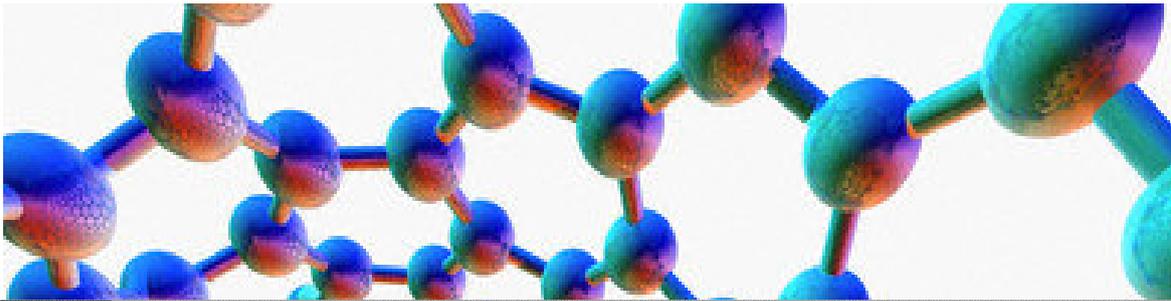


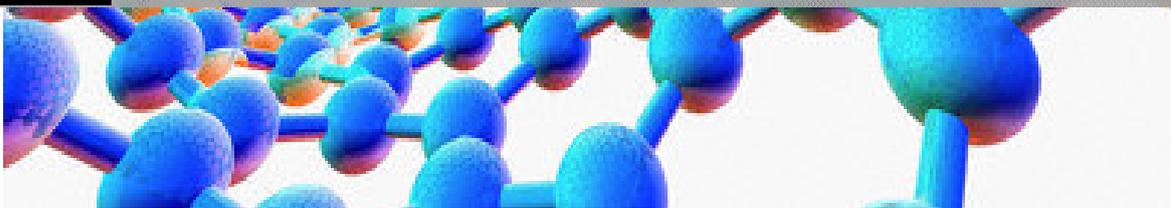
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VALUE CHAIN RESPONSIBILITY

IN NANOMEDICINE



Science and Innovation Management
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2 Introduction

Nanotechnology beholds a world of amazing promises: the fuel problem will be solved, surfaces will be self-cleaning, and all illnesses will be curable.

All these opportunities are possibilities because of the properties of nanoscience and –technology. The different properties of substances at this small scale are key to all the possible applications. These nanoscale properties, such as high strength, enhanced catalysis, reaction to light and electrical conductivity have a wide range of applications, ranging from IT to medical to consumer products. (Shelley, 2006)

Even though the technological progress of the last century has brought many advantages for mankind, most emerging technologies also brought about questions about social, economical and political implications. This is no different for nanotechnology. (Swierstra and Rip, 2007)

Furthermore the applications of nanotechnology have caused some reasons for alarm because of possible health risks. The nanoscale properties, which differ significantly from the micro- or macro-scale properties, could perhaps form a health risk. The very small size of nanoparticles could provide more health risks, because of inhalation or even possible penetration through the skin. (de Jong et al, 2005)

However, while research is still being conducted which nanoparticles could *possibly* be dangerous, the media are reporting both about amazing promises and alarming implications, leaving the public unable to decide.

These questions about social, economical, political and health implications are certainly pressing, but also pose another problem. Who is to answer these questions? Who is responsible for the effects that nanotechnology could bring to the society?

All technological products and services now-a-days are produced through a complex web of agents, ranging from universities and research institutes for fundamental research, to suppliers, the physical producers, intermediate buyers and the end-users. Moreover, this whole process is regulated by several government agencies. Also banks and other financial institutions exercise power by judging which projects and companies to finance.

Furthermore, pressures for firms to be more sustainable and responsible are rising. Because of the interrelatedness of the current value chains, firms are not able to address these issues alone, but are forced to consider the whole chain. Within this web of agents, a division and coordination of responsibility is useful.

For emerging technologies the challenge is even greater. Here the value chain only partially exists or does not exist at all yet. This research will therefore compare the notion of responsibility in value chains which are in different stages of development.

Since nanotechnology has such a broad spectrum of possible market segments and value chains are known to vary greatly in different segments, it would be impossible to make a meaningful analysis when studying different market segments of nanotechnology. (Kaplinksy and Morris, 2001)

Thus for reasons of comparability one field, namely medical, is chosen as a subject of this study. The medical field is especially purposeful for this research, because here the stakes are high and thus it can be expected that responsibility is considered carefully.

The following research question will be answered in this research:

How is responsibility distributed among the agents in existing and emerging value chains involved in producing nanotechnology products for medical purposes?

When looking into an ethical subject such as responsibility, a distinction will always have to be made between whether a normative ethical question or a descriptive ethical question is answered. As can be read in this introduction, the motivation to study this topic is normative. The thread in the introduction is that considering the large potential impact of nanotechnology; it *should* be handled with a certain responsibility.

The research question to be answered is, however, a descriptive one. Answering this question will be done by describing how responsibility *is* currently distributed in value chains. Hopefully, by answering the descriptive research question of this research, some light will also be shed on the normative motivation.

This research question will be answered by conducting three comparative case-studies in the Netherlands. Each case-study will address the value chain of an application of nanotechnology. In the first case the value chain will be the most developed, i.e. the company is a large and established company with many ties with suppliers and other agents in the value chain. The second case will be an emerging technology, where the product is already available for market purchase, but not all – potential – value chain linkages are fully developed. The third case will be a new technology, which is not yet available for market purchase and where thus the value chain still has to be fully developed.

This research intends to shed some light on a complicated topic as nanotechnology. It hopes to provide a framework to study the responsibility distribution in emerging technologies, may this be other nanotechnology applications or other emerging technologies. Furthermore it can provide recommendations for firms that want to produce in a responsible manner on how to address emerging technologies throughout the entire value chain. Also it will provide insights for government and other agents on how to coordinate the distribution of responsibility.

3 Theory

Today, questions about the ethical implications of nanotechnology are covered widely in the media and in scientific literature. Because of the seemingly endless application possibilities, increasingly more expressions of concern were uttered during the last decade.

As all new technologies, nanotechnology enables many incredible options to become reality. It enables the human society and thus gives a certain power to it. Power however, always comes with a downside: responsibility. (Jonas, 1985)

3.1 Responsibility

Power entails responsibility. If you have the power to relieve someone's suffering, you should, many classical ethicists would argue.

Modern technology has, however, rigorously changed the concept of responsibility. During the last decades ecological concerns have made us aware of how modern technologies are slowly changing nature, due to pollution and the greenhouse-effect. This led to the notion that if we have the power to slowly 'destroy' the world, we should also be held responsible for preserving it. This resulted in the concept of sustainability with the famous "people, planet, profit"- notion, by which the society as a whole, but also all individuals separately are held responsible for the living environment of all current and future generations. (Jonas, 1985)

This is exactly what is happening with the rise of nanotechnology; especially because nanotechnology has such an immense range of potential applications, the power and thus the risk and responsibilities, it entails are also enormous.

Before continuing this research, it should be noted that responsibility is in no way an objective or clear concept. Also no real distinction between what is responsible and what is irresponsible can ever be found. Naturally, this causes limitations for researching this concept. This study tries to capture the concept of responsibility in value chains, by zooming in on the notions of corporate social responsibility and more specifically value chain responsibility.

This has two purposes: first of all, since we are looking at how technologies change societies in ways that raise societal questions, it is most important to consider the responsibility of the agents producing these technologies, companies.

Furthermore the notion of corporate social responsibility (CSR) is one that has been integrated in the corporate world over the last years, which means most interviewee will already have a certain notion of what it means. This research tries to find the different notions on responsibility by asking firstly about CSR and then continuing on what this actually beholds.

From this an understanding of what social responsibility beholds will be revealed. This will consequently be used to answer how this social responsibility is distributed. This means that the construction of the understanding of responsibility relies on a social construct.

3.1.1 *Corporate social responsibility*

During the 20th century the concept of corporate social responsibility (CSR) has gained increasingly more interest. This started with the work of Howard R. Bowen, *The social responsibilities of the*

businessman, in 1953. (Bowen, 1953) Bowen addressed the fact that the largest companies had the power to make decisions that would influence almost all lives of citizens.

In the decades after that the notion of CSR would be extended but mostly on a theoretical basis. Only in the 1980ties to 1990ties when companies actually started to implement social responsibility practices, the research could become more empirically based. (Carroll, 1999)

Many views on CSR have been expressed in the last half of the 20th century. Garriga and Melé (2004) tried to map all the CSR views. According to them CSR is mostly focused on four main aspects: "(1) meeting objectives that produce long-term profits, (2) using business power in a responsible way, (3) integrating social demands and (4) contributing to a good society by doing what is ethically correct."

This looks like the definition that Carroll (1999) arrives at in his overview of the history of corporate social responsibility: "the CSR firms should strive to *make a profit, obey the law, be ethical, and be a good corporate citizen*".

It remains however the question how "being ethical" and "being a good corporate citizen" should be filled in. For this reason Pinkston and Carroll (1996) argue that CSR is elusive because it is based on the current values and beliefs which vary in time. Snider et al (2003) argue that the stakeholder perspective is most suitable for looking at CSR. Different stakeholders can be identified and categorized by categories such as interest or position. (Snider et al, 2003)

This stakeholder perspective can be very useful for studying the different actors in the value chain, because, since businesses are becoming more networked and interlinked, not only the own corporate social responsibility needs to be considered, but that of the entire value chain.

3.1.2 Value chain responsibility

"The *value chain* describes the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use." (Kaplinsky and Morris, 2001, p. 4)

Even though this definition is quite linear, this research will take on a more broad view of the value chain. This means that not just the agents that make the product from raw materials to consumer products are considered, but also agents that are not directly in this chain, but for example through collaborations.

In their research on value chain responsibility (VCR), Phillips and Caldwell (2005) note that the emergence of large value chains has caused a large increase in – international – power, but that the notion of a changing responsibility in these networks, is lagging.

Value chain responsibility (VCR) means that firms not only consider their own CSR, but also for the firms with which they interact.

In other cases it can be seen that if multinational companies don't take the responsibility for the whole chain, public protests will be inevitable. The example of Nike, whose manufacturing was mostly done by subcontracting companies in Asia, where the labourers worked under slave-like circumstances and where child labour was common, is striking. Even though Nike protested that they did not own the subcontracting companies – they were merely suppliers to Nike – and was thus not able to change these conditions, the public did not agree. Nike was seen as such a powerful

customer that it could demand and dictate the suppliers to change their labour circumstances. (Phillips and Caldwell, 2005)

The study of Phillips and Caldwell shows a complicated aspect of the concept of responsibility: the difference between where the responsibility *ought* to be found and where the responsibility *is* to be found. If the public opinion is that a large company *should* take responsibility for its actions, it is not clear whether the responsibility also legally lies with this company. There is thus a tension between what a company's legal responsibility is and what its responsibility in the eyes of the public is.

3.1.3 Formal and informal responsibility

The concept of responsibility has been addressed and discussed since the ancient Greek philosophers and still no evident description or definition can be given. One definition given is "the social force that binds you to the courses of action demanded by that force" (Wordnet, 2008)

This definition clearly shows how responsibility has always been socially constructed. However, now-a-days many of these social constructs have been agreed upon over the discourse of many centuries and have thus become embedded in our laws and justice system. While these laws are supposed to be clear and valid in every situation, when a judge makes a decision, he will always consider the social construction of the situation.

This means two forces in responsibility can be found: the legal and formal aspects and the socially constructed and informal aspects. These two forces are on the one hand clearly separated, but are on the other hand heavily intertwined, since laws are built upon social constructions and what is socially accepted is depended on what is legally acceptable.

3.1.4 Order of implications

The way in which responsibility is viewed, has much to do with the consequences that this responsibility entails. If the consequences could be severe, people will be hesitant to take on this responsibility. The severity of the responsibility also has to do with which consequences are taken into account.

In the case of responsibility of nanotechnology, much is said about the first order implications. These are implications that directly come from the use of nanotechnology in a certain product. These are implications such as health issues through inhaling nanoparticles.

However, the implications of nanotechnology could go much further. Nanotechnology promises' are almost unlimited, especially in the realm of healthcare. What if for example nanotechnology will finally be able to develop a drug for the most pressing deceases in the Third World, such as AIDS or malaria? The first order implications are clear and are very positive: Many people, who were first sentenced to die, can now be cured. A second order consequence of this could very well be that because of this the earth's population will increase dramatically faster than it did before. The third order implications which will follow to that very large earthly population can only be imagined.

The difficulty with the higher order implications is whether or not to take them into account, when looking at the responsibility of a new technology. First of all, this has to do with the fact that even though the first order implications can usually be quite easily determined, the second and even third order implications are much more unpredictable. We cannot say for sure what may happen.

A second argument for not taking it into account is that technological progress will be slowed down if all possible implications of a technology will need to be considered first. This will not only take so

much time and one clear aspect of technological progress over the last decades is that it happens very fast, it also might cause a certain fear of new technologies that will work paralysing.

In recent literature a division can be found between on the one hand authors who think it useful to ethically reflect on predictions of the future, in order to be prepared *before* the actual ethical dilemma arises. On the other hand, several authors find it too early to do any meaningful predictions and advocate a developing of ethics alongside the development of the technology. (Randles, 2008)

In the corporate world today there is a consensus on the first order implications, also by law: you cannot bring any product onto the market which will cause risks for human health and/or safety. This is also what is now found with the responsibility of nanotechnology. The general opinion is that the laws and regulations, such as the European standard for chemical REACH (see p. 10) are updated to handle nanotechnology, so at least the first order implications can be taken care of.

How to handle the higher order implications is not clear, but this is not unique for nanotechnology; it exists for every technology.

3.2 Aspects

These aspects of social responsibility have been extracted from different studies in the areas of value chain analysis and technology assessments. (Phillips and Caldwell, 2005; Kaplinsky and Morris, 2001; Merkerk, 2007) No framework exists yet to study social responsibility in value chains, especially not in new technologies. Since this research is exploratory, it might prove that some of the variables described here, might not be relevant, but hopefully this will then provide a framework for further investigation.

3.2.1 Recognizing importance of responsibility

The notion that power entails responsibility does not automatically lead the agents to recognize the importance of value chain responsibility. The relation between size and power leads to the paradoxical situation, that the powerful agent can demand and force actions from other agents, while on the other hand the powerful agent can remain deaf for the demands of the other agents. (Kaplinsky and Morris, 2001)

Value chain responsibility means that all agents together are responsible for the products they produce. Thus, this can only be possible if all agents recognize the importance of value chain and/or corporate responsibility.

Official agreements on VCR can contribute to both the positioning of responsibility as to recognizing the importance of responsibility. Agreements can make clear which role an agent has and thus provide clarity on who has which responsibility. These agreements can consequently be seen as an indicator for recognizing the importance of responsibility.

Many firms have started doing this, by making corporate social responsibility agreements with their suppliers. These agreements, however, usually only addresses their direct suppliers and not all agents in the value chain.

3.2.2 Formal and legal value chain responsibility

Different formal guidelines and standards have been developed during the last decades. Since formal documents on CSR can be an indicator for the recognition of social responsibility, here some mayor guidelines and standards that are currently in place in the Netherlands will be discussed.

Attention for corporate social responsibility and with that value chain responsibility has increased in the last decade. The Dutch Corporate Governance Code, which first only described internal good governance practices, now contains some references to corporate social governance. (Dutch Corporate Governance Code, 2008)

A recent initiative of the Dutch government is the Transparency Benchmark, which is initiated by the Ministry of Economic Affairs, Agriculture and Innovation. The Dutch government wants companies to be transparent about their CSR policies and activities. This should be reported in the annual reports of the company. The Transparency Benchmark judges how Dutch companies report their CSR policies and activities.

The 500 largest Dutch companies, which are also listed on the Dutch stock market, are included in the main research group. These companies are obliged to take part in the Transparency Benchmark. Smaller or non-listed companies can participate voluntarily. (Transparantie Benchmark, 2011a)

In 2008, the Dutch Social and Economic Council made an elaborate advice on sustainable globalisation for the Dutch government, which also included a section on value chain responsibility. (SER, 2008) In accordance to this, the Dutch government made a recommendation for CSR, in which it is stated that companies that are facilitated by the government, need to have value chain responsibility as a *primary* responsibility. (Heemskerk, 2008)

Also in the end of the value chain, laws and regulations have been made to protect the safety and health of consumers. The EU Council Directive 85/374/EEC (1985) shows when a company can be held liable for the harming of consumers. One part of this Council Directive is especially interesting regarding emerging technologies such as nanotechnology. It namely states that the “producer is freed from all liability if he proves: (...) *that the state of scientific and technical knowledge at the time when the product was put into circulation was not such as to enable the defect to be discovered.*”

This could mean that a dangerous product can be marketed, if the discovery of the hazard comes after the commercialisation. This phrasing can however lead to discussion if a company should then also try to provide all the scientific and technical knowledge to be aware of all possible defects and hazards.

Internationally, the ISO 26000 code, which is a code of conduct for social responsibility for businesses, is the widespread standard for CSR. The compliance with this ISO code can be a way for organizations to select the other companies with which they cooperate.

Noted about ISO 26000 should be that they employ the term social responsibility (SR) instead of corporate social responsibility (CSR). This is done so also non-corporate organisations could take their social responsibility.

ISO26000 gives a broad overview of the understanding of SR and also provides practical guidelines for implementing SR in an organisation, such as stakeholder identification and engagement and organizational governance guidelines on different topics as environment, labour circumstances, human rights and consumer issues.

Even though the ISO26000 was developed to become a standard for all companies, research from the International Institute for Sustainable Development (IISD) showed that small and medium enterprises (SME's) have trouble implementing ISO26000. The research showed a direct correlation between size of the company and implementation of SR. Also it is noted that SME's lack negotiating power across the value chain, which further troubles the implementation of VCR. (IISD, 2008)

Regarding nanomaterials that could be harmful for human health, the REACH list is the most used standard. It deals with the Registration, Evaluation, Authorisation and Restriction of Chemical substances. REACH's aim "is to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances." (EC, 2011) The REACH standards are made and controlled by the European Chemical Agency (ECHA).

Also nanosubstances fall under the scope of REACH, because any potentially harmful substance needs to be submitted to REACH regulation, irrespective of their size. However, the following is noted in the frequently asked questions about REACH:

"The evolving science of nanotechnology may necessitate further requirements in the future to reflect the particular properties of nanoparticles." (ECHA, 2011)

This suggests that the ECHA is considering whether the current REACH legislation is broad enough to include nanosubstances or that a new legislation needs to be developed.

Another concern, raised in a Swedish research council magazine is that REACH as it is now cannot be used for nanotechnology for two reasons. Not only because the earlier mentioned properties of certain substances may react differently on the nanoscale, but mostly because the REACH legislation only has to be applied when a certain volume (number of tonnes per producer per year) is produced. With smaller volumes, producers do not have to report to REACH and with nanotechnology exactly those smaller volumes will be made, because the nanoparticles are so small.

REACH misses nanoscale because only certain quantities are considered and not the right properties. (Hassellöv, 2009)

3.2.3 Power and size

As already mentioned, in ethical literature the concept of responsibility is usually coupled with the concept of power. (Jonas, 1985) This also seems to be true for in value chains. The more power an agent in the supply chain possesses the more responsibility rest upon his shoulders. Phillips and Caldwell (2005) illustrate this by the example that a large company with large investments should be able to dictate certain actions of its suppliers and purchasers, while a small firm cannot always do this and thus is held less responsible for actions of other agents in the chain.

This shows that a third concept has to be coupled with responsibility and power, namely size. The size of the agent influences the power an agent can exercise.

3.2.4 Governing agent

Although size is usually related to the power that is exercised within the value chain, this is not always the case. A company can, for example, hold the right to the key technology of that value chain and therefore exercise the most governing power over the value chain, while not being the largest.

In their research, Kaplinsky and Morris (2001) indicate which measures are useful indicators to identify the 'main governor' – i.e. the agent with the most power – in the value chain.

3.2.5 Informal responsibility

As already described in the Theory section, CSR means taking actions for other purposes than mere profit and also doing more than what is legally required.

Many of the cases described by Phillips and Caldwell (2008) on VCR are cases in which the companies were complying with the law, but were nonetheless scrutinized for their policy on VCR. This is very

well possible, because even though many codes and regulations have addressed CSR or VCR in last decade, not many are legally binding.

This means that a company first has to find which laws and regulations it *has* to comply with, and then decide which regulations and codes of conduct it *wants* to comply with and lastly has to decide how to judge the CSR and VCR of the stakeholders it cooperates with.

3.2.6 Strategic responsibility

Within this non-legal responsibility there can be made a distinction between a more moral responsibility and a so-called strategic responsibility. What is meant by this distinction is that the reasons for taking social responsibility can vary from moral reasons – “harm no one by your actions” – to more strategic reasons such as a good image or to be more likely to sustain a certain business relation.

This does not imply that strategic responsibility is ‘less good’ than social responsibility for moralistic reasons. In fact, the current sustainability framework is built on combining sustainability with strategic advantages. As already mentioned the notion of sustainability is often addressed in the “profit, planet, people” notion. Here it is key to combine the profit with the planet and people part which can be done by gaining strategic advantages from sustainability.

3.2.7 Positioning of responsibility

One difficulty in VCR is that there can be an asymmetry of power and thus of responsibility within the value chain. This asymmetry exists because the views of one agent’s role can be very different from different points in the value chain. (Kaplinsky and Morris, 2001)

This phenomenon can be described by positioning. “(...) actors use positioning (expressions of positions) to express the roles of selves and other.” (Merkerk, 2007) By studying how all agents address responsibility to the other agents in the chain, it can be seen if symmetry exist between an agents’ view of own responsibility and the others view.

4 Methodology

4.1 Case selection

As mentioned in the introduction three comparative case-studies will be conducted. Each case-study addresses the value chain of an application of nanotechnology. The medical field is especially interesting for this study of responsibility, since in the medical field the stakes – human health – are high and thus are expected to be coupled with more responsible actions than is the case in other market segments. The whole research was conducted in the Netherlands. Not only are the Netherlands quite active in developing new nanotechnologies, also an overall tendency seems to be that European countries are more active in the responsibilities issues concerning nanotechnology than North-American countries. This makes the Netherlands an interesting research area.

The contact with the case companies was guided by the help of NanoNed, a research consortium for nanotechnology in the Netherlands. NanoNed is interested in this research and was willing to help with providing contact details for several nanotechnology companies.

In the first case the value chain will be fully developed, i.e. there are several agents in the value chain. The company that is aimed for interviewing for this case is Philips Magnotech. Philips has been a large player in healthcare for the last decade. Their work on nanotechnology includes, among others, their “Magnotech” research department. (Philips.com, 2011a) Magnotech is Philips’ brand name for their development in Lab-On-A-Chip technology. Magnotech is a compact, handheld biosensor that is sensitive enough to measure substances such as hormones,

Case	Information source	Type of source
Philips Magnotech		Interview with Vice-President Research Prof. Dr. Hans Hofstra
	CTMM – CC	Interview with principal investigator Prof. Dr. Gerard Pasterkamp
	CTMM	Interview with project manager Dr. Ir. Henny Bruinewoud
	Philips.com	EcoVision reports Annual reports Visual material Background material

Table 1 Information sources Case Philips Magnotech

drugs, proteins and nucleic acids.

Within Philips contact has been made with

Senior Researcher Toon Evers, who has further contacted Prof. Dr. Hans Hofstra, who is the Vice President of Philips Research. He was the interviewee for this case.

For further investigation into the value chain, the collaboration with CTMM (Centre for Translational Molecular Medicine) was investigated. Here interviews have been held with the principal investigator of one project, Circulating Cells, Prof. Dr. Gerard Pasterkamp and with CTMM overall project manager Dr. Ir. Henny Bruinewoud.

Furthermore information reports and information of the Philips website have been used to add to the interview information.

Unfortunately Philips could not give away which suppliers of nanotechnologies they had contracts with. There was tried to contact some producers of nanoparticles to at least get a general overview even though this would not be related to Philips.

Unfortunately all these nanoparticle producers were companies located outside of the Netherlands which made contacting them more difficult. Even the companies that did respond eventually decided not to enter the research.

Philips also cooperated in another project of CTMM, but here the principal investigator was not interested in participating in the research due to time constraints.

The second case will be an emerging technology, where the first version of the product is already available for market purchase, but not all value chain linkages are fully developed.

Here contact has been made with TSST, which is specialised in design and production of customised thin film deposition equipment, specifically Pulsed Laser Deposition equipment for advanced studies. They deliver this equipment to research institutes. (Tsst.nl, 2011)

The interview had taken place with Dr. Ir. Cas Damen, the co-founder and CEO of the company.

Here TSST is not the company in the value chain that produces medical products, but the research institutes in the value chain possibly use their equipment for research in the medical field. An interview with TSST can thus provide insight in this value chain.

Further along the value chain interviews have been held with two suppliers Bouman – Interviewee Mr. Masseur – and Pfeiffer – interviewee Pieter Heidema. Both of them were sales managers who had been in contact with TSST.

For collaborations STW (Foundation for Technical Research) has been contacted and the interviewee here was Dr. Rens Vandenberg. Also a customer has been interviewed: the University of Groningen. Here the interviewee was Prof. Dr. Beatrix Noheda.

The website of TSST has been used for background information, such as details about the technique used and visual material, such as images.

Case	Information source	Type of source
TSST	TSST	Interview with CEO Dr. Cas Damen
	Bouman	Interview with sales manager Mr. Masseur
	Pfeiffer	Interview with sales manager Pieter Heidema
	University of Groningen	Interview with Prof. Dr Beatrix Noheda
	STW	Interview with project leader Dr. Rens Vandenberg
	TSST.nl	Visual material Background material

Table 2 Information sources Case TSST

The third case will be a new technology, which is not yet available for market purchase and where thus the value chain still has to be developed further.

MyLife Technologies develops micro needle arrays. Micro needles are needles with micrometer dimensions, which do penetrate the outer skin but do not reach the sensitive nerves which lie below, thus making application painless. The needles can take up fluids from the skin or can be used to administer various substances. MyLife Technologies aims to develop intelligent skin patches with multiple micro needles.

Case	Information source	Type of source
MyLife Technologies	MyLife Technologies	Interview with Dr. Regina Luttge
	STW	Interview with project leader Dr. Rens Vandenberg
	Drug Delivery – University of Leiden	E-mail answered questions of Prof. Dr. Joke Bouwstra
	RIVM	E-mail answered questions of Dr Gideon Kersten
	MyLifetechnologies.nl	Visual material Background material

Table 3 Information sources Case MyLife Technologies

(Mylifetechnologies.nl, 2011)

Within MyLife Technologies contact has been made with dr. Regina Luttge, who in 2007 won a grant for her research in micro needles with which MyLife Technologies has been founded. Regina Luttge is now the scientific advisor of MyLife Technologies.

For the rest of the value chain also the STW interview was relevant here. Also contact has been made with the collaboration partner of the University of Leiden. Unfortunately Prof. Dr. Joke Bouwstra was very busy in this period so no face-to-face interview was possible, but she was willing to answer questions send to her by e-mail.

Through STW contact details of the user-committee that was installed when MyLife Technologies was started were obtained. These contact details came unfortunately very late in the research time, which made it not possible to conduct interviews with these respondents anymore. However questions by e-mail have been send out to which one of the user-committee participants replied. This was Dr. Gideon Kersten who at the time of the user-committee worked at the Netherlands Vaccination Institute which has now merged with the National Institute for Public Health and Environment (RIVM).

4.2 Aspects

In the theory section (section 2) different aspects of social responsibility were discussed. In order to research these concepts properly, it will be discussed how these aspects will be derived from the information from the interviews and other sources. First however the mapping of the value chain will be discussed, since this is necessary to continue with the rest of the research.

4.2.1 Value Chain

For mapping the value chain different approaches have been discussed in the literature. For one, the way of value chain mapping is dependent on the point of entry of the value chain. Kaplinsky and Morris (2001) identify methods of value chain mapping for these different points of entry. Since this research addresses the technology of one key producer in order to map the whole value chain from there, this key producer would be a logical point of entry. This means that the mapping will have to be done in two directions: backwards to suppliers (and their suppliers) and forwards to buyers, retailers and end-users.

Even though this approach seems straight forward, value chains are complex and Kaplinsky and Morris (2001) therefore warn that researchers will have to make arbitrary decisions on which actors to include and which to exclude. To ensure a clear research structure, these decisions about inclusion or exclusion in the value chain will be explained in the research results.

4.2.2 Recognizing responsibility

Having formal agreements on responsibility is obviously an indicator that the importance of VCR is recognized within the company. One part of this aspect is consequently the presence of formal agreements.

This does, however, not fully cover the whole variable. It is quite possible that also without the existence of formal agreements the importance of VCR is recognized. This can only be found by asking the interviewee's opinion on this matter.

4.2.3 Formal legal responsibility

Following the previous section, not just formal agreements on VCR that are made, but also all other cases of legal responsibility will be studied. This will be done by asking about the presence and compliance with formal codes such as the Dutch Corporate Governance Code, REACH and ISO 26000.

4.2.4 Size

The size of the agent might seem quite straight forward, but proves more difficult when looking into it. The main problem is that many companies – especially large companies – are part of many different value chains. This means that just a small part of a company can contribute to a certain value chain. This means that looking at the total size of the companies – e.g. in number of employees or total turnover/profit – does not show their size relative to a particular value chain.

Size is not only represented in how big a company actually is – in terms of turnover, employees, or assets – size about how a company is perceived by other agents. As can be read in the Theory section, public opinions are that large companies should be held responsible for their entire value chain. This is not precisely measured but a question of perception. The research will thus also address how the size of the company is perceived by other agents.

4.2.5 Main technological governor

As already mentioned, the main governor – i.e. the agent with the most power – is not necessary the largest agent. Kaplinsky and Morris (2001) describe different indicators to identify the main governor in a value chain. Since this research studies a particular technology, the indicator that is most useful is that of the possession of the key technology. As Kaplinsky and Morris indicate this indicator can be found by conducting firm-level interviews.

4.2.6 Informal socially constructed responsibility

Socially constructed responsibility can be difficult to measure and study. The positioning concept is one concept that can also be used for the informal responsibility concept.

Furthermore also questions about why certain codes of conducts are in place and how stakeholders are selected will be asked for this subject.

Based on the responses about informal responsibility it will be identified if this responsibility leans more toward moral or toward strategic responsibility.

4.2.7 Positioning

For the positioning concept, the methodological approach of van Merkerk (2007) will be followed. This approach lists the statements that agents make about themselves or others. By comparing this, it can be seen if the statements of agents about themselves correspond to the statements by others. Here will also be described how the idea of responsibility is thought about throughout the value chain.

4.3 Data collection

Since this research is of explorative nature, aiming to get first insights of VCR in emerging markets, a qualitative case study comparison was chosen as research design. This approach enables to obtain qualitative insights on VCR in the different stages of development of the value chain and is also very well suited when, as in our case, the amount of available data is limited.

Interviews have been chosen as the main method, since they enable to gain rich and detailed insights from the intended person and also give the opportunity to explain questions and clarify answers given by the interviewee (Frechtling & Sharp, 1997). Yet, this approach also has its limitations, as interviewing is a time-consuming process generating high amounts of data that might not be easily prioritized. Furthermore, the interviewee might give biased answers due to selective perception and in general inconsistencies across interviews can occur easily due to their flexible nature (Frechtling & Sharp, 1997). All these factors can compromise the validity and reliability of the research.

These limitations can however be counteracted by the use of three case studies to ensure triangulation of the results. As more than two sources of data are used, the results are stronger than when using single sources of data, enabling to derive a single conclusion from different data sources instead of different conclusions for every data source (Yin, 2003).

Furthermore, the effect of selective perceptions of the interviewee can be further reduced, by the fact that different agents are interviewed within one case. These answers can also be compared, i.e. conducting inter-subjective testing.

Other data is written data which is also gathered, such as websites, written regulations or statements on CSR. These written data will be used as a background to the interviews or to place the interviews in the right context.

The interviews held were semi-structured as this allowed the interviewees to freely express their thought about VCR and CSR. The interviews mostly followed the following structure: first, the interviewee would tell some general information about the organisation that it represented. Secondly, the interviewee would be asked about the value chain(s) that it operated in. Thirdly the subject of conversation would be directed towards responsibility. Usually this started with responsibility within the organisation (CSR) and would then turn to responsibility in the value chain (VCR). When the interview was with one of the agents in the value chain, questions would be asked about the relationship with the case company and the CSR and VCR stands of the case company. Sometimes the interviewees would be asked for clarifications or would questions be directed to go further into a certain subject.

4.4 Data analysis

The interviews which are held are recorded and transcribed. Then the transcribed interviews will be labelled in different categories. These categories will be fitted under the different aspects that were discussed in the theory section.

Furthermore all results of the interviews within one case will be compiled and compared. This is especially important since the research question can only be rightly answered when the entire value chain has been considered. This will result in answering of the research questions for each case separately.

Consequently, the results of the three different case studies will be compared, while trying to find reasons for similarities or differences in literature on emerging technologies. This will provide a detailed overview on how the VCR differs in different stages of emerging technologies.

5 Results – Case A: Philips Magnotech

Philips is a large organization, which has become a major player in healthcare technology in the last decade. Philips is a large and international company, with total assets of over 30 billion euros and 119.000 employees in over 60 countries.

One of their recently founded research departments seeks to develop a handheld diagnostic device, using nanoparticles.

The technology is based on magnetic nanoparticles, which are coated with the appropriate ligand molecules for the target protein molecules that are to be measured. A small sample of blood or saliva can be inserted in a cartridge which can in turn be inserted in the device. (Fig. 1A)

In the device the magnetic nanoparticles bind to the target protein molecules in the sample blood or saliva. One side of the ‘testing space’ within the device is also coated with the appropriate ligand molecules. A magnet on the coated side is then activated to pull the magnetic nanoparticles with their bound proteins to the active surface. (Fig. 1B) The proteins then bind to the active surface, ending up locked between the active surface and the attached nanoparticles. Then the magnetic field on the other side is activated to pull the unbound nanoparticles away. (Fig. 1C) This way a fast and accurate separation between the bound and unbound particles can take place. Finally, using an optical technique, the total number of bound nanoparticles is measured.

The company focuses on three application areas, namely oncology, cardiology and women’s health. The reason for oncology and cardiology is straightforward: these are the two most occurring deceases (at least in the western world). The focus on women’s health can be explained by earlier involvement in this field: the company has developed many solutions for diagnostics for (pregnant) women and this specific knowledge was thus already present in the company. This however does not mean that Philips does not want to use their technology for other health care applications, but for these three areas they are focused on finding more complete solution.

5.1 Value chain

Even though the product has not yet reached the market stage, it can profit from being within the large network of Philips.

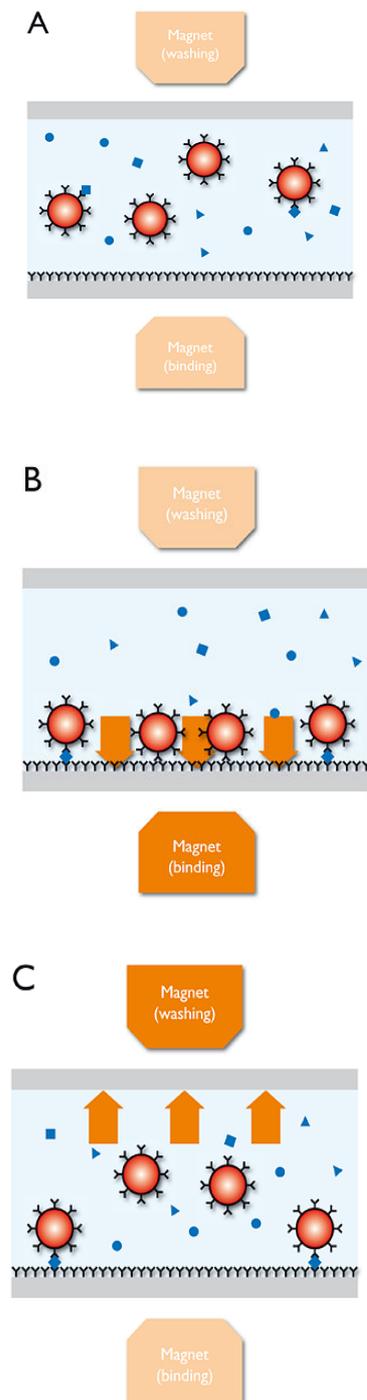


Figure 1 Principle of Philips Magnotech (Philips.com, 2011b)

In the supplier field, links with the suppliers of the nanoparticles have been made. Philips has chosen to not produce the nanoparticles themselves, since this is not their core capacity. However, since the kinds of nanoparticles needed for this device are very specific, co-development has taken place between the suppliers and Philips. Unfortunately, the interviewee from Philips was not allowed to give names of the suppliers of nanoparticles with which Philips is engaged. This means that this side of the value chain could not be properly explored.

The product has not yet reached the market stage, but in the medical field it is impossible to prepare a product for commercialization without partnering and cooperation. A large number of collaborations are taking place as can be seen in the graphical view of the value chain. (Fig 2.)

Also the company is involved in two projects of the CTMM (Centre for Translational Molecular Medicine).

The Centre for Translational Molecular Medicine (CTMM) is a consortium between private and public partners. Their projects allow collaboration with universities, university hospitals and medical specialists. Via these projects also groups of specialists and certain patient groups have been identified as potential partners. They are a non-profit-foundation, which start was commissioned by the government, because the Netherlands had very highly valued scientific research, but not much of this was actually being commercialised for the public.

In 2007, when CTMM started eight different projects were commenced with, all in the field of diagnostic medicine. A year later a second call for projects was held which generated ten more projects. Lastly a joined call with other research consortia was held which generated another three projects.

All these projects study a different research field within molecular medicine and include public partners – universities – and private partners – companies – and will last until the end of 2014. Both the companies and the universities had to invest money in the project in order to participate. Half of the project is funded by government money, the companies and universities both have to pay 25%.

The project propositions are always written in the academic world and later suitable companies will be connected to the project. This happens either through personal connections of the university researches involved or CTMM intermediates in finding the right partner.

These project teams come together approximately four times a year, with at least one person of every organisation present in the project team.

All projects have an extensive intellectual property (IP) contract for how to treat any discoveries made in the project. The hope of CTMM is naturally that one – or more – of the companies within the project will be able to use this IP to create and market a product.

Within CTMM, two interviews have been held. One was focused on getting a more overall view of CTMM, this was with Dr. Ir. Henny Bruinewoud, a project manager at CTMM. Furthermore, an interview has been held with Prof. Dr. Gerard Pasterkamp, who is the principal investigator of the CTMM project, Circulating Cells and the head of Experimental Cardiology Laboratory at the UMCU. This is one of the two projects in which Philips is involved.

Circulating Cells investigates 'circulating cells' (for example, white blood cells and blood platelets) to see if they carry biomarkers suitable for discriminating patients with an increased risk for cardiovascular deceases, together with quantification of that risk.

Together with the biomarker discovery, the project partners will also develop and validate novel technology to measure cell-based biomarkers, with the objective of generating technology that allows portable screening or testing. This is naturally of great importance for Philips to develop their Magnotech handheld device within a shorter time. (ctmm.nl, 2011)

Circulating Cells is one of the largest research consortia within CTMM, with 4 university hospitals, 4 universities (including a technical university), The Interuniversity Cardiology Institute of the Netherlands and 11 companies participating.

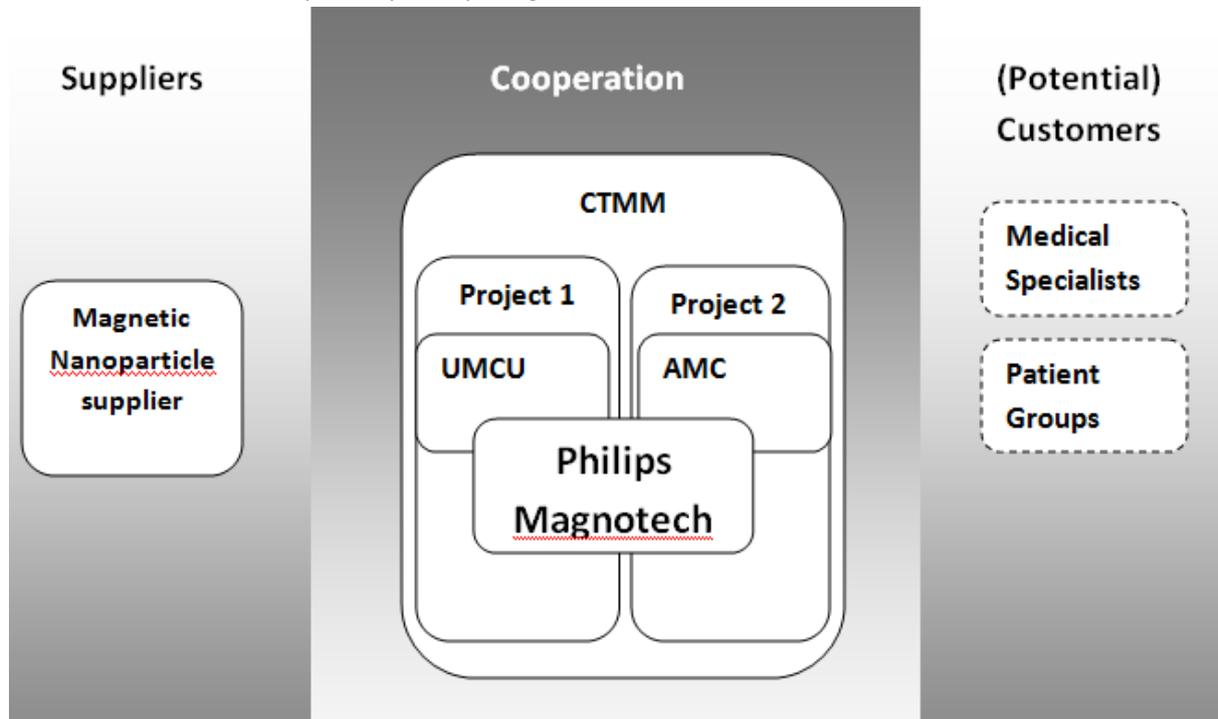


Figure 2 Value Chain of Philips Magnotech

Since the product is not yet ready for commercialisation, no existing customers of Philips Magnotech can be found yet. However, Philips already is a large supplier of medical technical devices and has thus already made the connections with customers in this field, such as hospitals or medical specialists.

5.2 Responsibility within company

Social corporate responsibility is high among Philips's values. They have an elaborate sustainability program, which is renewed every five years, called EcoVision. The first EcoVision program was launched in 1998, with mostly a focus on producing with more sustainable resource use.

In 2010 the latest program, EcoVision 5 started, in which they have extended their sustainability focus from not just environmental issues to more social issues, such as access to healthcare.

The different EcoVision programs have resulted in a continuous formalisation on sustainability and social responsibility. The EcoVision 4, which runs from 2007 until 2012, has as main parameters for success:

- Generate 30% of total revenues from Green Products
- Double investment in Green Innovations to a cumulative EUR 1 billion

- Improve the operational energy efficiency by 25% and reduce the CO2 emissions by 25%, all compared with the base year 2007.
(Philips.com, 2011c)

These goals reflect the main focus on environmental aspects within EcoVision4. This however changed somewhat in the EcoVision 5 program. Here the program shows more focus towards societal responsibility. The main parameters for EcoVision 5 are:

- Bringing care to more than 500 million people. Target: 500 million lives touched by 2015
- Improving energy efficiency of Philips products. Target: 50% improvement by 2015 (for the average total product portfolio) compared to 2009
- Closing the materials loop. Target: Double global collection, recycling amounts and recycled materials in products by 2015 compared to 2009.
(Philips.com, 2011d)

The first parameter is what is seen as their greatest societal impact, creating access to care for as many people as possible. Hans Hofstra also directed to this in the interview:

“In EcoVision 5 we really look at that (*social aspects*) and we will also really try to measure what our impact is on what we call ‘access to care’. That is access of people to medical care.”

In the department studied this sustainability program is not something that is focused on in everyday activity.

“To say that it would have an influence on day-to-day activity, would go a bit too far.”

However knowing that all preconditions (i.e. raw materials or supplier activity) comply with this sustainability program, allows the department to continue their daily activities in good conscience.

“It (*EcoVision 5*) is mainly expressed in the way the product is developed and the preconditions that you impose on the product. (...) Of course it is relevant in the processes in which choices need to be made. (...) choices about the use of materials, the design of a product, the way it is marketed, if the product can be made with a closed materials loop.”

The EcoVision 5 program is used as a guideline for choices made for preconditions. These are probably mostly choices made by managers of the project on not by scientist working on Magnotech.

Furthermore as Philips is a listed company in the Dutch stock market, they have to comply with the Dutch Corporate Governance Code, for which they have to report yearly on their corporate governance activities. As already mentioned in the theory section, the Dutch Corporate Governance Code however does mainly apply to internal affairs considering corporate governance and will thus not reveal much about responsibility in the value chain.

Also the REACH approach of the EU on dangerous or toxic substances is complied with. Since this list is updated regularly, Philips also asks their suppliers to always be up to date with the latest version.

Also on the suppliers of nanoparticles the following of the REACH approach is imposed. As however can be read in the theory section, the ECHA is continuously developing the REACH framework to completely fit nanosubstances and may therefore not yet be fully up-to-date.

In respect to this Philips says that this is at least the most updated regulation that exists and furthermore is an international standard.

Lastly, since the studied department in Philips is aiming to develop a medical device, it will eventually have to be tested at patients. In the Netherlands the MEB (Medicines Evaluation Board) is the authority for regulation of medicine in the Netherlands. MEB is a part of the European Medicines Agency. (EMA, 2011) In former medical developments of Philips, Philips had their new healthcare products also presented to and judged by medical ethical committees.

As already mentioned, Philips is a large and international company. Even though the department studied specifically is not that large, they do have the advantages and disadvantages of being part of a large organization.

From the interview, it surfaces that such a large company has as an advantage the power to demand social corporate responsibility from other actors. This can be seen in the interview when the interviewee compares the relations with collaborators and suppliers.

“The relationship with partners is different from the one with suppliers. With partners social responsibility needs to be negotiated, afterwards this will however be set in contracts. But this is very different than with suppliers: those you can just impose your policy on.”
(Interview Philips, 2011)

This shows the power that Philips can exercise in a value chain. This power has a strong relation with the wealth of the company. A supplier would rather not miss out on an investment from a company as large Philips and is thus willing to submit to the CSR demands that Philips makes. On the other hand, Philips can, because of their financial position, also make choices for suppliers not solely based on economical reasons.

Concerning the main technological governor, it seems that Philips itself is the main governor in the value chain, but not because Philips necessarily possesses a unique technology which will make them powerful. Also the device that is created by the Magnotech department is not much different from other Lab-On-A-Chip technologies that are now developed. This means that Philips main governor position in the value chain is mostly due to their size and the power which is derived from it.

As a large company, Philips feels a pressure to act as a role model in acting responsible. They recognize that their responsibility goes further than the Netherlands (their headquarters' country), but also further than the Western world of Europe and the USA. As they are a global actor, they want to try to take their responsibility on a global level.

“The development of this device (*Magnotech diagnostic device*) does not only have the potential to have an influence in the Western World, but also in the now growing economies, where access to healthcare is not yet that developed.” (Philips, 2011)

This does also relate to strategic responsibility. In countries where healthcare systems are still underdeveloped, a large market in healthcare is yet to be conquered. This shows how Philips combines economical benefits or potential benefits with social responsibility.

As a global company reputation and a good name are important for gaining and maintaining customer loyalty and satisfaction. One way that Philips tries to assure its reputation is by taking responsibility of their marketed products. This is mainly shown in their handling of suppliers.

“And also within the buying of materials, when we integrate them into our products, we will have and will take a responsibility in that.” (Interview Philips, 2011)

By demanding certain standards from their suppliers, they hope to assure that they can take responsibility for their products without reputation damage.

Also the choice of the studied department of focusing on oncology and cardiology for the handheld device shows a responsibility towards society to addresses the two most serious and common diseases of this time. This responsibility is paired with the strategic advantage that, since these diseases are present so frequently, the market for these products will also be large.

5.3 Responsibility within value chain

A significant part of the sustainability program of Philips is about suppliers and value chain responsibility. Suppliers have to agree to comply with their “Supplier Sustainability Declaration”. This declaration addresses labour, health and safety and environmental issues. Also it demands the supplier to have a sound management and act in an ethical way. (Philips, 2009)

To assure that suppliers comply with the Supplier Sustainability Declaration, Philips regularly issues audits at suppliers to check these points. Here again the power of Philips as a large company comes forward: this organization can demand that their suppliers comply with their environmental code, because losing a customer with such large investments would be more costly for a supplier than to conduct a more sustainable business.

With their Supplier Sustainability Declaration, Philips has won the award of the Transparency Benchmark of the Ministry of Economic Affairs, Agriculture and Innovation on the theme of chain governance.

“The annual report of Philips contained much extended information about their chain governance. Not just the collaboration of Philips with their suppliers is clearly described, but also the actions that Philips undertakes in this matter. “ (Transparantie Benchmark, 2011b)

If suppliers comply with Philips’s sustainability standards, this also means that Philips expects of them that they also try to impose CSR standards on their own suppliers. In this way Philips wants to ensure that the entire value chain is considering social corporate responsibility and not just their direct suppliers. Philips considers it its own responsibility to check their direct suppliers on corporate social responsibility, but then it becomes the responsibility of the suppliers to check their own direct value chain on these aspects.

For the nanotechnology products, they want to comply with the REACH EU standards on toxicity of the used nanoparticles and thus also ask from their suppliers that they do. However, because it was not possible to contact the nanoparticles suppliers of Philips, it is not clear whether or not the nanoparticles companies have any other regulations that they follow. Also the understanding of the division of responsibility in this part of the value chain could not be studied.

Attention to sustainability also comes forward in the collaborations of Philips. Here is it mainly present in selecting a collaboration partner with a shared vision on sustainability.

The interviewee stresses that this is different from the relation with supplier: in a collaboration that is also important for company sustainability cannot be demanded, but it has to be negotiated. When a shared vision between Philips and the partner is reached, this is all carefully documented and both parties have to declare to comply with these agreements.

This however mostly accounts for one-on-one collaborations with industrial partners. Within larger research consortia, such as CTMM, this is less present. Resulting from the interview with the coordinator of the Circulating Cells (CC) project, this also results from that many partners are not companies, but universities or university hospitals.

“Corporate social responsibility? I don’t work in a company. Maybe social responsible research would be more appropriate.” (Interview CTMM-CC, 2011)

CSR is not explicitly present within the CC project. There are no guidelines for companies working within the CC project to have CSR regulations. The interviewee says that he is not aware of the how CSR is filled in within Philips:

“I really have no idea. This (CSR) never comes to the table in a CTMM setting” (Interview CTMM-CC, 2011)

This is also confirmed by the interview with CTMM program manager Henny Bruinewoud. She does show another reason for why this might not be a subject within CTMM project meetings:

“Well, during those progress meetings usually only researchers of Philips are present. And those, I won’t say that they don’t consider corporate social responsibility, but it isn’t something that is high on the agenda. I’ve never seen that (CSR) come forward in a meeting. But that’s probably because you’re still in the research phase.” (Interview CTMM, 2011)

This fits with the statement of Hans Hofstra that CSR is not included in day-to-day activities. The researchers are not considering CSR in a research setting.

Even if CSR is not a topic of conversation, social responsibility does show in CTMM, according to Gerard Pasterkamp, mainly in how the collaboration is set up: with both academic and industry partners. He thinks this helps the university research to learn from the companies, which technologies have the potential to be commercialised and for the companies to learn more about the fundamental research involved.

“In a hospital or in science you are judged on publications and dissertations. But within CTMM, there are different ways to measure success and those are to help companies reach society in a better way. To place the product within society.” (Interview CTMM-CC, 2011)

Within CTMM projects there is room for thought about how a certain product or research outcome might reach society and what the impact there will be. This is done by the work packages of the medical technology assessment (MTA).

“So our projects are so divided that they have a principal investigator and dependent on the size of the project, the work is divided into work packages. (...) And in many projects one of these work packages is the MTA work packages. So it has quite a big role in the project.” (Interview CTMM, 2011)

Even though MTA is thus considered, the composition of the MTA work packages is not mixed with public and private partners as the rest of the program but just comprises of academic researchers. This means that even though the companies do hear about the progress of the MTA, they are not actively taking part in it.

Studying nanotechnology does not change anything in the consideration of the projects or of the MTA work packages. Both Gerard Pasterkamp and Henny Bruinewoud address how the media have been hyping nanotechnology.

“I don’t think it’s (*nanotechnology*) really subject of a societal debate. It’s more a hot topic” (interview CTMM-CC, 2011)

“Nanotechnology is such a broad concept. And it has really become a buzzword I think.”(Interview CTMM, 2011)

Even though nanotechnology might be hyped in the media, projects with nanotechnology in it are not treated differently within CTMM than projects without nanotechnology.

Another responsibility issue is discussed in the interview with Gerard Pasterkamp about the judging of whether or not to develop a certain drug.

“Because academics are usually so optimistic. (...) Academics look at the scientific value, but companies have to make money with it, so they have a much higher risk when investing in something. (...) For example, the market is way too small. It won’t give any profits, quit that business.”(Interview CTMM-CC, 2011)

In the medical field, companies have a large power on what medicine will be available for society and which won’t. This gives a large tension between what is needed in society and where money can be made.

Both interviews show that Philips does not actively show its CSR policies within research consortia such as CTMM. Both CTMM interviewees agree that this is likely due to the fact that within research

this is less relevant, because you are not actually bringing a product to the market for which you have to be responsible. However it doesn't quite stroke with Philips' idea of reputation upkeep: why not also leave an impression of conducting CSR on research partners instead of just on the large public?

5.4 Conclusion

To answer the research question about how responsibility is distributed in the value chain of this case, first an illustration needs to be given about how social responsibility can be described in this case. This is not only illustrated by how the interviewee defines social responsibility, because this would only result in a view on responsibility and not in a definition. Zooming in on responsibility can be done by comparing the definitions of other interviewees in the same case and by looking at which actions that spring from the views on responsibility.

After the social responsibility in the case has been discussed, the rest of the research question, regarding distribution of responsibility and the influence of new technologies can be addressed.

5.4.1 Social responsibility

This case illustrates that social responsibility can exist out of many aspects. From this case can be concluded that one of the aspects of social responsibility is the improvement and protection of reputation.

At Philips, reputation and image play a large role in their social responsibility. Philips wants to distinguish itself as a company that sells good quality consumer products and, even more now they have entered the medical field, as a company that cares about people. Or as their website states:

“As a world leader in healthcare, lifestyle and lighting, Philips integrates technologies and design into people-centric solutions, based on fundamental customer insights and the brand promise of “sense and simplicity.” (Philips.com, 2011e)

The upkeep of reputation is of course not something new, how to do this, however changes over the years. When Philips started over a hundred years ago with making light bulbs, good quality of the products and affordable prices were probably what their reputation consisted of then. Since today the public opinion beholds that it is good to be sustainable in environmental terms and responsible towards society, this is what Philips directed their strategy towards.

This confirms the study of Pinkston and Carroll (1996) discussed earlier, where they argue that CSR is based on the current values and beliefs which vary in time.

While the improvement of image seems an important aspect of social responsibility, the protection of reputation is a crucial one. A large company as Philips cannot afford to lose face in front of its customers so it is responsible to preserve their reputation. This means that Philips takes up the responsibility for its value chain – e.g. by checking its suppliers – so they can make sure they have covered all bases.

Social responsibility thus has a twofold relationship with reputation of a company. It is important as a message to outside public, which can improve the image that a company wants to portray. On the other hand it is crucial to the protection of reputation.

This reputation upkeep does cause much pressure on Philips to be socially responsible and to consider this in every aspect of their business undertaking. To be sure that this maintained within the large organisation that they are, they have created the formal documents of EcoVision. This sets a standard for all of Philips' conducts in social responsibility.

Having such a standard is necessary for a company the size of Philips; you cannot have every department decide their own stand on social responsibility. However, even though every employee is probably aware of the EcoVision regulations, only a handful of the 119.000 employees – such as the specially formed Philips Corporate Sustainability Office or managers deciding on the policy – are actively considering social responsibility measures and implications.

Social responsibility can in this case thus also be defined as something which is clearly stated in guidelines and regulations with measurable parameters to determine success. These regulations provide guidance in situations where actions are required. By making choices that follow the regulations, a straight forward approach to acting socially responsible can be taken.

Another aspect that came forward, not only in the interview with Philips, but also with other value chain interviewees is the so-called 'greater good'. What is meant here by the greater good, is quite literally the most good that can be given to the most *people*. This can be found in how Philips wants to make access to care for as most people as possible and how Philips and CTMM are focussing on cardiovascular deceases and oncology, because these are the deceases that affect most people.

So a different aspect of social responsibility is making choices for the greater good.

Social responsibility in this case can consequently be summarized as being important for the improvement of reputation and crucial for the protection of it, as something that is clearly stated in regulations which can guide actions, which can then be rendered socially responsible actions and as making choices that positively affect the greater good.

Just like any ethical definition, this illustration of social responsibility raises questions about the limitations of it. These limitations also come forward out of the results of the case.

A limitation related to the reputation aspect of the definition, is whether or not reputation is actually what is at stake for a company like Philips. Reputation is namely something that a company wants and needs to keep in order to stay in business. So in this sense, it could be argued that it is the social responsibility of a company is to stay in business. This does match the definitions of CSR given by literature as described in the Theory section, where almost all definitions included a section of "making a profit". However, since social responsibility means more than just sustaining a business, this definition is circular: social responsibility is sustaining a business, but sustaining a business is necessary for social responsibility – i.e. also the other aspects of social responsibility.

However, just as in the definitions given in literature, the definitions illustrated by this case are also broader than just sustaining business. This case shows social responsibility as something that is clearly stated in regulations and guidelines. While the previous limitations were more theoretical in nature, here more practical limitations to this definition can be found.

A first objection to this definition could obviously be: can social responsibility be stated in regulations? And if it can, can all choices and consequent actions that are derived from following

these regulations be automatically considered socially responsible? These limitations are however not new or exclusive for this case, they apply to all attempts to make practical regulations derived from theoretical ethical subjects – such as laws, ethical medical codes, etc.

Another limitation can be how social responsibility is considered throughout the company when it is stated in regulations. This is also reflected in the interview with Hans Hofstra where he states that CSR is not something that is considered an everyday business, but that having the EcoVision regulations set the right preconditions. Naturally Philips doesn't want all of its employees to be actively thinking about social responsibility everyday; this wouldn't be very efficient for the company. Thus just the handful of people that make the regulations are the ones that are actively considering social responsibility. The rest of the employees of Philips do have the sense that they work in a socially responsible company, while they might never have to consider it themselves. This practical limitation thus relates to how a standard corporate social responsibility can be transferred to an individual responsibility of the people working in that company.

The greater good aspect of the definition also experiences limitations. These limitations are also not exclusively applicable to this case, but relate to the general objections of utilitarianism. Utilitarianism is an ethical theory which states that the good actions are the ones that cause the most happiness for the most people. These theories have always raised objections in many aspects. These objections can also be related to the medical field that Philips is in. The most pressing questions here are: on which diseases should money be spent or should it be divided and how? These questions are difficult, if not impossible, to answer, especially since not spending money on research or facilities for a certain means that people will die.

The understanding of social responsibility that follows from this case thus has both its merits and objections, which is true for all ethical definitions. The question of this research is however not what social responsibility is, but how it is distributed in value chains. The understanding of social responsibility that has been described here will be used to answer the distribution question.

5.4.2 Distribution

The distribution of responsibility in this case is related to the understanding of social responsibility that has surfaced.

First of all, the aspect that social responsibility is crucial for the protection of reputation, has consequences in the distribution of responsibility among the value chain. It is for Philips so important that no harm will be done to their reputation that they take upon them the task of making sure that their entire value chain produces socially responsible. Philips takes responsibility for the products they bring onto the market and does that by checking their value chain linkages.

This checking of the value chain is again related to the understanding of social responsibility in this case, because this checking of the value chain happens by also making regulations for other parties in the value chain, which are derived from their own corporate social responsibility regulations. The Supplier Sustainability Declaration is a clear example of this.

Not much of the responsibility is thus distributed among the value chain; it is mainly concentrated in one actor, Philips.

However, this responsibility does not only lie with Philips because they have decided to take it to protect their reputation. Also other parties – such as the public or other value chain agents – expect that this large player takes this responsibility because they have the power to do so.

Philips namely is a powerful player in many ways. It has many employees that believe in their company, it has enough money to make large investments and it has ties all over the world with not only other companies, but also with public institutions such as universities and hospitals.

This power shows clearly in this research in the relation they have with their suppliers: Philips can simply demand them to meet their sustainability standards, because Philips can always choose another supplier even if that is not the most economically feasible one and the investments of Philips can be so large that no supplier is willing to turn those down.

Even with most power and responsibility concentrated in the largest player, some responsibility is still distributed among the value chain. Even if Philips sets the rules for what social responsibility is, the suppliers still have the responsibility to follow these rules or to at least determine what their own social responsibility is. In value chains with large players, even if both the small players and the large player want the responsibility to lie with the large player, it should be noted that the small players are still a part of the collective social responsibility.

5.4.3 Emerging technology: nanotechnology

The social responsibility and the distribution of it that are described here are derived from a case where a product involving nanotechnology was produced. This research was namely started because of the public and scientific concerns about what nanotechnology could mean for society. The question that remains is: is the understanding of social responsibility reflected in this case specific for nanotechnology value chains or does an emerging technology such as nanotechnology not change the understanding of social responsibility?

This case illustrates that producing a product with nanotechnology does not change the illustration of social responsibility. Also considering nanotechnology Philips relies on their existing social responsibility framework. This means that new and mature technologies alike are fitted into this framework.

This is confirmed by the other agents in the chain. In research collaborations, nanotechnology projects are not treated differently or more precautionary than projects that apply other technologies. The technology assessment techniques that are used to assess the implications for society are the same for new and mature techniques.

An objection to this is whether this understanding of social responsibility is appropriate to a new technology such as nanotechnology. This has to do with the possible health risks, large utility possibilities and speedy development. The possible health and safety risks can be illustrated by ignorance of the REACH legislation whether or not nanotechnology fits into their framework. The large utility possibilities relate to the fact that applications which could not be imagined should now be handled responsible. Lastly also the speedy development makes both of the previous objections even more serious.

Social responsibility regulations such as Philips' are evaluated on a yearly basis and updated on a 5-year basis. Whether or not these periods are regularly enough to keep up with new social responsibility challenges that new technologies pose, remains the question.

6 Results – Case B: TSST

TSST is a small company, which has begun as a university spin-off in 1998. The University of Twente needed specific lithography equipment for their nanotechnology research and since they could not find a suitable supplier, the science department decided to have some employees develop and build the machine themselves. The eventual machine turned out to be of such good quality that universities and research institutes all around the world requested to also have one built. Thus a spin-off was created to develop these lithography machines.

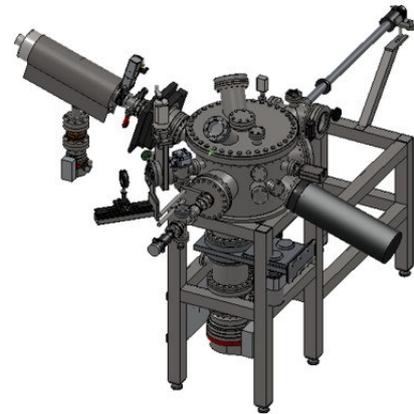


Figure 3 Example of PLD System (www.TSST.com)

The machines that TSST builds are Pulsed Laser Deposition Systems. This technique is used to deposit high quality thin films of materials. High power laser pulses first melt, then evaporate and ionize materials from the target surface. This evaporated material expands quickly away from the target surface and is then collected on a substrate. On this substrate the material condenses and the thin film can grow accordingly. (Andor Technology, 2011)

The lithography machines that TSST develops are complex and are all built specifically for the consumer's wishes. Different research areas namely require different machines. The construction of these machines takes about six months from designing to the final delivery to the customer. First the designing process takes one month. After the customer is fully satisfied about the design, the actual manufacturing of most components is outsourced. After two months the outsourced components are finished and are assembled by TSST, which takes approximately two months. In the last month the machine is thoroughly tested and is set up at the customer. TSST makes two or three machines a year in this manner.

6.1 Value chain

The supplier side of the value chain of TSST compiles of roughly two groups: suppliers for ready-made catalogue parts, these are usually large and international companies and specifically designed machine parts; these are local and smaller companies.

Since every machine is customer-specific, different parts are needed for every construction. This means suppliers can vary for different machines, which makes fixed agreements with suppliers undesirable. Even though no fixed contracts exist, TSST does have a trusting relationship with most suppliers.

A local supplier is Bouman. Bouman is a 60 year old company, which has its origins in the textile industry. In the 1970ties the textile market declined and the company converted to the metal and machine industry. Bouman does not produce their own products, but only makes machines and other metal applications on specified order for customers.

Bouman has a very broad spectrum of customers in almost any market segment. They deliver to chemical companies, such as Akzo Nobel, but also to customers in the aerospace, food, semiconductor or nuclear industry.

The company is comprised of four different business units. First of all, the machine factory which is the unit that delivers to TSST. The interviewee, Mr. Masseur, was the sales manager of this business unit. Furthermore an Engineering and a Process Technology unit are part of the company. The last unit is Bouman Industrial Solutions, which intends to provide companies with complete industrial solutions. This business unit operates more independent of the rest of the company.

Another supplier is Pfeiffer Vacuum. Pfeiffer Vacuum is a large international company, with over 2000 employees worldwide, which was founded in 1890. (Pfeiffer Vacuum, 2011) For over hundred years the company has produced vacuum pumps. The last 30 years Pfeiffer has focussed their research and expertise on pumps in the high and ultra high vacuum, which require more powerful pumps. Pfeiffer is now market leader in the high and ultra high vacuum market, but has recently returned its attention to also low vacuum pumps to become market leader in the whole vacuum market.

Pfeiffer has many different customers in almost all industrial markets. To TSST they deliver the vacuum pump that is needed in their Pulsed Laser Deposition System.

In their start-up phase TSST was within a project of STW ("Stichting Technische Wetenschappen", in English: Foundation for Technical Science). STW tries to couple university research which has commercial potential with so-called 'user-committees'. These committees comprise of potential interesting consumers for the technology.

STW was founded in 1981 to finance and facilitate technical university research. STW's goal is to get researchers of a certain technology in contact with potential users of this technology. These users are usually companies which operate in the right market, but it can also be representatives of certain interest groups, such as consumer or patient organisations.

These users are represented in a user committee which is able to follow the research closely and can also possibly have influence on the direction of the research. This way fundamental research can more easily find a commercial application.

The customers of TSST are all universities or research institutes from all over the world. TSST has costumers in the Netherlands, France, Norway, Singapore, USA, Spain, China and Japan. They however do not have regular costumers because it rarely occurs that a consumer needs a second machine.

For the first time since it existence TSST is now considering request from commercial companies instead of research institutes or universities. It is still uncertain whether TSST will start supplying to these commercial companies.

One of the buyers of the PLD systems is the Zernike Institute for Advanced Materials of the University of Groningen. The Zernike Institute is together with the nanodepartment of the University of Twente the most advanced in the Netherlands in making nanomaterials.

The person most involved in this purchase was Prof. Dr. Beatrix Noheda. She was the interviewee for this case.

The department of Noheda attempts to grow oxide materials layer by layer. More specifically they study ferroelectric or piezoelectric materials. These materials are needed to transform sound waves to electrical signals and vice versa. This is thus used in electrical devices such as telephones, but also in medical applications as ultra sound generators.

The department of Noheda studies how the piezoelectric properties of these materials exactly work and how they could possibly be made from smaller atoms. This is done by changing an atom at a time of a certain molecule and then testing if the properties have changed.

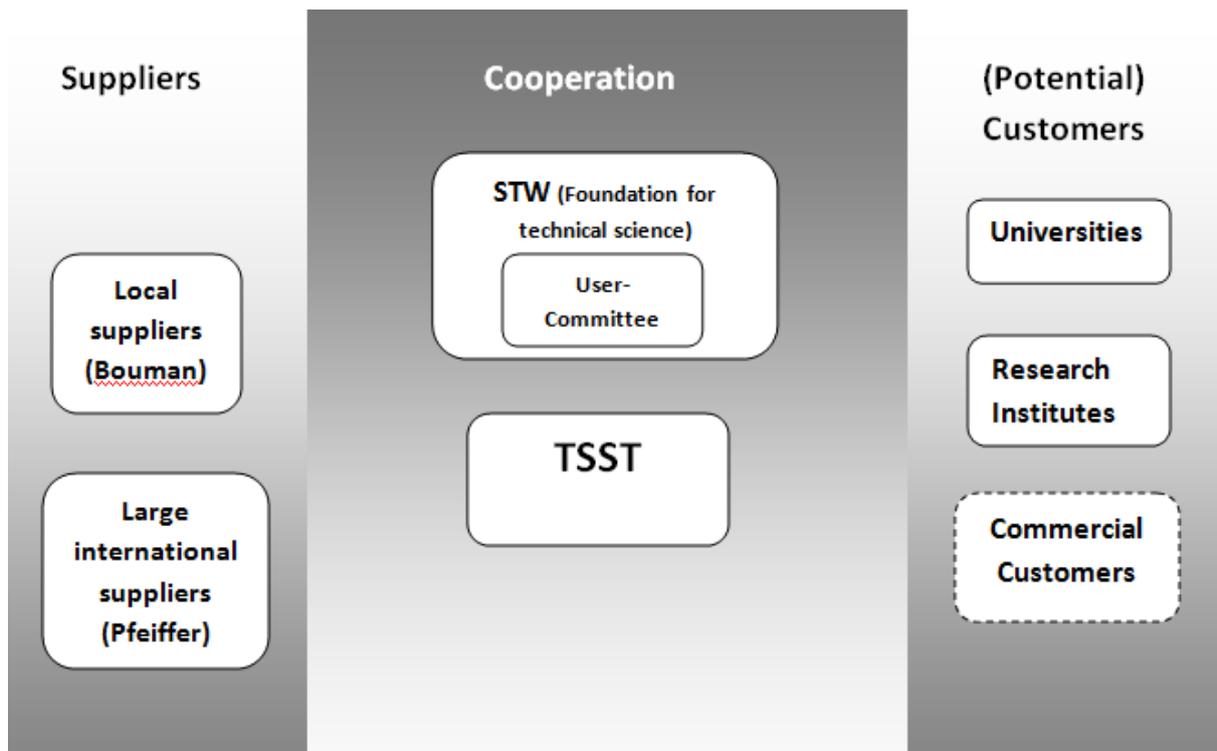


Figure 4 Value Chain of TSST

6.2 Responsibility within the company

The company has not addressed much attention to corporate social responsibility.

“We don’t run into a lot of issues concerning it (CSR).” (Interview TSST, 2011)

The fact that not much attention has been paid to corporate social responsibility is mainly due to the fact that the machines that TSST builds are specifically build for a specific research area. TSST knows exactly for which kind of research the machine can be used and can thus be confident about how the machine is used.

“You cannot do anything else with these machines than the research that is specifically built for.” (Interview TSST, 2011)

TSST’s responsibilities towards other agents in the value chain are mainly related to safety regulations in using their machines. The machine uses a laser with high energy pulses which could form a safety hazard if not set-up correctly. When TSST delivers the machine including a laser, they

can usually be sure that it is rightly installed. However, because lasers are expensive, many universities use their own laser for this machine. In this case TSST tries to take a look at the set-up of the machine in the lab, but since some customers are situated on the other side of the world, this cannot always be the case.

The interviewee can recall one time where he wasn't sure if it was responsible to sell a requesting customer a machine:

“We once had a bit odd request: a guy from Pakistan wanted one of our machines, but when we talked about the specifics of the machine he only seemed interested in a very specific laser type and not at all in the rest of the machine.” (Interview TSST, 2011)

TSST didn't exactly know what to do with this request. They had the feeling something was off, but on the other hand also didn't want to send to the customer away on a hunch. TSST decided to check with the government regulations concerning this laser:

“There were no import regulations on these kinds of lasers to Pakistan. So, yeah, what more can you do?” (Interview TSST, 2011)

TSST does obey the law and regulations, and will in specific cases look extra into those regulations, but does not feel responsible to go further than this.

Since TSST does not explicitly recognize CSR as important and it is a small and still developing company, no formal documents about CSR exist within TSST.

Furthermore TSST is, as spin-off company, housed within the building of the University of Twente (UT). This means that TSST is depended on the UT on many regulations concerning CSR (such as environmental or building regulations). The UT does however have an elaborate annual report including sections on CSR and is scored as second best university by the Transparency Benchmark of the Ministry of Economic Affairs, Agriculture and Innovation. (Transparantie Benchmark, 2011c)

The CSR activities of the UT are focussed on their own core-activities – education and research – and thus mainly address CSR concerns in these directions. The annual report does address attention to the fact that the university is committed to validating research in a way that it can be useful for society and gives their many spin-off companies as an example. How CSR is or should be interpreted by the spin-off companies is not mentioned in the report. (Jaarverslag UT 2010)

As already mentioned TSST is a small company, which cannot exercise much power over their value chain. They do need a strong collaboration with some suppliers, because their machines are so specific that different machine parts are needed each time.

The lack of power also has to do with the fact that the company is still housed in university buildings, which for example means TSST cannot decide their own policies on environmental issues.

In the case of TSST is it hard to determine who the main technological governor is. As indicated by the interview with the customer, the University of Groningen, TSST has developed a certain kind of PDL systems that are unique and that only they are currently making.

“They actually don’t only make regular pulsed laser deposition systems, but they actually were the inventors of a part of the machine, that actually allows much better samples with much better quality. At the moment everyone in the field of pulsed laser deposition that wants to have this quality materials are using their invention.” (Interview University of Groningen, 2011)

This would imply that TSST would hold some power over the value chain because of their unique technology. This is however not completely true, because the market that TSST is selling to is very small and specific. This means that even though TSST might have some power towards customers, it doesn’t have much power towards suppliers. Here size seems to be of more importance than the holding of a unique technology.

Practically all customers are well-known by the company. The company was founded by Cas Damen, a PHD-researcher in the area of these thin films that the machines of TSST produce. This means that Cas Damen knows most people within this research field.

“We operate in the scientific world. Everybody knows everybody. (...) We don’t really have unknown customers. So there is a lot of social control.” (Interview TSST, 2011)

The interview does indicate that now interest for their products has been shown by commercial companies in Asia. Cas Damen indicates that he is not sure whether delivering to this new group of customers might change the way responsibility is filled in within TSST.

In general, TSST does believe that running a company comes with certain responsibilities to customers and to society. Their view is that a company has to take these responsibilities and think about potential harm or danger to the society of their products, because acting in an irresponsible manner will not be sustainable, because you will eventually lose customers because of it. A company, especially in a new field such as nanotechnology, needs to prevent a societal discussion about their products from happening. This can only be done by trying to address these issues up front.

“Of course you can act irresponsible, but that will stop at some point: you’ll start to lose customers over it. When the societal debate get going, then you are already too late. (...) You have to be prepared for that one crazy person can very easily cause great distress at the public and you have to act before that. Because trying to mend it afterwards won’t work. So you have to welcome the debate and not try to evade it.” (Interview TSST, 2011)

The strategic responsibility within TSST is thus mainly related to the preservation of customers, which is needed for a business to sustain.

6.3 Responsibility within chain

Since no fixed agreements are made with suppliers, it is not possible to make agreements about conditions such as corporate social responsibility. The selecting of supplier is mainly done via personal networks and a good ‘gut feeling’ about the supplier. TSST does want their suppliers to meet official safety and health regulations, but has to trust the supplier to also do this, since they don’t have the ability to check this.

Both the suppliers interviewed are quite interested and active in CSR. Pfeiffer, being a large company which is listed on the German stock market, is obliged to report on their CSR activities in their annual report. Bouman, on the other hand, is a smaller company which mainly delivers to local parties, but has given some thought to CSR.

In the way both suppliers are handling CSR topics again the importance of size comes forward. In Pfeiffer the fashion of CSR is much more formalised: They have specific guidelines based on the ISO26000, which are used throughout the company.

“We have several (CSR) certificates, which we use as guidelines for production. We are quite busy with that.” (Interview Pfeiffer, 2011)

However within Bouman the formalisation has not developed as far. CSR is within Bouman mostly making a sustainable business, in more than one sense of the word. They try to make environmental rules as good as possible, but sustainability in social relations is even more important. They see this as good and durable relations with suppliers and customers, but also with their employees. Even though this vision is not certified by official organisations, they have made some formal guidelines.

“It more like that they are rules that we made ourselves. (*Than official formal rules*) And it (CSR) is one of the goals in our company’s objectives.” (Interview Bouman, 2011)

However, since TSST is not particularly concerned about social responsibility, it would seem as if both these suppliers would not be interested in also making their value chain more socially responsible instead of just their own company. Pfeiffer indicates that again size of the company makes the difference, also for discussing responsibility in the value chain:

“With our large customers, you have contracts of millions per year. (...) With smaller companies, the connection is more based on a feeling, a gut feeling. And the vacuum pump market is based on trust. Everybody knows everybody.” (Interview Pfeiffer, 2011)

Also Bouman indicates that their opinion of TSST’s responsibility is mainly based on mutual trust. They do indicate however that it is difficult to know whether or not to be alarmed by a certain technology if you don’t have the expertise about this technology.

“In the case of TSST we don’t really think about that (*VCR*), about the safety of those products and what kind of consequences they could have for others in general. We are not enough into this technology to know this. I sometimes come there and then they explain what happens, but I don’t have the feeling that TSST handles their products irresponsible.” (Interview Bouman, 2011)

The interviewee from Bouman compares it to another customer of theirs, Urenco, which is a manufacturer of enriched uranium for nuclear power utilities worldwide.

“We sometimes do have that for example when we are in a process with Urenco. There you have to deal with radioactive materials and than questions are sometimes asked for which you really have to carefully consider: do we want our people working there? And I don't think that these questions are an issue at TSST, because they operate on the machine level.” (Interview Bouman, 2011)

Here Bouman shares the opinion of TSST, that they are not doing nanotechnology themselves and are thus less accountable.

Both suppliers thus know that TSST is not addressing social responsibility actively and accept that because they know small companies usually do not have this interest.

“At TSST, that is a real small firm and you see that they are totally not interested in looking into that (CSR) and you see that there are a lot of small customers who are in the same position.” (Interview Pfeiffer, 2011)

The interviews with the suppliers show that even though both suppliers are active in CSR, they did not impose this on TSST. Both suppliers indicated that they did not really know how active TSST was in CSR, but they both did not think that TSST was active in it. This could be an indication that social responsibility was probably never a topic of conversation or discussion between these companies. Even though Pfeiffer indicates that with large suppliers, CSR is something which is more important, for smaller companies they assume that it is not something that they are concerned with and don't want to bother them it.

When TSST was founded, it was supported by STW. The University of Twente took part in a project by STW and STW provided the research on the PLD systems with suitable users. Probably those users were positive about the technology, because TSST was founded as a company not shortly after. Unfortunately, STW has only published their so-called valorisation reports from 2003 on. This meant that the project code could not be found anymore and it was thus impossible to contact the participants of the user committee of TSST.

An interview has however been held with an employee of STW to get a more general overview of how STW works. STW also hosts the organisations NanoNed and NanoNext NL which are research consortia in nanotechnology to bring university research and companies together. Within these programs there has been explicit attention for the impact of nanotechnology on society:

“But for nanotechnology it is nice that there within NanoNed and NanoNext, is explicit attention for that. On top of that we also had the Committee Societal Dialogue Nanotechnology. They really looked specifically to: what do we, as a society, think of nanotechnology.” (Interview STW, 2011)

Also the interviewee indicated that STW itself was part of a program for corporate social governance. This shows that within STW CSR is an important issue, mainly because of their goal of connecting society and business.

However, in the communication to the user committees and the potential start-up companies the message about responsibility is less explicit.

“The whole idea is that if we involve users with the research that will cause the research to fit the wishes and needs of the market. (...) Traditionally, the idea is that the company knows what the consumer wants. (...) I think that that’s true for the most part, but if you want to look from a broader perspective, it is wise to also involve other stakeholders. And that is what you see happening now.” (Interview STW, 2011)

The goal is thus to make the researchers more aware of in what way society is interested in their research and to adapt their research to it.

STW thinks that it is very difficult for small research companies such as TSST to be aware and actively engaged in their social responsibility.

“I think that is very difficult. (...) The researchers are still trying to figure those things (*other things besides their research expertise*). (...) And it is difficult because you don’t know what kind of impact a new technology will have. (...) And lastly, these boys, it’s mostly boys, are really devoted to their technology and you need that passion to be able to continue with it. But that means that you won’t go think about implications that are much further away.” (Interview STW, 2011)

The idea of STW is thus that the reason that small and young companies are not that busy with social responsibility, is on the one hand that social responsibility is one the many things to think about when starting a new company and small companies can just not have gotten around to thinking about it. On the other hand a new technological start-up requires a passion for the technology and a strong believe in its attributes. This could have two consequences: either some thought has been given to social responsibility, but because of their faith in the technology this would turn out as beneficial to society, or certain negative societal influences are not given that much attention because they would harm the passion for the technology.

The interviewee of STW said that the main attribution to social responsibility of the user committees is to help the researchers think in a broader context about their research.

“When you see that the people with whom you talk about this (*social responsibility*), that their ideas start to change. I think that just the awareness is already a great attribution.” (Interview STW, 2011)

The responsibility of TSST to their customers is mostly present in that they want to deliver a high quality product which meets the customer’s specific qualifications. After the machine is delivered to the customer, TSST feels it is then the customer’s responsibility to use it in a sound way. They also feel assured in this, because they know specifically that the machine can only be used for a certain purpose because they are so specific. TSST also feels that the academic world in a certain field is so closely intertwined, so that it provides a strong social control on studying nanotechnology in a responsible way.

Furthermore, TSST feels it does not have the power in the value chain with which it could demand its consumers to use their machines in a socially responsible way. This also has to do with the fact that most consumers will just buy a machine of TSST once. When a company has a regular customer, which acts irresponsible, the company can decide to stop supplying to this customer. However, when there is only one machine to be supplied, this process cannot take place.

“The machine itself isn't dangerous, but if they (*customers*) make a dangerous layer with it there is not much you can do about it. The only thing you can do is, put that customer on a 'black-list', but almost no customer comes for a second machine, so there's not much use to that. (Interview TSST, 2011)

One of the customers of TSST is the University of Groningen. The interviewee here indicates that the main issue for TSST is about safety issues and health issues concerning people working with nanotechnologies. She also indicates that she thinks it is likely that TSST is thinking about societal implications of nanotechnology since they are closely involved with the University of Twente and the University of Twente has many research agenda's concerning nanotechnology and society.

“I guess they are because they are very much in contact with the research in Twente. And yeah I guess they are aware of these problems, so I believe they are very much aware of that. And that is the difference with a company which is not attached to a research institution.” (Interview University of Groningen, 2011)

The assumption that TSST is not only involved with the University of Twente in technological research but also with the social research is not strange. However, this doesn't seem to be the case, since TSST did not mention this and does not seem very aware of social responsibility.

The University of Groningen does not utter large worries about nanotechnology risks. Beatrix Noheda thinks the main risks for universities lies in handling the technologies safely. She says that this is not very necessary for their department, because with the technology that they use there is no chance of nanoparticles coming loose.

“In our case, fortunately, we don't have to think about that. Because our materials are made in a vacuum chamber, which is enclosed and even when we take them out then they are completely fixed into the substrate. So they do not have this danger. “

The interviewee from the University of Groningen mainly mentions first order consequences of nanotechnology such as health and safety risks of university employees. This could be related to the fact that the department of Prof. Noheda mainly conducts research without direct applications.

6.4 Conclusion

As in the conclusion of the previous case, first an understanding of social responsibility in this case will be given. After the social responsibility in the case has been discussed, the rest of the research question, regarding distribution of responsibility and the influence of new technologies can be addressed.

6.4.1 Social responsibility

Deriving an understanding of social responsibility from this case is more difficult than it was for the previous case. This is related to the fact that the interviewee from TSST did not have a clear definition of social responsibility for its own company.

However, aspects of what TSST's social responsibility means can be derived from the case. One aspect is related to the delivering of sound and safe machines. TSST takes responsibility for doing this and also the other agents in the chain think of this as a main responsibility of TSST.

Another aspect of social responsibility in this case is the social network of trusted agents. TSST knows all of its customers and trusts them to handle the machines that TSST delivers to them in a sound and responsible way. This trust is mainly based on personal relationships and the personal liking of a person. This also comes forward from the interviews with the value chain agents. They 'feel' that TSST is not acting irresponsible and this feeling is based on a personal liking.

This social network actually shows a different kind of social responsibility. In the interview TSST says that the social control within one academic field is so strong, that if one university or research institution would be conducting research that would be considered irresponsible or dangerous, the whole network would very quickly be aware and would probably condemn it. The whole academic field acts as a sort of alarm system for irresponsible behaviour.

Social responsibility in this case can thus be summarized as producing safe and solid products and having and maintaining a trusting social relationship with other agents in the value chain.

Also to this definition objections can be raised. A first objection is that this definition is a very narrow understanding of the concept social responsibility. As described in the Theory section, a given definition of corporate social responsibility is to "*make a profit, obey the law, be ethical, and be a good corporate citizen*". (Carroll, 1999) Compared to this definition, the understanding of social responsibility that follows from this case is limited and might actually not cover those areas that make it social responsibility. The producing of good products is a prerequisite for making a profit and obeying the law relates to the safety measures that have to be taken. However the whole definition of Carroll (1999) implies that *more* than making a profit and obeying the law needs to be done for a company to be socially responsible.

Relating social responsibility to maintaining a trusting social relationship could have merits which for example a regulation on social responsibility does not have. As mentioned earlier in the Philips case, making a regulation on social responsibilities will make it difficult to translate this corporate social responsibility to personal responsibility of the employees. In the case of TSST, corporate social responsibility is almost equal to personal responsibility.

The case of the man from Pakistan who wanted to buy a machine can illustrate this. Here Cas Damen had the feeling that something was off with this order. He did not know this man well enough to have a trusting social relationship with him. Because no regulations for social responsibility were in place he himself was forced to consider how to act responsibly.

The downside of a more personal approach instead of a regulated approach to social responsibility is that each case will have to be considered separately and personal feelings of liking and trust can be deceiving.

6.4.2 Distribution

The distribution of social responsibility in the value chain of this case is intertwined with the position and status of TSST in the value chain. This is related to the size and age of the company, their social network of customers and to the fact that they are not producing an end-user product.

For a young and small company such as TSST social responsibility is one among the many things that comes with starting up a company. Since they don't see an immediate need for thinking about or generating guidelines concerning it, they probably consider other things a more useful use of their time.

This is not only implied by TSST implies about itself, it is also something that is said by others in the value chain, namely STW and both suppliers Pfeiffer and Bouman. That a small and young company has limited means to consider social responsibility or just hasn't come around to it yet, is accepted by other agents in the value chain, even if those are themselves active in CSR.

This means that large companies such as Pfeiffer do not demand social responsibility from all of their customers, because they think they cannot demand such a thing from a company like TSST.

These expectations show resemblance with the case of Philips, where Philips takes on the largest share of responsibility and the other actors expect that Philips does so. Here is it also not clear whether the one causes the other. TSST could not be taking much social responsibility, because other actors do not expect this of TSST. Or the other actors could not be expecting this of TSST because TSST does not show initiative to take this responsibility on.

Another aspect that influences the distribution of responsibility in the value chain is that TSST is not a producer for a large population of end-users, but for only a small and very specific group of people. TSST knows and trusts their buyers, which is a very different situation than with a large population of end-users, whom you do not know and trust.

This trust indicates a distribution of responsibility that is centred within every agent of the value chain and does not cover more than one value chain linkage. Hereby is meant that every agent in the chain just has the responsibility for its own conduct and products and that this responsibility stops when the product reaches the next link in the chain. The agent than trusts the next link in the chain to also act responsible, but does not make sure whether this happens.

6.4.3 Emerging technology: nanotechnology

Also in this case a value chain of nanotechnology products was considered. A difference which also shows from the distribution of the responsibility, is that here the case company is not the one who is producing nanotechnology and is not the distributor to a large end-user public.

Concerning nanotechnology, this case indicates that nanotechnology is not considered differently from other technologies. All agents agree that when bringing a product to the market, a producer has to think about – at least – the first order implications such as health or safety risks for customers. However they don't see any special risk attached to nanotechnology. Or as the interviewee from Bouman puts it: making nuclear substances is much more dangerous.

Here different objections to this approach can be found than in the case of Philips. Since choices concerning social responsibility are at TSST made on a personal basis, they could be able to react quickly to new developments in nanotechnology that call for a different social responsibility. However, when social responsibility is not high on the agenda of the company, as it is now, the question is whether implications and consequences will be fully considered.

7 Results – MyLife Technologies

MyLife Technologies is not yet an actual company in the sense that it has not yet been registered at the Dutch Chamber of Commerce. It has developed a product, which has potential to be commercialized, but it still has to go from the organization of a university research group to a company organization.



Figure 5 Prototype of Micro Needle Array

The technology that MyLife Technologies has developed and is still developing further is microneedle arrays (MNA). These are needles with micrometer dimensions, over 50 times shorter than a classical syringe. Since they only penetrate the outer skin but do not reach the sensitive nerves which lie below, this makes the application painless. The small volume of the needle is compensated by placing multiple microneedles in an array. This array is then integrated in a patch.

The patches are easier to handle than classical syringes. This could make the patches good candidates for things as vaccination of children.

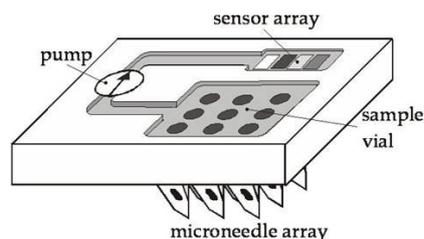


Figure 6 Possible combination with Lab-On-A-Chip technology

Another possible application is the combination of the patches with Lab-On-A-Chip technologies to create easy ways to self-test certain levels in the blood. (Fig. 6)

Furthermore the technology is developed further to see if there are possibilities for ‘intelligent patches’ which could for example contain more also newly developed ‘nanomedicine’. This would make the patches a totally new way of drug delivery combined with specifically new drugs for this way of delivery, instead of just creating a new way of delivering for existing drugs.

7.1 Value Chain

Since this is still a young company not much value chain linkages have been made. The interviewee does give an indication of how a possible future value chain might look:

“(...) probably we will find a partner, who will deliver the product directly to the patients.”
(Interview MyLife Technologies, 2011)

MyLife Technologies is thus not planning to become the part of the chain that delivers to end-users. This is because it will probably be more convenient to find a partner that already has the appropriate certifications for delivering medical devices, since it could be a long process before MyLife Technologies could do this themselves. Furthermore this allows MyLife Technologies to focus more on the technological side of the innovation.

The supply of the materials needed is still directed through the university’s supply chain and thus MyLife Technologies cannot influence this.

Just like TSST, MyLife Technologies was supported by STW. STW has created a users-committee in which also vaccination programs take place.

In previous research stages, MyLife Technologies has collaborated with the department of Drug delivery, the Skin Research Group under the supervision of Prof. Dr. Joke Bouwstra. The research project at STW was also filed under the supervision of Prof. Bouwstra. After the STW period was over and the company had actually been formed, the contact has remained limited.

As already mentioned in the previous chapter, STW's goal is to get researchers of a certain technology in contact with potential users of this technology. These users are usually companies which operate in the right market, but it can also be representatives of certain interest groups, such as consumer or patient organisations. These users will be represented in a user committee which is able to follow the research closely.

One of these users was Gideon Kersten, who at the time worked at the Netherlands Vaccine Institute (NVI) which has currently merged into the National Institute of Public Health and Environment (abbreviation in Dutch RIVM).

Even though the users-committee of STW judged the technology as valuable to be developed commercially, no real customers are present. The Netherlands Vaccination Institute was part of the user committee at STW and is seen by MyLife Technologies as a potential customer. However they do realise that to develop their technology so that it can really be used by vaccination programs, could still take several years.

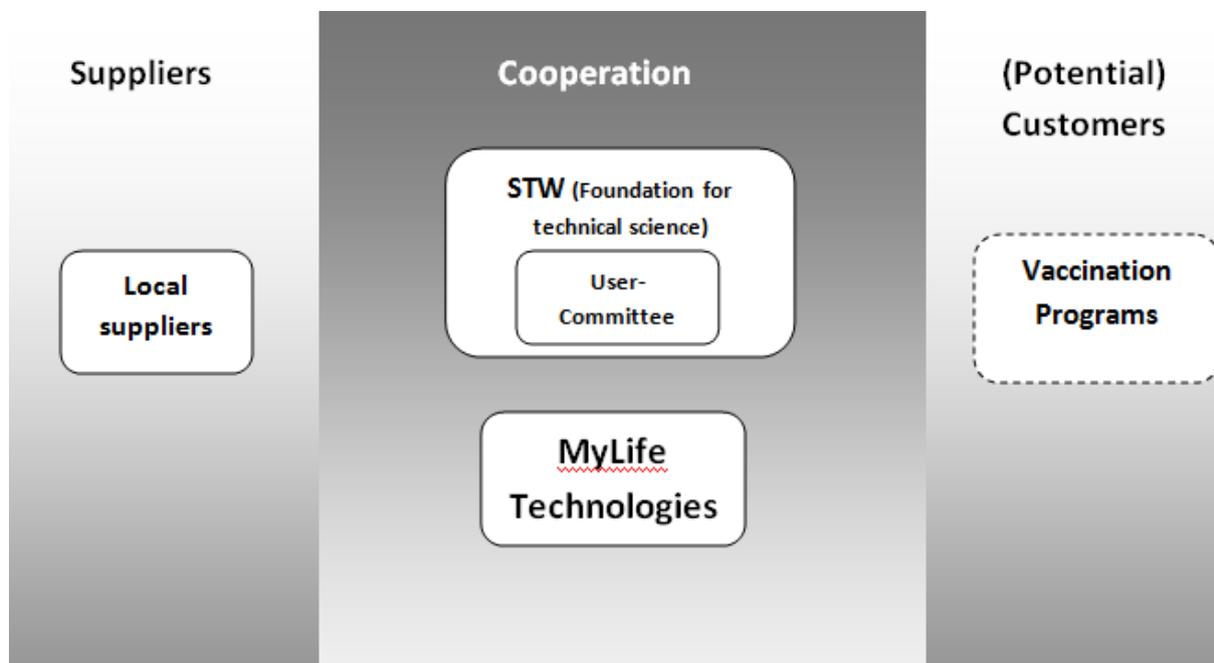


Figure 7 Value chain of MyLife Technologies

7.2 Responsibility within company

MyLife Technologies feels that it cannot address *corporate* social responsibility yet, since there is no company yet. On the moment the developing the technology is the main focus and issues like corporate social responsibility will have to wait until an actual company is formed.

“Corporate social responsibility will come when we really form a company. (...) My point of view is now from the technology, to develop the technology and I cannot also be involved in CSR regulations.” (Interview MyLife Technologies, 2011)

MyLife Technologies does feel a social responsibility in the sense that they believe that they are developing something that will be useful for society and that they want to make sure that it would in no way be harmful for society.

“This is not just about making something and stacking money. The government, and thus society, invests in science, so we have to give back to society. (...) Universities have to do what seems best in the eyes of society.” (Interview MyLife Technologies, 2011)

How this social responsibility will translate into a more corporate social responsibility when MyLife Technologies progresses as a company is not certain.

The company is still housed in the university and so has to comply with the university's safety, health environmental and labour regulations. Just like TSST, this is the University of Twente. Again the university has not provided the spin-off company with many options or tips for CSR.

MyLife Technologies is still very small and has very little negotiating power within the value chain. This is shown by how MyLife Technologies is willing to adapt the precise direction of their research to the wishes of a potential customer. They cannot decide independently which direction they would like to pursue, because having a customer is better for the company.

In the value chain of MyLife Technologies not much can be said about a main governor, since no value chain exists yet. Even though MyLife Technologies might possess a unique technology, as long as there are no customers there is no one to exercise power on. This could thus only develop as the technology and the value chain develop.

MyLife Technologies most pronounced feeling of responsibility is towards society: university research is paid by the whole of society and should also 'give back' to it in the form of new technologies and discoveries.

Also responsibility is felt in an obligatory feeling to follow through with this approach, since they have developed a technology which could improve healthcare.

“The responsibility for a new technology lies with the people who initiate the idea. But if you believe that this is a technology that could help people, I think you also have a certain responsibility when you don't do it.” (Interview MyLife Technologies, 2011)

Here the interviewee is saying that not pursuing this opportunity would mean MyLife Technologies would be responsible for *not* trying to improve healthcare and standards of life.

MyLife Technologies believes they will have to address the fears of society of nanotechnology in relation to their product, especially because it concerns a healthcare product. They fear that if they

don't, they will lose (potential) customers. MyLife Technologies wants to address this issue by talking about potential consequences with future partners such as the vaccine programs.

“Vaccination is something established. It is initiated from the government and it is socially accepted. This would be a good way to let people come in contact with our MNA patches.”
(Interview MyLife Technologies, 2011)

MyLife Technologies hopes that the vaccine programs will be a good partner, since they are an established authority on healthcare. This means that if the vaccine programs will be convinced of the safety and feasibility of their products, the microneedle arrays have a much larger chance of also being implemented in other fields.

7.3 Responsibility within the value chain

Regarding their partner in drug delivery, MyLife Technologies feels that it has the responsibility to select a good partner, which has the right qualifications to for example do animal tests for their products.

“It is our responsibility to select a good partner. After that the responsibility of the partner starts.” (Interview MyLife Technologies, 2011)

They believe their responsibility goes as far as making sure that the partner works in a sound and responsible way and that their responsibility stops there. Which choices the partner makes in the value chain, then becomes the responsibility of the partner and because they selected the partner carefully, MyLife Technologies has to trust the partner will make the right calls here.

The Drug Delivery Department (DDD) of the University of Leiden was a good collaboration partner in the start of the project. After that the actual company has been formed there hasn't been much contact, according to interviewee Prof. Dr. Joke Bouwstra. She thus indicated that she could not say how she thought social responsibility was filled in within MyLife Technologies.

Her own view on social responsibility is as following:

“To start something that is actually useful for society, keep on working on that focussed without unnecessary intermediate steps.” (Interview Drug Delivery Leiden, 2011)

Prof. Bouwstra thus generally shares the opinion of MyLife Technologies that university research should 'give back' to society.

Furthermore Prof. Bouwstra thinks the debate on nanotechnology is hyped too much by the media.

“It is too exaggerated. We have been working with nanoparticles for years and now it suddenly seems as if everything is toxic.” (Interview Drug Delivery Leiden, 2011)

The view of STW on social responsibility has been elaborated on in the previous chapter. STW thought that the user committees would contribute to social responsibility, because it would raise awareness of the researchers of how their research can reach society and how it would be received there.

One of the members of the users-committee does not wholly share this opinion. When asked whether he thought that the committee contribute to more social responsibility, he replied:

“Sometimes, but not usually. If a project is accepted, there will be mostly attention for scientific and technical aspects, but coupled with that probably sometimes also societal matters might be addressed.” (Interview RIVM, 2011)

However, even though societal issues might not be a topic of conversation in the user-committee gatherings, the perception of the STW interviewee that the researchers are made aware by the opinions of other might still be true.

Furthermore Gideon Kersten of the user-committee does share the opinion of MyLife Technologies that they are undertaking a socially responsible business.

“The applications that the company is developing can lead to health gain and thus serve a larger goal than just economical.” (Interview RIVM, 2011)

The other participants in the value chain and MyLife Technologies itself thus share this opinion that bringing something good for society to the market is currently their largest attribution to social responsibility.

7.4 Conclusion

As in the previous cases, first an understanding of social responsibility in this case will be given. After the social responsibility in the case has been discussed, the rest of the research question, regarding distribution of responsibility and the influence of new technologies can be addressed.

7.4.1 Social responsibility

Even though MyLife Technologies is a small and starting company, which has no official regulations regarding social responsibility, some aspects did come forward from this case.

The first aspect of social responsibility which can be derived from this case is ‘giving back to society’. This giving back to society is twofold: firstly, MyLife Technologies started as a university research which is funded by public money. By starting a business the money that was used for this research can be repaid to society. Starting a business is beneficial for society because it contributes to the economy, generates jobs and fulfils a need that society has.

This need is the second aspect of giving back to society. MyLife Technologies’ contribution is also to provide a better health care solution, which can lead to a health gain for many people.

Derived from this contribution to society that MyLife Technologies wants to make, is the social responsibility of taking the opportunity to do so when it presents itself. This is what Regina Lutge means when she indicates that there is also a responsibility in not pursuing an opportunity, when you know that this opportunity could contribute to health gain.

Lastly, another aspect which is related to social responsibility in this case, is the product being socially accepted. This is again derived from the ‘giving back to society’-aspect. When MyLife

Technologies will bring a product onto the market which is not socially accepted, no or little products will be sold and the business will not take off, making giving back to society impossible.

Social responsibility can in this case be summarized as giving back to society, where this implies taking the opportunity when presented to start a business which products provide health gain and are socially accepted.

This conception of social responsibility is limited. When again comparing this definition to the ones described in the Theory section, this definition actually only relates to 'making a profit'. Following this definition of social responsibility would also mean that automatically every company conducts a socially responsible business, just because it is a business which provides something beneficial for society.

Furthermore the aspect of the technology being socially accepted raises objections. MyLife Technologies is willing to adapt their product to the customers that will be interested in buying their product. MyLife Technologies does not have such an elaborate view on what social responsibility means for them that they might adapt to the understanding of social responsibility that the customer might have, instead of continuously considering what their social responsibility is.

7.4.2 Distribution

Not much can be said about the distribution of responsibility among the value chain, since the value chain is still very immature. Currently MyLife Technologies has most of the responsibility for their own product, since no other actors are involved in making the product.

Some responsibility also lies with STW and the participants in the user-committee. The main reason why MyLife Technologies was founded was because the participants of the user-committee judged the technology of the microneedle arrays as promising for a health care application and beneficial for society. This means that some of the social responsibility of initiating MyLife Technologies lies with STW.

This distribution will probably change as soon as more links in the value chain will be established. MyLife Technologies is a company that is planning to produce products that come in contact with a large end-user public. They are therefore already considering carefully how the product will be accepted by the public. Seeing as they are thinking about possible social responsibilities in the future, this could indicate that a more elaborate understanding of social responsibility will come in place, when the company develops.

7.4.3 Emerging technology: nanotechnology

Also in this case a value chain of nanotechnology products was considered. Contrasting with the previous two cases, here nanotechnology did have consequences for the understanding of social responsibility.

MyLife Technologies is carefully considering the public opinion on nanotechnology. They need their product to be socially accepted and not rejected because it is produced with nanotechnology. This is why MyLife Technologies is looking to partner with a socially accepted and established partner: the

vaccination institute. They can provide the social acceptance that MyLife Technologies needs in order to sell their products.

Another consequence for social responsibility of making a product using nanotechnology is the high speculation of the technology. MyLife Technologies does not yet know how the technology will develop, who will be their most important customers and how this will relate to acting responsible. On the one hand this speculation puts a temporary hold on thinking about responsibility. This is not only a prioritisation of precious time and resources: also not much can be said about how responsibility will be filled when one doesn't know what the consequences of the technology will be. On the other hand, the speculation contributes to thinking about responsibility. When speculating about possible futures, possible scenario's of how to act responsible can be considered. This means that even though responsible behaviour can only follow the technology, it can follow very quickly because it has been given thought beforehand.

8 Discussion

The conducted research is of explorative nature and thus consequently has a number of limitations, which will be discussed in the following.

First of all this research is based on only three cases of which the three companies are all very different. Even though it was tried to stay within the field of medical technologies, TSST is not a direct medical company and can not be seen this way. However, because this research studied the differences in value chains, the fact that position in the value chain is also of importance could have not been seen if TSST was not part of the research.

Furthermore more respondents within one company would have increased the validity, as triangulation of the results would have been possible. On the other hand the interviewees were either as in Philips a higher-level manager or as in TSST and MyLife Technologies the founder of the companies. They will probably be good representatives of the companies' views on social responsibility.

Another aspect is that no research framework for value chain responsibility existed to start this research on. The aspects of social responsibility used are found by combining different studies on ethical responsibility, corporate social responsibility, value chain responsibility and technology assessment. Because of this it turned out that some aspects, such as the "main technological governor" proved less relevant, since this aspect was always overshadowed by the size aspect.

Even though this research, as every research, has had some limitations, some interesting results have emerged. Sometimes these results can not be fully explained by the gathered data and further research will be required. The results and possible interesting areas for further investigation will be discussed in the following section.

9 Conclusions

9.1 Social responsibility

The definitions of social responsibility that were derived from the three cases show similarities. Philips' emphasis on the protection of reputation, relates to the way TSST wants to deliver sound and safe machines to its customers and to how MyLife Technologies wants to deliver a socially accepted product. All three companies want to stay in or want to start a business for which they need satisfied customers.

As already mentioned this aspect of the definition of social responsibility can be confirmed by literature as it is mentioned as 'building a sustainable business' or 'making a profit'. (Carroll, 1999; Garriga and Melé, 2004)

When looking further into the understandings of social responsibility derived from the cases, differences occur. The social responsibility of the case of TSST and of MyLife Technologies does not go much further than the above mentioned sustaining a business. On the other hand Philips' case illustrates a more advanced definition, because of the attempt of Philips to make regulations concerning social responsibility. These regulations can be seen as to cover the rest of the definition that is present in the literature: 'to act ethical and to be a good corporate citizen', because the regulations should provide guidance to make choices to act ethically. (Carroll, 1999)

This formalization of social responsibility – i.e. the composing of official written guidelines and rules on social responsibility – is a size related difference in the cases. This first of all can be explained by the fact that larger companies are usually listed on the stock market, which means that they are – in the Netherlands, but also in many other European countries – obliged to report on social responsibility in their annual report. This makes it probable that most large companies will have a policy on social responsibility.

Another reason is that for a large company it is necessary to make formal rules on any policy, not just CSR policies. This is because a company like Philips operates in many different places over the world and has many employees, which means a formal guideline is necessary to communicate this message to all parts of the company. In smaller companies such as TSST or MyLife Technologies the communication only needs to reach around 6 to 10 people, which makes an informal guideline much easier. The supplier of TSST, Bouman, clearly shows a company that is in between these really small and really large companies. This SME has started making some formal guidelines and have included them in the company strategy although the interviewee wouldn't call them official guidelines.

From the comparison of these cases regarding social responsibility can be concluded that the larger company with the more developed value chain has a broader understanding of social responsibility than smaller and less mature companies. This confirms the theory that larger companies which have more power also have a larger responsibility.

9.2 Distribution

The distribution of responsibility in three cases is very different. In the first case Philips is a large player which takes most responsibility upon itself. This is done by making rules and standards for

social responsibility also for other agents in the value chain. These other agents, such as suppliers, are also thoroughly checked by Philips.

This checking of other agents by one centralized point of responsibility contrasts with the trust-based relationships that exist in the value chain of TSST. Here every agent is only responsible for its own conducts and trusts the other agents to also act responsible.

The case of MyLife Technologies is again different, since here no real distribution can be found yet. This means that practically all responsibility for the potential product is situated at MyLife Technologies. However it can be questioned what this social responsibility entails when no actual product exists yet.

These differences in distribution can be explained by the difference in development of the chain, position in the chain and size related expectations.

When new technologies emerge, new value chains have to be established to distribute this product in the market. The case of MyLife Technologies clearly shows that in this technological start-up, the technology is developing alongside the value chain. MyLife Technologies is still not quite sure on which market they will focus their product and are able – and willing – to adjust their product to fit a specific customer, once they find one. This uncertainty and speculation about the value chain makes it difficult for MyLife Technologies to consider their responsibility on the value chain, because they don't exactly know what the final application will be and how this will have to be addressed responsibly.

Another aspect of this uncertainty is that MyLife Technologies does not have the luxury to be critical towards potential customers on aspects such as corporate social responsibility. MyLife Technologies' current approach for this is the developing of responsibility alongside with the technology and the value chain: there is no point in speculating about possible negative scenarios, but with every step the technology and value chain takes, they need to make sure that the responsibility keeps up.

TSST, on the other hand, does not have this problem with uncertainty. They feel that the social control of the academic world is their main safety net for responsibility issues. However, the company is now considering starting to building machines for commercial customers. This will probably require a new approach of TSST towards responsibility, which has not yet been developed.

Even though the project of Philips that has been studied has not yet created their full value chain yet, they are embedded in the company's network. This decreases much of the speculation in the value chain, because Philips can easily use this network to find their preferred value chain. Also the framework of corporate social responsibility is already in place. Philips has the power to control and check the other agents in the chain, which it thoroughly does.

Another aspect which comes forward in the case of TSST is the position in the value chain. Both Philips and MyLife Technologies are planning to deliver health care products to a large consumer group. TSST however makes machines for research purposes for a specialised and small consumer group. So, not only is TSST not making something that a large consumer public will be in contact with, but they are also not producing anything medical.

This causes large differences in their attitude to social responsibility. TSST knows their small group of customers and knows that they are not laymen who could be worried about possible risks of

nanotechnology. Furthermore TSST is not making a medical device which has to be considered in many more ethical ways than any other product.

Lastly, size does not only matter in what the company can or cannot do, it also matters in the expectations that other agents in the value chain have of that company. This shows in the case of TSST. Here both suppliers and collaborator are quite active in CSR themselves, but do not expect of TSST that they are because TSST is a small company. The case of Philips shows the other side: Philips is a large company which takes its responsibility and other agents in the value chain also expect that of Philips.

As already mentioned, it is here not clear how the expectations of other agents, the own uptake of social responsibility and size are causally connected. Probably these three factors influence each other so that they develop along side each other.

9.3 Emerging technology: nanotechnology

All the value chains studied in this research are connected to nanotechnology. Nanotechnology is a very broad term and it shows from this research that is more a term used by media or laymen than by the actual researchers themselves.

All three cases show that the nanotechnology concerns that might exist in the media are not always shared by scientists and specialists in the field. Many of the interviewees refer to the word nanotechnology as a 'buzz word' which is mostly wrongly used by the media.

However, the final question remains whether an emerging technology such as nanotechnology in the sense of social responsibility or social consequences is different from other technologies.

In the first case nanotechnology is considered in the same way as every technology used by Philips. The framework that Philips has for social responsibility is also applied to a nanotechnology product. The second case also does not show much difference in social responsibility when looking at nanotechnology versus mature technologies. No special measures for nanotechnology products are taken by any of the value chain agents.

The third case, however, does show that the social responsibility is influenced by nanotechnology. MyLife Technology is considering how its nanotechnology products can be socially accepted. Also the fact that they are conducting an emerging technology brings much speculation into their potential value chain, which in turn influences their ability to consider social responsibility.

This difference can be explained by the fact that for MyLife Technologies, the public opinion of nanotechnology is much more important than for Philips and TSST. For TSST, the public is not of much importance, because TSST is only selling to a small specialized niche. For Philips, the public opinion of nanotechnology is more important, because they do not want their reputation to be damaged, but it is not the most important aspect of their social responsibility, because nanotechnology is not their core and only technology. If the general public opinion of Philips remains positive, people will probably also accept nanotechnology from them.

For MyLife Technologies, this is different. Nanotechnology is their core and only technology. If the public opinion on nanotechnology will be negative about nanotechnology, they will not be able to start their business.

As mentioned earlier, objections to not considering nanotechnology in a different way when it comes to social responsibility are present. This is one the hand, for Philips, related to the matter whether or not its current social responsibility framework is able to respond to new technologies which impose possible health risks, many possible applications and are developing quickly.

On the other hand, TSST, which does not have extensive regulations, is perhaps able to react more quickly to developments which impose social responsibility questions, but since it is not actively considering its social responsibilities now, it might not recognize its social responsibilities.

9.4 Aspects of responsibility

In the Theory section, different aspects of responsibility have been described that had emerged out of the current literature on social responsibility. These aspects have guided this research by giving direction. What hasn't been discussed yet is whether the conclusions of this research are in line with the literature on the subject of social responsibility.

One important piece of literature for this research was the work of Phillips and Caldwell (2005) on value chain responsibility. The conclusions of this research support their findings about the public expectations of responsibility at large companies which shape their need to act responsible. Even so, the finding of this research that smaller companies do not have a high expectation of social responsibility does not come forward in Phillips and Caldwell's research.

Furthermore in the Theory section, different definitions have been given for corporate social responsibility. These definitions were composed out of overviews of different literature strands and were consequently broad definitions. This research shows, however, that the understanding of social responsibility in two of the three cases was much more limited than explained in the theoretical definitions. Only the understanding of social responsibility of the Philips case came close to the broad definitions.

This could be regarded in different ways: it could be judged that TSST and MyLife Technologies are simply not social responsible companies. On the other hand, these companies do – even if it is limited – have an understanding of what social responsibility means to them and how they comply with that. Then the question is not whether or not TSST and MyLife Technologies are socially responsible judging by the theoretical definitions, but whether the theory corresponds to the practice of social responsibility in companies.

Even if some differences exist between the conclusions of this research and the theoretical background, most of the mayor viewpoints of the theory are confirmed. These are aspects such as the relation between size, power and responsibility and the difference between formal and informal forms of responsibility.

This research does extent the current view with the value chain viewpoint. This research showed that actually a distribution of responsibility can be found in value chain. This can differ from a very evident distribution by one large leader as Philips to a silent consensus as in the TSST value chain. This perspective of distribution of responsibility can add to the current understanding of social responsibility.

9.5 Concluding remarks

As mentioned in the introduction; in this research a descriptive ethical question was answered to also shed some light on the underlying normative motivation.

The answering of the descriptive question has shown that differences exist in the distribution of responsibility among different development stages of those value chains. Also it has shown that as expected, size, power and responsibility are intertwined. Furthermore it has shown that larger firms make formal regulations for social responsibility – not only because they are obliged by law, also because this is better communicable throughout the company.

These answers are interesting and could be used for further investigation. Why large companies do not expect a small company to be socially responsible, such as in the case of TSST, could be an interesting question. Also how these expectations and the level of social responsibility interact and how these influence each other, could be a worthy research topic.

Another area where further investigation could clarify answers given in this research, is if and how formalized regulation on social responsibility is transferred throughout a large company such as Philips to a more personal considering of responsibility.

However, when returning to the normative motivation that sprung this research, the descriptive answers are not corresponding to this normative idea. The normative motivation was that because nanotechnology has potentially many applications, may cause health and safety risks and has a speedy development time, the question of how to handle it with social responsibility would be more pressing than in developments with mature technologies.

The results show that in two of the three cases, the fact that nanotechnology was involved in the value chain, did not give raise to different understanding of social responsibility. Philips relied on its current social responsibility framework and TSST trusted on its social academic network. Only MyLife Technologies showed to be thinking about what the fact that they were producing nanotechnology products could mean for their societal impact. As already mentioned above, this could be explained by how the societal acceptance of nanotechnology products is much more important for MyLife Technologies as for the other two companies.

This does still leave a gap between the normative assumptions and the descriptive answers of this research. Should social responsibility be adapted when the company is in a nanotechnology product value chain?

After talking in the interviews to different specialists and studying this subject, it can be concluded that the concept of what social responsibility is to a company needs to be updated in the light of new technologies. In the current public debate, health and safety risks are the largest concern. The health and safety issues can however probably be managed quite well. Many laws and regulations are already in place for health and safety issues for non-nanotechnology products and consumer products will always be tested thoroughly before releasing them to the market.

What is, also in the light of these laws on health and safety issues, more pressing is the speedy development time. Regulations such as REACH will have to keep up with the development, which can only happen by more regular updating of the REACH protocol.

This does not only apply to legislation such as REACH, but also to social responsibility frameworks such as Philips has in place. In the light of emerging technologies a more frequent update of the social responsibility framework and adaptation to this emerging technology can be very useful.

The third aspect of nanotechnology that might be alarming is the seemingly endless possibilities. Here the case of MyLife Technologies is illustrative. MyLife Technologies is trying to develop a new technological product, but is considering beforehand what kind of impact it will have on society. The social responsibility will in this case develop alongside the technology.

Here initiatives such as STW and CTMM can be very useful. Not just because it is useful for academics to learn about the views of industrials or vice versa, but because discussing the possible consequences of a technological application in society among others than your own peer group, can lead to a better understanding of what societal impacts really means. Because, after all, we are all a part of society.

10 Interviews

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Interview Drug Development Leiden, 16-05-2011. Interviewee: Joke Bouwstra. Type: Via e-mail.

Interview CTMM, 26-07-2011. Interviewee: Henny Bruinewoud. Type: Face to face. Place: CTMM building, High Tech Campus, Eindhoven.

Interview CTMM-CC, 27-05-2011. Interviewee: Gerard Pasterkamp. Type: Face to face. Place: University Medical Centre Utrecht.

Interview MyLife Technologies, 05-04-2011. Interviewee: Type: Face to face. Place: MyLife Technologies, University of Twente.

Interview Pfeiffer, 30-05-2011. Interviewee: Pieter Heidema. Type: Face to face. Place: University of Utrecht.

Interview Philips Magnotech, 12-05-2011. Interviewee: Hans Hofstra. Type: Via telephone.

Interview RIVM, 21-07-2011. Interviewee: Gideon Kersten. Type: Via e-mail.

Interview STW, 16-06-2011. Interviewee: Rens Vandenberg. Type: Face to face. Place: STW building, Utrecht.

Interview TSST, 19-04-2011. Interviewee: Cas Damen. Type: Face to face. Place: TSST building, University of Twente.

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