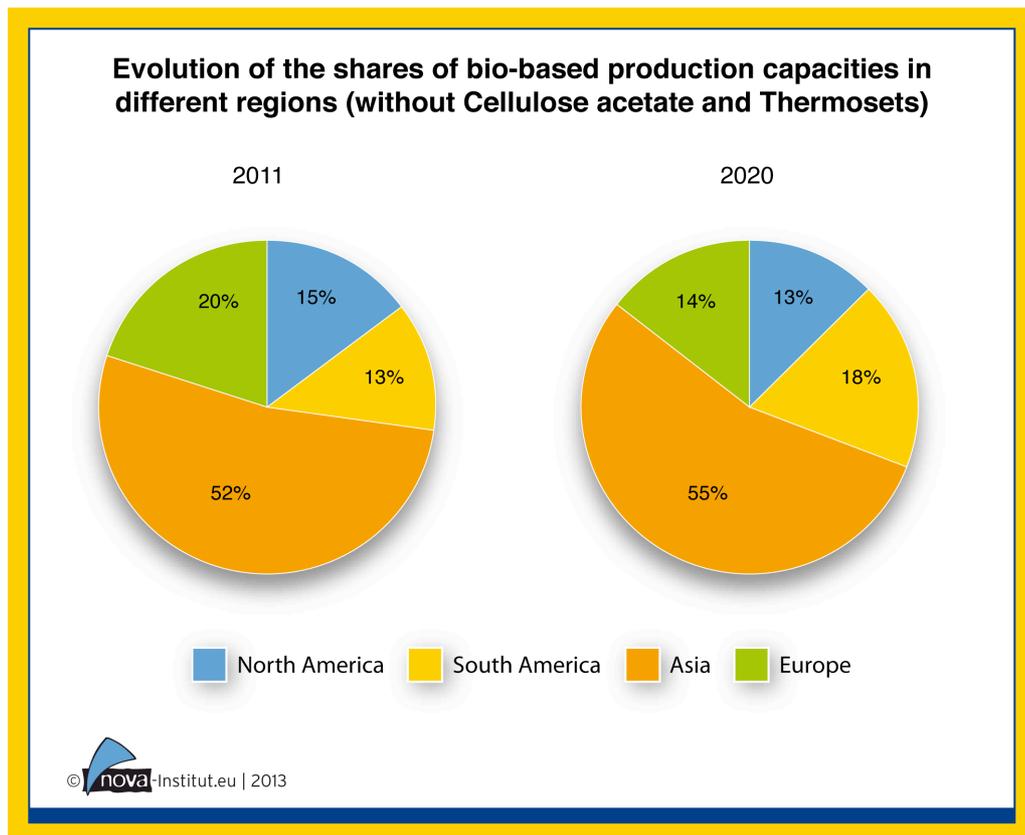


Figure 1: Evolution of the shares of bio-based polymer production capacities in different regions

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In order to get a more comprehensive picture and due to the political realities of the European Union, not only industries in the Netherlands were examined, but also companies from surrounding countries: Germany, Belgium and France. The perspective during the interviews was global, taking into account also developments in Asia or the Americas.

In order to achieve the objective of the study, we conducted interviews with companies active in the bio-based economy. The main focus was on start-up companies and other small or medium enterprises with a view on expansion, since they are in regular exchange

with potential investors and know the reasons pro and contra investment in the focus regions very well.

13 interviews were conducted in total, five with companies in the Netherlands, five in Germany, 2 in France and one in Belgium. The interviews were held in personal meetings, via phone or communication software such as Skype or go-to-meeting. The guideline underlying the talks was sent out to most interview partners before the talk in order to enable optimum preparation. (See Annex I for the interview guideline and a list of interview partners.) The questions covered topics from the general background of the company, their current size and employees, their product portfolio and manufacturing infrastructure to their experiences with investors and what hinders or enables investment in their bio-based business activities. The questions were posed with a focus on those circumstances that can be addressed by policy-makers.

In addition to the results of the interviews, some insights into the structures of the Dutch bio-based economy from previous projects are used to shed light on the advantages and disadvantages of the Netherlands as a location for bio-based production. This makes it possible to narrow down the broad issue of investment climate and to derive concrete recommendations at the end of the report.

### 3 Investment climate and barriers for investment

The investment climate experienced by bio-based start-ups varied to some degrees, mostly depending on the product, but several impressions were shared by a large majority of interview partners. Interestingly, there were no significant differences in general statements between the four selected countries. The market and investment in bio-based chemicals and materials is a least a European issue, and often even global.

According to the statements of the interview partners, small companies active in bio-based economy in Europe face several issues when acquiring funding. The following graph depicts the frequency with which the different topics were mentioned during the interviews. It should be noted that some of the companies already had partial funding when they started their bio-based business (e.g. from selling former companies), so they faced less obstacles in acquiring their funding. Also, the levels of difficulties seem to vary strongly depending on the product and market sectors. Therefore, the overview should be perceived with some caution.

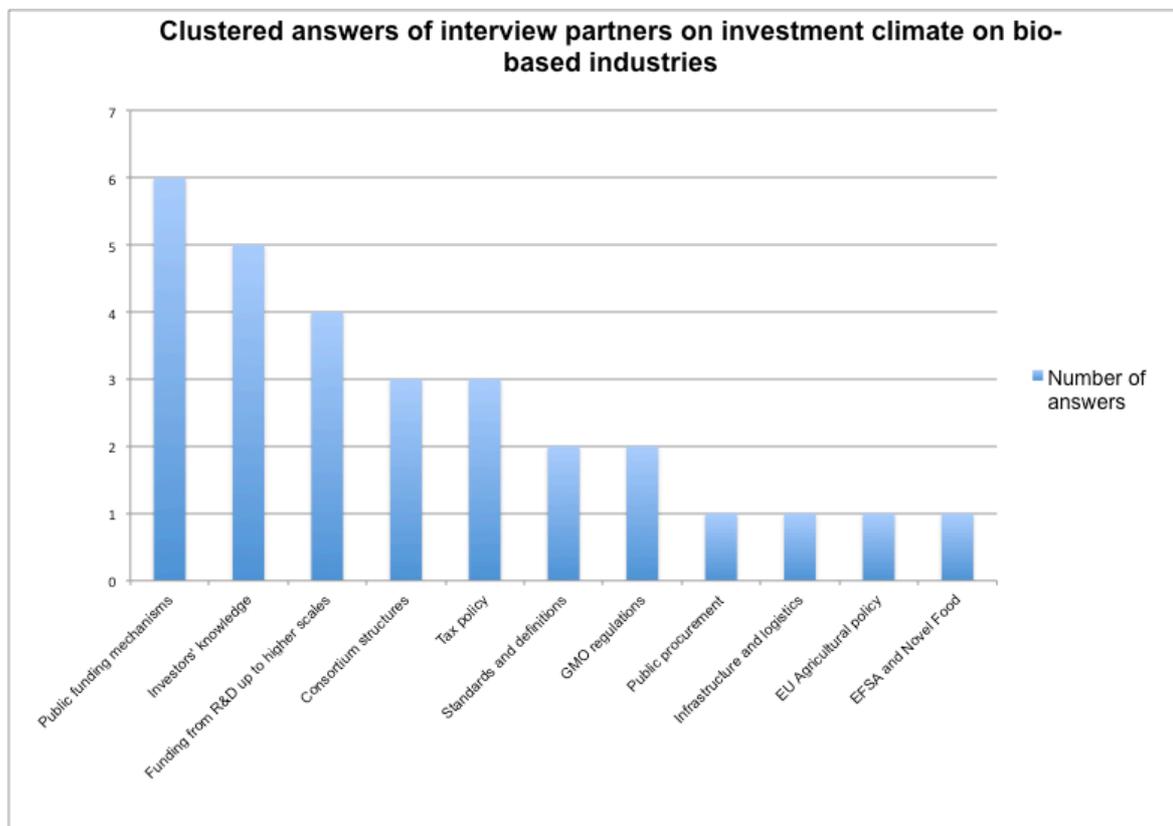


Figure 2: Clustered answers of interview partners - relative weight of barriers

First and foremost, many companies lament the lack of political will and direction in terms of bio-based industries for the EU. This is not depicted in the number of mentioned barriers in the graph above but still matters, since it was not seen as a specific hurdle, but more as an underlying factor for several barriers. There are no clear goals or priorities that guarantee a stable market, thus not giving any security for investors. Experiences with the biofuels policy make stakeholders even more cautious, fearing a quick change in political direction once public opinion changes or new scientific findings are made. This makes

Europe a less attractive place for investment than more pragmatic countries such as the U.S., Brazil, Malaysia, etc.

Another general tenor found in most interviews was the fact that an abundance of public funding is available for research and development, but almost none for the later stages. Some funds exist for pilot and demonstration scale, but the closer a product gets to commercialization, the less support is available, even though it would be especially necessary to cross the “valley of death”. Some more concrete insights into the problems with public funding structures can be found below.

The following presents a clustered summary of the specific hurdles faced by the interviewed companies.

### 3.1 Definitions and standards

Some interview partners stated it was a barrier for the development of a bio-based market in Europe that there are not enough definitions and standards in place for the new business sector. It was stated that there is no definition of what constitutes a bio-based product, that the term “bio-based” is not protected, that many logos and claims confuse the consumers and that agencies take a long time to update definitions and classify new products.

These claims hold up only partially to a “reality check”. In fact, a dedicated Technical Committee within the European standardization body CEN is working on bio-based products (CEN/TC411). They have defined a set of relevant terms in a pre-norm (PrEN 16575 Bio-based products) that is expected to be adopted into a full norm in September 2014:

**Bio-based:** derived from biomass

**Biomass:** material of biological origin excluding material embedded in geological formations and/or fossilized

- Biomass can have undergone physical, chemical or biological treatment(s).
- The correct spelling of ‘bio-based’ is with a hyphen (‘-’). It is however in common usage sometimes spelt without a hyphen.
- The methods to determine and communicate “bio-based” as a characteristic are detailed in specific standards of CEN/TC 411.
- The commonly used biomass, also called bio-based resources, is starch, sugar, vegetable oils, (hemi)cellulose (timber, natural fibres, straw and other by-products) and special biomolecules such as lignin or natural rubber.

**Bio-based product:** product wholly or partly derived from biomass

- The bio-based product is normally characterised by the bio-based carbon content or the bio-based content. For the determination and declaration of the bio-based content and the bio-based carbon content, see the relevant standards of CEN/TC 411.
- Product can be an intermediate, material, semifinished or final product. “Bio-based product” is often used to refer to a product which is partly bio-based. In those cases the claim should be accompanied by a quantification of the bio-based content.

The work on standardizing bio-based content measurement in Europe is on-going, so in that regard the claim of missing standards is factually correct. However, in terms of practical application, the ASTM standard D6866 Test Methods to Determine the Bio-based Carbon Content of Materials Using Radiocarbon and Isotope Ratio Mass Spectrometry is already in usage in Europe. Two certifiers, DinCertco and Vinçotte have introduced “bio-based “ labels, indicating a range of shares of bio-based carbon. These labels are already widely used and globally accepted.

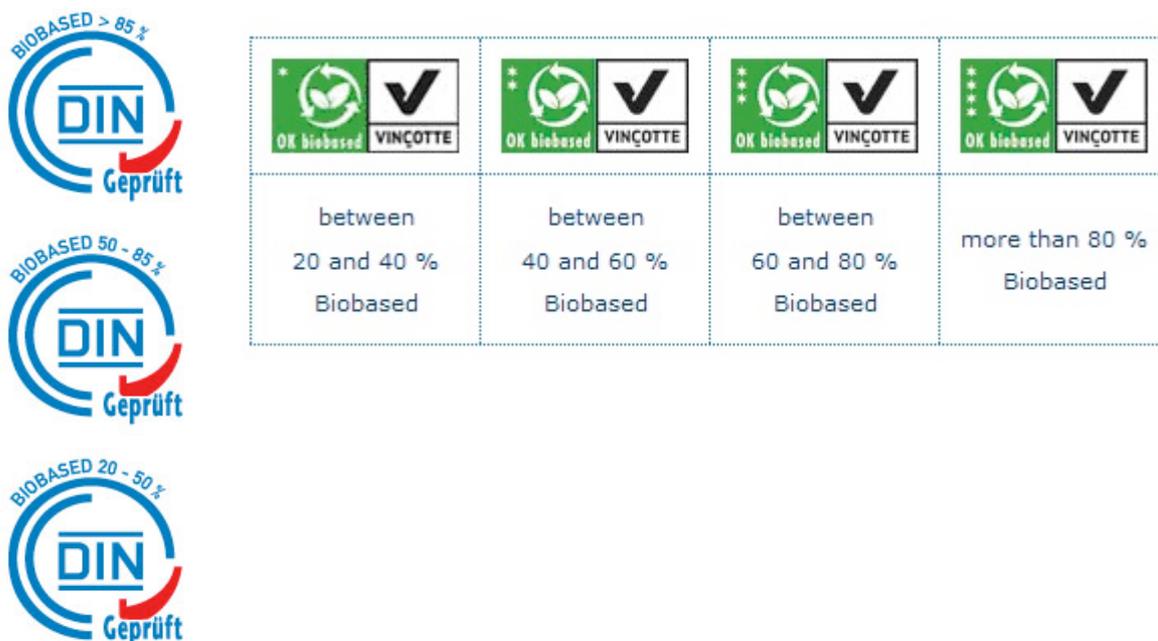


Figure 3: DinCertco and Vinçotte bio-based labels, indicating a range of shares of bio-based carbon

This means that there are already a few helpful definitions and labels in place, but they are not established and well-known enough by players of the sector.

### 3.2 Knowledge and education

Several interview partners quoted a lack of knowledge about the new business sector of bio-based chemicals and materials within the investor scene as important barrier for acquiring funding. Since many banks and investment funds do not know enough about the new products and market dynamics, they cannot make an informed decision and instead often “go with their guts” - which is mostly a decision against too much unknown risk. One interviewee compared the circumstances of industrial biotechnology to the pharmaceutical sector and explained that in the latter, a whole range of specialized and knowledgeable potential investors can be addressed with ideas of new projects, while this is not the case for bio-based chemicals or materials. More and more emerging family offices are positive exceptions and seem to counter this situation to some degree, but the general problem still exists. France was mentioned to possess a slightly livelier investor scene for industrial biotechnology.

Also consumers' perceptions were mentioned repeatedly and interview partners stressed the importance of continued awareness raising about environmental issues, such as waste reduction, resource efficiency, saving energy and protecting the climate - many goals that can be supported by increasingly using bio-based products. This matches the necessity for a clear prioritization of bio-based materials by policy makers mentioned above, in order to be clear about the reasons for deciding in favour of bio-based materials and to improve their visibility and image on the market.

### **3.3 Infrastructure**

For many small companies and start-ups it would be a tremendous help if they could start their business in an existing infrastructure so they could focus their attention exclusively on developing their product and bringing it to the market instead of setting up facilities, complying with waste regulations, etc. One interview partner who set up their pilot facilities in Europe, but then established their first commercial plant in Malaysia told us that among others, the support by the Malaysian government in terms of infrastructure was one of the main reasons for this decision. They had the possibility to open their facilities at a dedicated bio-hub, thus relieving them of many arduous tasks and decisions that are related to these steps.

Also for Europe, it seems to be a good opportunity to bring new life to industrial sites such as chemical parks by equipping them with specialized features for bio-based industries. Supply routes for biomass as raw materials, special pipelines for bio-based intermediates or waste removal systems are factors that can make one location very attractive for the settling of new companies. Modern energy systems would ensure the companies that their energy consumption was efficient, thus saving money and contributing to a sustainable image. It would be a win-win situation to support small, innovative companies while at the same time reviving the industrial infrastructure of Europe and keeping jobs, which is also in line with the proclaimed goal of the Commission to strengthen Europe's producing industry again so that it will contribute 20% to GDP by 2020 (European Commission 2014).

### **3.4 Public procurement**

European public authorities spend almost 2,000 billion Euros on goods and services every year, which means that public procurement can be a powerful tool for creating market pull, also for innovative bio-based products. Interview partners noted, however, that at the moment it is not an effective tool and that even though sustainability and environmental factors are to be considered under the Green Public Procurement of the EU, often buyers in the end decide just for the most economical option.

It is true that at the moment, bio-based products are barely covered by public procurement, but there is movement to change this. It should be noted that the property of being bio-based is not an advantage per se and does not automatically mean that the product is "green". Furthermore, most people in charge of public procurement do not know about the state-of-the-art of bio-based products, therefore not considering these options in their buying decisions.

The BioPreferred® program of the USDA is a very pragmatic example, how public authorities can promote bio-based products. Depending on the product group, products

need to have a minimum share of bio-based carbon content, certified according to the already mentioned ASTM standard D6866. Then they are placed on an online product list where they can be found by public authorities in charge of procurement. Also, there is a directive that these products should be treated preferentially, thus giving legal certainty to decision makers.

The situation is a bit more complicated in Europe. Currently there are several initiatives, mostly aiming at improving knowledge about bio-based products and how they are compatible with procurement law. On the European level, public procurement is covered in a working group of the Expert Group on Bio-based Products and also in a Horizon2020 call that aims at building procurement networks for innovative bio-based products (European Commission 2013). There are already a multitude of national and regional platforms that support sustainable procurement, and some of them have dedicated information on bio-based products, too. The FP7 project Open-Bio has collected these product information platforms and found 25, mostly in Europe, but also elsewhere in the world (publication forthcoming on [www.open-bio.eu](http://www.open-bio.eu)).

If these initiatives manage to make public procurement officials really aware of the possibilities of bio-based products and to give them legal certainty for their buying decisions, then public procurement might become a truly effective tool to create market demand for bio-based materials.

### **3.5 Public funding structures**

Several public funding structures were mentioned very positively by the interview partners, as for example the GO and GROWTH programmes in the Netherlands, KfW or FNR programmes in Germany or support by the Flemish Agency for Entrepreneurs in Belgium. However, also complaints were made about the general structures and some inefficiencies. As stated above, one structural issue was the fact that a lot of funding is available for R&D, but almost none for up-scaling to pilot and demonstration, or even to commercial levels.

Furthermore, many funding programmes make it (almost) obligatory to have universities or big companies as partners, or to form big consortiums in general. This makes the acquisition process very lengthy, research becomes more inflexible and small companies are often worried about their intellectual property, too.

Even without the necessity to form big consortiums, many application processes are very complicated and bureaucratic and the approval takes a long time. One company stated that by the time their applications were processed, the direction of their research had changed significantly and their previous proposal was not applicable anymore. Flexibility is one of the most crucial advantages of small companies, and that is taken away when public funding is slow. Also, in many cases, small companies do not have the resources to bridge a longer amount of time when expected funding is delayed due to administrative complexities.

Another problem mentioned were the “trends” of public funding which forces many companies to do research on subjects where funding is available instead of what they originally wanted to do research on or what makes sense on the market (a current example would be the hype on second-generation lignocellulosic feedstocks).

### **3.6 Tax policy**

There was wide agreement that tax policy in Europe does not give sufficient support to innovation in small companies. First of all, tax incentives are only advantageous for larger profitable companies, because company taxes only apply to profits. So a tax reduction is not useful for start-ups with losses only due to investment in their technology, but interesting for bigger companies only. Someone stated that tax legislation and loss carryforward are unnecessary administrative burdens.

Also, the tax structure does not make it attractive to take any risks with investments, since one has to pay as much taxes on return on investment (ROI) from innovation as one has to do on ROI from established technologies. The recent report on biotechnology in Germany by Ernst & Young has found that only very limited risk capital is available for this sector, despite of Germany's excellent competitive situation in the world market (World Economic Forum 2014). A press release of Ernst & Young therefore demands a reform of tax policy for innovation and supports a concept by two entrepreneurs who suggest that private investors should be allowed to invest one per cent of their assets into biotechnology without paying any capital gains tax.

Another concept would be to directly give tax cuts to companies that establish a new innovative bio-based business. Malaysia, for example, offers several incentives for investment in various industries, among others for the biotechnology sector. Companies active in biotechnology that have been accredited with the BioNexus status by the Malaysian government are eligible for measures such as 100% exemption from statutory income tax for a duration of 10 years, a concessionary tax rate of 20% on statutory income from qualifying activities for 10 years upon the expiry of the tax exemption period, exemptions from taxes on dividends distributed by the company, double deduction on expenditure incurred for R&D etc. (MIDA 2012).

### **3.7 Other**

Several smaller aspects were mentioned during the interviews, which shall be summarized here. Since they were mostly quoted only by one or two participants, the urgency of these factors seems to be lesser than for the ones in the previous sub-chapters, which were all brought up by several interviewees.

GMO regulations, which are important for numerous biotechnological processes, are seen to be too strict and out-dated by a few market players. The regulations are written with a view on modified crops, but do not take into consideration the use of GMO in processes. The use of GM bacteria is even further complicated by the fact that the regulations are different in the Member States. For example it is allowed to use plasmid bacteria in Belgium, but not in the Netherlands.

European legal procedures in terms of permits etc. are seen as too complicated, similar to the public funding structure. One company told us that even though they had acquired a pledge for funding, the legal procedures that were necessary to approve their production process before really obtaining the money took so long that they almost lost the funds and were only able to survive because of short-term (and quite expensive) bridge financing. They are now moving more to the U.S. where permits and similar documents take much less time.

Feedstock security was not stressed as a strong barrier in Europe, but one interview partner mentioned it and especially lamented the protectionist agricultural policy of the EU, especially the sugar quota that impedes feedstock availability. Since the latest CAP reform abolished the quotas, the situation will probably change in 2017; however, it is not yet clear how that will affect prices and supply structures.

Some policies concerning valorisation of biomass are not harmonized among Member States, or are changed quite quickly (e.g. the EU biofuels policy). Another example is that in some countries, it is allowed to process glycerol from Cat. I fats into biogas and then wastes into fertilizers, but in others it is not.

Lastly, Novel Food and EFSA regulations are a huge problem for companies that make new food products. However, this does not concern the materials sector very strongly (e.g. cosmetics made from oil extracts), but more the production of food supplements.

## 4 Strengths and weaknesses of the Netherlands as a location for bio-based economy

In a previous study, we investigated the position of the Dutch bio-based economy on the global market, coming to the conclusion that the Netherlands is the location of many top players in the sectors of bio-based polymers and plastics, building blocks and composites. (see Dammer et al. 2013, report for NL Agency, reference number 52202). For that purpose, we interviewed several experts who have been active in the Dutch bio-based economy for many years.<sup>1</sup> They assessed the strengths and weaknesses of the Netherlands with the following conclusions that will – in combination with the results of the interviews – be the basis for the recommendations in the next chapter:

### *“Strengths of Dutch economy for bio-based materials and chemicals:*

Several of the interviewees in this previous project named the presence of a large and state-of-the-art chemical industry infrastructure in the Netherlands as one of the key advantages. In the vision paper of the VNCI, the search for alternative feedstocks is mentioned as an element of further developing the chemical industry in the Netherlands. However, some of the experts also pointed at the circumstance that often, existing industries have vested interests in keeping up the status quo and are not very willing for new developments, which also mean new competitors. One expert correspondingly criticized the VNCI report for not expressing real interest in true innovation, but focusing more on making existing things better. So, an established chemical industry can present advantages, but the motivation for changing to bio-based feedstocks needs to be strong in order to create change.

On the other hand, there are already a multitude of bio-based industries in the Netherlands (agriculture, food industry, horticulture, paper industry) that are looking for new outlets in order to diversify and develop. Here, new bio-based materials and chemicals are very attractive options, since the value added created from biomass is much higher for these products than for energy products. In the Netherlands, there is great potential for a stronger cooperation between agricultural, chemicals and plastic industries, which are all already existing and for which also the know-how is there. Competencies that were not associated before (like chemistry and agriculture) now need to become strongly associated to enhance innovative power and subsequent economic activity.

The knowledge base is further improved by excellent university programmes and top-notch research, which was stressed by all experts.

Furthermore, the Netherlands is a trading hub and thus possesses an excellent logistics network via sea, air, road, rail and rivers, which provides access to all European markets. Especially for biorefineries, this could be a decisive advantage, since they need to be built where biomass is easily available, which is often next to ports. Especially the port of Rotterdam as the most important trading port of Europe therefore gives a crucial asset to the Dutch bioeconomy.

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<sup>1</sup> Please note that the interviewees and experts referred to in this Chapter 4 are not the interview partners from start-up companies or SMEs that were contacted for this recent study. The experts who gave input to this quoted study were: Jan Ravenstijn, one of the leading international experts on bio-based polymers, Elsbeth Roelofs (and her team), consultants from TNO, as well as Christiaan Bolck and Harette Bos, both researchers from Wageningen University.

Access to aquaculture might be an important advantage for the development of 3<sup>rd</sup> generation feedstocks, too.

But also “soft” factors have come up during discussions. It was mentioned that in the Netherlands, there is a culture of cooperation between government, industry, research institutions, NGOs and the public. This also leads to a very strong awareness of the necessity of improving the public’s knowledge and perception of the bio-based economy. The qualitative study “My 2030s”, which was carried out at four different locations in the Netherlands, for example found that consumers do not have a clear definition of the term “bio-based” in mind, but mostly associate good things with it. Even though the study also found that many consumers do not really know much about what is going on in bio-based production and development, the existence of such a study shows that the Netherlands is one of the pioneers in this field. Also the willingness of government and public authorities to consult with expert knowledge from different sources signals openness for development, change and innovation.

#### ***Weaknesses of Dutch economy for bio-based materials and chemicals:***

Although the experts in this previous study identified many strong points, they also saw room for improvement in some aspects of the Dutch bioeconomy. One more general remark was that still, the political awareness of opportunities for prosperous future developments is inadequate, or that politicians are not willing to make tough choices, which results in far too low support levels for several areas, including the bioeconomy.

Strong criticism was expressed about the unlevelled playing field between bio-based materials and bio-energy as well as between bio-based and fossil materials. More concretely, bio-based energy receives a lot of subsidies, whereas materials do not receive funding on the commercial level.

As a potential weak point, the lack of available feedstock was mentioned. However, this seems to be somewhat controversial, since other experts expressed the view that biomass is available in sufficient amounts in the Netherlands, especially sugar and starch plants. According to them, the true problems lie with the investment conditions.

Concerning incentives for bio-based businesses, all experts agreed that the conditions need to be improved in order to make the Netherlands more attractive for setting up new bio-based productions. The example of Corbion<sup>2</sup> illustrates very well that innovative and successful bio-based companies often do not choose the Netherlands as a production location, due to much better conditions offered in other countries, e.g. Thailand. Also other Asian or North and South American countries offer stronger incentives for these companies. Experts explained this lack of incentives with the strong mind-set that is convinced of a free market, which is predominant in the Netherlands. Therefore, subsidies for industries are frowned upon (and would – at current legislation – often lead to legal disputes over distortion of competition). All experts, however, stressed how important it would be to support especially small and medium enterprises in their innovative ventures – by providing more financial incentives and capital, space for experimentation and by reducing bureaucracy. This was seen as the crucial weakness of the Netherlands, which fits well into the overall structures in Europe and which results in more and more investments taking place elsewhere in the world.” (Dammer et al. 2013)

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<sup>2</sup> Corbion (former Purac, a Dutch company) established their big LA production facility in Thailand in 2012.

## 5 Conclusions and recommendations

The evaluation of the interviews has shown that small companies active in bio-based economy in Europe face several issues when acquiring funding.

Clearly, the criticism of public funding schemes dominates the answers (see Figure 2). Many companies made positive mention of public funding mechanisms, mainly for the research that they had done. However, when it came to the following steps in the direction of pilot plants or even commercialization, they felt that support from the public side was lacking. For small companies that have no resources to fall back on, the first years of commercialization are crucial and in need of support. Several interview partners also complained about bureaucracy and suggested solutions similar to the ones in Canada or the U.S. In Canada, a one-stop shop - the SDTC - helps innovative entrepreneurs with all their questions about setting up business and acquiring funding for their activities. In the U.S., especially Delaware was mentioned as a positive example of public administrative procedures - one company reported that it took them only 24 hours to obtain a business permit, instead of eight weeks that it had taken in Germany. In cases where funding is dependent on timely implementation of business activities, such aspects might be decisive for the survival of a small company.

The other two aspects receiving quite a lot of attention are lack of investors' knowledge about the new industries and tax policy. They seem to be part of a bigger issue in Europe: Lack of political commitment to the bio-based industries. It was also mentioned in the introduction to the barrier analysis that many companies lamented the lack of clear goals or priorities that guarantee a stable market for bio-based products. Several countries have introduced bio-based economy roadmaps, and also the EU is focusing more and more on the topic. However, in terms of concrete measures, there is not much to be seen in Europe. Experiences with the biofuels policy make stakeholders even more cautious, fearing a quick change in political direction once public opinion changes or new scientific findings are made. The debate about the use of food crops, or first generation feedstocks, is also detrimental for the development of these new industries. Many companies fear that they will get negative press for using plastics made from starch or sugar, for example.

All of this creates insecurity for investors. These impressions were also supported by statements by the German biotechnology cluster CLIB2021. During discussions it was mentioned that in general, there is more than enough risk capital available in Europe, but that it does not go to new, bio-based industries. For instance, there are pensions funds containing hundreds of millions of Euros. Often, these funds are simply too big for investments in small, innovative firms. But it is also a very important factor that politics in Europe have not made it a clear priority to improve the framework conditions for bio-based chemicals and materials.

### 5.1 Level playing field – the competition triangle

Still, there is no level playing field for these materials, since they need to compete for resources with a heavily subsidized energy sector, and for market shares with a stable established fossil-based chemical industry that does not have to pay any taxes on the material use of fossil carbon. This state of affairs can be summed up in a “competition triangle”, which is shown below and illustrates the following:

*Right side: Bioenergy/biofuels and material use competing for biomass*

Material use is competing with bioenergy for biomass that is not used for food or feed. As a result of the comprehensive support system for bioenergy and biofuels, which was ultimately created by the EU RED, the prices for biomass and land have greatly increased.<sup>3</sup> This makes access to biomass for material use much harder and more expensive, but this is not compensated for by support measures. This market distortion hinders the competitiveness of producers of materials from biomass.

*Left side: Petro-chemical products competing with bio-based products*

The bio-based chemistry and plastics industries are exposed to full competition from chemical industry products. Without any accompanying measures, new, bio-based industries must be developed that can prove their viability in the face of the well-established and long-optimized mass production of the chemical industry. Then there are high biomass prices resulting from the promotion of energy use, which are not counteracted by taxes on fossil carbon sources as a raw material for the chemical industry. All of this creates an extremely tough competitive environment.

*Upper side: Fossil energy competing with bio-energy/biofuels*

Due to the comprehensive support system for the energetic use of biomass, originating from the RED and its national implementations, an artificial competitive situation compared to fossil energy sources has been created over the years. Furthermore, the latter are subject to a substantial energy tax – this makes for extremely favourable, artificially created competitive conditions for bio-energy and biofuels.

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<sup>3</sup> Several concerned companies have confirmed this increase in prices (see forthcoming publication of nova-Institute: Carus, M., Dammer, L., Hermann, A., Essel, R.: Proposals for a Reform of the Renewable Energy Directive (RED) to a Renewable Energy and Materials Directive (REMD). nova-paper #4 on bio-based economy. Hürth 2014-05.). The statement, however, is not based on official statistical data.

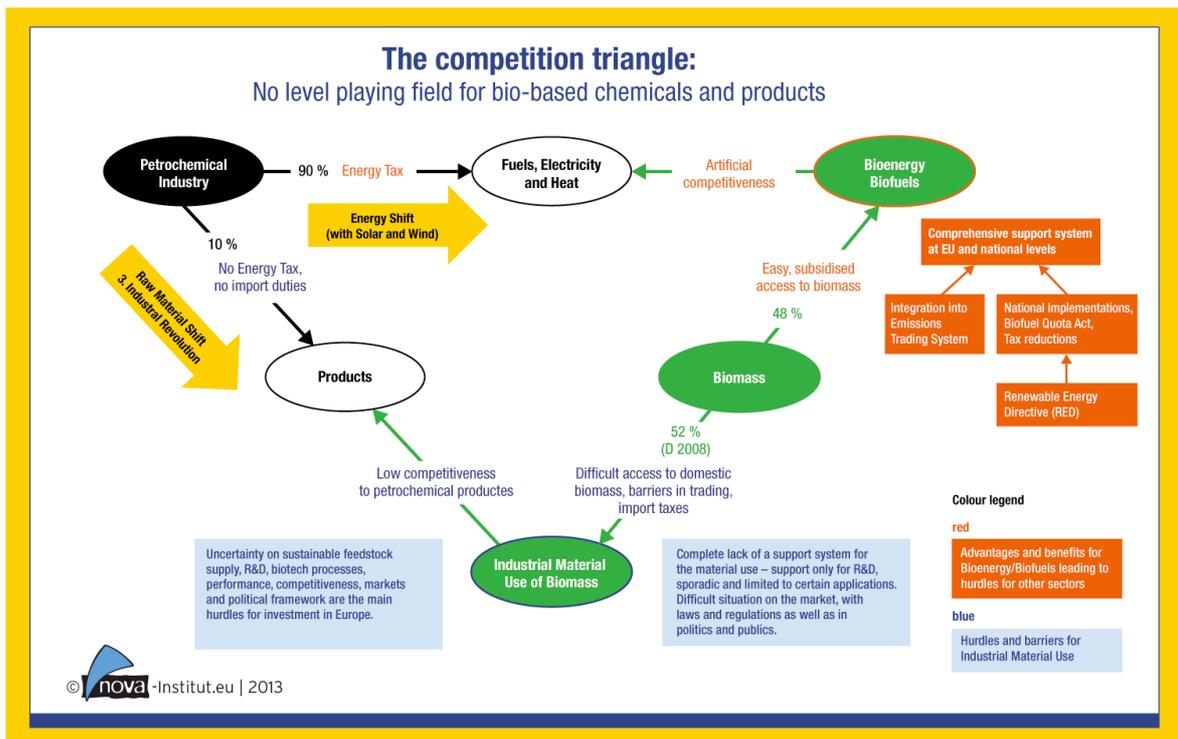


Figure 4: The competition triangle: Industrial material use of biomass - Biofuels/bioenergy - Petrochemical industry (Carus et al. 2014)

## 5.2 Sustainability and incentives – two sides of one coin

Another interesting aspect that is rarely talked about in the discussion about a level playing field is the aspect of feedstock sustainability. Recently, a few organisations and initiatives have been working on defining standards for sustainability certification of bio-based feedstocks for industrial material use (CEN/TC411 WG4 on a European level, INRO in Germany). ISCC+ and RSB already offer sustainability certification for bio-based feedstocks for industrial material use, which is used by some industrial players.

From a general environmental perspective, it should be welcomed that any use of resources should be determined by sustainability factors. And the discussion mostly follows the logic that biofuels have to fulfil sustainability criteria, so material use of biomass should do the same.

However, that is not a fair depiction of the situation. Biofuels and bioenergy only have to prove any kind of sustainability certification if they want to be eligible for the substantial support mechanisms available in the EU. Incentives and sustainability are inextricably linked for biofuels. This fact is not acknowledged at all when suddenly multiple stakeholders demand sustainability certification for bio-based materials as well. So far, companies voluntarily obtain this certification in order to fetch a Green Premium price on the market. However, when looking at the proposed sustainability schemes for bio-based materials they even suggest more obligatory sustainability criteria to be fulfilled than is asked from the heavily subsidized biofuels.

Furthermore, the petro-based sector is completely left out of any sustainability discussion. Except for the specific agricultural aspects, many criteria could also be applied to the use of fossil resources, but this is never seriously taken into consideration. In terms of a level playing field, there is still much to be done also in this regard.<sup>4</sup>

**Table 1: Sustainability criteria for different sectors and applications (energy and material) (nova 2014)**

	Industrial material use, CEN TC 411 on bio-based products (draft version)	Biofuels	Biofuels	Bioenergy	Bioenergy, proposal for solid and gaseous biomass (draft version)	Fossil-based energy, fuels & products (petro-chemicals)
Incentives	no	no	with RED incentives (accounted for in the renewable fuel quota)	no	with RED incentives (accounted for in the renewable fuel quota)	different subsidies in many countries
Number of environmental criteria	9	0	5	0	7	0
Number of social criteria	6	0	0	0	0	0
Number of economic criteria	1	0	0	0	0	0
Total number of sustainability criteria	16	0	5	0	7	0

## 5.3 Recommended measures

### 5.3.1.1 Prioritization

The first step towards a strengthening of the bio-based economy would be a clear definition of why this is a priority of European policy. “Bio-based” in itself is not accepted as an advantage in many regards, because of the food competition, negative environmental impacts such as eutrophication or other aspects. The U.S. has a very pragmatic approach and makes it clear that bio-based materials create jobs and value added, especially in the faltering agricultural sector. Secondly, an increased use of renewable raw materials grants more independence from fossil resources, which is accepted as an advantage, too. Environmental aspects are appreciated as well, but are not the only reason why bio-based materials are supported. The new Farm Bill 2014 grants funding for biorefineries for chemicals and materials under the same mechanism that supports biofuels plants. (Buckhalt & Goodman 2014)

The Bioeconomy Strategy published by the EU in 2013 is a good step in the right direction. As one result, the Bio-based Industries Initiative (BBI) was founded as a Public Private Partnership (PPP) by the Commission and the Bio-based Industries Consortium (BIC). This initiative has already raised 3.7 billion Euros of investment in bio-based innovation and is therefore one important measure to support this sector. However, less ambiguity about the motives and priorities for bio-based chemicals and materials would be helpful also in national policies. One example is also the issues of resource efficiency,

<sup>4</sup> More details on the unlevelled sustainability discussion can be found in the forthcoming publication of nova-Institute: Carus et al. 2014: Proposals for a Reform of the Renewable Energy Directive.

cascading use and circular economy which are stressed more and more often by the EU as well as by national governments, while at the same time the subsidies support direct energy use of raw materials, preventing them from entering cascades or circles. This is very contradictory and makes investors more insecure. Just very recently, the European Parliament has commented on the Bioeconomy Strategy by emphasizing “that bioeconomy policies must be better designed to ensure a cascading use of biomass [and called] in this respect, for the development of a legal instrument that will pave the way for a more efficient and sustainable use of this precious resource” (European Parliament 2013). Apparently, also the Parliament sees a need for more concrete actions.

### **5.3.1.2 Public procurement of bio-based products**

Green public procurement could also be designed to strengthen the public procurement of bio-based products, thus creating market demand and providing more security for manufacturers and investors. However, the doubts about the general environmental advantageousness of bio-based products and an unclear legal situation make it currently difficult for public procurement officials to prefer bio-based products. As mentioned before, the European Commission has included activities on this issue in a Horizon2020 Call in order to educate procurement officials about bio-based products and to make sure that such action will comply with European procurement law. The Dutch Public Procurement Expertise Centre PIANOo is furthermore starting a pilot project on public procurement of bio-based products very soon.

### **5.3.1.3 Infrastructure: Dedicated bio-hubs and chemical parks**

Some of the strengths of the Netherlands mentioned in the expert interviews was the already existing infrastructure in chemical industry as well as in agriculture that can be combined to create new value added with innovative bio-based outlets. In combination with the also mentioned excellent logistics and the knowledge present in the Netherlands, it could be a very valuable step to create more “bio-hubs” at strategically interesting points in order to facilitate the set-up of small innovative companies. Combining state-of-the-art production facilities with dedicated supply routes of bio-based resources, specialized waste removal systems and efficient energy systems would make it very attractive for companies not only to develop the ideas and technologies in the Netherlands, but also to set up production there, thus creating more jobs and value added.

In terms of infrastructure, it is also interesting to note that bio-based chemicals can be profitable on a much smaller scale according to some recent studies, thus relieving the pressure on feedstock transports and making local, small-scale production of high-value specialty chemicals possible. This is a very distinct property of bio-based materials compared to both energy and the petro-chemical sector. The following quote highlights the advantages this could mean for the Dutch economy:

“The conclusion I is that the chemical industry is the only sector that allows a higher cost price for its raw materials because these can be compensated by lower capital costs.

A second important conclusion II has been made in the recent study, that because of the lower capital costs per ton of product, also the scale of operation is less an important factor in the competition between companies of the future. It is anticipated that factories of 10 000 tonnes of product per year can become as competitive as the large petrochemical factories that have annual capacities of 200 000 and even 500 000 tonnes. The dominant competitive factor will become how to obtain the right raw material/conversion process

combination. Especially in times that the biomass raw materials are not available yet as commodities, the sourcing is an additional risk factor when financing has to be done. Also for the introduction of totally new products, small factories will be a competitive factor since this gives time to develop the market. [...]

The third conclusion III is that the chemical industry 50% based on biomass will create a lot of new jobs. Employability can grow with 40,000 jobs to supply the Dutch chemical industry with 50% of biomass raw materials (now being ca. 80,000 fte). This is revolutionary in a way because in agriculture but also in the process industry we have seen only reduction of labour because of the ever-growing productivity reached by automation, taking over of human and animal labour by machines. [...]

The conclusion IV is that when the chemical industry can afford to pay higher prices for components with suitable molecular structures that lower the need for capital, the other biomass components that result from a biorefinery, can become available at a much lower price, enabling the electricity and transportation fuel sectors to obtain their raw materials at competitive prices.

Therefore, conclusion V, the chemical sector is key and could pave the way towards our biobased economy.“ (Sanders 2014)

#### **5.3.1.4 Tax incentives**

Tax incentives could be very effective instruments in order to support small innovative companies and their bio-based products, the Malaysian example shows that exemption from taxes make it a very attractive location for biotechnology companies. Similar measure could be put in place for other, non-biotechnological bio-based businesses. However, tax policy is always a very controversial topic and is therefore expected not to be easily implementable.

#### **5.3.1.5 “Small” measures for market pull – directives and bans**

The following measures, in contrast, could be relatively simple to implement and are not expected to have large, undesired side effects. They would create more market pull and signalize a dedication of the Dutch government to bio-based materials.

Several directives and bans are conceivable that would promote bio-based and / or biodegradable products in context where they have significant advantages over other products. The example of biodegradable and compostable plastic bags has been widely discussed lately and most recently been backed by the EP vote on 16 April 2014, supporting the draft rules stating that plastic bags used to wrap foods such as fruit, vegetables and confectionery should be replaced by 2019 by carrier bags made of recycled paper or biodegradable and compostable bags (European Parliament 2014). Other very reasonable rules could be to only use bio-based and biodegradable lubricants in environmentally sensitive surroundings or starch-based, biodegradable mulch films in agriculture.

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## Annex I: List of interview partners

<b>No.</b>	<b>Company</b>	<b>Country</b>	<b>Interview partner</b>
1	Avantium	NL	Frank Roerink
2	betaproces	NL	Hans van Klink
3	biométhodes	FR	Gilles Ansalle
4	Bioprocess Facility Delft	NL	Arno van de Kant
5	corvay	DE	Albrecht Läufer
6	Direvo	DE	Jörg Riesmeier
7	ecotreausres	BE	Kris Schattemann
8	metabolic explorer	FR	Manuela Falempin
9	millvision	NL	Leon Joore
10	Phytowelt	DE	Peter Welters
11	QMilk	DE	Leonie Völsgen
12	Rodenburg Polymers	NL	Thijs Rodenburg
13	Zelfo	DE	Richard Hurding