

TRIODOS & NANOTECHNOLOGY

A reconsideration of Triodos' position in nanotechnology

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Triodos  Bank

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Abstract:

The Triodos Bank is of two minds regarding the phenomenon of nanotechnology. Companies involved in this technology might be of interest for investments, e.g. because nanotechnology can contribute to a more sustainable world. Triodos aspires this and therefore wonders whether it should implement nanotechnology as a sustainability criterion (or minimum standard) in its absolute analysis of companies. In this analysis stock-listed companies are assessed on different criteria to conclude whether or not they are eligible for investments. Or, should Triodos leave the phenomenon aside for a while, and wait for significant discoveries to be made?

Earlier studies (2007-2009) towards nanotechnology have been executed by Triodos' researchers and a Nano-framework was built up. However, as a result of the studies, the pro's of nanotechnology were not perceived as being able to outweigh the con's. And due to internal developments, nanotechnology was left aside. Triodos now wonders if there are any significant changes in the present time. Therefore Triodos asks the following question: "*should we again consider nanotechnology?*".

In order to address this question I firstly analyze Triodos' current Nano-framework. I identify different claims in it and establish its fundamental attitude as being *defensive*. Secondly, I oppose the Nano-framework to Triodos' core business principles. Those business principles – which create the existence of the bank - are *offensive*, and therefore, a field of tension between both assemblies is constituted. On the one hand the business principles want to change the world actively by promoting sustainability, whilst on the other, the Nano-framework is precautious towards nanotechnology. Above all, nanotechnology has the ability to match Triodos positive aspirations. So why being as precautious as the Nano-framework tends to see? I therefore A) attempt to comment on this via an ethical perspective (the Precautionary Principle), B) consult three Nano-experts on behalf of the results and C) conclude that Triodos' Nano-framework requires reconsiderations. Ultimately, I present a set of recommendations on how Triodos can accomplish this optimally.

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PREFACE

During the Master's program 'Applied Ethics' in 2012/2013 I opted for a traineeship at the Dutch bank known as: 'Triodos Bank'. During this traineeship, which lasted for three months at the head office in Zeist, I worked as a Sustainability Analyst at the Research Department. I operated in the same research-work as my colleagues, which made the traineeship – as an apprentice researcher - a brief, intense, instructive and inspiring period. Research assesses large stock-listed companies, advises Triodos Bank on criteria settings and engages with companies. In order to adapt, I had to get trusted with the ethical/ analytical framework the bank had built up since its establishment in the 1980's. This framework consists of twenty-one minimum standards, e.g.: *corruption, nuclear power, human rights, pornography, animal testing, genetic engineering or hazardous substances*. To assess whether a company violates a certain minimum standard, one analyses its background and controversies and links this data to a so-called 'factsheet' in which every minimum standard is elaborated in detail. By linking the data and the factsheet, one can conclude whether a company has major, minor or no involvement. If it turns out a company has a major involvement it is by definition excluded from investments. As such, it is not eligible because it does not (sufficiently) cohere with the ethical standards the bank lives up to.

Now, Triodos embraces new input and perspective. Never before have I been introduced with an organization so strongly committed as such. With Triodos' *practice what you preach* - attitude and - eagerness to *doubt certainties*; the mix was complete to make me identify with the organization. As a result of this identification, I started opening doors to find entrances in possible need of new input and perspective. Finally, after deliberations with some of my colleague's the following door hypothetically opened its gates:

CHAPTER I:

BACKGROUND AND INTRODUCTION

1.1. The incentive

In 2007 the Triodos Bank started investigating the phenomenon of nanotechnology. More specifically, the Research Department within the bank's full subsidiary named 'Triodos Investment Management' (TIM). By that time nanotechnology aroused Triodos' interest because it rose in publicity as an emerging technology. It stimulated critical questions from different groups in society, the most critical one being: "what are the effects on human health and the environment?". Therefore the researchers executed studies to gain more knowledge about the phenomenon and to formulate a nuanced study-based policy for the bank. The studies resulted in insights regarding the pro's and con's of nanotechnology, and by that time, led to the conclusion that the con's outweighed the pro's for most companies investigated. According to Triodos, the most striking cons are the *prevailing uncertainties* towards nanotechnology's impact on the *environment* and *human health*.

The Triodos Bank, via its investment funds, is an active player on the stock market. This means that via its sustainable funds, money is invested in all kinds of sustainable projects/enterprises. The bank concluded that due to nanotechnology's cons, companies that operate in high-risk industries, are involved in controversies or have no specific or sufficient Nano-policy, are by definition excluded from investments. But there's a catch: nanotechnology might also contribute to fundamental positive improvements towards the environment and human health (EU, 2011). And this happens to be exactly in line with the mission of Triodos, i.e.: "*to finance companies, institutions and projects that add cultural value and benefit people and the environment*". Therefore, Triodos asks and reflects introspectively: "*should we again consider nanotechnology?*". Rather, this time in the light of possible new developments.

1.2. Problem analysis

Nanotechnology seems to raise attention due to the major discrepancy in its actual effects. I.e. on the one hand it is perceived as the asbestos of the 21st century, on the other it might be a stairway to paradise (Nature Nanotechnology, 2008). Nanotechnology has significant benefits that might be of positive influence on the way we live our lives. Those benefits can be improvements of products, the energy sector, manufacturing, food or medicine (Nano.gov, 2013). Thus, enough reasons for Triodos that aims to work for positive social, environmental and cultural change, to investigate companies that are involved in this technology.

But there are also significant disadvantages; those include health and environmental risks and increased accessibility of atomic weapons (Nanogloss, 2013). Due to this discrepancy the Triodos Bank is of two minds regarding the phenomenon. Is it time for the bank to include the issue in its absolute analysis? (i.e. analyzing stock-listed companies for their potential for investments). Or should the bank leave the phenomenon aside for a while? And wait for new significant discoveries to be made.

With the above (the pro's and con's of nanotechnology) as a starting point it seems that nanotechnology can bring good and bad to the world and that Triodos wants to invest in the former. Now if such is desired, then, what is and were does Triodos' own current Nano-framework consist of? What drives the Triodos Bank? And thus, what are its core business principles? How can this be commented on from an ethical perspective? Are there new developments in the Nano-world? And if they happen to be present, do they contain enough significance to influence the bank's current position towards nanotechnology?

1.3. Problem statement

Is Triodos' position towards nanotechnology to be adjusted in the light of new Nano-developments?

1.4. The goal

To conduct research to Triodos' Nano-framework and new Nano-developments, in order to gain insight in the possibilities whether the bank's current position can be adjusted.

1.5. Research questions

- 1) What is Triodos' Nano-framework?
- 2) How to comment on this from an ethical perspective?
- 3) Are there new developments in (thinking about) nanotechnology?
- 4) Are those developments of influence on Triodos' Nano-framework?

1.6. Methodology and structure

In chapter two I will answer research question one, in chapter three question two, in chapter four question three and in chapter five question four. After the background and introduction in chapter one I will, in chapter two, analyze Triodos' Nano-framework. This allows me to interpret and establish Triodos' claims and values centralizing around nanotechnology. From here I will in chapter three introduce the business principles that the bank has set, e.g. to discover why the bank exists and what its fundamental attitude is. I now take a step back to the Nano-framework and discover a relation between both the Nano-framework and the business principles. The relation constitutes a tension and to get my thinking about this tension one step further, I comment on it through an ethical perspective (the Precautionary Principle). Here I examine whether or how Triodos' precautionous attitude affects its Nano-framework. As a result, the discussion regarding the Precautionary Principle aroused me with new questions for further scrutiny. In chapter four I will consult the field regarding the results so far. It seems that there are important developments that Triodos wouldn't want to miss. The experts provided intelligence regarding developments in (thinking about) nanotechnology that put Triodos' Nano-framework under pressure. As such, in chapter five, I conclude that those developments affect Triodos' Nano-framework and recommend a reconsideration and redefinition of it.

CHAPTER II:

AN ANALYSIS OF TRIODOS' NANO-FRAMEWORK

2.1. Introduction

In this chapter I will answer research question 1.5.1): "*what is Triodos Nano-framework?*". I will identify what Triodos regards as important in nanotechnology by examining its Nano-framework. This in order to acquire perspective on what the bank exemplifies as noticeable Nano-subject(s), what claims can be identified, and which values are respected. The framework consists of two documents that contain study results, respectively: a memo from 2008 and 2009. The memo 2008 I will analyse below provides an overview of the relevant facts and considerations for the development of the banks approach towards nanotechnology. In it's core notion the memo addresses the risks and benefits of nanotechnology. In particular the free-engineered Nano-particles that are insoluble in water and not biodegradable. According to the memo's those particles pose the biggest threat and uncertainty when exposed to humans and the environment.

Readers who are already trusted with the content of the Nano-framework might want to skip the upcoming two sections. For these sections merely depict the general structure and claims of the framework to form the analysis. However, the information is of more importance for individuals who are not yet trusted with Triodos' Nano-framework. The complete documents can be found in the appendices. I will now first of all present a general picture of the memo 2008, after this I will identify the resulting claims.

2.2. Memo 2008 nanotechnology

General picture of the memo 2008:

The memo 2008 was made to elucidate the - in that time - current Nano-developments. This was done to explore whether Triodos' needed to include the issue in its sustainability analysis and formulate it as one of its minimum standards¹. However, Triodos Sustainability Research also provides advice on the basis of a wide range of social, environmental and corporate governance criteria. Such criteria may cover issues that Triodos Bank considers to be important elements for assessing the (relative) sustainability of a company. The sustainability issues may directly or indirectly affect various interest groups, organisations, and individuals. To provide a formal platform for a regular dialogue on these issues, an international advisory panel was set up. The panel consist of around eight experts each from employers, consumers, environmental organisations, trade unions, human rights groups, development- and aid organisations and academia (Triodos' Handbook Research, 2013). Therefore, in order to discuss the phenomenon of nanotechnology, the memo 2008 contains a summary of the most important elements of the study results, e.g. nanotechnology' different applications, EU regulations and the development of codes of conduct by companies and initiatives. It also formulates a proposal on how to assess companies involved in nanotech and the effects this has on the investment universe. The latter is an overview of all selected companies that are eligible for investments. Besides this, the memo 2008 also includes questions that centralize around how the advisory panel perceives the presented data. E.g.: does the panel think nanotech should be a separate criterion? (i.e.: a minimum standard for assessing companies), or: does the panel agree with the free- engineered particles being crucial for assessment? The memo 2008' annex defines nanotechnology, its risks, benefits, applications, new developments, regulations, initiatives and companies that are involved.

Nanotechnology is defined in the following manner:

¹ Those minimum standards are: AL (Alcohol) + APP (Absence of Precautionary Principle) + ARM (Arms) + AT (Animal Testing) + BLP (Black List Projects) + CG (Violation of Corporate Governance) + COR (Corruption) + END (Biodiversity, Fishery, Palm Oil, Climate change, Deforestation) + FF (Factory Farming) + FUR (Fur) + GAM (Gambling) + GE (Genetic Engineering) + GE (Plants) + HaS (Hazardous Substances) + HRBL (Basic Labour Rights) + HRNW (Respect for Human Rightss + Coltan¹) + ICC (Violation of Internal Codes) + NP (Nuclear Power) + POR (Pornography) + TOB (Tobacco) + VOL (Violation of Legislation).

“Nanotechnology can be defined as research and technology development at the atomic, molecular, or macromolecular levels using a length scale of approximately one to one hundred nanometers in any dimension; the creation and use of structures, devices and systems that have novel properties and functions because of their small size; and the ability to control or manipulate matter on an atomic scale. A nanometer is one billionth of a meter (10^{-9} m)—about one hundred thousand times smaller than the diameter of a human hair.”
(memo, 2008)

Identification of claims:

Although the memo 2008 holds an inventory of developments, a set of implied claims can be identified. I will briefly present those claims in order to discover what Triodos regards as relevant when it comes to assessing companies on the Nano-criterion.

- 1) *Claim: companies involved in nanotechnology, especially when involved in products that contain free-engineered Nano-particles, are required to have a policy and programmes that demonstrate their awareness and measures taken to prevent exposure or demonstrating safety of products.*

By having a formal policy or program a company makes a first step to explain, justify or merely show awareness of its actions. As such, a company can prove its awareness and measurements to prevent e.g. exposure to employees, consumers and the environment to hazardous Nano-particles. By the time of study the 12 selected companies involved (see memo 2008 in appendix) had only four of them showing awareness through policies or participation in initiatives. *“However, as there appear to be unpredictable risks for consumers, it seems reasonable to apply a policy requirement to companies that produce consumer products containing free, engineered nanoparticles that are insoluble in water and that can lead to internal exposure”* (memo, 2008). If a company were to be eligible for investment(s), it would have to adhere to Triodos’ claim of a policy requirement. However, the activity of a particular company in a particular sector also poses a claim. Companies in the following sectors pose the highest risk for Nano-involvement:

- 2) Claim: *high-risk sectors are: food products, beverages, personal products, biotechnology, pharmaceuticals, health care equipment and leisure products (specifically toys), Chemicals and Textiles & Apparel.*

The above sectors are of high-risk because they all, in each a specific way, pose a threat to the exposure of free- engineered Nano-particles to the human body or environment. Companies active in these sectors are checked for involvement by analyzing their consumer product inventories. The difference with other companies not being active in high-risk countries, is that they are only evaluated when involved in controversies, or when there is evidence found of involvement in the production of consumer products containing free-engineered Nano-particles.

2.3. Memo 2009 Converging technologies and nanotechnology: next steps

General picture:

Memo 2009 was made to discuss the next steps Triodos Sustainability Research needed to take to further develop its approach to converging technologies including nanotechnology. It summarizes a presentation given to the Triodos Research team that elaborates on new technological revolutions². By that time it was concluded that it is still too early to include nanotechnology in the minimum standards. *“Time is a crucial factor in finding scientific evidence for potential harm”* (Triodos’ Minutes Advisory Board, February 2009). There was no consensus regarding the effects of nanotechnology yet.

Identification of claims:

Memo 2008 states that companies must at least provide information and be transparent concerning nanotechnology. It is often in their interest that the positive side of nanotechnology is stressed. Therefore, the pro-active approach of companies is elemental in

² This presentation was given by dr. ir. Rinie van Est from the Rathenau Institute.

the analysis of them. After this transparency test, memo 2009 indicates that, as a second stage of assessment, a new threshold should be set.

3) Claim: “*in a second stage, we should set a threshold. Consider relating involvement to the revenues of the company. Willingness to sign a code of conduct may be sufficient.*” (Memo, 2009)

The second stage of assessment provides a more accurate view of a company's involvement in nanotechnology besides mere transparency. When one relates company X's involvement in nanotechnology to the amount of revenues it returns on behalf of nanotechnology one gets a clearer picture of X's complicity. Furthermore, the signing of a code of conduct (i.e. a document outlining the responsibilities of or proper practices for an individual, party or organization) also adds to a company's transparency level. However, it also tells us something about the *principles* and *values* the company in particular lives up to. Those are of major importance to assess how a company perceives itself and its actions in the context of the world it functions in. To state differently, company-values show us what a company regards as important or how a company perceives what action is best and what is not. Let us therefore briefly focus again on the Nano-framework, does that contain any underlying values?

Two noticeable values inside the Nano-framework:

As depicted above, the two nanotechnology memo's provide information that enables the reader to learn more about Triodos' point of view and position in nanotechnology. Therefore, in the first part, I mentioned what Triodos regards as the most important consequences of nanotechnology. Those are the consequences of the free-engineered Nano-particles insoluble in water and not biodegradable. These particles are considered important due to the obscurity of their repercussions on A) the human body and B) the environment. And exactly here the underlying values inside the Nano-framework can be pulled to surface. On the one hand Triodos concerns itself about the value of *protecting human health* whilst on the other, the value of *protecting the environment*. Rather, if the protection of human health and

the protection of the environment wouldn't be valued as such, investments in nanotechnology might have already taken place. Also, if they wouldn't be valued as such, a further examination of Triodos' position in nanotechnology was unnecessary³.

2.4. Conclusion

With the above formulated analysis I acquired the sentiment that Triodos is somewhere holding the feeling that its position in nanotechnology contains reservation. Why else would the bank now ask the question: "should we again consider nanotechnology?". This question indicates that Triodos is at the same time retracted to, but also open to new input in nanotechnology. There is therefore a field of tension between the sentiment of being reserved (or reluctant) towards nanotechnology on the one hand, and having the desire to learn more about it on the other. The manifestation of this tension leads me to believe that the Nano-framework is generally *reserved* but not inherently *negative* towards the phenomenon. The Nano-framework does not completely reject nanotechnology, and it is most certainly curious towards new dimensions of the phenomenon. Dimensions, that might be suitable with the ideals of the bank.

At the same time the bank's position, as is described above, is immersed with precaution. This precautionary attitude is built up from the three claims I presented above. Those claims are:

1) The policy requirement (especially when a company is involved in the free-engineered Nano-particles) 2) The high-risk sectors. 3) The optional threshold.

The progression of the claims can be seen as follows:

Ad 1: because there are unpredictable Nano-risks for consumers, companies involved in nanotechnology, especially when involved in products that contain free-engineered Nano-particles, must have a policy or program. The policy or program must demonstrate a

³ Above all, the values I described can be disputed and more can be said about them. But for now it is sufficient to filter these particular values out of the Nano-framework.

company' awareness and measures taken to prevent exposure or must demonstrate the safety of products.



Ad 2: therefore, high-risk sectors for companies involved in products that contain free-engineered Nano-particles are: food products, beverages, personal products, biotechnology, pharmaceuticals, health care equipment and leisure products (specifically toys), Chemicals and Textiles & Apparel.



Ad 3: finally, as a second stage, an extra threshold is set. With this threshold a company' involvement in nanotechnology is linked to the revenues of the company. Also, a company' willingness to sing a code of conduct can be assessed.

The above presented claims indicate that Triodos' Nano-framework is written in a defensive style. One could summarize or phrase that defensive style like: "*we don't invest in nanotechnology for it holds risks and uncertainty*", or: "*we should not invest in nanotechnology because of the possible problems attached to it*". This approach is, regarding the fact that nanotechnology is a new technology filled with uncertainties⁴, understandable. However, not yet do I fully comply with this defensive sentiment. For I am at this stage not aware of new Nano-developments and their possible impact(s) on the Nano-framework. Perhaps they can influence the bank's perspective towards nanotechnology, and perhaps, even in a positive manner.

Now, when I consider my conclusions mentioned, they at least urge me to engage in conducting further investigations towards the phenomenon. But before I engage in further investigations towards nanotechnology, it is now first time to confront the current feeling of reservation in the Nano-framework. In order to do so, I will first need to introduce one more character into the ring, i.e.: Triodos' core business principles.

⁴ For more information about nanotechnology's uncertainties see e.g.: Nanotec, 2004.

CHAPTER III:

INTRODUCING TRIODOS' BUSINESS PRINCIPLES AND PRECAUTION

3.1. Introduction

In this chapter I will answer research question 1.5.2): *“how to comment on this from an ethical perspective?”*. In order to comment on the Nano-framework I will first examine Triodos' business principles (for the official documentation see appendices) to discover why Triodos exists and what its fundamental attitude is. The business principles and the Nano-framework together create room for further thought on which I will also elaborate here.

I will firstly introduce and interpret the bank's business principles to secondly, connect them with the current Nano-framework. This results in the discovery of a relation between the business principles and the present Nano-framework. This relation is distinct and requires further thinking. Therefore, thirdly, in attempt to bring the thinking about this relation one step further, recent literature around the Precautionary Principle might help. I will use the philosophical thinking around the Precautionary Principle' discussion to make this step. Therefore I will not make an exhaustive philosophical analysis of the Precautionary Principle itself. However, the discussion around the Precautionary Principle and its analysis create value for this subject. The literature might support me in commenting on the Nano-framework and in giving applied advice to the bank.

I will now first of all introduce Triodos' business principles to give a depiction of and reveal what Triodos has formulated as a starting point for operations. Here below we see what Triodos stands for:

3.2. Triodos' business principles

The official document containing Triodos' business principles provides a framework for the way Triodos Bank operates in business. It also supports its day-to-day decision-making. Here

below I will present the goal of the bank, its vision and business principles, because they are elemental to the point I want to assent to. The official document starts by stating the goal:

“Triodos Bank is one of the world’s leading sustainable banks. We enable money to work for positive social, environmental and cultural change by offering a comprehensive range of banking services (...) We believe we have a responsibility to help bridge the gap between economic development and the interest of people and the environment. We try to do this in three different ways – by providing sustainable services, by developing new and innovative products and by engaging in public debate about the benefits and challenges of socially responsible business and sustainable banking” (Triodos official business principles document, 2010)

Subsequently, the vision of Triodos is formulated as follows:

“Triodos Bank exists because it believes that people have the freedom to develop themselves, have equal rights and are responsible for the consequences of their economic actions on society and the planet. We only lend to and invest in organisations that contribute to a more sustainable society” (Triodos official business principles document, 2010)

Finally, this leads to the following core business principles:

“Promote sustainable development”, “respect and obey the law”, “respect human rights”, “respect the environment”, “be accountable”, and “continuous improvement” (Triodos official business principles document, 2010)

If we start by looking back at the goal of the bank again, one can distill an underlying tone out of this goal. If I requote some of its elements, the underlying tone I want to bring forward, becomes evident. The following part of the second sentence: *“we enable money to work for positive social, environmental and cultural change”* partly reveals this attitude. Here phrases as *“enabling money”* and *“working for (...) change”* carry up the *offensive*, as opposed to *defensive* position of the bank’s goal and attitude. Other phrases such as *“enabling”* and *“working for”* can be interpreted as ‘forging ahead’ and thus, are progressive. The following fragments in the third sentence also exemplify this progressiveness, e.g.: *“helping to bridge the gap”*, and bridging it by: *“providing sustainable services, (...) developing new and innovative products and by engaging in public debate (...)”*. Here verbs as *“helping”*, *“providing”*, *“developing”* and *“engaging”* illustrate the offensive fundamental underlying tone.

The vision of Triodos also resembles its offensive position as such. Especially the second sentence of Triodos' vision reveals this. I.e. because Triodos merely unites with organizations that “*make a contribution to a more sustainable society*”. “*We only lend to and invest in organisations that contribute (...)*”. Here another offensive verb clarifies the banks progressive attitude, i.e.: only to lend or invest in organizations that “*contribute*”. In other words: if an organization does not somewhere match the offensive vision of Triodos, it is not eligible for loans or investments.

The above described fundamental attitude also sipples through in Triodos' core business principles. If one takes a closer look at the business principles; one reads at first that Triodos wants to “*promote sustainable development*”. Here another offensive verb, i.e.: “*promoting*”, can be pulled to surface. This particular principle is one that can be perceived as one that wants to change things in the world. Or rather, a principle that wants to change current (unsustainable) developments, activities or practices into sustainable ones. Because the principle wants to *change* and *bring something forward*, it wants to actively contribute. Therefore its character is offensive.

This offensive character is also found in the other principles, e.g.: “*continuous improvement*”. As it's description (see appendices) states: “*we seek to continuously improve all facets of our business*”. Here: “*to continuously improve*” shows us, again, a fundamental attitude of going forwards and wanting to bring forward change in the face of current practices.

Now, does the abovementioned presentation have any meaning towards the Nano-framework? Does it affect it? Or is there at all a connection between the above described fundamental attitude of Triodos and it's own Nano-framework? Below I will briefly step back to Nano-framework with the information presented so far.

3.3. A step back to the Nano-framework

In chapter 2.3 I concluded that the Nano-framework of Triodos is generally *reserved* but not inherently *negative* towards nanotechnology. The Nano-framework contains a sentiment of precaution and therefore, *defensiveness*. The core business principles, however, contain an *offensive* fundamental attitude. In this perspective both assemblies can be distinguished from each other. But moreover, in this distinguishment an inherent field of tension is constituted.

This field of tension consists of the Nano-framework as being defensive towards nanotechnology, whilst the business principles provide an overall impression of offensiveness. The business principles want to promote sustainable development and bring ideals forward, whilst the Nano-framework is operating out of precaution and defensiveness. The Nano-framework is, thus, not able to carry up the offensive nature of the business principles due to its precautionary attitude. And therefore, the two seem to be out of tune towards each other.

The Nano-framework internally has a field of tension in it between *preventing from doing something wrong* (e.g. investing in nanotechnology and the uncertain risks concerned) whilst also *being eager contribute to something good* (e.g. Triodos' eagerness towards the positivities of nanotechnology). Subsequently, when one connects the Nano-framework to the business principles, the origin of the tension is found. The tension between the business principles and the Nano-framework consists of A) the business principles *wanting to bring forward change* whilst B) the Nano-framework is *being precautionary*.

This precautionary attitude towards nanotechnology can also be traced back to the following internal proposition:

"When it's not clear that nanotechnology is not harmful, the Precautionary Principle should be observed."
(Triodos' minutes from the advisory board, 9 February 2009)

Notice in the above quote that a reference is being made to the 'Precautionary Principle'. The quote tells the reader that if there is uncertainty about nanotechnology's effects, one should observe the Precautionary Principle. As such, the above attitude results in Triodos not investing in nanotechnology. This is because, as we can see in the memo's, by that time (2007-2009) it was not clear that nanotechnology is not harmful. But in the fact that Triodos refrains from investing in nanotechnology there is an important notion that I share. That notion is: if there are risks, one must be precautionary. However, being precautionary is not necessarily the same as doing nothing, or in this case, to refrain from investing in nanotechnology.

Now, in order to make one step between Triodos' simultaneous defensiveness and offensiveness, or to say: refraining from investing in nanotechnology's and wanting to bring

forward change at the same time, literature around the Precautionary Principle might help. Therefore I will now briefly investigate what the discussion around the Precautionary Principle is and whether or how this can help me in making one think-step about Triodos' Nano-position. In order to approach the former I will first have to learn more about the Precautionary Principle itself. In the section below I will indicate aspects of the discussion around the Precautionary Principle in current literature to interpret it and present its characteristics.

3.4. The Precautionary Principle

In "The Precautionary Principle" (2012), Atheensu & Sandin review the history, current discussion and research on the Precautionary Principle. In their conception of the general idea of precaution they refer to Phillippe H. Martin from the European Commission Joint Research Centre who claims that: *"the precautionary principle is an age-old concept. Unambiguous reference to precaution as a management guideline is found in the millennial oral tradition of Indigenous People or Eurasia, Africa, the Americas, Oceania, and Australia (Martin, 1997, p. 276)"*. With this claim we can see that the principle is not completely new. Precautionary thinking can even be traced back to the famous dialogues in the book *Republic* (around 380 BC) written by the Greek philosopher Plato. In the following quote Plato briefly discusses the use of precaution when one shares arguments with others: *"and wasn't everything that was said before this also directed to precaution- that those with whom one shares arguments are to have orderly and stable natures, not as is done nowadays in sharing them with whoever chances by and comes to it without being suited for it"* (Republic, 539-d). Though in his quote Plato elaborates on precaution in the relationship of one human being to another. But within the form of a principle, precaution might also emphasize a more abstract level. E.g. the level of the human being and the consequences of its acts in relation to its environment (or the world). The first usage of precaution in the form of a principle dates back to the 1970's and still some scholars differ in whether the principle has a Swedish or a German origin (UNESCO, 2005).

As a general understanding of the Precautionary Principle Atheensu & Sandin (2012) state that: *"precaution has played a role in oral traditions (...) and guides us not to inflict harm with our actions"*. In line with this general understanding, Atheensu & Sandin (2012) also state that taking precaution has always been in line with common sense thinking. E.g.: *"the idea that care*

and foresight are required in the face of (...) uncertain future is universal and of all times (Trouwborst, 2002, p.7)". Therefore, as a general understanding of the Precautionary Principle, one can say that the principle emphasizes the avoidance of harm and preparation for an uncertain future. Notice, however, that within the understandings of the Precautionary Principle presented so far, there has been no reference made to the environment or human health in them.

However, both notions are prominent in the approach of Triodos towards nanotechnology. In line with those notions, Ahteensuu & Sandin (2012) state that the Precautionary Principle embodies the idea of "*in dubio pro natura*". Which means: if in doubt, decide in favor of the environment. But although the latter phrase appears quite straightforward, the Precautionary Principle seems to take different forms. Two widely known formulations of the principle can be found in the United Nations Conference on Environment and Development (1992)⁵ or by the Science and Environment Health Network (1998)⁶. In the latter formulation we can see that, besides the idea of *in dubio pro natura*, a reference is being made to the effects of actions on human health and the environment. In line with this more specified focus on environmental effects and human health, the definition adopted by the United Nations General Assembly (1982) is interesting:

"Activities that are likely to pose a significant risk to nature shall be preceded by an exhaustive examination; their proponents shall demonstrate that expected benefits outweigh potential damage to nature, and where potential adverse effects are not fully understood, the activities should not proceed" (Principle 11b; line added).

Here we see that the above definition is, in the end, quite defensive. Rather, "*when effects are not fully understood, the activities should not proceed*". So in this definition we see that precaution means to refrain from activities under the light of risk. However, on the other side, there are also definitions that propose a more offensive character. The following definition proposes a different attitude: "*a precautionary approach is necessary which may require action to control inputs of such substances even before a causal link has been established by absolutely clear scientific evidence*" (Second International Conference on the Protection of the North Sea 1987, Paragraph 7; line added)

⁵ I.e.: "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (UNCED, 1992, Principle 15).

⁶ I.e.: "when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically (Wingspread Statement on the Precautionary Principle, 1998).

Here we can see that, instead of directly refraining from action, a more pro-active attitude is described. Rather, in the above definition, the principle allows one to act in order to control safety. Here below we can see another illustration of this:

“Precautionary principle, that is to take action to avoid potentially, damaging impacts of substances that are persistent, toxic and liable to bioaccumulate even when there is no scientific evidence to prove a causal link between emissions and effects” (Third International Conference on the Protection of the North Sea 1990, Preamble; line added)

It is remarkable that in this definition we can see that, besides allowing action to *control* safety, one is also allowed to take action under the motto of *avoiding* risks. Therefore as a first interpretation of the Precautionary Principle - although there are many different forms of the principle to be found – I can now see that some definitions state that when there are risks: refrain from action. Another example to illustrate this: *“the PP [Precautionary Principle] generally bans (very) risky action, in effect forbidding us to do any of the things we can do, including the option of “doing nothing” (...)* (Munthe, 2013). However, other definitions imply that the Precautionary Principle is more than “doing nothing” or “refraining from action”. E.g. the definitions I formulated above that confirm the requirement of action in order to control safety or avoid risks. One could therefore say that living up to the Precautionary Principle also means to *take action* that helps tackle or control an occurring problem instead of “doing nothing”. These two meanings of the principle strongly differ from each other, i.e. A) as long as there are risks: do nothing or B) when there are risks: take action. Being precautionary, thus, also means to prevent something from getting worse. But then, how does one prevent something from getting worse? This can be done in different ways (see ‘The Precautionary Principle in Action – a Handbook’, 1998, p.6) and here below I will present one example.

In ‘The Precautionary Principle in Action – a Handbook’ (1998) Tickner & Raffensperger (et al) present some noteworthy examples of the Precautionary Principle in action. In one of those examples the authors refer to a case of “The Massachusetts Toxics Use Reduction Act” (TURA) as a salient example of precautionary action that can be taken. TURA requires that *“manufacturing firms using specific quantities of some 900 industrial chemicals undergo a biannual planning process to identify ways to reduce use of those chemicals”* (Tickner & Raffensperger, 1998). Herebelow I will briefly present the precautionary actions taken. I present those actions to

give an example of and confirm the earlier use of precautionary action which has the aim of preventing riskful activity from getting worse.

Precautionary actions in TURA taken:

- 1) *Goal-setting*: in TURA goals were set to reducing toxics by-product (waste) by 50 percent.
- 2) *Alternatives*: not only industrial facilities were instructed to identify the "safe" level of toxic use, TURA also considers any amount of toxics use too much.
- 3) *Monitoring and reporting*: this means that chemical companies were required to measure their progress yearly at reducing their use of toxic chemicals.
- 4) *Responsibility*: while the burden is on the firm to identify alternatives and analyze their chemical impacts, TURA provided support and incentives to ensure that progress is made in reducing toxic chemical use.

With the above examples of precautionary action we can now see that being cautious doesn't have to necessarily mean: "do nothing". One can also take action in the light of uncertainty. However, fact is that the abovementioned approach is not to be found in Triodos' position in the Nano-framework. Although profound criteria are formulated (e.g. that companies ought to have a policy or program), those are not the same and as offensive as the precautionary actions just described. Rather, eventually, in the Nano-framework the uncertainties about nanotechnology' repercussions lead to: "do nothing"⁷. Notice however that Triodos' offensive business principles *do* require action to be taken. Wouldn't it then, perhaps, be a suitable way for Triodos – a way that is also mentioned in the Precautionary Principle' discussion – not to resign when there are risks? So in this case, not to resign when there are risks towards nanotechnology and instead, take precautionary action. Especially because A) literature has shown that precaution is more than "doing nothing" and moreover B) Triodos has an important goal or (business) principles to be pursued.

3.5. Conclusion

By introducing Triodos' business principles I attempted to confront the sentiment of reservation (or defensiveness) in Triodos' Nano-framework. And after a depiction and

⁷ Notice here that with "doing nothing" I refer to "not investing".

interpretation of those business principles, an area fraught with tension was discovered. This tension consists of Triodos' Nano-framework as being defensive, whilst the business principles are offensive. On the one hand the business principles indicate that Triodos exists for a higher purpose (e.g. to promote and actively strive for sustainability), whilst on the other, the fundamental attitude of Triodos' Nano-framework is essentially trying to prevent something from going wrong. It is defensive. However, as was stated before in chapter 1.2, there are parts of nanotechnology that have the ability to positively comply to Triodos' business principles.

In attempt to bring the thinking about this area of tension one step further, the literature around the Precautionary Principle has provided me with a useful insight to comment on the Nano-framework. Rather, the discussion around the Precautionary Principle has shown that precaution is more than "doing nothing". It has shown that being precautionous is understandable in the light of uncertain outcomes. However, it has also shown that precaution is a consideration of what is at stake in a particular situation, and that precautionary action can be taken. By retrieving the former notions I can now understand Triodos' Nano-framework as being a consequence of the Precautionary Principle. That is because the Nano-framework is essentially precautionous in the light of uncertain outcomes.

However, there is a tension between referring to precaution (as the fundamental attitude in the Nano-framework) and being progressive/ offensive (as the fundamental attitude of the business principles) at the same time. One could phrase this in the following question: "does being precautionous to nanotechnology lead to promoting sustainability?". The question can remain unanswered. But the important notion within it is that it seems that the current Nano-framework is unable to carry up the fundamental attitude of the business principles. Furthermore, if Triodos "does nothing", nanotechnology' cons are left open and therefore they might grow. Moreover, "doing nothing" also carries the risk that one might think it is always better to do nothing when there are risks. And exactly this approach of "doing nothing when there are risks" is incompatible with the Triodos Bank as a case. That includes it's offensive strategy and wanting to bring forward change.

Something must be done.

Now, with the conclusions mentioned above as basic assumptions, a closer developed frame of reference is created to consult experts for further advice. Perhaps they can enrich with intelligence about the current status of nanotechnology or developments in (thinking about) nanotechnology. Perhaps they can even provide information about developments that are relevant for Triodos' Nano-framework. I will therefore present the experts the following notions:

- 1) Does nanotechnology fit the offensive strategy of Triodos?
- 2) Are there developments in (thinking about) nanotechnology that put pressure on Triodos' Nano-framework?
- 3) What precautionary actions can companies take? and
- 4) How could companies make those actions transparent?

In the following chapter I will present the results from the expert interviews.

CHAPTER IV:

EXPLORING DEVELOPMENTS IN (THINKING ABOUT) NANOTECHNOLOGY

4.1. Introduction

In this chapter I will answer research question 1.5.3): “*are there new developments in (thinking about) nanotechnology?*”. This chapter consists of a depiction of core notions and a composition of shared notions derived from the expert interviews. The core notions are presented in concise descriptions of what the experts assent or dissent to⁸. The complete records of the interviews can be found in the appendices. Finally, some sentences are made italic because they are paraphrased from the interviews or were stressed by the experts during the interviews.

In order to discover whether there are any developments in the current Nano-world three expert-interviews were held. The experts interviewed have profound knowledge of nanotechnology and its various dimensions. Nanotechnology is a prominent subject within their professional activities. At first, an interview was held with with ir. ing. Bart Walhout, he is a researcher at the Twente University and researches governance processes, frameworks and discourses of emerging technologies. Second, I spoke with dr. ing. Rinie van Est, he works at the Rathenau Institute located in the Hague. He signalizes new developments in science, technology, politics and society. His focus is on emerging technologies like nanotechnology, biotechnology, information technology and cognitive science. Finally, I spoke with dr. Ineke Malsch, who is director of Malsch TechnoValuation. She is a consultant specializing in Technology Assessment of new technologies including nanotechnology, life sciences and other emerging technologies in their societal context.

⁸ The core notions discussed in this chapter exemplify or imply the answers of the experts to the questions formulated on page 26. In this chapter the core notions mainly regard the answers to question one and two. For all answers to all the questions see the appendices.

I will now start with presenting a summary of the interviews beginning with ir. ing. Bart Walhout followed by a subconclusion. Hereafter I will present the remaining expert interviews in order to make a composition of the outcomes and to formulate conclusions. Hopefully, hereafter, I will be able to formulate the final conclusions and recommendations.

4.2. Summary of the expert interviews

1) Core notions discussed during the interview with ir. ing. Bart Walhout (27-05-2013)

Defining nanotechnology

Regarding Triodos' current definition of nanotechnology Walhout remarks: *"one must notice here that this definition is centralized merely around Nano-materials"*. He emphasizes that Nano-materials are only a part of nanotechnology. This is why Walhout asks the following questions regarding Triodos' Nano-framework: *"what are we talking about? What is this framework about? Is that limited to Nano-materials? Or nanotechnology in a broader sense?"*. However, Walhout understands Triodos' precautionous position in nanotechnology. This is because he agrees that Nano-safety is the most important notion to address. Though, it's not the only important notion, *"especially not because nanotechnology can serve social goals"*. Triodos should therefore reflect on whether they can - in principle - change their own view to nanotechnology.

Developments in nanotechnology

Walhout presumes no new significant developments in nanotechnology which could be a reason for Triodos to reconsider it's current Nano-framework. At least, not a lot them. *"The envisioned applications of nanotechnology did not change that much, nor were there specific breakthroughs since 2007"*. However, as Walhout states: *"one must have in mind that nanotechnology development continues and progress is being made"*.

Cheap Diagnostics & Environmental Remediation

Although, there might be no significant new Nano-developments that can positively counter the attitude in the Nano-framework; there are two interesting tendencies. Tendencies that,

by looking at Triodos' offensive and progressive business principles, fit the bank's purpose/existence. Those tendencies are A) Cheap Diagnostics⁹ and B) Environmental Remediation¹⁰.

Triodos' involvement in the stock-market vs. investing in small companies

According to Walhout, investing in one of the two tendencies depends on how Triodos steers its money. Triodos steers money via its funds, the stock-market and loans.

Unfortunately, therefore, there would need to be stock-listed companies specifically focusing on the tendencies in order to be able to invest. *"If they [Triodos] would also invest in smaller companies this would change the situation"*.

Precaution in the Nano-framework

Walhout understands why Triodos' Nano-framework contains precaution. He mentions: *"if the money goes via this route [i.e. the stock-market] (...) you don't control it completely. If you directly invest in a specific company it would be different. Or you could say: I allow company X in my fund"*. Precaution in general has a lot to do with balancing considerations. Though one must have a mechanism for this, or ideas, on how to balance those considerations. This instead of merely being precautionous and say, "I'm not doing it" (to invest in).

Subconclusion

Nanotechnology can serve social goals and that is a reason on itself to positively perceive nanotechnology. Though, if Triodos has the intention to internalize a sustainability criterion as "nanotechnology" the first expert notices that this definition is insufficient. This is because it is limited to only Nano-materials. Also, according to Walhout, there happen to be no specific breakthrough's in nanotechnology that could put pressure on Triodos' current Nano-framework. By 'putting pressure' is meant: developments that could – considering Triodos' offensive business principles – shift the Nano-framework' fundamental attitude away from defensiveness. Two tendencies could fulfill that and those are Cheap Diagnostics & Environmental Remediation. However, Triodos' activity in the stock-market limits the accessibility of potential eligible nanotech-companies.

⁹ This includes improvements in medical diagnostics where Nano-risks (e.g. free- particles) are low.

¹⁰ This includes using Nano-materials to clean the environment (e.g. water purification). For more information about the tendencies see the appendices.

2) Core notions discussed during the interview with dr. ir. Rinie van Est (28-05-2013)

Defining nanotechnology

Regarding Triodos' definition of nanotechnology van Est remarks that it should be different. That is because nanotechnology has a small discussion, which centralizes around the Nano-particles and risks and a broader discussion. The broader discussion is about NBIC convergence, which concerns the intertwinement of nanotechnology, biotechnology, information technology and cognitive science. According to van Est, *"when you're talking about nanotechnology it is not only about Nano-materials, but about the complete NBIC development"*. If Triodos decides to focus on Nano-materials and their effects on the environment and health, that means that Triodos must confirm itself to the discussion of Nano-particles and Nano-risks (i.e. the small discussion). Van Est remarks that it is perfectly fine for Triodos to focus on Nano-materials, toxicity and risks. However, he remarks: *"if I could give an advice to Triodos: if you really want to understand what sort of new Nano-products come into the market, the focus needs to be on the complete and broader story of nanotechnology, i.e.: NBIC"*.

Cheap Diagnostics & Environmental Remediation

Van Est' advice is to consider Cheap Diagnostics and Environmental Remediation¹¹ for possible investments. E.g. within Cheap Diagnostics you can find Lab-on-a-Chip developments¹². Van Est remarks: *"it is an encouraging and interesting development, (...) you are able to measure your own health and lifestyle"*. Furthermore, Lab-on-a-Chip can either be A) outside the human body or B) inside the body. The latter application is called "wet sensors". Within this development there are prototype chips in the test phase, which could be seen as a positive development making progress. Van Est' advice is to start searching for developments like this and he recognizes that there can be potential investment opportunities for Triodos in both tendencies. He states that: *"the fact that there are opportunities in both: yes?"*.

A growth in awareness and: search for best practices

¹¹ For more information about both tendencies see the complete record in the appendices.

¹² Literally: laboratory functions on a chip.

Van Est mentions that companies involved in nanotechnology must confirm themselves to the most stringent safety rules. He states that there are big companies that deal with nanotechnology quite properly. But there are also companies who care less, or have no knowledge or awareness of what they're doing with nanotechnology. Also, van Est mentions that there has been a growth in company's awareness since 2008/2009. *"By that time, the Rathenau Institute frequently received callers asking: 'were reading in the newspaper that nanotechnology might have risks, whom should I contact?'"* Van Est notices here that the Dutch institute "RIVM" is important here. This institute created "KIR" (Kennis- en Informatiepunt Risico's nanotechnologie) which is a knowledge center for nanotechnology. Therefore, if one has a question about nanotechnology one can call them. For the Triodos Bank, van Est states, *"it is interesting to know more about what are best practices at this moment. From there they can start making claims"*.

Subconclusion

Van Est exemplifies: *"define nanotechnology as Nano-safety"*. So here again an expert mentions to a reconsideration of the current definition of nanotechnology in the framework. The focus must not be on the small, but rather, on the large discussion (NBIC convergence). Also both Cheap Diagnostics and Environmental Remediation can provide Triodos with noticeable developments that are worthwhile considering for investments. Although concrete investing examples are yet to be found, the future developments of both tendencies are definitely worthwhile considering. Finally, van Est expresses understanding for Triodos' current approach. Though, if we reason from this approach, Triodos should start looking for best practices in Nano-materials.

3) Core notions discussed during the interview with dr. Ineke Malsch (29-05-2013)

Defining nanotechnology

Malsch mentions that it's important not to generalize nanotechnology. Therefore, Malsch thinks that *"Triodos should make a distinction between Nano-particles and nanotechnology"*. However, with regard to the free-engineered particles, Malsch confirms Triodos' point of concern in them. She states that *"there is no evidence yet of the free-engineered particles being safe or not"*. We

could perceive this as ‘uncertain risks’. Although, perhaps after tests it just might seem that applications with free-particles are safe, or even safer than the ones already on the market.

Cheap Diagnostics & Environmental Remediation

Malsch remarks that *“within Cheap Diagnostics: there are a lot of interesting developments”*. E.g. in Africa were applications of diagnostics are used for infectious deceases in the tropics¹³. Unfortunately, when it comes to these types of developments, there is a problem of visibility. Malsch states: *“I think Triodos doesn’t have a complete picture of what is happening in nanotechnology and what its priorities are”*. For example in Brazil, Argentina or Colombia or Peru researchers are working on establishing educational programs in Nanotechnology. So there could definitely be an investment interest for Triodos. There are indeed initiatives that fit, but they are not getting enough investments. Malsch states also that: *“most people involved are academics and there is a big distance with the industry. Companies just don’t invest in developing countries”*. However, Malsch thinks that Cheap Diagnostics and Environmental Remediation are developments in which one could find positive case-examples for Triodos¹⁴.

Precaution in the Nano-framework

Malsch remarks: *“I think Triodos shouldn’t stare itself blind towards the Precautionary Principle”*. An important notion here is that the Precautionary Principle can work very conservative. If one says: *“it has to be proved that nanotechnology is completely safe before we invest”*, then there will always be other countries or investors who have lower standards or who have developed new products were the Precautionary Principle doesn’t play a role. Thus, they can take over the market. Strikingly, in this situation you put a brake on companies that do consider sustainability and their development or market opportunities.

4.3. A composition of shared notions + conclusions

The questions raised due to the results of chapter three were in this chapter presented to Nano-experts. With the results of the three experts interviews I became aware of different notions which are equally shared by the experts. It appears that within the current thinking about nanotechnology an important step can be made. I.e. three experts have indicated that

¹³ For more details and examples see the complete record in the appendices.

¹⁴ For examples of those cases see the complete record in the appendices.

it is not sufficient to define nanotechnology with a mere focus on Nano-materials. In our spirit of time technologies are intertwining and because nanotechnology is part of that intertwinement, it deserves a broader perspective. The three experts all confirm this and that is why I can conclude:

The current definition of nanotechnology in the Nano-framework shows deficits

Triodos' definition of nanotechnology is too small because of the focus on Nano-materials. If nanotechnology would be internalized as a sustainability criterion in Triodos' absolute analysis, nanotechnology' broad definition must be used. If this broad definition is not used, the use of 'Nano-safety' fits better than the use of 'nanotechnology'.

Furthermore, as the experts have presented their individual perspective, they all seem to have a hard time to come up with a business case that suits Triodos' investments. On the basis of this collective understanding I can conclude that:

There are at this time no suitable or eligible business cases for investments

At this point there are no suitable business cases that put pressure on the Triodos' Nano-framework. At least, not many of them or not ones that can enable Triodos to perceive nanotechnology positively. There are concrete cases¹⁵ but no companies involved in suitable Nano-developments that fit Triodos' way of steering money. That is because they are not active on the stock-market. However, most certainly there are institutions, groups, organisations or small companies active in suitable Nano-developments. Therefore I can conclude also:

Cheap Diagnostics and Environmental Remediation are worthwhile considering

There are chances for Triodos to invest in nanotechnology. But they are not closeby. Triodos should prepare itself for these chances. Within developments of the broad definition of nanotechnology several tendencies are relevant for the offensive aspirations of Triodos. Those are: Cheap Diagnostics¹⁶ and Environmental Remediation¹⁷.

¹⁵ For examples see the record of the interview with dr. Ineke Malsch in the appendices.

¹⁶ E.g. Lab-on-a-Chip developments that enables the creation of a healthcare system outside the walls of a hospital. This is also significant when one focusses on countries where there are no major healthcare systems, e.g. countries in development.

CHAPTER V:

CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

In this chapter I will present the answers to the four research questions, including the yet unanswered question 1.5.4): “*are those developments of influence on Triodos’ Nano-framework?*”. Hereafter the notions will be brought together in a main conclusion which finally results in formulating recommendations.

5.2. Answering the research questions

1.5.1): What is Triodos’ Nano-framework?

Triodos’ Nano-framework is a study based document of policy containing Triodos’ position in nanotechnology. The analysis of the Nano-framework revealed it’s fundamental attitude of precaution towards nanotechnology. The framework constitutes a defensive attitude wherein Triodos is eager to prevent mistakes in the light of Nano-uncertainty. The framework represents an internal contradiction and therefore a field of tension. A tension between the sentiment of being reserved (or reluctant) towards nanotechnology on the one hand, and having the desire to learn more about it on the other. The manifestation of this tension leads me to believe that the Nano-framework can be qualified as *reserved* but not inherently *negative* towards the phenomenon.

1.5.2): How to comment on this from an ethical perspective?

Due to the precautionous attitude in the Nano-framework and an internal proposition to the observance of the Precautionary Principle, I wondered: “*could an additional study of relevant literature regarding the discussion of the Precautionary Principle give me new insights?*?”. By first introducing the business principles, Triodos’ offensive fundamental attitude was revealed. By opposing this attitude to the Nano-framework, both assemblies were able to be distinguished from each other. In this distinguishment another field of tension is constituted. This field of

¹⁷ This tendency can be very helpful to counteract unsustainable economic growth and pollution.

tension consists of A) the Nano-framework as being defensive towards nanotechnology, whilst B) the business principles provide an overall impression of offensiveness. The business principles want to promote sustainability in which nanotechnology can fulfil a significant part. The Nano-framework is, thus, not able to carry up the offensive nature of the business principles due to its precautionary attitude. Literature concerning the discussion of the Precautionary Principle was consulted to make one step forward in thinking about this field of tension. Its discussion has shown that precaution is more than “doing nothing”. It has shown that being precautionary is understandable in the light of uncertain outcomes. However, it has also shown that precaution is a consideration of what is at stake in a particular situation, and that precautionary action can be taken. Taking action fits Triodos business principles.

1.5.3): Are there new developments in (thinking about) nanotechnology?

The experts agree that there are no suitable or eligible business cases for investments concerning Triodos' way of steering money. Not many of them are able to, at least, enable Triodos to perceive nanotechnology positively in the light of the business principles. However, there are opportunities for Triodos to invest in nanotechnology. Within developments fitting the broad definition of nanotechnology, two tendencies are relevant for the offensive aspirations of Triodos. Those tendencies are Cheap Diagnostics and Environmental Remediation. Also, the experts collectively agree that reticence with regard to loose Nano-particles is required. Furthermore, the current definition of nanotechnology in the Nano-framework shows deficits. Triodos' definition of nanotechnology is too small because of the focus on Nano-materials. If nanotechnology would be internalized as a sustainability criterion in Triodos' absolute analysis, nanotechnology' broad definition must be used. If this broad definition is not used, the use of 'Nano-safety' as a sustainability criterion fits better than the use of 'nanotechnology' as such.

1.5.4): Are those developments of influence on Triodos' Nano-framework?

The information received from the experts influences Triodos' Nano-framework. It can improve and increase the accuracy of the framework. E.g. the definition of nanotechnology. Also, if the information received were to be implemented it could enhance integrating Triodos' business principles with Triodos' Nano-framework.

5.3. Main conclusion

By creating a Nano-framework the Triodos Bank exemplified the objective to assess whether nanotechnology should be issued in its absolute analysis and minimum requirements. Although, its fundamental attitude gives rise to the sentiment that the Triodos Bank is somewhere holding the feeling that it doesn't want to make mistakes. E.g. to invest in nanotechnology under the light of its uncertain outcomes. The fundamental attitude within the framework consists of precaution. Or to say: a *defensive* attitude that is *reserved* but not inherently *negative* towards the phenomenon. Moreover, nanotechnology is not an inherently negative notion in Triodos' conception. However, the current Nano-framework is still essentially precautionous. This contradicts with Triodos' existential purposes; its core business principles. The bank's business principles are *offensive* and want to bring forward sustainable change in the world. Therefore, if we let both assemblies face each other, a field of tension starts revealing itself. That field of tension isn't troubling if nanotechnology was necessarily or essentially problematic (then a reluctant or defensive position would be appropriate). But, as the experts agree, fact is that nanotechnology can also positively contribute to sustainable change in our world. Which is one of the fundamental ideas for the existence of Triodos. Therefore, I can now answer Triodos' question: "*should we again consider nanotechnology?*". The answer is: yes, because some developments in nanotechnology match Triodos' business principles.

5.4. Recommendations

I will, in this chapter, present recommendations. Those recommendations realize the goal of this thesis. That goal was: "*to conduct research to Triodos' Nano-framework and new Nano-developments, in order to gain insight in the possibilities whether the bank's current position can be adjusted*". Recommendations will be made with a focus on Triodos' Nano-framework and further investigations. The recommendations will centralize around how the Nano-framework should be reconsidered on behalf the results of this thesis. Nevertheless, there are a lot of questions remaining yet unanswered. However, regarding new developments in nanotechnology, questions that will arise in the future will present themselves in policy based discussions.

I will now start with the recommendations:

1) Do not step out of nanotechnology

Step into those sides (or developments) of nanotechnology that fit the offensive business strategy. However, keep in mind that there are still risks attached towards nanotechnology. Therefore, I recommend taking the following measures to deal with nanotechnology's risks in an ethical and responsible way:

2) Continuous thinking and investigating

There is an important reason for Triodos to continue with thinking and investigating in nanotechnology. The experts show that Triodos disappoints itself by limiting its current definition to the Nano-materials and effects on mankind and the environment. It is relevant to have an eye out for these aspects. However, nanotechnology is an enabling technology that can positively contribute to making our economic structure more sustainable. This is a position where Triodos, considering her business principles, fits in well. The memo 2009 opened a perspective in this matter, but I recommend further research to find concrete business cases (see e.g. the ones mentioned in the record from the interview with dr. Ineke Malsch). Although there are, at this time, no developments bringing forward suitable business cases, there are significant developments suitable for Triodos' investments. Suitable cases couldn't be found with only three expert interviews. But it is worthwhile for a broader range of potential business cases to widen and deepen a frame of reference. Above all, the experts collectively agree that such business cases are actually present. To find them one must actively conduct intense research, because the cases aren't likely to be presenting themselves (considering the fact that most companies/ organizations/ initiatives suffer a lack of visibility).

3) Stick to precaution, however...

Precaution in the Nano-framework should be kept in tact. Moreover, applications of nanotechnology contain a certain amount of risk. This should be taken seriously. However, Triodos' precautionous attitude shouldn't determine it's complete conception of nanotechnology. The free- engineered Nano-particles are a single aspect of nanotechnology. Moreover, the Cheap Diagnostics and Environmental Remediation tendencies don't

necessarily lead to the usage of those free- engineered Nano-particles. No new loose particles affect the environment, which make the tendencies even more interesting.

4) The future: a company start-up policy

I recommend Triodos to consider creating a start-up policy to enable potential investments in starting nanotechnology companies (e.g. spin-offs). If Triodos wants to support nanotechnology, suitable developments will be found there. Another method could be Triodos participating research to start-up's that might be – in a later stage of development – eligible for regular investments. Therefore I recommend alertness regarding start-up's in current research and analysis in order prepare Triodos for what is yet to come in nanotechnology. As dr. Ineke Malsch remarks: *“there are cases, look for them”*.

5) Reinvestigation of Triodos' opinion on involvement in the stock-market

Triodos should start to think explicitly whether it wants to steer nanotechnology into a specific direction. Because, if one considers Triodos' foundations, the bank could utilize it's business principles more than by merely investing on the stock-market. One doesn't optimally realize positive sustainable change when one only invests on the stock-market. Besides investing on the stock-market and the money Triodos utilizes, more can be done. E.g. Triodos could start looking for whether there are developments in nanotechnology that it wants to support.

5.5. Epilogue

In closure I want to bring forward some remarks concerning choices made in this thesis and why they are constructed as they are.

First of all my intention was to be as concise as possible. My main objective was to present the thesis to my colleagues at Triodos as a serviceable and useable instrument for thinking. Therefore, this way of constructing the thesis inherently implied that I had to refrain from a lot of other interesting and relevant material. I could have gone into more depth regarding the values in the Nano-framework, the Precautionary Principle, quantity of experts, literature or other aspects.

Though I was eager to get into more depth in different segments of the thesis, it became clear that this was impossible due to the short time-span of ten weeks that could be utilized. I had to anticipate on this short timespan which limited my inquiries, though, I did my utmost best to maximally utilize the time available.

The process of writing this thesis has been an encouraging exercise. It was exciting and inspiring, as a lay-person, to learn more about nanotechnology and its amazing implications. I hope my story will be of service to the Triodos Bank.

Thank you for reading my thesis.

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APPENDICES

Triodos' Nano-framework

1) Ground document: 2008 memo nanotechnology

To : Content meeting TRT
From : Christa Florschutz
Subject : Nanotechnology
Date : 5 November 2008

Recently, an inventory was made of developments in nanotechnology. The objective of this inventory was to explore whether we need to include this issue in our absolute analysis and minimum requirements.

The results of the inventory can be found in the annex. Below, a summary of facts that are most relevant for our approach is presented.

Summary of most important elements of the inventory

At the nanoscale, materials behave quite differently from those at larger scales. This may be both a benefit and a risk, as this may result in different applications of the material, but also different exposure of employees, consumers and the environment.

The number of applications of nanotechnology is rapidly growing, as is the complexity. Most hazardous group of nanomaterials are free, engineered nanoparticles that are insoluble in water and not biodegradable.

In the EU, governments consider current regulation sufficient to capture nanotechnology. At the same time, there is a general understanding that development and standardization of (new) testing methods is needed. Several initiatives have just finished or are still developing codes of conduct for working with nanomaterials. On top of that, there is a call for a specific guideline for working with nanoparticles.

In the EU acceptance of nanotechnology rapidly declines with products that are in (direct) contact with the human body. Several NGO's plead for a ban on nanotechnology in consumer products, at least when it concerns engineered nanoparticles that are insoluble in water and that can lead to internal exposure.

Considering the rapid growth of nanotechnology, the number of companies involved is assumed to be growing as well. However, it is difficult to find out what companies are involved and in what kind of nanomaterials they are involved. Transparency on nanotechnology does not seem to be an issue for companies yet.

In diverse sources, names of thirteen currently selected companies were found that are somehow linked to nanotechnology. These are adidas, ASML, Black & Decker, Canon, DSM, GAP, Henkel, Johnson Matthey, Océ, Philips, Sharp, Smith & Nephew and Toyota. For eight of these thirteen companies information was found about one or more consumer products in which nanotechnology is incorporated. The products of two of these companies may contain free nanoparticles (Henkel and Smith & Nephew). There are also five companies for which no information was found about the kind of products they make with nanotechnology. Considering the activities of these companies, the Chemicals companies most likely also produce consumer products containing free nanoparticles (DSM, Johnson Matthey).

Only four out of these thirteen companies disclose information about their nanotechnology position.

Proposal

Assessment

Ideally, we would want all companies involved in nanotechnology to have a policy and programmes showing their awareness and measures to prevent exposure of employees, consumers and the environment to hazardous nanoparticles. But this is not feasible (yet), as out of 12 selected companies involved, only four show awareness through policies or participation in initiatives.

However, as there appear to be unpredictable risks for consumers, it seems reasonable to apply a policy requirement to companies that produce consumer products containing free, engineered nanoparticles that are insoluble in water and that can lead to internal exposure. In practice, this would mean:

- High-risk sectors are Food products, Beverages, Personal products, Biotechnology, Pharmaceuticals, Health Care Equipment and Leisure products (specifically toys). Possibly also Chemicals, because they may be suppliers of nanotech ingredients for the other industries.
- Companies in high-risk sectors are – in the absolute analysis of sector studies - checked for involvement in nanotechnology through the Consumer Product Inventories and the company's own information.
- The products that include nanotechnology are assessed for the possibility of internal exposure of consumers to free engineered nanoparticles.

- When such internal exposure is likely, the company is required to have a policy and programmes that demonstrate their awareness and measures taken to prevent exposure or demonstrating safety of products.
- As it requires expertise and thorough knowledge of the products of the company, the two last steps will most likely require (additional) information of the company.

Companies in other industries will only be evaluated when involved in controversies or when evidence is found of their involvement in production of consumer products containing free, engineered nanoparticles.

Effect on the universe

Four out of thirteen selected companies may be involved in the production of consumer products containing free nanoparticles. The interesting thing is that these four companies are exactly the same that disclose some information about their nanotechnology position. DSM is the only one to have a policy; the other companies are involved in initiatives regarding responsible use of nanotechnology.

This means that if we are satisfied with the information they disclose (see page 7), a new nanotechnology requirement would not affect the current universe.

Position in the absolute analysis

Before the inventory was made, it was assumed that nanotechnology might become a separate absolute criterion / minimum requirement in the absolute analysis. This would mean that the introduction would have to follow the formal path of approval by the AGM. However, considering that the focus is on exposure of employees, consumers and the environment, it could also be included in either POP's & pesticides (hazardous substances) or Environmental damage – Contamination of air, water and soil.

Questions

1. Do you agree that in assessing nanotechnology we should focus on companies that produce consumer products containing free, engineered nanoparticles?
2. Do you agree with the proposal regarding high-risk sectors and the approach to investigate the involvement of companies?
3. Do you think that the information, disclosed by selected companies about their position regarding nanotechnology, is sufficient, considering that transparency on the subject is still in its infancy? Or is it too early to include the subject in our absolute analysis?
4. Do you think that nanotechnology should be a separate criterion or can it be included in existing criteria?

5. NGO's call for a ban on consumer products containing free engineered nanoparticles that are insoluble in water and that can lead to internal exposure, until more is known about the safety of these substances. Should Triodos Bank consider to support this ban?

Annex. Nanotechnology – an inventory

Introduction

Nanotechnology is a rapidly growing area. As of summer 2008, a range of nanotechnologies is already used in more than 500 consumer products and it is estimated that in 2015 at least 10% of products may include nanotechnology. Revenues from such products in 2006 exceeded € 40 billion and is expected to grow to € 450 billion in 2010 and € 2000 billion in 2014.

Definition

Nanotechnology can be defined as research and technology development at the atomic, molecular, or macromolecular levels using a length scale of approximately one to one hundred nanometers in any dimension; the creation and use of structures, devices and systems that have novel properties and functions because of their small size; and the ability to control or manipulate matter on an atomic scale.

A nanometer is one billionth of a meter (10^{-9} m)—about one hundred thousand times smaller than the diameter of a human hair.

Benefits

Nanotechnology holds great promise for creating new materials with enhanced properties and attributes. Materials can have different properties at the nanoscale— some are better at conducting electricity or heat, some are stronger, some have different magnetic properties, and some reflect light better or change colors as their size is changed. Nanoscale materials also have far larger surface areas than similar volumes of larger scale materials, meaning that more surface is available for interactions with other materials around them.

At the nanoscale, objects behave quite differently from those at larger scales. Gold at the bulk scale, for instance, is an excellent conductor of heat and electricity, but not of light. Properly structured gold nanoparticles, however, start absorbing light and can turn that light into heat, enough heat, in fact, to act like miniature thermal scalpels that can kill unwanted cells in the body, such as cancer cells.

Other materials can become remarkably strong when built at the nanoscale. For example, nanoscale tubes of carbon, 1/100,000 the diameter of a human hair, are incredibly strong. They are already being used to make bicycles, baseball bats, and some car parts today. Some scientists think they can

combine carbon nanotubes with plastics to make composites that are far lighter, yet stronger than steel.

Nanomaterials also have promising environmental applications. For example, nanosized cerium oxide has been developed to decrease diesel emissions, and iron nanoparticles can remove contaminants from soil and ground water. Nanosized sensors hold promise for improved detection and tracking of contaminants. In these and other ways, nanotechnology presents an opportunity to improve how we measure, monitor, manage, and reduce contaminants in the environment.

Applications

Current applications are still relatively simple (first generation): often they concern particles that are stuck on a material. Developments are towards more complex structures, eventually even nanorobotics (little machines on nanoscale). Products using nanoscale materials that are already available:

- Anti-bacterial wound dressings use nanoscale silver.
- A nanoscale dry powder can neutralize gas and liquid toxins in chemical spills and elsewhere.
- Batteries for tools are being manufactured with nanoscale materials in order to deliver more power more quickly with less heat.
- Cosmetics and food producers are “nano-sizing” some ingredients, claiming that improves their effectiveness.
- Sunscreens containing nanoscale titanium dioxide or zinc oxide are transparent and reflect ultraviolet (UV) light to prevent sunburns.
- Scratch- and glare-resistant coatings are being applied to eye glasses, windows, and car mirrors.

Other examples of products that already use nanotechnology and nanomaterials:

- Health and Fitness: Pregnancy test, Toothpaste, Golf club, Tennis Racket, Skis, Antibacterial socks, Waste and stain resistant pants, Air filter
- Electronics and Computers: Games, Computer hardware
- Home and Garden: Paint, Antimicrobial pillows, Stain resistant cushions
- Food and Beverage: Non-stick coatings for pans, Antimicrobial refrigerator, Canola oil
- Other: Lubricants

New developments

- **Drug-Delivery Techniques.** Dendrimers are a type of nanostructure that can be precisely designed and manufactured for a wide variety of applications, including treatment of cancer and other diseases. Dendrimers carrying different materials on their branches can do several things at one time, such as recognizing diseased cells, diagnosing disease states (including cell death), drug delivery, reporting location, and reporting outcomes of therapy.
- **Nanoscale transistors.** Transistors are electronic switching devices where a small amount of electricity is used like a gate to control the flow of larger amounts of electricity. In computers, the more transistors, the greater the power. Transistor sizes have been decreasing, so computers have become more powerful. Now, the industry's best commercial technology produces computer chips with features as small as 45 nanometers
- **Solar Plastics.** Thin, flexible, lightweight rolls of plastics containing nanoscale materials are being developed that some people believe could replace traditional solar energy technologies. The nanoscale materials absorb sunlight and, in some cases, indoor light, which is converted into electrical energy. Thin-film solar cells paired with a new kind of rechargeable battery also are the subject of research today. This technology will be more widely used when researchers learn how to capture solar energy more efficiently.
- **Water-Filtration Techniques.** Researchers are experimenting with carbon nanotube-based membranes for water desalination and nanoscale sensors to identify contaminants in water systems. Other nanoscale materials that have great potential to filter and purify water include nanoscale titanium dioxide, which is used in sunscreens and which has been shown to neutralize bacteria, including *E. coli*, in water.
- “Nanonaise”, light mayonnaise with fat particles consisting of water and fat.
- Diagnostic tests for bacterial infection that do not need the time-consuming growth period.

Risks

Little is known about the risks of nanomaterials, including their toxicities, their potential for emissions and human exposure, their fate in the environment and their possible ecological impacts. Research studies to clarify the risks and benefits of nanotechnology are ongoing, but many results are still years away.

Some of the same special properties that make nanomaterials useful are also properties that may cause some nanomaterials to pose hazards to humans and the environment, under specific conditions. Some nanomaterials that enter animal tissues may be able to pass through cell membranes or cross the blood-brain barrier. This may be a beneficial characteristic for such uses as

targeted drug delivery and other disease treatments, but could result in unintended impacts in other uses or applications. Inhaled nanoparticles may become lodged in the lung or be translocated, and the high durability and reactivity of some nanomaterials raise issues of their fate in the environment. It may be that in most cases nanomaterials will not be of human health or ecological concern. However, at this point not enough information exists to assess environmental exposure for most engineered nanomaterials.

Most hazardous group of nanomaterials are free, engineered nanoparticles that are insoluble in water and not biodegradable. Powder and aerosols have the highest potential for uptake. In general, there is a lot of information about inhaling nanoparticles, but only little about oral exposure.

Sources of nanoparticle exposure are combustion, bulk manufacturing, engineered manufacturing and medical. The first two are classic; the latter two are new.

In the end, risk is a combination of hazard and exposure.

There are some recent examples of unexpected risks of nanomaterials. For instance, nano carbontubes of a certain length were found to behave like asbestos, invoking the same kind of inflammatory reaction in lung tissue. And DSM claims to have stopped developing dendrimers because they found them to be toxic to water fleas (a crustacean).

Regulation

There is currently insufficient knowledge of nanotoxicity. Responsibility for testing is with the government, but also with scientists and companies. For advanced applications additional legislation is necessary. Some claim that existing regulations and authorities are incapable of addressing problems of nanotech, especially as nanotechnologies become more complex and the applications become more diverse.

However, in June 2008, the European Commission determined that the production, sales and use of nanoscale materials can be regulated within REACH, although development and standardization of testing methods is needed.

Also in 2008, the European Commission recommended the member states to be guided by the general principles and guidelines for actions to be taken, set out in the Code of Conduct for Responsible Nanosciences and Nanotechnologies

This Code of Conduct is based on a set of general principles, which call for actions aimed at guaranteeing their respect by all stakeholders.

1. Meaning. N&N research activities should be comprehensible to the public. They should respect fundamental rights and be conducted in the interest of the well-being of individuals and society in their design, implementation, dissemination and use.

2. Sustainability. N&N research activities should be safe, ethical and contribute to sustainable development serving the sustainability objectives of the Community as well as contributing to the United Nations' Millennium Development Goals. They should not harm or create a biological, physical or moral threat to people, animals, plants or the environment, at present or in the future.
3. Precaution. N&N research activities should be conducted in accordance with the precautionary principle, anticipating potential environmental, health and safety impacts of N&N outcomes and taking due precautions, proportional to the level of protection, while encouraging progress for the benefit of society and the environment.
4. Inclusiveness. Governance of N&N research activities should be guided by the principles of openness to all stakeholders, transparency and respect for the legitimate right of access to information. It should allow the participation in decision-making processes of all stakeholders involved in or concerned by N&N research activities.
5. Excellence. N&N research activities should meet the best scientific standards, including standards underpinning the integrity of research and standards relating to Good Laboratory Practices.
6. Innovation. Governance of N&N research activities should encourage maximum creativity, flexibility and planning ability for innovation and growth.
7. Accountability. Researchers and research organisations should remain accountable for the social, environmental and human health impacts that their N&N research may impose on present and future generations.

Initiatives

Central in the worldwide debate on nanotechnology is the uncertainty about the safety of nanoparticles. While measures to limit possible risks are being reflected on, several initiatives are taken by NGO's.

- **Moratorium:** ETC Group and Friends of the Earth plead for a moratorium. Soil Association (UK) recently also pleaded for this and as of January 2009 no longer sells products that contain nanomaterials. The Dutch NGO-Platform Health and Environment calls for a ban on free nanoparticles that are insoluble in water and not biodegradable and that can lead to internal exposure in consumer products. They specifically focus on food, personal care products and toys.
- **Labeling.** The Consumer Union (US) pleaded in 2006 with the American Food and Drug Administration for the development of new regulation and standards.

- Responsible Nanocode. The European business community is developing a voluntary code of conduct. The Royal Society, Insight Investment and the Nanotechnology Industries Association (NIA) took the initiative in the UK. Release of the code is expected in October 2008. Its purpose is to establish best practices and temporary guidelines in the absence of sufficient legislation.
- In the US a Nano Risk Framework was released by Chemical company DuPont and NGO Environmental Defense Fund (EDF) in 2007. Its purpose is to systematically signal and evaluate possible risks of nanomaterials during the product cycle.
- At the Nano4all symposium in October 2008, most participants agreed that a specific guideline is needed for working with nanoparticles.

Responsible NanoCode

The Responsible NanoCode and Benchmarking Framework will be launched October 2008.

In May 2008, the Working Group of the Responsible Nano Code has finalized the seven principles of the Code and a series of examples of good practice. These examples will be the starting point for a Benchmarking framework, which will be used to independently assess the extent to which organizations involved in the research, production, retail and disposal of products using nanotechnologies are operating according to the Code. The Code and the benchmarking process are intended to stimulate organizations to consider and continuously improve all aspects of their involvement with nanotechnologies – including governance, risk assessment, broader social and ethical issues and to take into account the views of their stakeholders.

The seven principles of the Responsible Nano Code are:

1. Board Accountability. Each organization shall ensure that accountability for guiding and managing its involvement with nanotechnologies resides with the Board or is delegated to an appropriate senior executive or committee.
2. Stakeholder involvement. Each organization shall identify its nanotechnology stakeholders, proactively engage with them and be responsive to their views.
3. Worker health & safety. Each organization shall ensure high standards of occupational health and safety for its workers handling nano-materials and nano-enabled products. It shall also consider occupational health and safety issues for workers at other stages of the product lifecycle.
4. Public health, safety & environmental risks. Each organization shall carry out thorough risk assessments and minimize any potential public health, safety or environmental risks relating to its products using nanotechnologies. It shall also consider the public health, safety and environmental risks throughout the product lifecycle.

5. Wider social, environmental, health and ethical implications and impacts. Each organization shall consider and contribute to addressing the wider social, environmental, health and ethical implications and impacts of their involvement with nanotechnologies.
6. Engaging with business partners. Each organization shall engage proactively, openly and co-operatively with business partners to encourage and stimulate their adoption of the code.
7. Transparency and disclosure. Each organization shall be open and transparent about its involvement with and management of nanotechnologies and report regularly and clearly on how it implements the Responsible Nano Code. (18)

Companies involved

Surveys have proven that it is difficult to map institutions and companies that are active in nanotechnologies.

The Consumer Products Inventories (The Project on Emerging Nanotechnologies) provide an overview of 500+ manufacturer-identified nanotechnology-based consumer products currently on the market. From this overview, those relevant for Added Values Funds were gathered. Represented in the table below are companies that are selected and their nanotech products.

company	product	part/material/effect	sector
adidas	Lone Star spike	carbon nanotubes reinforced plate for more stability and flexibility	Textiles, Apparel and Luxury Goods
Black & Decker	DeWalt cordless power-tool set	battery cathode based on phosphate nanocrystals	Household Appliances
Canon	Surface-conduction Electron-emitter Display		Office Electronics
Toyota	Daihatsu Materia Truck Catalyst	metallic ions of palladium	Automobiles
GAP	Nano-Care Stressfree Khakis	anti-staining	Apparel Retail
Henkel	Theramed SOS Sensitive toothpaste with Nanitactive	calcium phosphate nanoparticles (apatite) and protein builds a protective film	Household Products
Sharp	refrigerator	Nano-Deodoriser	Consumer Electronics
Smith & Nephew	wound dressings	nanocrystalline antimicrobial protection	Health Care Equipment

Not-selected companies with nanotech products, according to the inventory, are AMD, Apple, Asahi Glass, Continental, Daimler-Chrysler, DuPont, Eastman-Kodak, General Motors, Hitachi, Intel, JCPenney, L'Oreal, Matsushita, Microsoft, Motorola, Nikon, Pioneer, Samsung, Siemens, Sony, Toshiba and Yamaha.

Note: in the database, some products are categorized under their brand name and not the parent company. It may be assumed that there are more relevant products in the database.

From other sources, some more names of selected companies were gathered that are somehow linked to nanotechnology: Philips, ASML, DSM, Johnson Matthey and Océ. Not selected companies involved are Akzo-Nobel, Shell, BASF, Unilever, Johnson & Johnson, Tesco and Samsung. It is not clear in what way these companies are involved, but it may be that the application of nanotechnology is still in the R&D phase.

Best Practices

Selected companies that are linked to nanotechnology were assessed on their best practices. Only four out of 13 companies disclosed information about their nanotechnology position:

DSM position: acknowledges health risks. To be coped with by taking practical management measures. Strives to exclude risks to mankind and the environment. Follows developments in the field. Participates in open discussions.

Johnson Matthey: participant working group responsible nanocode

Smith & Nephew: participant working group responsible nanocode

Henkel: member of the strategic steering committee of the German Environment Ministry's Nano Commission, in which representatives from the scientific and business communities, government authorities, consumer organizations, and environmental groups exchange views on the opportunities and risks of nanotechnology.

Acceptance

According to an American investigation, citizens in the US worry less about the risks of nanotechnology than scientists. In the EU this is different: acceptance rapidly declines with products that are in (direct) contact with the human body, like clothes, cosmetics and food. In Switzerland and Germany citizens assess the risks as greater than scientists.

2) Follow-up document: 2009 memo nanotechnology

To : TRT

From : Christa Florschütz

Subject : Converging technologies and Nanotechnology: next steps

Date : 26 March 2009

This memo was drafted to discuss, in a criteria meeting, the next steps we need to take to further develop our approach to converging technologies and nanotechnology.

Converging technologies

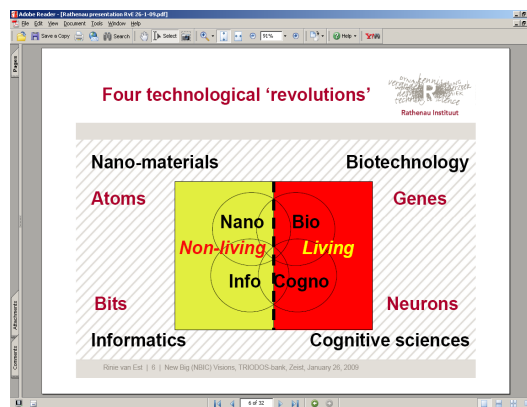
In the content meeting on 26 January, 2009, we had an introduction into converging technologies by Rinie van Est from the Rathenau Institute. The picture he painted was actually a bit overwhelming: there is a lot going on and at a very high speed. I guess we were all left with the question how to cope with this new world in our research process.

Two slides provide a good overview of what converging technologies are about. They are presented below (as we have his presentation as a pdf only, I made screen dumps).

The first slide illustrates what the four technologies are that together make converging technologies. You will notice that we already are studying three of them individually:

- Nano-materials: we currently call it Nanotechnology, but to separate it from the converging technologies Nano-materials is actually a better name.
- Biotechnology: we specifically look at genetic engineering and genetic modification.
- Informatics: we had a discussion about RFID in 2007. At that time, the main conclusion was that the issue is controversy driven and that we should keep an eye on new developments.

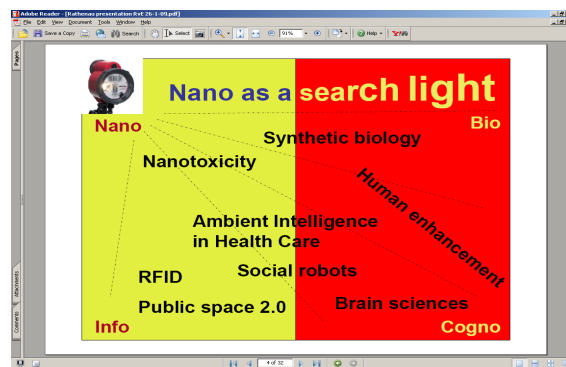
Cognitive sciences so far have not had any role in our research.



The division in the slide between “Non-living” on the left and “Living” on the right may give us some more grips.

The second slide provides more insight in actual applications of converging technologies. Here, again, we recognise some issues:

- Nanotoxicity: this is our current approach to nanotechnology. We focus on nanomaterials and their effect on the environment and health.
- RFID: mentioned above.
- Human enhancement: in the discussion about genetic engineering in humans, we came across some of the ethical dilemmas that arise from the discussion about human enhancement.



To be able to handle the fast growing field of converging technologies, it is important to set priorities. First step is to find out what companies will come up with in the next few years and whether we need a specific approach to cope with this.

- Nanotoxicity: use of nanomaterials is already becoming quite common and we are currently working on an approach – see second half of this memo.
- RFID: are there currently new developments? Do we need to reconsider our approach?
- Public space: developments?
- Ambient Intelligence in Health Care: developments?
- Social robots: developments?
- Synthetic biology¹⁸: developments in this field are moving fast. The DNA of viruses is already being synthesised and the arrival of “Synthia”, the first newly engineered micro-organism, is expected any day. Next steps will be the construction of mammal chromosomes (2012?) and human chromosomes (2014?). For the short term, we need an approach for the micro-organisms, because companies are very likely to start using them soon.

¹⁸ synthetic biology is the engineering of biological components and systems that do not exist in nature and the re-engineering of existing biological elements; it is determined on the intentional design of artificial biological systems, rather than on the understanding of natural biology. (European Commission)

- Human enhancement: this may still seem something for the removed future, but the report “Future man – no future man” from the Rathenau institute already provides four examples of “improper” use of current medical techniques for improvement of mankind. The number of examples will only grow. And we did start the discussion two years ago, with human genetic engineering Conclusion then was that we need a framework for a Triodos vision, a portrayal of mankind. This still is not available. ¹⁹
- Brain sciences: developments?

Proposal

In the criteria meeting, let’s try to fill in the gaps in this list and then set priorities and define next steps.

Nanotechnology

After the content meeting in November 2008, the issue of nanotechnology was also discussed in the advisory panel in February. From the minutes:

“The advisory panel is concerned about the stealthy growth of nanotechnology and converging technology. There is very little awareness yet with consumers, due to the fact that nanotechnology is very hard to imagine and therefore intangible for most people. The government is not in control. Self-regulation of scientists and companies may prove to be an illusion. Companies are reluctant to be transparent; they fear a discussion like the one about gene technology. It’s in their interest that the positive side of nanotechnology is stressed. The pro-active approach of companies in the research process is therefore elemental.

1. Focus on consumer products: the advisory panel thinks that the focus should be broader, because also the environmental aspects should be taken into account, including waste-disposal.
2. High-risk sectors: Chemicals and Textiles & Apparel should be included.
3. Information from companies: companies should at least provide information, be transparent. In a second stage, we should set a threshold. Consider relating involvement to the revenues of the company. Willingness to sign a code of conduct may be sufficient.”

Recently, I contacted four companies that are involved in the use or development of nanotechnology in consumer products. So far, three companies have responded to questions raised:

¹⁹ We could propose a very simple approach:

Triodos Bank = natural, organic.

Reject anything that is artificial, except when medical need is clear

Require policy from company and exclude when there is any suggestion that company is involved in non-therapeutic use or exclusion.

- Henkel provided a satisfactory answer: the company is very transparent and has a policy statement regarding nanotechnology. Its products do not contain free nanoparticles.
- Smith & Nephew confirmed the use of nanotechnology, but did not provide any details. However, the company did state that it would raise the issue to its CSR-committee.
- Johnson Matthey confirmed the use of nanotechnology, but the major part of them – used in catalysts - are not free. The company also offers a small range of nanomaterials for research purposes that are produced under strictly controlled conditions. Given this small scale, policies and procedures are developed at a local level. Furthermore, the company is part of the Working Group that is developing a global Responsible Nanocode.

The fourth company, Philips, promised to respond, but so far hasn't.

Proposal

It still is too early to include nanotechnology in our minimum standards. Therefore, I propose the following approach:

- High-risk sectors are Chemicals, Food products, Beverages, Personal products, Biotechnology, Pharmaceuticals, Health Care Equipment, Textile & Apparel and Leisure products (specifically toys).
- Companies in high-risk sectors are – in the absolute analysis of sector studies - checked for involvement in nanotechnology through the Consumer Product Inventories and the company's own information.
- When evidence is found that the company uses nanotechnology, we ask them to demonstrate their awareness and measures taken to prevent exposure of people and the environment.

Companies in other industries will only be evaluated when involved in controversies or when evidence is found of their involvement in the use of nanotechnology / nanomaterials.

Next year we will evaluate the responses of companies and decide if we can include nanotechnology in our minimum standards.

3) Minutes advisory panel february 2009

Nanotechnology

Christa explains the memo. Focus is on nanotechnology in chemical and physical processes and therefore on toxicity and environmental damage. It does not go into converging technologies, which is the meeting point of nanotechnology, gene technology and cognitive sciences, and that lead to topics like synthetic biology and human enhancement. Those technologies raise a lot of ethical

dilemmas. A first introduction into converging technologies was recently given in the content meeting of the research team by Rinie van Est of the Rathenau Institute. An elaboration of the subject is on the agenda for this year.

Recently, Christa has contacted four companies that are involved in the use of nanotechnology in consumer products. So far, two companies have responded to questions raised. Henkel provided a satisfactory answer: the company is very transparent and has a policy statement regarding nanotechnology. Smith & Nephew confirmed the use of nanotechnology, but did not provide any details. However, the company did state that it would raise the issue to its CSR-committee.

The advisory panel is concerned about the stealthy growth of nanotechnology and converging technology. There is very little awareness yet with consumers, due to the fact that nanotechnology is very hard to imagine and therefore intangible for most people. The government is not in control. Self-regulation of scientists and companies may prove to be an illusion. Companies are reluctant to be transparent; they fear a discussion like the one about gene technology. It's in their interest that the positive side of nanotechnology is stressed. The pro-active approach of companies in the research process is therefore elemental.

Other comments/suggestions raised:

- When it's not clear that nanotechnology is not harmful, the precautionary principle should be observed.
- Time is a crucial factor in finding scientific evidence for potential harm, as has been proved with genetically modified crops: the use of pesticides increases after a number of years. This calls for a slowing down of commercialisation.
- The application of nanotechnology goes further than genetic modification: basically it can be applied in all fields. Threats can be divided in new applications that we do not want (ethically) and unwanted side effects (toxicity and environmental damage).
- Part of the research budget should be reserved from the start for the study of side effects.
- Innovation should not be stopped. However, innovation should at the same time be socially responsible.

Questions

1. Focus on consumer products: the advisory panel thinks that the focus should be broader, because also the environmental aspects should be taken into account, including waste-disposal.
2. High-risk sectors: Chemicals and Textiles & Apparel should be included.

3. Information from companies: companies should at least provide information, be transparent. In a second stage, we should set a threshold. Consider relating involvement to the revenues of the company. Willingness to sign a code of conduct may be sufficient.
4. –
5. Ban on consumer products: it is too early to support such a ban. This is not the right approach and the NGOs involved should reconsider their position.

Triodos Business Principles

Triodos Bank is one of the world's leading sustainable banks. We enable money to work for positive social, environmental and cultural change by offering a comprehensive range of banking services that includes saving, investing, asset management, private banking, payment services and lending.

We believe we have a responsibility to help bridge the gap between economic development and the interests of people and the environment. We try to do this in three different ways – by providing sustainable services, by developing new and innovative products and by engaging in public debate about the benefits and challenges of socially responsible business and sustainable banking. Founded in the Netherlands

in 1980, Triodos Bank also has branches in Belgium, Spain, the United Kingdom and Germany.

This document outlines our vision, mission, business principles and how we put those principles into practice. In essence, this document provides the framework that supports not only our strategic future, but also our day-to-day business operations.

Our vision

Triodos Bank exists because it believes that people have the freedom to develop themselves, have equal rights and are responsible for the consequences of their economic actions on society and the planet. We only lend to and invest in organisations that contribute to a more sustainable society.

Our approach takes account of people, planet and profit to deliver a positive return over the long term. This people-oriented, environmental and financial approach is expressed in the Triodos Bank name itself. Triodos

– ‘Tri hodos’ – translated from Ancient Greek means ‘three-way’.

Our mission

Triodos Bank finances companies, institutions and projects that add cultural value and benefit people and the environment, with the support of depositors and investors who want to encourage socially responsible business and a sustainable society.

Our mission is

- to help create a society that promotes people’s quality of life and that has human dignity at its core.
- to enable individuals, institutions and businesses to use money more consciously in ways that benefit people and the environment, and promote sustainable development.
- to offer customers sustainable financial products and high quality service.

Our corporate values

Our corporate values guide how we do business. They support beliefs about what is important to us as a value- led organization.

Our corporate values are:

- Sustainability
- Transparency
- Excellence
- Entrepreneurship

Our business principles

Our Business Principles provide a framework for the way we conduct our business, and support for our day-to- day decision-making. They are the principles that govern our conduct and set the standard by which internal

and external stakeholders can judge us. Triodos Bank Business Principles apply to all directors, executives, management and co-workers, and are aligned to our core values. Triodos Bank subscribes to the Dutch Corporate Governance Code and the Dutch Banking Code, whilst the Business Principles of Triodos Bank remain leading.

We are committed to the following key business principles:

- Promote sustainable development

We consider the social, environmental and financial impacts of all that we do.

- Respect and obey the law

We are committed to complying with all legal requirements in all countries in which we operate.

- Respect human rights

We respect people, society and different cultures and support the aims of the United Nation's Universal Declaration of Human Rights.

- Respect the environment

We will do all that we can to create and support positive environmental impacts.

- Be accountable

We are accountable, responsible and committed to our stakeholders for all our actions.

- Continuous improvement

We seek to continuously improve all facets of our business.

Observance of our business principles

Our Business Principles apply to all Triodos Bank businesses, specifically all Triodos Bank branches, Triodos Investment Management and Triodos Private Banking. All co-workers must comply with the Triodos Bank Business Principles. Violations can be reported according to the Triodos Bank Whistleblower Policy and our Incident & Financial Crime Policy.

Responsibility

It is the responsibility of the members of the Executive Board and Senior Management to ensure that all co-workers are made aware of the principles and to ensure that they are observed. New co-workers are informed of our principles during their induction or by Human Resources in the initial days with the company.

Whistleblower policy

Triodos Bank has a whistleblower policy to promote the reporting of violations of business principles. The policy enables co-workers to make complaints on an anonymous basis without fear of retaliation.

Compliance and reporting

Triodos Bank places high value on compliance with our Business Principles. Senior and Middle Management monitor compliance, and appropriate measures are taken. In line with our Incident and Financial Crime Policy, Management of each branch is responsible for maintaining an up-to-date incident database and must report to the Executive Board. Serious incidents are reported to the Compliance Officer at international level. Our performance against our business principles is reported in both our financial and non-financial reporting.

Our principles in practise

The commentary below details our commitment to our business principles and how we apply them in our

day-to-day operations. Our principles are described using seven key themes that are important to us - stakeholder dialogue, business ethics & corporate governance, co-workers, community, customers, environment and suppliers & contractors.

Stakeholder dialogue

Triodos Bank defines stakeholders as all people, groups and organisations that it has a business or other relationship with, and defines three particular groups:

1. Customers (including depositors, investors and borrowers), shareholders (holders of depositary receipts), suppliers and co-workers – dialogue with these stakeholders mainly involves weighing up economic interests, balancing short and long-term interests and balancing self and public interest.
2. Non-governmental organisations (NGOs) and the government – dialogue with this group predominantly focuses on the social context within which Triodos Bank operates.
3. Individuals and groups, who between them make a wide range of contributions to the further development of the Bank's vision (including external advisors and innovative thinkers who respond to requests for their ideas or provide them spontaneously) – dialogue with these stakeholders is an important source of new and effective ideas.

Stakeholder dialogue is essential to us in terms of maintaining and developing our activities and our strategy. It is also essential for knowledge sharing, learning, and advancing sustainable development. It is therefore important to us that we:

- engage in stakeholder dialogue, in particular with our customers, non-governmental organisations, professional associations and forums to stay abreast of new sustainability issues. Where possible and relevant, we work with such bodies to develop and advance our sustainability criteria.
- By addressing these sustainability themes, and by using our influence as an investor or financier, and as a manager of investment funds, we aim to advance awareness of sustainability issues and encourage action.

Business ethics & corporate governance

Our business ethics and corporate governance help to define the parameters within which we can achieve our mission. Ethical business practice is key to that, and it is therefore important to us that we:

- monitor and report annually on our social, environmental and financial performance, and that our reporting is comprehensive, fair, accurate, timely and complies with applicable legislation and standards.
- report using the Global Reporting Initiative (GRI) Guidelines.
- support and commit to the aims of the United Nation's Universal Declaration of Human Rights and seek to ensure that none of our products and services abuse civil, political, social or economic rights.
- take measures to identify clients or beneficial owners of unusual or suspicious transactions. We are committed to taking appropriate measures against clients if they use our services to finance criminal conduct, including reporting to law enforcement agencies.
- maintain good corporate governance in line with our corporate values or explain why we differ (Dutch Corporate Governance Code and Dutch Banking Code).
- regularly monitor, review and report on our corporate governance performance in our annual report.

It is also important that our co-workers:

- avoid personal and financial activities that conflict with the best interests of Triodos Bank and its stakeholders.
- do not accept money, gifts, entertainment or benefits that may influence their decision making in business.
- do not - directly or indirectly - offer, promise, give or demand money, gifts, entertainment, benefits or other undue advantages to obtain or retain business.
- sign an insider trading agreement, which includes items such as use of non-publicly available information and trading of shares at specific times.
- are able to make complaints on an anonymous basis without fear of retaliation to the Chairman of the Executive Board. Alleged irregularities concerning the functioning of members of the Executive Board can be reported to the Chairman of the Supervisory Board.

Co-workers

Our co-workers are key to us achieving our mission. It is therefore important that we:

- encourage feedback to improve the effectiveness of our organisation.

- support and commit to the conventions and recommendations of the International Labour Organization.
- are committed to the health and safety of our co-workers.
- promote equal opportunity and support diversity.
- do not tolerate discrimination or harassment of any kind.
- reward performance and achievement fairly. We will not pay any bonuses, since our results are achieved by the contribution of all and we want to avoid that co-workers are working primarily for their personal profit instead of that of our customers and our organisation.
- support the right of co-workers to have freedom of association, freedom of expression, and the right to collectively bargain.
- provide training and development and opportunities for promotion and growth.
- ensure that our selection and recruitment processes are fair and professional.
- report on our performance of our social policy and our co-worker policy in our annual report.

Community

To encourage and actively help our communities and society to be sustainable, it is important to us that we make a positive difference and are active in communities and sectors we operate in.

Customers

We aim to provide our customers with products and services that meet their specific needs and contribute to sustainable development. It is therefore important to us that we:

- support social and environmental projects and develop partnerships with businesses and organizations whose direct and indirect output contributes to a sustainable society.
- ensure that our product, marketing and pricing information meets all regulatory requirements and is easy for customers to understand.
- assess our investment and lending decisions using social and environmental criteria.
- respect customer confidentiality.
- ensure that we do not discriminate on the basis of race, colour, sex, language, religion, political opinion, health status, marital status, sexual orientation, national

or social origin, social status, indigenous status, or disability.

- make access to financial products and services available to poor communities and low-income groups in developing countries through financing microfinance and fair trade activities.
- provide quality in all our products and services.
- listen to what our customers have to say and deal with any expression of customer dissatisfaction fairly, consistently and promptly.
- review and update our products and services.

Environment

Environmental considerations are an integral part of all

Triodos Bank's activities. It is therefore important to us that we:

- integrate environmental and social impacts into all our business decisions.
- obey environmental standards, regulations and legislation.
- evaluate and maintain our environmental policy statement.
- set targets and objectives and regularly monitor our performance.
- undertake internal and external auditing of our environmental performance and report on our progress annually.
- train and educate our co-workers about our internal environmental policy and performance.
- share our knowledge of environmental issues and best practice with our customers, partners and suppliers.
- use environmental criteria to assess finance and lending decisions.
- reduce adverse environmental impacts by minimizing consumption of energy, water, paper and fuel.

Suppliers & contractors

Our suppliers and contractors also contribute to sustainable development. It is therefore important to us that we:

- assess our suppliers based on sustainability criteria to ensure that our relationship with them contributes

to sustainable development.

- regularly review our list of eligible suppliers and contractors.

Feedback & comments

As mentioned in ‘Our Principles in Practice’, stakeholder dialogue is essential to us in terms of maintaining

and developing our activities. In order to continuously improve, we encourage you to provide comments and feedback about our business principles and other aspects of our business. If you have any comments about this document or issues related to our business, please contact:

Thomas W.A. Steiner, Head of Corporate Communication. Telephone +31 (0)30 693 6500,

E-mail thomas.steiner@triodos.nl

December 2010

Records of the expert interviews

Here below are the records of the expert interviews. The ‘T’ in front of every sentence resembles my first name, the ‘B’ Bart Walhout, ‘R’ for Rinie van Est, and ‘Im’ for Ineke Malsch. The interviews were held in Dutch but I translated them to English. Before every record I will briefly present the background of the individual expert. The first record below is the one from the interview with Ir. Ing. Bart Walhout.

1) Record of the interview with ir. ing. Bart Walhout (27-05-2013)

Walhout’s background:

Bart Walhout is researching governance processes, frameworks and discourses of emerging technologies. At the University of Twente he is working on the project “Practices, Institutionalisation and Impact of Responsible Innovation in Nanotechnology”, which is part of the Risk Analysis & Technology Assessment (RATA) theme of the research consortium NanoNextNL. Before Bart has been working as a Technology Assessment (TA) practitioner at the Rathenau Institute, the Dutch parliamentary TA organization. At this institute he has been working on nanotechnology, synthetic biology, ambient intelligence and their links to discussions about converging technologies. Bart Walhout has a background in innovation policy studies and radio electronics. He has a special interest in the political dynamics of new and emerging science and technology (NEST). (TU Twente, 2013).

I: Thank you very much for making some free time to do this interview. I also appreciate the tip you gave me to contact Ineke Malsch, I have an appointment with her this Wednesday.

B: Ok, very well, not a problem. To continue on that: she knows a lot about nanotechnology and also about the concrete cases you are looking for. I only know one case that might suit your wishes, that is the case of 'Koninklijk Instituut voor de Tropen'. Though I have an image of what is happening in the Nano field, I find it hard to present a fitting case. But when the focus is on the environment I am sure Ineke Malsch can help you.

I: Receiving a single case would already be very helpful. Shall I briefly introduce the context of the thesis so that we can, afterwards, connect that to your background?

B: Sure, fine.

I: Okay. I am following the Master's programme Applied Ethics in which I did an internship at the Triodos Bank in Zeist. I was/am curious what is happening around in ethics in the banking sector, it seems that there is enough to be said about it. Whilst doing the internship I started looking for a subject and it seemed that nanotechnology was raising questions at Triodos. From 2007 studies were executed to capture the important Nano reports and facts at that time. Afterwards internal memos were formulated. I base my story on those documents. Some important aspects that are raised in them are:

- A) The free-engineered Nano-particles are of high risk.
- B) Specific high-risk sectors have been identified.
- C) Companies involved in nanotechnology ought to have a specific policy or program.

The question that arises in my thesis is: are there, in this spirit of time, new developments that can be influenced by Triodos' current stance in Nano? New developments, perhaps one or two, that are in line with the values and identity of the bank. New developments that can make Triodos look positive at Nano. Here I must say that I presumed that you were aware of Triodos as a bank.

B: Yes, I knew that they were deliberating about Nano. A colleague of mine (Rini van Est) gave a presentation to them. But I am unknown with Triodos' concrete ideas.

I: I understand. So after my conversations with Frans Brom he tipped me to talk to you and other experts. I am curious to your background (and that in nanotechnology), could you elaborate on that a little?

B: Yes sure. I am educated as an engineer but I am also enrolled in the social side. I also studied technology and policy in Eindhoven and continued at the Rathenau Institute. I did that for six years and was always focused on the topic of nanotechnology. After my time at the Rathenau Institute I opted for promotional research in 'Responsible Innovation'. This is a term that has been a lot around nanotechnology. In short it says: "if we engage in Nano, we must do so responsibly". But it is the same as a term like sustainability: it is open for interpretation. It is also a term that is used within the European Commission and new research programs like 'Rise 2020'. The discussion around the term can be considered as person A perceiving it as a policy discourse and person B thinking about a code of conduct or regulations. A similar discussion is whether a policy should account for safety or contribution to social targets. This is what I focus on within nanotechnology. For example: what are

the discussions about it? How are such ideas institutionalized? And what are its impacts on processes of research and innovation?

I: About this institutionalization of nanotechnology, how should I understand this?

B: This is an instrument you can use, for example if you want to measure how companies comply with their own code of conduct. How can you measure that? There is debate about this in England, in institutions similar to NWO (institutions that finance science). Main questions are: what is responsibility and how to maintain it?

I: So can the claims Triodos makes (e.g. asking codes of conduct or assigning high-risk sectors) also be seen as a form of responsible innovation?

B: Yes, in a way. And then I directly turn to the point on how Triodos defines nanotechnology, i.e.: being precautious, seeing the free particles as worrying and appointing high-risk industries. One must notice here that this definition is centralized merely around *Nano Materials*. That is only a part of nanotechnology. So what are we talking about? What is this framework about? Is that limited to Nano materials? Or nanotechnology in a broader sense? In the latter one must also notice other ethical notions besides sustainability.

I: The core dichotomy they now make is the distinction between loose and stuck Nano particles. The loose materials are considered to form a high risk due to their (presumed) effects on the human body and the environment.

B: Ok. You could also say, when you talk about sustainable development (considering this a broader element the bank wants to stimulate), it is understandable that safety is the most important notion to address. But it's not the only one, especially not because it can serve social goals. There are e.g. all kinds of Nano scientist that conform to goals such as improving humanity. There one can also question whether 'improving humanity' contributes to a sustainable society. Or in the case of textile: here one can take antibacterial matter (Nano silver), to remove the unpleasant odor from clothing. The question is still whether Nano silver has risks attached. But what if it is considered to be completely safe? Still you can now ask the question: is this what we should and want to invest in?

I: Yes. Is Nano in line with our business principles and the values we live up to?

B: Exactly. And my first reaction would be that I'd consider it important to raise these questions. Perhaps Triodos already implemented such question in the current broader banking framework/policy. To state differently: what are the kind of product we want to invest in?

I: Yes Triodos defined to what companies they lend money to or invest in.

B: You asked me about a new development in Nano. At this stage I don't think there are a lot of them, at least not ones that are able to change the current position Triodos has now. There are no specific breakthroughs that would enable this since 2007. But on the other hand, within specific applications progress and developments are being made. So therefore I would say that there are no reasons to change the current stance. But the bank could ask itself, whether they can - in principle -

change their own view to Nano. Are we looking at it at the right way? Is focusing merely at Nano materials the right way? This is, I think, the relevant question to ask.

I: I understand. Though I think their current approach explains the way they look at Nano. There seems to be a discrepancy between the business principles (which are offensive, or eager to change things in the world) and the Nano-framework, which is immersed with precaution. Here is a tension, and new developments might affect this. As you said in your email there was one development that was of interest. Could you elaborate on that a little?

B: Yes, ok. So if you're looking for concrete examples, e.g. considered by the European Commission or the LUNT declaration or other international congresses. They share a list that contains social challenges where science and technology could contribute to. Examples of these challenges are health, sustainability or ICT security. Health and sustainability are prominent terms here. Here you see:
A) The case of 'Cheap Diagnostics' (improvements in diagnostics, e.g. that an individual can diagnose itself). This is a strong case that has a lot of potential and is of interest for Triodos.
B) The case of cleaning the environment ('Environmental Remediation'). This also has a lot of potential for Nano materials. But there still is a risk that the latter brings forward new types of risk. Titanium dioxide e.g. is a matter that has a photo catalytic effect (you can use it for water purification). But then you can ask: what happens to the particulates when they are used? Can you filter those, or perhaps isolate them? And if not, what happens then? For the present there are perhaps no definitive risks amongst these specific matters. But there is enough reason to investigate this because in general there is consensus that Nano materials can suddenly behave different. In the case of Cheap Diagnostics the risk of Nano material is smaller. The fundamental question is: is this concept useful? And can we initiate this responsibly? Therefore, at this moment, I don't see new developments that change the situation. Moreover, e.g. the Cheap Diagnostics are in need of a long-term vision (and financial investment) to bring it to a success.

I: Could you give me an example of a Cheap Diagnostics case?

B: We'll try to give you a useful one, it depends on how Triodos steers its money.

I: It goes via its funds and the stock market. Or via loans.

B: Ok, yes. So then there would need to be a stock-listed company specifically focusing on this. If they would also invest in smaller companies this would change the situation. Though I understand better now why their Nano-framework has a lot of precaution. If the money goes via this route (and you want to stimulate developments in a specific way), you don't control it completely. If you directly invest in a specific company it would be different. Or you could say: I allow company X in my fund.

I: Ok. Though it is unfortunate that there might be no specific (stock listed) company involved in new developments, this specific direction (Cheap Diagnostics) is of much interest.

B: Yes. And still you can ask questions concerning the banks cautious attitude. E.g. precaution has a lot to do with balancing considerations. And e.g. in the field of healthcare it is common that certain risks are allowed to go aside the benefits that are expected. Though one must have a mechanism for this, or ideas, on how to balance those considerations. Instead of merely being

precautious and say, “I’m not doing it”.

About the case I mentioned about the ‘Koninklijk Instituut voor de Tropen’ (who developed an electric nose). This case isn’t involved in the free particles, so that is why it is of interest. But here I presumed that Triodos also makes specific investments and that doesn’t seem to be the case.

I: I would have to check that with them. As far as my knowledge goes for now it mainly goes via the stock market. (note: I checked it later and the money goes via the stock market or via loans)

B: Yes. And I somewhere understand why Triodos is only involved in the stock market. In this way, the bank limits itself to merely keeping investments sustainable. Which is good goal. But thinking from this perspective, it is imaginable that Triodos says: “what is most important is that customers know that their money is being investment sustainable, or safe”.

I’m thinking out loud now: we could also think about how the pro-active approach of companies could be implemented in the bank’s criteria. Let’s for example say that the two examples (Cheap Diagnostic and Environmental Remediation) could fit in a fund of the bank. Then the bank would have to change the way it perceives nanotechnology. Or: if Nano particles are used, then they should think about *how* they are used.

I: Triodos has the free-engineered particle a criterion.

B: Ok. Then you could also state the bank’s criteria are fine, but you question how they are applied. This is as far as I’m getting right now.

I: Perhaps I should researcher further to see whether there are stock listed companies that engage in the two examples you gave me. If that is not the case, then still, the fact that there are two specific routes within nanotechnology that could contribute positively is interesting.

B: I’m sure there are developments that fit within the offensive strategy of the bank, but those aren’t new (as a short answer). But the good thing is that they do give a motive to further examine the current criteria, to check whether they are formulated in a too restrictive conception of precaution. The complex thing in this case is that it centralizes around the Triodos Bank, which finances via funds and not directly in companies. Again, on the one hand the restrictive character fits well within this strategy. On the other, when it goes via the stock market, it is more difficult to give form to a pro-active attitude as such. But still there is enough room to ask the question how Triodos Bank could get a more pro-active dimension in its current approach. I would say: there is enough incentive and there are enough developments to do so. E.g.: the future promises around making diagnostics cheaper and creating a cleaner environment.

I: Thank you very much for your time and input.

B: Not a problem.

2) Record of the interview with dr. ir. Rinie van Est (28-05-2013)

Van Est' background:

Rinie van Est has been working for the Rathenau Institute since August 1997. He signalizes new developments in science, technology, politics and society. Rinie's focus is on emerging technologies like nanotechnology, biotechnology, information technology and neuroscience. The combination of the former technologies brings forward a new technological wave and new future visions like: synthetic biology, ambient intelligence and virtual worlds. He also focuses on the problematical case of energy.

I: Introduction. The main question is: are there new Nano-developments that can be of influence on the Triodos' current stance? (make the bank look positive at nanotechnology due to its principles)

R: Introduction. Rinie's main focus has been on NBIC convergence, which is the intertwinement of nanotechnology, biotechnology, information technology and neuroscience.

R: If the above is the question, Bart Walhout knows more than I do. He is writing a piece that fits well in this matter, the subject of that piece is Nano governance and safety.

An interesting part of nanotechnology (since 2003/2004) is that it has been the initiator of the NBIC convergence. Nano has a small discussion, which centralizes around the Nano particles and risks and a broader discussion, which is the NBIC case. So when you're talking about nanotechnology it is, according to us, not only about Nano-material but about the complete NBIC development. The case of the Nano material is a typical Nano case but there are also other discussions, e.g.: ambient intelligence. The latter consists of sensors that react to persons, but raises other risks and ethical considerations. So in principle: Triodos' starts with Nano, but in fact it is really a very wide concept.

I: Ok. Triodos is aware of the notion of converging technologies (as you presented to them in 2009), but at this stage their current approach has a main focus on Nano materials and their effect on the environment and health. Is it possible to continue talking about Nano if this the conception?

R: Yes, I think that is possible. But by doing that they confirm to the discussion of Nano-particles and Nano risks (the small discussion). Though it means that eventually they will run to the same difficulties that arise in the broader discussion (e.g.: Nano-governance). Also, my presentation was about the broader discussion. The Rathenau Institute emphasizes this because the broader discussion is crucial for knowing what is the meaning nanotechnology.

When the social dialogue around Nano started, and policy questions were raised, those questions were mainly focused on Nano materials and toxicity. But rather, Rathenau stated that this discussion should take place in the broader sense. It is fine for Triodos to focus on Nano materials, toxicity and risks. But if I could give an advice to Triodos: if you really want to understand what sort of new products come into the market the focus needs to be on the complete and broader story: NBIC.

And I think, within the complete wave of new technologies, Nano toxicity isn't the biggest issue. That has to do with the fact that particles can be loose or stuck (there is also a difference between Nano structures and Nano particles).

I: Triodos shares this focus on the loose and stuck particles. Thereby, the focus is on the loose particles because they are supposed to create the biggest threat(s) for humans and the environment.

R: That is good. What I see – and I didn't follow the discussion of the Nano risks very well – is that it is in our agenda and also in the European agenda. Though the development goes very slow, it is present in the agenda nowadays. The Rathenau Institute cannot contribute much to that, perhaps it can signalize striking notions. For our agenda, the focus is also on the broader discussion, this is where we want to gain more vision on.

An interesting notion though, it that in the Netherlands, in the case of working conditions, steps have been made. Also if you focus on questions like: “do we know in what products there are Nano particles?”, “what do we know of the risks?” and “has there been enough research to that yet?”, steps have been made. But there is still no consensus. However, in the Netherlands the RIVM did study certain risk groups. I'm not sure what those are, but risks have been mapped there.

I: I understand. When it comes to my story: my current approach looks for positive developments in Nano. I am not pretending to make any Nano claims whatsoever. The only thing that I want to try is to show whether there are new developments (or tendencies) after 2009, to which the Triodos Bank can look positively. Developments that fit the offensive and positive tone of the business principles. E.g.: to contribute positively to the environment. In that case Bart talked about Lab-on-Chip developments and the tendencies of ‘Environmental Remediation’ and ‘Cheap Diagnostics’. Do you have an idea of a case within one or in both tendencies?

R: That's a tough one. We wrote a report on Nano healthcare and organized an excursion for politicians to the high-tech campus. In this particular report we gave a depiction on the state of affairs at that time within health care. Here we also discussed the Lab-on-Chip developments. Here we say: “the development of Lab-on-Chip is A) outside the human body or B) wet sensors (inside the body)”. I heard that there are wet sensors (prototypes that are now in the test phase), that can hold more than one matter. So this could be seen as a positive development making progress.

I: These types of developments are exactly the ones that I am looking for.

R: Do you know the book: “Om het kleine te waarden?”.

I: No, I don't.

- Rinie presents me the book.

R: The book was published in 2004 and it presents what is, according to us, the public agenda of nanotechnology. Here you can see application areas and risks. Although it was published in 2004, the application areas are still the same. And there are definitely developments in them, but very slow.

I: Ok. So it seems there are no significant developments were you know fo since 2009. If that would be the case then it would at least be of use if I could appoint certain fields, application areas, or tendencies that are of interest for Triodos.

- Rinie now grabs my telephone.

R: Within this device, there are probably more than 15 sensors. Whom's existence is impossible without nanotechnology. So if you say: "what is nanotechnology, is that in the particles?". No: "the phone is nanotechnology".

I: I think it would be best for me to just focus on the definition Triodos has at this moment and base my story on that. Of course I would recommend things concerning their current conception. So if I reason from this perspective (i.e.: the free- engineered particles are of risk, there are high-risk sectors and companies must show a policy), are there developments that are of influence?

R: I understand the intention very well. But if you look at the phone again: it could also say: "Nano-inside". Because the chips in it are so powerful that Nano is inevitable, else the phone wouldn't be there. Also, this raised new trends (the app-culture) and the smartphone.

I: So what your saying with this is that Triodos should focus rather on how they perceive Nano first.

R: Well, as far as I understand, they call it nanotechnology now. I don't think they should call it that way.

I: So what is it then? Do you imply that Triodos should reconsider their view on nanotechnology? Again: the memo merely holds a depiction of the actualities at that specific time. It was made to create a stance for the bank.

R: Well the focus should be on Nano safety or toxicity, that's the issue for them now. If they define it like that, I don't have any problems with it. Than it is clear, but they should not say that nanotechnology is nanotechnology as they define it now.

I: Ok. So if they would implement nanotechnology in their list of minimum standards to assess companies, you would say that the definition need to be changed. Rather, it is only about Nano safety now.

R: Yes, perfect. And they should define it as such. If you only ask the question "is there nanotechnology inside?", your doing it wrong.

I: Ok. But I didn't mention that Triodos also makes a distinction in the level of involvement when it comes to their minimum standards. For example major or minor involvement. Here you can see that there are also some filters implemented to decide the level of involvement.

R: Yes, ok. In principle, the approach of: "does a company have products in Nano?", "do they have a policy?", or: "how do they treat Nano?" is very good. Although, the definition mustn't be nanotechnology but *Nano safety*.

I: Ok. I understand your point.

R: Ok. So if we base ourselves on the current definition of nanotechnology Triodos has, I would search for developments in materials. New materials that are based on nanotechnology, for example self-healing materials. In fact, we are now speaking about the art of materials. Perhaps in that specific segment there are relevant developments coming forward. I have no insights in this specific segment. By the time we were into this we heard about a nano particle that was added to fuel (perhaps zink oxide). This case raised big worries but also had great advantages for the environment. There we get an interesting question: "what is the balance?". Something similar like this you also see at when people start using stronger lacquer in shipping. A benefit of this is that seaweed and other sea materials don't get stuck on the ships, which leads to lesser use of diesel. But also, you can ask the question: "how does this lacquer get into the environment?". I think you should look at practices like this.

But perhaps, the Lab-on-Chip development, for as far as I know, is just a production process similar to older chips. So I think there is not much new information to receive.

I: Well, within Triodos current Nano-framework I didn't find this particular trend. And intuitively it appears to me as very interesting one. Because: A) there are significant positive sides to it and B) those are in line with the bank's business principles.

R: But remember: Lab-on-Chip is not of issue here due to the bank's current definition.

I: Ok let me phrase it like this. If I'd ask you the question how Triodos should take stance to nanotechnology: then you would say that they should first consider it as Nano safety and not as nanotechnology, right?

+ If they implement it as a minimum standard, they will assess different aspects of involvement in Nano. It's all about the involvement of a company in nanotech, that can be none, major or minor.

R: Yes. But my point is still a little different.

- Rini now starts drawing the dia which is also present in the 2009 memo on the second page.

R: If you say: “were talking about nanotechnology” then the complete picture is valid. That also means that all the *opportunities* of the picture are valid. That’s a gigantic field were I can tell you everything about.

I: I’d love to hear the opportunities of the big picture, but that wouldn’t be of much use for my story.

R: Yes I understand. To continue: the first error in thinking Triodos makes is: “were talking about nanotechnology” and at the same time were only talking about the box in the upper left corner (see dia). That’s not right. Also you say: “were looking at toxicology”. This is one issue, which also acts in the process of making nanotechnological products. But how? I don’t know. If you for example look at chip production: how is the shifting there? The shifting is gradual and goes from micro till nanoelectronics. Say: your on 100 or 50 nanometers, what changes there from a environmental perspective? I don’t know. My estimation is that in the area of chips the processes are exactly the same. That is because the structures are burned into products on the same way, light is used for that and that doesn’ change. There a chemical matters coming free but that is not different than Nano. So if you say: “Lab-on-Chip isn’t that of interest?”, of course it is. But the other fields in the picture are also.

Let’s now turn to the toxicology question: does that play in Lab-on-Chip? I don’t think so. But perhaps it does, I have no insight in that.

I: But isn’t the above exactly the nuance I can use in my story? So: Nano is as you described (the broad picture), and within this broad picture, there are a few positive tendencies.

R: When were talking about nano toxicity (which is one element of all nano-products) you can label every product that there is nano inside. So if you look at opportunities, there are enough of them, in the whole nano area.

I: And within this area, isn’t there one development of which you say: “this is a development that Triodos may not miss”. I.e. a development that fits with contributing to positive change. Of which you say: “they should invest in this direction of Nano”.

R: That’s very difficult. We always look very critical.

I: I can feel that, yes.

R: I would say, indeed, Lab-on-Chip might fit. Though in fact this is a sensor technology.

I: So this might be an entrance for Triodos?

R: Yes, it is an encouraging and interesting development. Because devices like your phone arise, you are able to measure your own health and lifestyle. On that you can even start e-coaching, but is that

positive or negative? (ambient intelligence in health care). Also if you look at diabetes patients, their life is significantly made more easy by Lab-on-Chip, this is fantastic (also for developing countries).

I: Do you perhaps have a tip for me for a source which I can consult best to find concrete initiatives in this? For example within Cheap Diagnostics or Environmental Remediation. My gut feeling is saying that these two tendencies possibly contain interesting material. In other words: if I'd want to look for more specification within the tendencies, what would a good source be?

R: Yes I think there are. Though I don't know that much about Environmental Remediation.

I: Tomorrow I have an appointment with Ineke Malsch, I'm told that she might be able to tell me more about Environmental Remediation.

R: Yes I think so, she is also co-author of some of our books.

- Rinie now show's me some Rathenau publications (o.a. "keuzes voor de e-coach" en "Nederland Nanoland)

R: Here you can get an image of some developments in the area of sensors. I think you should start searching for developments like this. If we look at Nano products from which you can expect environmental benefits, those fit in the definition of Nano materials. But if you take the Lab-on-Chip case, you are already changing the categories/ definition. But that there are opportunities in both: yes.

I: Ok, that is useful information.

R: There are also things happening within Nano & Bio.

I: Could you give an example such a development?

R: Yes. So if we look at synthetic biology is it not only about reading DNA strings, but also about producing DNA structures. That is also nanotechnology, on the Nano scale. At this time we also see Nano structures (note: this is in the category of Lab-on-Chip) were they pull the DNA through a hole to rapidly map genetic info. But also the making of DNA strings is Nano, we used to call that chemistry (macro molecular). This is also an exponential development, the technologies are all coming together.

I'm sorry I can't help you any further.

I: That's ok, this already gives me food for thought. I have a few short questions left. If a company takes precautionary measures, could you give me an example for what should be at least one of them?

R: Companies have certain labrules that they have to obey. I think that the most stringent rules in them should be followed for Nano. But I think it is best for you to talk with people from companies.

Perhaps Bart referred to Germ Visser? He works at DSM. So if you want to know more specifically about regulations you could ask him, or Bart. For all I can say is that a practice has grown within companies that deal with Nano. What always comes forward in that discussion is that there are big companies that deal with Nano quite properly. They use the existing practice to deal with Nano particles. So good thinking is done in this form of self-regulation. But there are also companies who care less, or have no knowledge or awareness of what they're doing with Nano. From 2008/2009 there was a growth in the level of awareness. By that time we had frequent calls saying: "were reading in the newspaper that nanotechnology might have risks, whom should I contact?". The RIVM also created KIR, a knowledge centre for Nano. So if you have a question about nanotechnology you can call them. For the Triodos Bank, I think it is interesting to know more about what are best practices at this moment. From there on they can start making claims.

I: Ok. Perhaps, indeed, the industry might bring me new information. So if you would ask if there are developments that put pressure on the current framework, then you would say: yes?

R: What do you mean 'put pressure' on?

I: That the Nano-framework is precautionary and the business principles are offensive (wanting to create change). So in the corners of Cheap Diagnostics and Environmental Remediation there will probably be developments as such?

R: Yes, absolutely. But I think you should get in contact with the industry for that.

I: I'm not really sure whether that will fit in my piece as the direction it is going in now. I know A) there is a tension between the two documents B) I use ethical theory to comment on this and receive new questions which I C) discuss in expert interviews to D) discover whether there are new developments that put pressure on the framework.

R: Ok, I understand. But about this tension you mention: on the moment that Triodos formulates conditions (e.g. "properly dealing with Nano toxicity") for Nano involvement, isn't it resolved then?

I: Well the framework is precautionary, as Frans also puts it in his speech: "hands off when there are severe risks".

R: I thought that Triodos formulated some conditions. Or do they say: "when a company is engaged in free particles then it is excluded?"

I: Yes they formulated conditions. And if a company is involved in the free-engineered particles they start working. Then it can quickly become the end of story for a company. Whilst on the other hand they say: "we want to work for positive social, environmental and cultural change". That is exactly, in my interpretation, where Nano can contribute. So there is the tension between the ends of the bank (precaution & dedication). This is the starting point from which I start searching for new developments that are in line with the principles. The tone in my thesis will probably be pro-nano. So

to advice for example: perhaps you can reconsider the framework, perhaps it can be less precautionous (considering new developments). But the latter, thus, depends on whether there *are indeed* new relevant developments.

R: I understand. I would say what is important is that they build up this framework because there are no regulations. I can tell you: those regulation still aren't there. But in the area of working conditions there are new developments. What developments exactly: I don't know. So the context where the framework has been written in, the regulation context, might be the most prominent factor for the framework. You can ask: "is that regulational context changed?". But in your story you say: "perhaps there are developments on the product-side of Nano". We'll that could be. But I don't think there are much, compared to 2009. Lab-on-Chip for example also existed by that time.

You're a philosopher/ ethicist that looks at the principles, i'm focusing more on the institutional field. I do confirm the tension you presented, but I want institutions to function and deal with it properly. When there is no regulational framework you say: "we want nothing do to with it". When things are organized properly on company or institutional level, what's wrong with Nano? E.g.: if a company can show that they have a new product, that works with nano particles and organizes it in a particular way. But, indeed, when there is complete uncertainty, its hard to make up a story. If you look at DSM, they have story. Because probably, they have some business cases, internally, for which they follow the same conditions. So the tension you describe is also felt in other companies.

So to give advice to Triodos, I would say: you give insight in the tension, but must also give insight in how this is institutionally dealt with. Are there changes there?

In the case of DSM. They come with a product, it has Nano inside, and Triodos doesn't invest. But perhaps this is to simple, because DSM is working properly (has state of the art knowledge, policy and procedures) and shows that they responsibly deal with the new products.

I: Triodos recognizes this.

R: So in principle the Triodos policy shouldn't be a categorical "no", but a "no, unless". Also, the pieces that Bart Walhout is writing share this subject. The Rathenau Institute says in 2004: there is an issue, but it must be institutionalized, money should be released to research in Nano toxicity. Then problems can be solved.

I: Thanks for the input so far. I'm gonna have to take my time to see how i'm going to implement this. Some of the information does not fit in my current structure, but it is useful though. Also the point of regulational changes raises more questions.

R: Yes. Indeed, some of it doesn't fit your structure. The point concerning the regulations I wanted to makes was: A) the assumption in your research is that the Nano-framework is phrased rigidly and

B) subsequently you start to look for new developments/ products that show that the Nano-framework is indeed to rigid.

I: Exactly.

R: Then the only thing I'm saying is: the assumption that the Nano-framework is rigid because of the Nano products that were on the market by that time isn't necessarily true. Perhaps the Nano-framework was written as a reaction to the regulational/ institutional context of that time. So the incentive might have been that there was nothing organized by that time. That could have been changed and might also be of interest for you. Perhaps it is changed in a positive way that might also lead to changes at Triodos.

3) Record of the interview with dr. Ineke Malsch (29-05-2013)

Malsch' background:

Ineke Malsch is owner of Malsch TechnoValuation. She is a consultant specialising in Technology Assessment of new technologies including nanotechnology, life sciences and other emerging technologies in their societal context. Director Ineke Malsch has given the company a track record of international and national collaboration projects and publications with partners throughout Europe and in North and South America and Asia since its foundation in 1999. Currently, Malsch TechnoValuation is a partner in NanoEIS: Nanotechnology Education for Industry and Society: www.nanoeis.eu. From autumn 2012, she organises workshops and trainings in Responsible Innovation in EthicSchool: www.ethicschool.nl/english.

I: Introduction of my background and thesis subject.

Im: Introduction of her background and experience in nanotechnology.

Im: I think Triodos should make a distinction between Nano-particles and nanotechnology. Nanotechnology is a container-term, what both have in common is the size of particles/ structures or parts of chips. Nanotechnology was created because policymakers in different countries wanted researchers from different disciplines to work together in the border regions of their discipline. The idea of the policymakers was that in the border regions of the disciplines innovation would take place. There would be new researchable questions to discover and the term nanotechnology was created. This was picked up by policymakers in Europa, Asia and the States and money was invested. Especially from the end-90's to now. Now you also see that companies are getting involved and new Nano products enter the market. But oftenly Nano isn't that prominent in the products, e.g. in most cars nanotechnology is already used (airbagsensors, coatings, anti-reflection coatings, lacquer, tires). But nobody says: "I want to buy a Nano car". You just want a car that works proper and is environmentally friendly or confirms other criteria.

There is a discussion about Nano-particles (as being a part of nanotechnology). That is about small particles that are not biodegradable.

I: Triodos recognizes those particles.

Im: Ok. Those particles can enter the environment, water or food. The point is that there is no evidence yet of the free- engineered particles being safe or not. You could call it 'uncertain risks'. But it could be that after tests it just might seem that a lot of them are safe or even safer than the ones already on the market.

I: I understand. What you are describing now is also clearly present in the current Nano framework, i.e.: the uncertainties around the free- engineered particles.

Im: Important here is that you don't generalize nanotechnology. On the one hand you could say that one has to be careful with the free particles, and on the other there are a lot companies who invest in Nano electronics or sensortechnology that you can use to measure environmental quality. Or perhaps food packaging with a sensor so that the consumer can immediately tell whether the food is fresh or not. So there can also be a lot of gain for the environment and the consumer. There is also a focus on individuals in developing countries. There are companies that focus on diseases specifically in the tropics. E.g. to develop new medicine(s) or cheaper diagnostic devices.

I: Those developments are very interesting. I filtered out three notions that I consider as important claims in the current framework. Those are: a) the identification of high-risk countries b) risk of the free- engineered particles and c) if a company is involved it must show a policy or program. How should a bank like Triodos take a stance in nanotechnology?

Im: Ok. So the goal of the bank is to invest in products or developments that are sustainable but also bring in money?

I: For example, yes.

Im: I think Triodos shouldn't stare itself blind towards the precautionary principle. The point is that the precautionary principle can work very conservative. If you say: it has to be proved that nanotechnology is completely safe before we invest, then there will always be other countries or investors who have lower standards or who have developed new products were the precautionary principle doesn't play a role. Thus, they can take over the market. So in this situation you put a brake on companies that do consider sustainability and their development or market opportunities.

I: Ok. If I may briefly add: in my story the precautionary principle goes before the interviews. An analysis of its discussion brings me multiple questions that I am asking experts at this stage. The precautionary principle on itself will not be the ground for me to advise whether Triodos should invest in Nano or not. It functions by giving me questions concerning the offensive and defensive side of the bank.

Im: Ok. And I understand that the bank doesn't want to invest in products that are bad for people. An alternative could be (and this is a project I was involved in) 'Observatory Nano' (www.observatorynano.eu). Colleagues of mine developed an internet tool to – whilst the development of a Nano product is going on – ask questions like: “what does the new Nano product mean for the currently existing product for the same application?”. E.g. in water purification with Nano membranes or Nano catalysis. So if you compare that to an existing water purification method that is already on the market, then, does your product have more risks for mankind, environment etc? “How sure are you about your own opinion of Nano?”, or: “do you, as a product developer/ manufacturer really know where you are talking about?”. With this tool a company can estimate where there is a lack of knowledge, where problems are expected or investments should be prolonged/ stopped. It considers also: “how would consumers or NGO's respond to this product when it is on the market?, will there be questions or will people be happy with it?”. Methods like this also align to the ISO 26000 method, but then in the area of innovation.

I: Observatory Nano, interesting.

Im: Yes. It's a European project and the tool is free online for everybody to use. It's also completely anonymous. Unfortunately not many persons are aware of this project. I'm also in another project 'Ethic School' (www.ethicschool.nl) where I also inform people about this.

I: Could you elaborate some more on the Observatory Nano tool?

- Im demonstrates how the tool works on her computer by entering a case of water purification.

Im: the tool focuses on an individual project or product.

I: So a company wants to bring a Nano product on the market.

Im: Yes. For example: you want to develop a water purification system that works with titanium dioxide particles and sunlight to improve water quality. Here you can say: “what if the Nano particles are loose?” Then there is the risk that they can enter the water streams. But also toxicity risks by entering fish and thus humans. Therefore it now has to be researched what happens with those titanium dioxide particles. Do they join together? Do they stay small? Are they more toxic?

Now on the one hand you can say: “we're not investing in this”. But on the other: a company can also decide to anchor the particles into e.g. a coating and reduce risks. Also: if a company brings a product like this on the market, how will the customers react on it? Or an environment protest group? As a company you don't want these risks and the tool can help to prevent them. What if you are convinced that the product is safe, how do you convince the protest group?

I: I understand, so actually it's sort of a guidebook?

Im: Yes. Or you could call it a checklist. So it might be of interest for Triodos to learn about this tool or perhaps even consider it as another claim. “If you want money from us, then use this tool to show us the results”.

I: Yes. It seems like an interesting device in line with precaution.

Im: Yes. And if you complete the process you will receive a form with the results of the differences between the old and new product. Now you have a clear overview on a paper of what the risks are and what your knowledge of the risks is.

I: And how long has this project been going on? Is it completely new?

Im: Actually it is a follow-up on another European project called “Nanologue”. The NanoMeter was developed in that project in 2006/2007. But the discussion about precaution and how to find a balance between the expected risks en benefits has been going on 2002/2003.

I: Ok. Let’s go to another point. Bart Walhout told me about two tendencies within the Nano field called ‘Cheap Diagnostics’ and ‘Environmental Remediation’. They might be of interest for Triodos. This is because both are able to fit well with the banks business principles. He also gave me an example of the TBC sensor from the Koninklijk Instituut voor de Tropen.

Im: Yes, I am familiar with that.

I: I am not yet completely satisfied with the information I received yet and I was wondering whether you can tell more about specific developments that might be of interest for Triodos to consider. E.g. stock-listed companies or eligible companies for loans. Do you have an idea on that? E.g. within the two tendencies I just talked about.

Im: Yes. E.g. within Cheap Diagnostics: there are a lot of interesting developments here but it seems that companies (e.g. big ones in the pharmaceutical industry) merely focus on supply and demand within Europe. So if Triodos would want to make a difference it would be good to also check for research in South-America or Asia. Or in Africa were applications of the diagnostics are used for infectious deceases in the tropics. Also, in another European project ‘ICPC NanoNet’ (www.icpc-nanonet.org) we made an overview of nanotechnology in developing countries. There are different groups and governmental programs were researchers focus on these types of deceases. I also cooperated in a project in 2006-2008 called “Nano ForumEULA” were we mapped nanotechnology in Mexico and Brazil. The ICPC project followed after this and focused on developing countries in emerging economies. Here we also made a website with databases of organizations that are involved in nanotechnology. This was an attempt to make clear what was happening in developing countries and emerging economies but also to generate ideas from out the countries to set priorities for European research collaboration. The point is that the European program finances research wherein also researchers from countries outside Europa may participate. They are paid from the European

budget. Unfortunately there is not much awareness of this and a European organization must be project leader. If they don't know who to search for researchers outside Europe it forms a problem.

I: Ok so it seems that there is a complete picture of all the tendencies within Nano, also ones that are of interest for Triodos. But I'm still missing some concrete cases. Are there specific examples right now that are interest for Triodos? (at least it seems that a lot of pre-work has been done already) (also projects in developing countries are interesting).

Im: Yes I think so. But I think there is a problem when it comes to visibility. I think Triodos doesn't have a complete picture of what is happening in Nano and what its priorities are. For example in Brazil, Argentina or Colombia or Peru researchers are working on establishing educational programs. So there definitely is an interest. I went to a conference in 2011 in Peru where the researchers faced two problems were they'd want to contribute to. On the hand there is water purification and on the other there is adding value to local mining. The problem is that a big share of the income is from mining, but it happens in a way that pollutes that water significantly. So most people, except the rich, don't have fresh water. So researchers now try to take Nano particles from copper or other materials to put them in sensor technology. Or create water purification techniques for farmers. But these initiatives are not getting enough investments. Also most people involved are academics and there is a big distance with the industry. Companies just don't invest in developing countries.

I: I understand. What also makes it tough for Triodos is that money goes via the stock market to companies. Bart also told me about organizations connected to universities that could also be of interest for Triodos. But the problem is that those organizations aren't on the stock market.

Im: Last year I was at the first conference from the European Institute of Physics. This is an organization that originates from a collaboration between national physicist unions. Last year they initiated 'Physics for development' to improve education. But they also focused on stimulating starting companies and entrepreneurs. I know that IOP (Institute of Physics) in England is working on this. So for Triodos its interesting to also look at what is happening in the scientific community or scientist unions (e.g. ICSU). From their perspective (fundamental science) they are also looking for applications of Nano or ways to stimulate starting companies and support developing countries. You could also join UNESCO and it's institutes including ICTP (International Center for Theoretical Physics) were researchers from developing countries can get education or visit conferences. So Triodos might also be interested to look at what kinds of initiatives there are in the scientific community. Although there is risk here. If you invest in Cheap Diagnostics, your not sure whether it will bring money in the next five years. But when Cheap Diagnostics enters the market it can mean a lot for humanity.

I: In the beginning you told me about the way Triodos defines Nano. Could tell me some more about the distinction between 'particles' and 'technology'? How is this relevant for Triodos?

Im: Nano is about the length-scale. Something falls in nanotechnology if it concerns materials or structures on materials that are (at least in one dimension) smaller than 100 Nano meter and bigger than 1 Nano meter. That is from the atom to a molecule or clusters of molecules. The 100 Nano meter bar was chosen because it was the minimum line width of structures on microchips. But at this time the structures have already become much smaller than 100 Nano meter. You can see it in computers, for example a structure printed on a computer chip. So I think the concept 'Nano' on itself doesn't say much. One must always specify: are we talking about Nano particles? What kinds of particles are we talking about? (e.g. colloids in milk are also the size of Nano particles, but those are just natural particles). What is striking at this stage is that we don't know yet whether titanium dioxide or silver Nano particles or other non biodegradable (metals) are safe for the applications there are used for now.

A company like DSM is very clear about this. They cooperate in research, but if it would seem that adding titanium dioxide particles in food is bad for the health of consumers, then a company like DSM will formulate this in a material safety sheet. And thus say that one shouldn't use this for a particular application.

I: How could a company make this transparent?

Im: Different chemical companies are developed in this, e.g. BASF or DSM. There is also CEFIC (European Chemical Industry Council) that invests in safety research but also goes in dialogue with environment and consumer organizations. In conversation with those organizations they ask the question: "how can we deal with this technology in a responsible way?". Of course there are differences between the NGO's and companies, but the good thing is that they are open for the discussion. The food products industry reacts with more fear to this. They rely on positive messages. They deny that there are Nano particles in the products (that later get discovered by scientists, or RIVM) and don't share the openness to NGO's as such. You less often see a food company invite NGO's to come and see how the work is going over there. Triodos could also look at the different sectors and see how a company positions itself. For example, if a company has a clear MVO program that states how the company deals with stakeholders in this discussion, it would be a positive point. Then it wouldn't be only about certain Nano materials (and whether they are safe or not) but also about how to deal with this. Are there enough safety measurements taken on the workplace? Are the employees educated enough to guarantee their own safety?

I: Ok. Triodos has the intention to add a transparency criterion as such in its factsheet. Are there also other ways how companies could communicate this best to society? (i.e.: how they deal with Nano)

Im: Well they should at least put it on their website and enter dialogue. There have also been multiple European projects that opted to stimulate this dialogue. Sometimes companies finance the dialogue by themselves but then you see that some NGO's are very suspicious in this. The NGO's refrain from joining because the dialogue is organized/ paid for by the company itself. In 2010 there also was a national dialogue about nanotechnology in Holland. There were also companies participating in

this. So Triodos could also assess whether a company has in the past, or has the intention now to join a dialogue organized by others. The RIVM also has multiple 'klankbordgroepen' that focus on Nano particles (DSM and Philips participate in this). Last year RIVM also created a platform for Nano medicine, here also DSM and Philips were present. But also other companies with other medical applications of Nano and universities (and NanoNextNL).

I: And a company like Philips, with its Lab-on-Chip developments, would you see that as a potential for Triodos?

Im: Yes definitely. Because Philips is also working on applications that contribute to society. There is a project where they look at the ethical and social aspects of diagnostics. The aim is to help individual people to control whether certain specific foods are good for them or not. And also to train them in how to deal with this.

I: Do you have any concrete cases of this?

Im: Well I just saw it passing by. STW (Stichting Toegepaste Wetenschap) opened a call for an allowance were they work together with Philips. They finance the second cashflow for applied research. There is also NWO who finances the fundamental research, both are linked to each other.

- Im shows me the website and the call by STW.

Im: So here its all about creating knowledge to make people responsible for their own (healthy) lifestyle. Philips is also working with sensor technology (together with Wageningen University) to see whether you have an allergy. Also to give you advice on whether you should eat certain foods or not. There are also a lot of small companies working on this. They also focus on open innovation so that the research isn't happening in one lab but that it is also open for other researchers. I also heard a story from Hans Hofstraat (he is from Philips and is often present at discussion about nanotechnology) on how Philips helps the Chinese government to also create a health care system in the country side. With the use of technology ('point of care') they try to stimulate easy diagnoses and medicine supply. So Philips uses the newest technologies to help people in developing countries. Of course this is a story of Philips itself, but is at least show that they concern about more than just making profit. (See this lecture during the seminar: "nanotechnology for right and piece", HET instrument, October 2010, http://www.nanopodium.nl/CieMDN/content/Nanopodium_rapportNanorechtenvrede01102010.pdf)

I: Ok. So now we briefly looked at the Lab-on-Chip developments. I'm told that you are a specialist in the area of environmental Nano developments. Is there perhaps a concrete case there?

Im: In this area there are different possibilities. If you let alone energy applications like wind and solar energy aside here, then, there is Environmental Remediation. Which is the cleaning of the

environment. In this area there is being experimented with Nano particles to clean soil. Of course the discussion goes: “is it responsible to pump those Nano particles in to the soil?”, “where do they go?”. Though there are techniques that succeed in controlling the particles within the devices used.

I: Are there specific organizations working on this?

Im: Observatory Nano is a good source here. I was working on the ethical and social aspects but there were also other partners that researched nanotechnology for ten different markets. The environment was one of the sectors studied. We developed general sector reports but in a later stage we developed briefings. For example: some partners looked at photocatalysis for water purification (which is an environmental application). So within this project we mapped different applications that are in development. E.g. biodegradable food packaging, membranes for water purification or plastic for cars. This is interesting for Triodos because here they can see what developments are present and in what stage of development they are or what companies are active.

I: How are initiatives like this financed in this spirit of time?

Im: In Europe or in the Netherlands? The European Commission started investing in nanotechnology as a separate priority in the early 2000's. In 2004 they wrote their first Communication on Nano (a policy document), in 2005 they made an action plan. This plan is still valid and there is still a lot of money invested in Nano (Billions) (see: <http://ec.europa.eu/nanotechnology>) Universities, research centers and also companies are financed by the EU. Also there are European Technology Platforms, e.g. in Nano medicine or Nano Electronics. Those can be seen as public-private collaborative platforms that focus on developing a strategy. But they also influence the priorities of calls by the European Commission and member states. In the Netherlands NanoNextNL (www.nanonextnl.nl) is the big program. The Dutch government invests a lot of money in nanotechnology, NanoNextNL also has water as a major priority. The focus of NanoNext is on what is relevant for our society via innovation. Also there has been an earlier national program called Nanoned. Their focus was more on fundamental research.

A theme within NanoNext is ‘Risk analysis and Technology Assessment’. Harro van Lente is responsible for Technology Assessment here, Adrienne Sips from the RIVM is responsible for the whole theme Risk analysis and Technology Assessment. But NanoNext also contains research in energy applications and Nano-medicine where they also look at Lab-on-Chip applications. Within the latter, start-up companies are working on applications of controlling lithium. This can help people with psychological problems to control their levels of lithium when they are at home. In this way they don't have to visit the hospital often to check their blood values. But this could also be used for the diagnosis of other diseases. Examples of other programs are water and food. Within the latter researchers investigate how they can make meat replacers taste the same as normal meat. Here they examine the connections between nano structures and macro structures.

I: So if we look at the tendencies, then the Cheap Diagnostics and Environmental Remediation are developments of which you'd think: "here one can find things that are positive, or at least worthwhile to consider for Triodos? (as an ethical bank)"?

Im: Yes I think so. In broad terms you see on the one hand diagnostics (or monitoring) with sensor technology to assess the environment, and on the other, membranes or catalysis for cleaning the environment.

I: Ok. So if one wants to dive further in to those tendencies the websites we've discussed are worthwhile visiting?

Im: Yes. And also for sustainable materials (weak & strong), solar energy or hydrogen storage.

I: Ok. So in summary the question: "are there developments that put pressure on Triodos' Nano-framework?" can be answered with: "yes they are there". But unfortunately, I'm still not aware of new concrete cases or companies that are available through the stockmarket. It seems like the new developments that can be in line with Triodos are mostly circulating around universities/ academics.

Im: Well, that doesn't necessarily have to be so. In april this year there was "the week of the entrepreneur" where innovation was also discussed. There was a company present of which a spokesman told a story that he had developed Nano coating. This coating could be used for the packaging of all kinds of materials (e.g. sand). He had an idea (of which he thought he could also arouse interest from investors from Saudi Arabia) to dig up the top layer of the Sahara and replace the sand with coated sand. The water that will fall on this sand will not sip through but remain in it. And with the fertile soil you can grow forests or use the Sahara as agricultural land. So that was his long-term goal, but he also had short-term one. He treated the outside of the Sagrada Familia in Barcelona to protect it against damaging rain, graffiti or others forms. It was open for investment and he said that it was completely safe (though I had questions concerning this). So there definitely are companies that concern themselves about such matters.

Minacned (www.minacned.nl) e.g. focuses on sensors. But there is also a company that fills fat particles with water so that icecreams contain less fat. I'm not sure whether those companies are within the start-up phase or already commercially active.

I: So different companies are covered by Minacned?

Im: Yes. So you have Nanonext NL which is the big program that contains more than 130 companies. Close to that you have Minacned which is part of FHI (Federatie van Technologiebranches). But there are also other companies that focus more on Nano materials, Nanohouse (www.nanohouse.nl) e.g. which is an initiative of Bart van den Berg (who has contact with companies in nanotech). Nanohouse is more in line with DSM and is not a union of companies but more a service provider to small companies. Those can be small companies around Philips and

DSM that are working with Nano materials. I also think they brought products on the market. I also heard a story of someone who wanted to sell Nano coating to the NS. Although the NS was interested there were uncertainties about security.

As you can hear, a lot is happening.

I: Yes, indeed.

Im: Syntens (www.syntens.nl) might also be of interest. This is an organization that is being financed by Agentschap NL. They advice MKB companies about innovation. There are two people that I know that specifically focus on nanotechnology. They have contact with companies that want to do something with Nano. Perhaps they can tell you even more about interesting new developments. Nano house also has a network of companies.

I: That is very interesting. Thank you very much for this interview.

Im: Not a problem

