How to make an innovative company Cleantech

A Case of HTC Sweden AB

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LIU-IEI-TEK-A—09/00659-SE

Abstract

This thesis was undertaken in order to determine whether or not an innovative company in general would be classified as a Cleantech company and how this could be done.

Cleantech is a diverse range of products and services that harness renewable materials and energy sources and substantially reduce the use of all resources and dramatically cut or eliminate emissions and waste. So far Cleantech is a fairly new concept which has caught a lot of Investors attention, making it even more interesting to study.

In the thesis report, the data used ranges from face to face interview results, telephone interview results, email information, documents and various articles. Apart from having a general aim, the thesis also looks at a case study in order to have an in depth study. HTC Sweden AB is the case study company that has been studied. The company is located in Söderköping Sweden, and it specialises in professional floor systems. The company is focused on being innovative while maintaining its environmental consciousness.

With the use of a Backcasting methodology, various strategies were suggested on how HTC Sweden AB would be globally recognised as a Cleantech company; having discovered that it already qualifies to be called Cleantech. The suggested strategies for HTC Sweden AB include:

- ✓ Marketing HTC Sweden AB as Cleantech
- ✓ Promoting the companies environmental image
- ✓ Focus on energy technology

The thesis also discusses how other companies in general would also be able to use the strategies that have been suggested for HTC AB.

Acknowledgement

First and foremost I would like to thank God for giving me the strength and wisdom to undertake this thesis report.

Special thanks go to my supervisor Olof Hjelm for not only helping me find an interesting thesis subject to work with but also for his guidance in my research work.

I would also like to thank the following people:

Håkan Thysell,Sten Jeansson,Kåre Kilgren,Charlotte Uhrbom Karl Thysell,Robert Kreicberg and Tobias Linden for their support and cooperation during the interviews

The Cleantech experts for taking time off their busy schedules to respond to my questions

All the lecturers at the department of Management and Engineering, PIE division, Linköping University for the knowledge they instilled in me which enabled me to undertake this thesis.

My parents, John and Anastasia Tembo for always being there for me and encouraging me to be the best that I can be.

My fiancée Per Eriksson for his love and support and for just being there for me always.

Maj-lis and Alf Eriksson for their support and encouragement .

Amma and Peter Lindgren, Sally and John Biederstedt, Moses, Faith Debbie Kristina, John, Tinashe and Nicole for being the best and the most supportive family one could ever have.

Beth Gomolka my opponent for her contributions on how I could make my research work better.

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1 Introduction

1.1 Background

The issues of global warming and climate change have raised many concerns among not only a vast number of organisations but also various people from all walks of life. For instance government officials have expressed their concern for the environment through the introduction of various laws and regulations. An example would be that of the state of California which is well known for its efforts to promote energy efficiency and alternative energy. California State has introduced various policies, including the global warming solutions act of 2006 -AB 32 (Mazmanian et al 2008). The act calls for the reduction of greenhouse gas by the year 2020.

Furthermore, customer awareness on global warming and climate change has also influenced customer demand for products that are better for the environment (Wright, 1990). Hence in order to meet changes in customer demands and also to follow government laws and regulations, many manufacturers are working on changing their work practices. However it is important to note that some companies change their work practices for the better due to their sense of social responsibility to environmental issues and not only because of customer changes in demand and government regulations.

For instance most raw materials used in various industries are non renewable and depleting resources. Hence manufacturers are ensuring that they provide for current demands without jeopardising the needs of the future generation by using resources in a way that they can last for a long time. This is known as the practice of sustainable development. Sustainability is a subject that deals with avoiding the loss of depleting resources, where resources are used with caution and waste is limited as much as possible to save for future generation.

According to the Brundtland report (2001), the core of sustainable development is to satisfy the needs of the present generations in such a way that it does not lower the chance of future generations to satisfy theirs.

In line with meeting customer needs and changes in demand, manufacturing companies undertake many other practices other than just practicing sustainable development. Among others, Innovative practices are adopted. Innovation is the implementation of new ideas or changes which may be big or small and they have the potential to contribute to organizational objectives (Schroeder et al 1989). R. Varadarajan (2008) gives a description of the two types of Innovation which are Radical and Incremental Innovation. According to the author, Radical innovations are those that are new to the firm, the market, and the industry; and they incorporate different and new technology which provides higher customer benefits compared to current products in the industry. On the other hand, incremental innovations

are concerned with improvements in a firm's existing product offerings that satisfy the needs of its current and potential customers better.

The concept of Cleantech is also another recent adoption by manufacturers. This is one fairly new concept that has also caught many investors attention. It could be seen as another way in which more sustainable innovation is being promoted. According to Patel (2006), Cleantech is a venture capital buzzword, making eyes sparkle the way biotech and InfoTech once did. While Makower (2009) defines Cleantech as a diverse range of products, services and processes that harness renewable materials and energy sources and substantially reduce the use of all resources and dramatically cut or eliminate emissions and waste.

Furthermore Burtis et al. (2004) defines Cleantech as products and services that use technology to compete favourably on price and performance while reducing pollution, waste, and use of natural resources. Cleantech encompasses a broad range of industries, these include energy generation, energy storage, energy infrastructure, energy efficiency, transportation, water and wastewater, air and environment, materials, manufacturing/industry, agriculture, recycling and waste (Cooke,2008). However in as much as the concept may seem to be broad, the concept is mostly attributed to better energy sources or renewable energy more than anything else. For instance in the USA the emphasis is strongly towards renewable energy sources and energy efficiency because the issues of security and supply are important. (Cleantech Östergotland, 2008)

Considering the brief descriptions of both Innovation and Cleantech, one would notice a similarity between the two. This is in the sense that they both strive at making products better one way or another. However it is not clear as to which extent they are related and hence their relationship may be interesting to look into further.
Furthermore, a better understanding of the relationship between Cleantech and Innovation may provide a good knowledge base for this research work which is mainly looking to find how Innovative companies can be seen as Cleantech.

Cleantech also seems to have benefits, and the stated benefits of Cleantech are both economic and environmental. Economic in the sense that there is demand for Cleantech products by many customers and environmental benefits in the sense that Cleantech benefits the well being of the environment (O´Brian, 2008). These stated benefits may be the motivation behind various manufacturers who want to be recognised as being Cleantech. It is also important however to note that the need to be recognized as Cleantech by various manufacturers may vary according to the firms intention. For some, being recognized as being Cleantech may be a way of attracting financial investment from Cleantech investors, and for others it is a way of getting more customer awareness and increased demand for their products while on the other hand some manufacturers would like to be recognized as being Cleantech so as to have a positive company image.

However the actual benefits of being classified as Cleantech are not clearly defined in literature. Hence it would be interesting to investigate whether the stated benefits of being classified as Cleantech are the actual benefits that could be reaped.

The concept of Cleantech has been discussed by many authors in terms of its definition, its Importance and its benefits.(Burtis et al,2004;Cooke,2008;O´Brian,2008;Patel,2006). However when the theory on the definition of Cleantech is compared to many of the companies that have been labelled as Cleantech in actual practice, there seems to be a gap. This can be seen by looking at the various Cleantech company lists in comparison to theory. The gap is such that in theory, Cleantech is much broader than it appears to be in practice. For instance most firms that have been labelled as Cleantech in practice are more inclined to the business of energy technology. Energy technology firms comprise of firms that deal with more energy efficient technologies, fuel efficient technologies, and renewable energy technology just to mention a few.
Furthermore, most available theory does not state the criteria for companies to be seen as Cleantech

Hence the above mentioned gaps make interesting angles to investigate. Therefore the thesis will not only investigate the gap between the theory on Cleantech and Cleantech in practice, but it will also look at how companies can be seen to be Cleantech both from a general perspective and also specific to a case study for a more detailed analysis.

The case study in question is HTC Sweden AB. HTC Sweden AB is a company that produces and sells patented professional grinding and janitorial systems which comprises both tools and machines for preparation, concrete, granite, natural stone and wood. The Company was founded in 1987 by Håkan and Gunn Thysell. It is a fast growing company and it is a market leader within diamond based concrete grinding. HTC Head office is situated in Söderköping Sweden.

The case study is particularly interesting to analyse due to the fact that it is an Innovative company which can be seen from its patents. However despite being innovative and having products that are environmentally friendly it is not particularly clear as to whether or not it can be classified as Cleantech

1.2 Aim:

The purpose of undertaking this thesis is illustrated in the following points:

- ✓ To understand the concept of Cleantech.
- ✓ To determine the benefits of being Cleantech.
- ✓ To investigate the relationship between innovation and Cleantech.
- ✓ To determine the Criteria for companies to meet in order to be seen as Cleantech.

Apart from having a more general aim, the thesis will also look into the following points that are more specific to the case study in order to have an in depth study.

- ✓ To investigate how HTC Sweden AB can be seen as a Cleantech company.
- ✓ To determine how HTC Sweden AB will benefit from being classified as Cleantech.

1.3 Aimed users and readers

The thesis is for various companies in general that would like to produce more Cleantech products and also be seen as Cleantech. Furthermore, it is aimed at helping HTC Sweden AB find strategies that would enable the company to be seen as Cleantech. It is also useful to readers who would like to learn more about Cleantech and its various aspects.

1.4 Structure of the thesis

The purpose of having the structure of the thesis is in order to give the reader an overview of what the thesis contains in terms of the main chapters and contents.

Chapter 1: Introduction

This is the first chapter of the thesis and it gives a background as to why the thesis is being carried out. Also elaborated in the introduction are the research questions and the aimed users of the thesis report.

Chapter 2: Company Background

The company Background describes the case study in terms of its history, product portfolio, and the environmental benefits of the products. This chapter enables the reader to have a clear understanding of the case study.

Chapter 3: Methodology

Here the method used in collecting data, the means of the data collection and how the data collected is further utilised in the thesis is elaborated. The methodology chapter gives a full account of all the activities that were undertaken during the entire data collection process.

Chapter 4: Literature review

This gives detailed information of the general aspects that surround the concept of Cleantech. This ranges from information about achieving resource efficient products to the importance of research and development, just to mention but a few. The literature review provides a data base for the facts that have been researched and they are valid and reliable since they are from credible sources. The literature review gives good background information about Cleantech. The Literature review is also meant for the reader to have a good understanding of Cleantech in terms of the various aspects that surround the concept.

Chapter 5: Case study Results

This gives an account of the interview responses from both HTC Sweden AB interviews and investor interviews. The case study results also summarises the perceptions of Cleantech by both HTC AB and the investors.

Chapter 6: Results Analysis

This analyses the interview results and discusses the similarities and the differences and the main findings of the results.

Chapter 7: Backcasting

Here the Backcasting methodology that was used on the case study is elaborated by giving details of the entire process step by step. It concludes by giving a set of recommendations on how HTC AB can be classified as Cleantech**.**

Chapter 8: Discussion

The discussion chapter gives an analysis of the general perspectives of Cleantech with reference to the literature review, interviews and Backcasting in previous chapters**.**

Chapter 9: Conclusion

This chapter establishes the conclusions that have been generated based on all the previous chapters in the thesis. The conclusion mainly answers all the research questions.

2 Company Background

This chapter describes HTC Sweden AB in terms of its products and also its environmental aspects that have been already studied by other Authors. The chapter not only describes the company's different aspects, but it also describes it in relation to Cleantech.

HTC Sweden AB is a company that was founded in 1987 by Håkan and Gunn Thysell. Its headquarters are situated in Söderköping, Sweden.
Håkan Thysell´s interest in floor grinding and diamond technology led to the founding of HTC AB. The main business idea then was floor grinding and innovation of marble floors. In 1992 HTC AB built the first grinding machine which became the industry standard for all grinding machines. HTC did not stop there, within a period of sixteen years after the first grinding machine in 1992, HTC AB invented 12 different products. The company growth can be seen in Table 1.

Table 1.HTC Growth through Innovation, as cited in HTC corporate presentation

GROWTH THROUGH INNOVATION AND EXPANSION
1992-Launch of first grinding machines
1995-Launch of new machine series
1997-Launch of wet concrete polishing
1999-Launch of dry concrete polishing-HTC Super floor
2001-Launch of DCS-first diamond cleaning system for auto scrubbers
2004-Established Subsidiary in Knoxville, USA
2004-Launch of 950RX-remote control
2006-Launch of Twister™ at ISSA
2006-Established subsidiary at Frankfort Germany
2007-Established subsidiary in Milton Keynes, UK
2007-Launch of HTC 2500ix
2008-Established subsidiary in Caen, France
2008-Launch of HTC 1500ix

The company has grown not only in terms of product innovation, but also in terms of personnel and partnerships. It has about 200 employees in 5 countries. Furthermore, the company has global investments in subsidiaries and distribution partners in 21 countries. The company´s continuous growth through innovation can be seen from its patents which amount to over 350. The company is a global market leader in not only floor grinding machines but also of polished concrete. One third of the company is owned by 3i, which is a leading UK private equity company.

According to HTC corporate presentation power point document, the company`s business concept is to develop, manufacture and sell professional floor grinding systems and floor

solutions. This business concept has enabled the company to grow tremendously through innovation and expansions.

The company`s products include floor grinding machines and Vacuum systems. Floor grinding machines come in various sizes (standard or industrial) and they have a variety of diamond tools that can be used on the machines depending on the type of job that needs to be undertaken. While vacuum systems also come in various sizes depending on the work space.

The company has also introduced a floor solution concept which is known as Superfloor™. Superfloor™ is a concept invented by HTC where raw concrete floor is refined into a polished surface using HTC grinding machines and diamond tool technology (HTC corporate presentation). Superfloor™ can be applied in industrial, warehouse and public areas. It can be applied in new constructions as well as old concrete floors (HTC Superfloor™ document). The application of Superfloor™ is not only aesthetically appealing but also has greater benefits compared to other types of floors. According to an LCA study that was conducted by Hellström (2006) the HTC Superfloor™ is a far much better floor solution in comparison to the others. The study was based on the comparison of HTC Superfloor™ to Epoxy flooring which is the most common and widely used. The LCA covered Energy consumption for new floor installation and also acidification, eutrophication, global warming based on a 20year period. These Environmental benefits can be seen in Appendix 1. Other benefits include High resistance to wear, even floor surfaces, slip resistance and also high electrostatic discharge (HTC Superfloor™ document).

Twister™ is also an invention by HTC which is part of the floor solution portfolio. It is a daily floor cleaning system consisting of floor pads prepared with billions of microscopic diamonds which clean and polish the floor mechanically (HTC corporate presentation). The initial purpose for inventing the Twister™ was to use it for maintaining the HTC Superfloor™ (ibid). However the Twister™ can be used to clean and polish various floor types such as epoxy and linoleum floors to mention but a few.

Twister™ eliminates the use of chemicals in daily cleaning routines; this is because only water and a Twister™ is needed. From an environmental and economic perspective, the Twister™ system protects the environment from cleaning chemicals that would otherwise end up in the sewerage system causing more harm than good to the environment while also saving money spent on millions of litres of cleaning chemicals. The Swedish society for nature conservation´s report ``Environmental aspects on floor care´´, as cited by an HTC document “Environmental technology for business development and export”, states that Sweden would save 7,2 million litres of cleaning chemicals per year if Twister™ system was used.

Furthermore, according to HTC diamond cleaning system magazine, the benefits of using Twister™ include:

- No periodic maintenance is required.
- The Twister™ pads last long due to the diamond coating.
- It can be used on any floor type with no changes needed to the cleaning method and cleaning equipment.
- The Twister™ pad fits all types of machinery and they come in different sizes.

However, the benefits of Twister™ do not end here; more benefits were elaborated when an LCA study was conducted by Larsson (2009) in his thesis "Lifecycle Analysis of Floor Care".

The LCA of the Twister™ was made on the basis of one square meter to be kept clean for a year. In the study, the whole life cycle of the Twister™ was considered starting from its manufacturing to the residue management.

It was discovered that the scrubbing machine and its energy use, contributed to the biggest environmental impacts of the floor care with Twister™. While in the manufacturing of the Twister™ pad, the elements with the greatest environmental impact were found to be the industrial diamonds and the pad itself.

The Twister™ was also compared to other floor care methods such as Polish and Wax. These comparisons with polish and wax were based on energy consumption and not on possible cause of chemicals on the environment. The polish scenario is based on the floor that has been treated with polish and frequent cleaning is done with an all-purpose cleaning machine, where periodic maintenance is once a year and frequent cleaning is three times a week. While the wax scenario is based on the floor that has been treated with wax and frequent maintenance is done by a floor scrub with a mop and recyclable detergents also with once a year periodic maintenance and frequent cleaning is three times a week(Larsson,2009).

The energy consumption of both the polish scenario and the wax scenario are shown below:

Table 2.Energy use for Polish Scenario as cited by Larsson,2009

Parameter	Energy (MJ)[1]
Frequent Maintenance	3,11
Periodic Maintenance	6,50
Manufacture of machinery	0,46

[1] BUWAL 250, 1998; Frischknecht *et al.*, 1996

Table 3.Energy use for Wax Scenario as cited by Larsson,2009

Parameter	Energy (MJ)[1]
Frequent Maintenance	12,75
Periodic Maintenance	0,69
Manufacture of machinery	0,14

[1] BUWAL 250, 1998; Frischknecht *et al.*, 1996

An environmental impact assessment that was based on a damage assessment was conducted to find the impact of scenario Twister™ which would be compared to both scenario polish and scenario wax. Having done that, all the results of the three were compared and the results can be seen in the figure below.

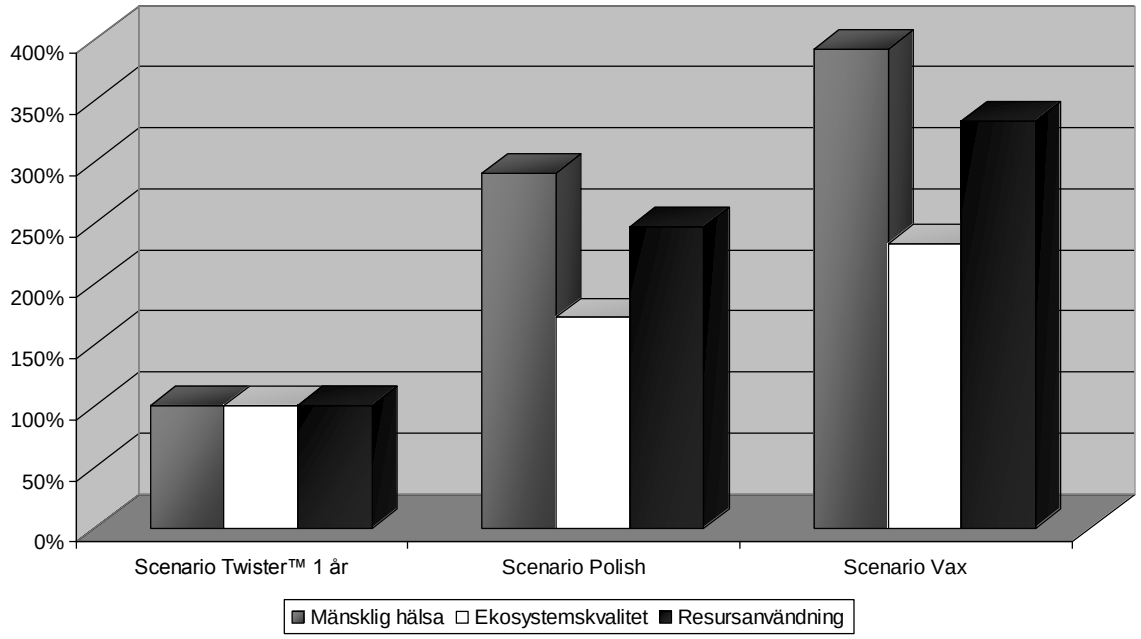

Figure 1. Damage Assessment of all scenarios(Twister™, Polish and Wax) as cited by Larsson,2009

In the figure above: Mänsklig hälsa means Human health, Ekosystemskvalitet means Ecosystem quality and last but not least Resursanvändning corresponds to Resources.
As can be seen in the diagram above, both the polish Scenario and the wax scenario have a bigger environmental impact than Scenario Twister™.
Hence among the benefits of Using Twister™ is the fact that it has a lower environmental impact compared to other floor care methods such as Polish and Wax.
The table below represents the information in the above figure in Table form for clarification.

Table 4.Damage Assessment of all scenarios, as cited by Larsson,2009

Injury category	Human health	Ecosystem quality	Resources
Scenario Twister™ 1 year	100 %	100 %	100 %
Scenario Polish	291 %	172 %	246 %
Scenario Wax	392 %	232 %	333 %

In summary, HTC AB is not only a growing company, but it is also a company that is positively affecting the environment with its environmental friendly products such as the Superfloor™ and the Twister™. Both the Superfloor™ and Twister™ have been compared to other products and it has been found that the environmental impact of installing a Superfloor™ is lower than that of other floors and also the environmental impact of using Twister™ in floor maintenance also has a lower environmental impact compared to other floor maintenance solutions. (see Appendix 2 for the Superfloor™ and Twister™).

3 Methodology

Research work can be conducted either by using quantitative or qualitative research analysis. However, the choice between the different methods should depend on what one is trying to find out (Silverman, 2000). Quantitative and Qualitative research analysis are two different methods with different features.

For this research Qualitative Research methodology was chosen. The reason was due to the fact that the research required finding out about peoples everyday work behaviour and also their perceptions about Cleantech. Hence a qualitative methodology was considered to be the most appropriate.

The thesis was undertaken using a case study, in particular HTC Sweden AB was investigated in an in depth study. Seven face to face interviews were conducted with managers at HTC Sweden AB. This was for the purpose of having more than one individual perspective of the company which in turn would give a more comprehensive comparison of the data to be collected. The reason for conducting the interviews was in order to get an overall understanding of the company. Furthermore, six interviews were also conducted with various Cleantech experts who will be collectively called investors throughout the thesis. The interviews with the investors were in order to find out how they perceive the concept of Cleantech.

To jump start the research work, a first visit to HTC Sweden AB was arranged. My research supervisor and I travelled to Söderköping to meet with three managers from HTC Sweden AB. This was in order for me to meet and get acquainted with the managers while also getting an overview of the company.

During this meeting, a company presentation was done by Sten Jeansson the business development manager and Robert Kreicberg the business unit manager also made a presentation about the business and product portfolio. This was in order to give a formal introduction of the company. During the meeting among other things, it was discussed what the HTC managers expected from myself and the thesis work and I also presented my research proposal to ensure that the managers also understood what my intensions were and the boundaries of the study. At the end of the meeting both parties had agreed on what was expected from them. The expectations were such that I would investigate whether or not HTC was a Cleantech company and further offer suggestions on how the company could be classified as Cleantech. On the other hand the HTC managers agreed to provide all the necessary data that was needed for the research work .

3.1 Development of Questions

After the first meeting it was time to prepare interview questions. The interviews were developed from the research proposal and also based on what was expected out of the interviews. The development of the interview questions was such that, for a start a list of broad categories relevant to the study were written down. Thereafter a set of relevant questions to each outlined category were formulated. The development of the interview questions can be seen in the figure 2 .

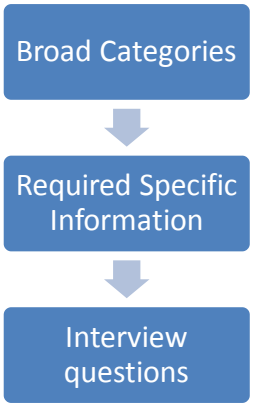

Figure 2.Development of interview questions

The broad categories that were used to come up with the interview questions include:

- Cleantech
- Innovation
- Environmental Responsibility
- Marketing Strategy
- Product Development Strategy

Appendix 3 clearly shows all the information that was considered in developing the interview questions.

A short summary of some of the interview questions is listed below.

- What does Cleantech mean to you?
- What are the most significant changes that have taken place at HTC?
- What do you think about HTC from an environmental perspective?
- Tell me something about HTC product development strategy?
- Tell me about HTC´s waste management strategy?
- Tell me something about HTC sales and marketing strategy?

3.2 HTC Sweden AB Interviews

Having identified the type of questions to ask, seven interviewees were selected from the company organisational chart. The interviewees were selected based on the questions and also their ability to understand the questions and give relevant responses. Having collected all the necessary and relevant documents from HTC with information about the company and products before hand, the interview questions were mainly based on inquiring about strategies and interviewees personal perceptions.

Since the interview questions were mostly strategic, all the seven selected interviewees held managerial and strategic positions within the firm. Among them were the company innovator, the director business development, the head of quality and environmental assurance, the director product management, the head information technology and research and development, the production director and HTC business unit manager.
In as much as the most of the questions were similar, they were also specific to different individuals depending on what position they held. This was in order to get different perspectives and also get all the necessary function specific information that was not known by everyone. The case study interview questions which have been summarised above, can be seen in Appendix 4
Berg.B,(2004) has Identified three types of interviews. These are standard interviews, semi standard interviews and unstandardized interviews. According to the author, standard interviews use formally structured schedule of interview questions. For this kind of

interview, the interviewer asks the subjects to respond to each question exactly as worded. While unstandardized interviews are such that no schedules are used and the interviewer does not develop a complete list of questions before hand. Instead most questions are developed and formulated as a result of the interaction during the actual interview. Last and not the least, semi standardized interviews could be a combination of both standard and unstandardized interviews. “This type of interview involves the implementation of a number of predetermined questions and special topics. These questions are typically asked of each interviewee in a systematic and consistent order, but the interviewers are permitted to probe far beyond the answers to their prepared standardized questions.” (Berg.B. page 81, 2004).

For this thesis, semi standard interviews were used. This was due to the nature of the research which required both a level of structure in the interview process while also being flexible enough to introduce more questions.

The duration of the interviews differed depending on the interviewee, and also on the follow up questions. All the interviews started with informal introduction, where I began by introducing myself and the first question of all the interviews was ``Tell me about yourself´´ This was in order to have a good rapport and create a comfortable environment between myself and the interviewee, while also learning about each other.

Among the questions that were formulated were Essential questions, Extra questions, Throw away questions and Probing questions. According to Berg.B (2004), essential questions represent the central focus of the study and they are formulated to elicit specific desired information. The author further elaborates that extra questions are equivalent to essential questions but they are used to check on reliability of responses and they are worded different, while throw away questions are used to allow change of focus in the interview and probing questions are used to draw out more complete information from interviewees, with an example of a probing question being “Could you elaborate more”.

The questions were sequenced in such a way that they began with mild non threatening questions that were easy for the interviewee to answer. Then as the interview proceeded, more complex questions were introduced. This was also for the purpose of creating a good rapport between the interviewer and the interviewee.

The interviewees were asked beforehand whether or not they were comfortable with the interview being recorded. Since all of them agreed, all the interviews were conducted using a tape recorder.

Having recorded all the interviews, It was easy to go back to all the interviews and transcribe the data that was recorded. This was done by playing the recorder over and over again and writing down all the questions and answers word for word. After the interviews were

transcribed, they were sent back to the interviewees at HTC in order to get feedback on the accuracy of the data collected.

One respondent responded back and confirmed that what was written was accurate. The transcriptions were later written down in a form of a discussion that could be easily understood by the reader. This is found in the case study results section below.

Direct observation was one of the ways in which i further obtained other important information. For instance i had the chance of observing the production of the Twister™, the assembly of machinery and also the production of grinding machine tools. This provided me with information that would not be found in documents or be mentioned in interviews with the interviewees. Also various documents from HTC Sweden AB including academic articles and books were also used as sources of data for the project.

3.3 Investor Interviews

Other means of data collection that was used were phone interviews with various investors to get their views on what they consider to be Cleantech or not. An email interview was also used where questions were sent to a respondent who in turn answered the questions via email. The feedback was for the purpose of getting an understanding of how Cleantech is defined from various investor and individual perspectives.

Among the people interviewed were Michael Wood the former US ambassador to Sweden, Hank Habicht from Sail Venture Partners, Christer Nilson from 3iGroup, Amol Deshpande from Kleiner Perkins Caufield and Buyers, Berit Gullbransson from Swentec and a representative from Zouk venture Limited.

Prior to the phone interviews, emails were sent to various investors requesting their participation in the research work. These investors were selected from the list of Cleantech investment firms that have been listed on the Cleantech group website. From a total of 50 emails sent to various investors working with Cleantech, only a few were willing to cooperate.

The former US ambassador to Sweden was chosen to be one of the interviewees due to the fact that while he was in Sweden, he developed a list of Swedish Cleantech companies that he come across. Hence he was a good candidate for an interview regarding the concept of Cleantech. Christer Nilson from 3i also qualified as an interesting interviewee in the sense that he was from an investment firm that is actually currently working with the case study and the firm is also among the listed Cleantech investors. Berit Gullbransson was chosen because she came from a Swedish organisation that is a strong advocate for Cleantech, while the rest of the three interviewees were from Cleantech investment firms listed on the

Cleantech group website. Hence all the interviewees were selected because they were all familiar with the concept of Cleantech one way or the other.

Among the interviewees were investors and other influential people with knowledge on the subject of Cleantech. However in this report, all the interviewees will be collectively called investors just for the purpose of easy explanation.

The use of phone interviews was selected mainly because they were the easiest to use in terms of getting investors cooperation. Most investors did not have the time to fill in questionnaires or actually have a face to face interview. Furthermore, face to face interviews were not possible due to the geographical dispersion of many investors. Hence phone interviews proved to be the best choice of data collection from investors.

However, Michael Wood preferred to use email instead of a phone interview due to time constraints. Hence the same questions that would have otherwise been used for a phone interview with him where mailed to him and he responded back via email. A summary of the questions used can be seen below.

The following are the phone interview questions used:

- What does Cleantech mean to you?
- What do you consider as important characteristics for a company to be Cleantech?
- How do you know about a Cleantech company?
- Are all Cleantech companies good for investment?

The phone interviews were all recorded so as to make certain that all the information was accurately captured. After each interview, the data was transcribed in such a way that the question and answer where written down in a word document. This information was also sent back to the interviewee to get their feedback for the sake of ensuring that it was accurate. Unfortunately, none of the interviewees responded back.

Later on all the interview data was brought together and discussed. The interview responses can be seen under the investor interview results discussed later in the report.

The main limitations were that I did not interview as many investors as I had anticipated. Most of the emails sent to investors were not responded to and there was also an aspect of not having enough time to make several follow-ups. The initial plan was to make over 10 phone interviews with various investors working with Cleantech investment, However It was hard to find investors who actually were willing to cooperate. Most of the investors that were contacted were busy with other projects of their own.

3.4 Interview Analysis

After writing both interviews in discussion form, it was imperative to analyse them and compare and contrast. The HTC Interview results were analysed and they provided much information with regards to, how the interviewees perceive their current position with regards to current strategies used, where they see themselves going as a company in terms of company growth and how they perceive Cleantech.

From the interview responses it was easy to come up with a summary of the main characteristics of Cleantech according to HTC´s understanding. While the other information added to a better understanding of the company as a whole.

While for the investors interview results, the discussion was such that each interviewee response was written down one after the other. By so doing, it was easy to see the differences and similarities among the different individuals. Having analysed all the investors' responses, all the common perceptions of the characteristics of Cleantech were listed down.

The results from both HTC and investors were analysed in terms of their differences and similarities. Having done the analysis, the results were later used in a Back casting Methodology.

3.5 Backcasting Methodology

According to Mander et al (2008), Backcasting techniques, emerged during the 1970s with the 'soft energy path' approach proposed by Amory Lovins. The motivation behind developing Backcasting was the inherent uncertainties in accurately predicting future energy supply and demand. Lovins considered it more appropriate to describe a range of energy futures and explore how these may be implemented; hence Backcasting involves exploring future scenarios in the present.

In other words, "Backcasting is a process of starting from a vision of success, then looking back to today to identify the most strategic steps to achieve success." (Arising website).It is a process where a desired future is imagined and then by looking at the present situation one would ask the question "what do I need to do now to attain my desired future outcome?". The two main aspects of Backcasting have been illustrated in figure 3.

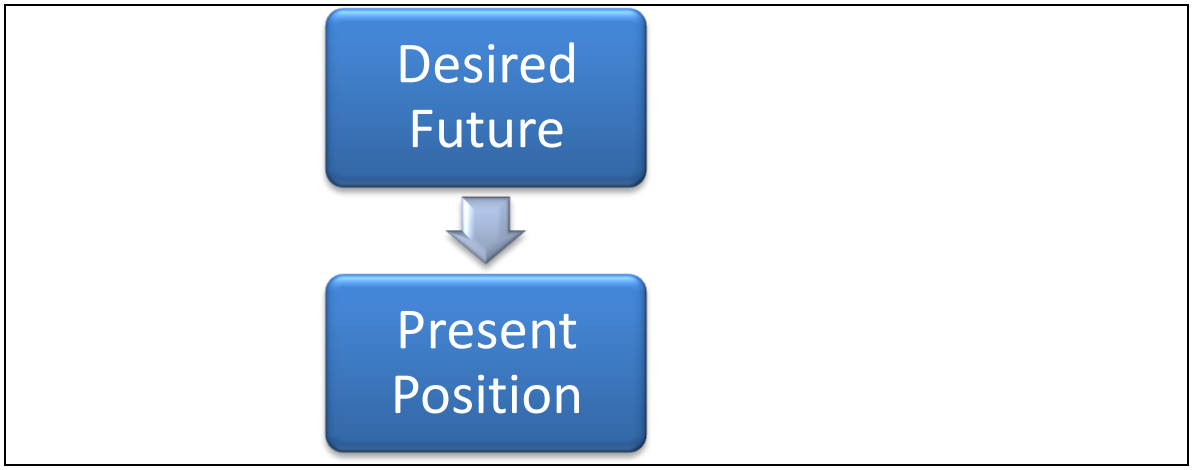

Figure 3.Backcasting

The process of the Back casting approach begins with identifying a desirable future. This desirable future can range from one to several alternatives. The alternatives are then analysed for their feasibility, consequences and policy implications (Schade and Schade, 2005). Once the desirable future is chosen and it is known to be feasible, the aspects of the present position are also defined. This is depicted as phase one in figure 4.

Having identified the desirable future and knowing ones present position, different strategies are then suggested on how to reach the desired future goal. As shown in phase two.

Once the strategies are defined, phase three involves the formulation of a clear path in which the strategies can be implemented in order to move from the present position to the desired future.

Finally, there is need to analyse the implications of both the desired future and the implementation of the strategies on the present position.
The whole process is depicted in figure 4.

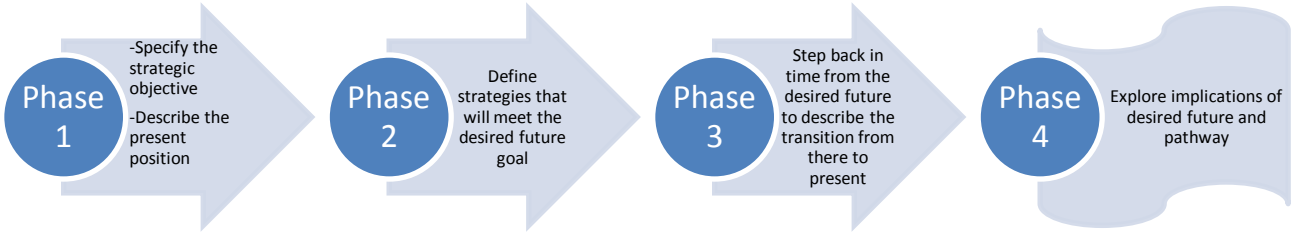

Figure 4. Backcasting methodology process as cited by Mander et al 2008

The Backcasting methodology was applied at HTC Sweden AB and details of how it was applied and the results can be found in Chapter 7.

4 Literature Review

This Chapter aims at giving a theoretical analysis of Cleantech and all its aspects. This is in order to investigate and understand the concept of Cleantech. It also discusses other aspects that have been briefly discussed in the introduction and they would be interesting to look into further in order to fulfil the purpose of the research work.

4.1 Concept of Cleantech

Cleantech is a broad concept that has different meaning from one person to another. For some it literally means any Clean Technology in any industry in its broadest sense (NGEN Partners website; Cleantech group), while for most American Investors it has a more specific meaning. The definition has a greater focus on Energy technology that is renewable energy and energy efficiency (Cleantech Östergötland,2008). According to the study ``Vad menas med Cleantech?´´ which was published in 2008 by Nutek, different players on the risk capital market define the concept differently and there are also major variation in how the concept is viewed. Furthermore the study shows that applying a narrow definition of Cleantech when allocating financial resources can result in loss of many businesses.

However in order to avoid the loss of businesses that are not only Cleantech but also relevant in sustaining the environment, the concept of Cleantech must be well understood and defined as broad as possible. To elaborate the broadness of Cleantech, the Cleantech group has pointed out that the concept spans many industries and eleven segments have been identified. These segments include: Energy generation, Energy storage, Energy infrastructure, Energy efficiency, Transportation, Water and wastewater, Air and environment, Materials, Manufacturing/industry, Agriculture, Recycling and waste (Cleantech group LLC website). In line with the Cleantech group, cooke(2008) also conquers with the fact that Cleantech is a broad concept by giving the following definition, "Cleantech is the complex of industry activities dealing with energy-related, agricultural, air and environment, materials, manufacturing, energy generation, efficiency, storage and infrastructure, recycling and waste treatment, transportation, water and wastewater that utilize renewable resources enhanced, as appropriate by life science technologies".

More definitions of Cleantech include, Ngen partners`` Economically Valuable products and services that positively affect the environment´´ while according to the Swedish Cleantech incubators(SCTI),Cleantech is the technology which according to the four sustainable principles is :Proactive, Sustainable in the long term and addresses the problem areas that distinguish our present society from a sustainable society.

4.1.1 Summary of the Characteristics of Cleantech

- Economically valuable products(profitable)
- Positively Affect the environment(Reduce climate change/GHG)
- Energy Technology(efficient energy technologies)
- Transportation (Better fuel sources e.g. biogas)

- Water and waste water (conserving water resources)
- Air and environment (reduce pollution)
- Materials (better use of materials)
- Manufacturing (More efficient processes)
- Agriculture
- Recycling and waste

4.1.2 Cleantech as New Energy Technology

The concept of Cleantech might have a broad perspective as seen from the above definitions; however it has been associated with some segments more than others. For instance, the energy technology segment appears to be the most well known and accepted by various stakeholders as fitting in the spirit of Cleantech.

According to a number of Cleantech company lists, energy technology related companies are the most common types of companies found on these lists. (power 10 ranking of top Cleantech companies ;the oregon Cleantech cluster : a to z list of alternative energy players; the washington Cleantech cluster; former ambassador Michael Wood´s, Swedish Cleantech list). Furthermore according to Cleantech of Sweden, a Swedish energy agency initiative, among its criteria for Cleantech companies is that ``the company and its products must have significant relevance to energy and advance the transition to a sustainable energy system.´´

While in terms of investment, energy technology companies have received not only the most attention but also the highest level of investment compared to other companies in other segments. Examples of investment companies whose main portfolio of Cleantech companies are those that are based on energy technology include ngen, nth power, rockport capital partners, sail venture partners, zouk, and kleiner perkins caufield & byers just to mention but a few.

However, it is important to note that the concept of Cleantech is amorphous and it is understood differently by different people depending on the area of interest.

But there must be some reasons as to why the energy technology segment has received more attention than the others.

4.1.3 Importance of Energy Technology

For any country to be economically viable, they must be able to produce efficiently, export their excess products and be able to import. At the core of all the activities mentioned above is energy technology. Without energy, manufacturing industries would not be able to function effectively. Without energy in terms of fuel, the transportation of goods and services would not be possible. Hence the importance of energy cannot be emphasized enough.

In as much as energy is the driver of most economies, It is also the most hazardous to the environment. Most of the energy currently used comes from fossil energy. ``CO_2 emissions are derived from fossil energy use and fossil energy consists of oil, coal and gas´´(

Onishi,2007:806).According to the annual greenhouse gas emissions by sector, CO_2 has the highest percentage in comparison to gases like methane and nitrous oxide.(see Appendix 5) Hence the energy technology segment has received a lot of attention from investors because of both environmental and economic concerns.

4.1.4 The Growth of Cleantech

Cleantech is a fairly new concept which has been a success and is still expected to rise in its popularity and growth. O´Brien (May 2008),has identified four drivers behind Cleantech growth: Firstly the fact that there are many real assets being constructed to provide core services such as power, water, waste and recycling. Secondly, there is growth in the demand for these core services due to the growing population and increasing wealth. Third is the pressure on communities to act sustainably due to the depletion of natural resources. And the fourth is the recognition of climate change and consequent regulatory regimes. According to O´Brien(2008), the fourth driver is separate from those above and, whilst it will result in additional growth in some Cleantech sub-sectors, it does not underpin the Cleantech sector as a whole. Hence Cleantech will continue to grow tremendously.

4.1.5 Manufacturing Process efficiency

Among the many other aspects or characteristics of Cleantech is efficiency in terms of materials, manufacturing processes and technologies. Hence manufacturing process efficiency will be discussed here since it is one of the main aspects of Cleantech.
The analysis of the manufacturing process efficiency is one way of finding improvements for the current processes. Among the methods manufacturing organizations use to attain manufacturing process efficiency include Lean manufacturing.
Lean manufacturing principle is one that has many definitions. Vladimir Kajdan (2008) came up with the simplest definition,` `Do more for less´´. Which means producing more, having more services, increased flexibility, more quality and more money while using less materials, less manpower, less space, less inventory and spend less money. The use of lean manufacturing is one way of making a manufacturing process more efficient (less input and more output). Some ways of implementing lean manufacturing include having multi-skilled workers, the use of highly flexible and increasingly automated machines that produce a variety of products with large volumes (Vladimir Kadjan,2008).
By doing more for less, the lean principle encourages waste elimination in production. In fact,``A lean system is achieved by eliminating waste and unnecessary actions, and linking all the steps that create value in a continuous sequence´´ (Haque and James-moore,2004:3). Waste can be seen in different categories, according to the Toyota production system(TPS) the seven commonly accepted wastes are scrap, over-processing, unnecessary motion, Overproduction, waiting, Transportation and excessive inventory (Vladimir Kadjan ,2008;Haque and James-moore,2004).

However it is important to note that manufacturing leanness is a process which happens over a period of time, and that it cannot happen overnight. According to Bayou and Korvin (2008) a manufacturing system can be described as lean, leaner or leanest. Therefore an organization can move from one state to another over a time period and also depending on their practices. Among the different practices that companies follow are JIT/continuous improvement, Pull system/kanban, Quick-changeover techniques, Lot size reductions, continuous-improvement techniques, Cross-functional work force, Preventive maintenance, Total quality management, self direct work teams, cellular manufacturing, Focused factory production, cycle time reduction, Process capability measurements, new process equipment, safety improvement techniques, bottleneck removal, quality management programs, re-engineered production process, competitive bench marking, maintenance optimization, planning and scheduling strategies (Shah and Ward ,2003:131).

4.1.6 Legitimacy and Cleantech

Legitimacy is an important resource for gaining other resources. Zimmerman (2002) views legitimacy as a social judgement of acceptance, appropriateness and desirability and it enables organisations to access other resources needed to survive and grow.
With legitimacy comes the opportunity of acquiring various resources such as capital, technology, managers, competent employees, customers and networks (ibid).
These resources are acquired by motivating investors with the means of signalling that the organisation is properly constituted in the sense that it is committed to proper scripts, rules and norms among others (ibid).
The resources that are accessed lead to the growth of the organisation. According to Zimmerman (2002), apart from survival, growth is also recognised as the effect of legitimacy.
Sources of legitimacy include those derived from regulations, rules, expectations created by government, credentialing organisations and the like, and they are known as social political regulatory legitimacy (Scott,1995). Also those derived from norms and values of society such as profitability, fair treatment of employees, endorsements which are known as social political normative legitimacy (Selznick,1957). Other sources of legitimacy are cognitive legitimacy which can be derived from beliefs and assumptions that provide a framework for everyday routines (Scott,1994).

Cleantech could be seen to add to the legitimacy of an organisation. This is because when an organisation is endorsed as a Cleantech company (by being listed on a Cleantech list of companies), it is a way of signalling to the concerned stakeholders that the organisation is properly constituted and that it is dedicated to products, practices that are better for the environment. Furthermore, legitimacy through Cleantech can also come from being a part of the Cleantech industry. According to Aldrich &Fiol (1994), entire industries can have more or less legitimacy that can be conferred upon the firms operating within them.

Having discussed Cleantech in relation to legitimacy, one would synthesise that since Cleantech adds to legitimacy then the resources that are achieved from legitimacy could also be seen as benefits of Cleantech. Hence the benefits of Cleantech could be seen to include:

- ✓ Acquiring capital from Cleantech investors
- ✓ Efficient technologies
- ✓ Competent employees
- ✓ More customers and networks

4.2 The Practice of Innovation

Innovation is commonly seen as the driving force behind long-term survival in today's rapidly-changing business climate (Von Hippel,2005). Eisenhardt and Tabrizi(1995) also point out Product Innovation as being a primary way in which organizational adaptation can occur. Organizational adaptation is defined as how an organization changes its way of operating to suit the changes in its surrounding. For many Organizations, the introduction of new products is a path by which they adapt and sometimes even transform themselves in environments that are continuously changing (Eisenhardt and Tabrizi,1995). Literature has categorized Innovation in different categories (Henderson and clark ,1990; Macher and Richman,2004), these being radical and incremental. Radical and incremental Innovation are types of innovation that are extreme in the sense that they require quite different organizational capabilities. Radical innovation brings out a new dominant design and hence, a new set of core design concepts that are embodied in components that are linked together in a whole new architecture, while incremental innovation basically improves an established design (Henderson and Clark ,1990).

The practice of Innovation is dependent on the whole organisation in terms of its strategy and structure. These include the type of organisational structure, importance of research and development within the organisation, organisational growth orientation just to mention but a few.

4.2.1 Organisational Structure

Eisenhardt and Tabrizi (1995) discuss two types of organizational thinking; the first being one where there is certainty, everything is well understood and it is predictable with daily routines and the second being uncertain and unpredictable. In the first case, planning is possible while in the second case planning is not possible and it is based on being very experiential. Daft(2007), classifies the above organizational thinking into what is known as a mechanistic organizational structure and organic organizational structure.

Mechanistic organizational structure is one which is found in a stable external environment and the internal organization is characterized by rules, procedures and a clear hierarchy of authority. Hence the organization is more formalized and centralized and most decisions are made at the top. While an organic organizational structure on the other hand is one where rules and regulations are often not written down and if they were written down they would

be ignored, furthermore it is found in an environment full of uncertainties with a much adaptive, looser and free flowing internal organization. Employees in this type of organization have to find their own way through the system to figure out what to do and authority is also decentralized.

In many large organizations the initiation of innovation is assigned to separate departments that are creative (Daft 2007:409). Furthermore Daft (2007) adds that these creative departments are organically structured in order to facilitate the generation of new ideas and techniques. While in order to have an efficient production system, a mechanistic structure is more suitable.

Whether an organization is in a stable environment or not, it has to be able to change according to the situation of its environment. According to Utterback and Suarez (1991:2) "A Firms inability to change its organization structure and practices along with the evolution of technology in the industry will be its major source of failure".

4.2.2 Investing in Research and Development

In order to be competitive, organizations must invest extensively in Research and development (R&D), this ensures continuous technological improvement and introduction of new products. According to Trott (2005), there are numerous organizations that have spent large amounts of money on R&D and they have been doing extremely well.

The positive aspects of undertaking and investing in R&D also mean that the lack of it may have negative effects. The Investment Company Institute (ICI) conducted a study in 1982 and found that profits would decline slowly for 15years before dropping sharply if an organization stopped investing in R&D and product innovation (Trott,2005). This proves that investment in R&D has a positive relationship with profitability. Apart from that, Trott (2005) also cites the study by Geroski et al .1993, which revealed that there was a positive relationship between R&D expenditure and organizational long-term growth.

According to Trott (2005) the main activities of industrial R&D include: Discovering and developing new technologies, improving understanding of technology in existing products, improving and strengthening understanding of technology used in manufacturing and understanding research results from universities and other research institutions.

R&D is defined as developing new knowledge and applying scientific or engineering knowledge to connect the knowledge in one field to that in others (Trott 2005:243). According to Trott (2005), this definition of R&D reflects scientific knowledge which is expanding rapidly and hence makes it difficult for one company to remain abreast of all technologies such that they have to pull together knowledge from a variety of sources.

Examples of R&D knowledge sources include: contracting R&D, forming strategic alliances and joint ventures and R&D consortia in terms of external knowledge sourcing. While in the case of internal R&D knowledge sourcing, centralized laboratories, decentralized laboratories and internal market can be used.

4.2.3 Achieving Technological leadership

Organizations that try to achieve technological leadership normally go for centralized R&D (Trott,2005). Under centralized R&D, scientists work together in teams as opposed to working alone. Far more can be achieved when people work in teams and share knowledge. For instance each member of the team brings his or her own expertise and perspective to the collaborative task (Edmondson and Nembhard ,2009). Furthermore when the team consists of members from different functions, ``It provides for the opportunity for timely integration of critical information into new product development (NPD) through processes such as increased access to new knowledge and information, heightened, high quality learning experience and facilitated interdepartmental product transfer´´(Edmondson and Nembhard, 2009: 126).

Hence R&D/NPD teams play an important part in organizations that consider themselves highly innovative. Since innovations are to an increasingly extent seen as the result of an interactive process of knowledge generation, diffusion and application (Tödtling et al, 2009).

From an environmental perspective, organizations that want to be leaders in producing environmentally friendly products, might want to consider having an environmental expert on the R&D team to ensure that environmental perspectives are considered when designing new products.

5 Case study results

5.1 HTC Sweden AB Interview results

Name of HTC Manager interviewed	Position
Håkan Thysell	Company Innovator
Sten Jeansson	Director Business Development
Charlotte Uhrbom	Head of Quality and Environment Assurance
Kåre Kilgren	Director Product Management
Karl Thysell	Head IT and Research and Development
Tobias Linden	Production Director
Robert Kreicberg	Business Unit Manager

Table 5. HTC Sweden AB Interviewees

Table 5 briefly shows the names and the positions of the seven interviewees at HTC.

5.1.1 HTC and Innovation

According to the interviewees, HTC Sweden AB is a company that is quite innovative and it has developed through its ability to introduce new products on the market rapidly. Håkan Thysell stated that most of the grinding machines currently on the market are based on the company's technology which was introduced in 1992. Following the launch of the first grinding machines in 1992, HTC has continued to introduce more products to date.

5.1.2 HTC and Research and Development

According to Robert Kreicberg, much of the innovation is attributed to the fact that much time and money is spent on research and development (R&D). Karl Thysell confirms the above statement by stating that R&D makes the ideas happen. The R&D department consists of engineers and a project leader. This department has the technical expertise of HTC AB´s products and is responsible for making ideas into reality. Karl Thysell also adds that an Advisory board (A group of people from different departments within the organization) decides on which projects to be pursued further by R&D. However Customers are not involved in HTC product innovation. The interviewees affirm that it is because HTC´s products are fairly new on the market and customers do not know much about them technically.

It was also confirmed by all interviewees that the most significant changes that has taken place within HTC has been its growth in terms of increased number of products and also increased number of employees. Håkan Thysell stated that the Twister™ was the most significant new product for him because not only is it his invention but it is also a product that has both economically and environmentally positive aspects. Sten Jeansson also agrees

that Twister™ is one of the most phenomenal products that HTC has developed and adds that apart from providing economic and environmental benefits, it also generates pride for the user. This is due to the fact that a janitor anywhere in the world could achieve clean and aesthetically appealing floors with minimum effort by using the Twister™ in their daily cleaning routines. According to Håkan, Twister™ was developed to maintain polished concrete. He further added that it was not known at the point of development that Twister™ would actually clean all types of floors until later.

5.1.3 HTC and waste management

When asked about the waste management strategy, both Tobias Linden and Charlotte Uhrbom head stated that all the waste from production is given to a waste management company by the name of Allren AB. Tobias Linden also added that one of the ways in which they try to eliminate waste in production is by not overproducing. The inventory safety stock has been lowered significantly by 20%.

5.1.4 Production Efficiency

In order to attain efficiency, the production department has adopted lean manufacturing strategy. According to Tobias, HTC production department involves workers in everyday work thinking and a platform has been created where workers are able to make suggestions for continuous improvement. Workers are encouraged to make these improvement suggestions by the fact that monetary incentives are offered for suggestions that are implemented.

5.1.5 Supplier Selection

In selecting raw material suppliers, Tobias mentioned that they look for the one that has the best offer, in terms of capacity, flexibility, price, lead time, delivery position and quality. He also added that they follow REACH[1] (Registration, Evaluation, Authorization and Restriction of Chemical substances) in evaluating the types of materials that their suppliers use in producing their products. However in as much as they try to access the types of materials suppliers use, Karl Thysell mentioned that HTC has not much control of how their components from suppliers are produced and where their raw materials come from.

5.1.6 Renewable Material

[1] "Reach is a new European community regulation on chemicals and their safe use.The aim of reach is to improve the protection of human health and the environment through a better and earlier identification of the intrinsic properties of chemical substances".
http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm, EUROPA, Environment, Available online, checked 3/03/2009

In terms of whether or not renewable materials are used in production, Tobias stated that HTC uses packaging material such as card board boxes that are renewable. Furthermore Tobias mentioned that some plastic material used on some of the machines is renewable material but he was not certain how much of it was renewable. Kåre Kilgren also added that Twister™ pads actually contain 15% recycled material and it is made of polyethylene terephthalate (PET).

5.1.7 Company Growth

According to Robert Kreicberg, the most significant changes that have taken place in HTC since he joined in the year 2007, was the fact that HTC gained more market share. For instance with the help of 3i new subsidiaries were opened in France and the United Kingdom. He alluded this growth to their marketing strategy which involves working with Swedish companies that are already on the global market and also shifting from exclusive distributors who tend to control the price to more open distributors. Open distributors are those that who are not limited to selling only HTC products but they also have other products.
However Sten Jeansson also added that some Exclusive distributors who sale all the solutions are still used. This is to encourage loyalty to HTC. He further stated that they shifted from many distributors to subsidiaries. The distributors who have been maintained are those that are more business oriented. Furthermore HTC AB has moved from having a supplier/customer relationship to stronger partnerships with its distributors. To boast HTC and distributors partnership, a global partner's newsletter is published and it is relevant to both parties.

5.1.8 HTC Marketing

The form of advertising used at HTC involves placing adverts in the relevant magazines, taking part in exhibitions all over the world and demonstrating at customer sites.

5.1.9 Environmental Perceptions

As to whether or not HTC is an environmental conscious company, all the interviewees agreed that it is. For Instance Karl Thysell stated that regarding what HTC produces, it is an environmental conscious company while in terms of the parts from its suppliers probably not because they do not have much control over how these parts are produced. He also added that four years ago R&D starting looking at ways in which weight of its products would be reduced and how they can design their machines for disassembly. Charlotte Uhrbom also adds that the fact that the Twister™ eliminates the use of chemical, that in itself shows how good the product is for the environment. Also considering the HTC AB Superfloor™ concept where the concrete is not covered with any material and that saves energy which is in turn

good for the environment. The interviewees all agreed that compared to other floors such as epoxy, HTC AB Superfloor™ is absolutely better for the environment.

5.1.10 Perceptions of Cleantech

The meaning of Cleantech according to the interviewees was quite similar. The general understanding of Cleantech was that it is Clean Technology. For Sten Jeansson it means doing something right from the beginning and not doing it wrongly in the beginning and taking care of the problem later. He also added that for the Cleantech concept to be a success, the root cause of environmental problems must be assessed. While for Charlotte Uhrbom, Cleantech means a company whose products do something good for the environment. She also added that she has observed that most Cleantech companies are those that prevent water pollution and air pollution but it should actually be more than that. Karl Thysell added on to say that there are many aspects to Cleantech and for a company to be known as Cleantech it must have more good for the environment than harm. It must have more positive than negative aspects with regards to the environment. While Tobias Linden also added that the end of life of a product is important in assessing whether it's clean or not. Finally Robert Kreicberg also added that a Cleantech product is one that is produced without any bad aspects and is not hazardous to the environment when it is being used.
All the interviewees believe that HTC would benefit from being classified as a Cleantech Company because their customers want environmentally conscious solutions.
Finally all the interviewees see HTC AB growing even more in future in terms of market share, number of products and number of employees. According to Sten Jeansson, HTC AB´s biggest market is in Sweden and it has only penetrated 10% of the Swedish Market. Moreover it is an immature business which is yet to have good margins.
Below is a summary of main characteristics of Cleantech according to HTC AB Interviewees.

5.1.11 HTC Cleantech Characteristics Summary

- Being a stewart of the environment
- Clean technology
- Reduce climate change(pollution prevention)
- Efficient production processes
- Environmental thinking

5.2 Investor Interview results

Name of interviewee	Organisation	Type of interview
Michael Wood	Former US Ambassador to Sweden	Email Interview
Hank Habicht	Sail venture partners	Phone Interview
Amol Deshpande	Kleiner perkins caufield and buyers	Phone Interview
Christer Nilsson	3iGroup	Phone interview
Berit Gullbransson	Swentec	Phone interview
Wished to be Anonymous	Zouk ventures limited	Phone interview

Table 6.Investor interviewees

Table 6 shows the names of the interviewees as well as the type of interviews that were conducted.

5.2.1 The Investors Background

Four of the five phone interviews were conducted with investors who represented investment firms. As earlier mentioned in the methodology chapter, the investment firms were selected from a list of Cleantech investment firms which have been mentioned on the Cleantech group website.
Among the investors interviewed were Amol Deshpande a partner at Kleiner Perkins Caufield and Buyers, who is also actively involved in the Greentech team within the firm, Hank Habicht who is one of the five team members at Sail Venture partners, and is also a nominee for the Air and waste management association´s Richard Beatty Mellon Environmental stewardship award[2] , Christer Nilsson who is the Director of Growth Capital at 3i group Stockholm and last but not least a representative from Zouk ventures limited.

According to the company website, Kleiner Perkins Caufiled and Buyers is an investment firm that invests in early stage and breakthrough ventures that have the promise to create new market opportunities. The firm is currently actively investing in Greentech[3] innovation and

[2] Richard Beatty Mellon Environment Stewardship award recognizes an individual whose contributions of a civic nature-whether administrative, legislative or judicial-has aided substantially in pollution abatement in some field related to the mission and objectives of the association.
[3] Greentech is an abbreviation of green technology which encompasses a continuously evolving group of methods and materials, from techniques for generating energy to non-toxic cleaning products. Examples of green technology subject areas include energy, green building, environmentally prefared purchasing, green chemistry, green nanotechnology. http://www.greentechshow.com.au/what_is_greentech.shtml
Available online, checked 20/08/09

entrepreneurs. The firms portfolio of companies ranges from Greentech to life science, semiconductors, security just to mention but a few. The firm has offices both in California, USA and China.

Sail venture partners on the other hand, invests primarily in early stage companies in the energy/Cleantech sector. The firm has investments in eight companies and it is the lead venture investor in each. These companies represent different segments of the energy/Cleantech sector. Among the eight companies is Cleantech capital group LLC which is a source of developments in the Cleantech industry. The firm is located in California.USA.

Zouk ventures limited is an investment firm situated in london and it is a dedicated Cleantech investor supporting experienced entrepreneurs expanding in europe. The firm's portfolio of companies includes Cleantech investments, infrastructure investments and its previous investments. For the firms Cleantech investment, the firm focuses on three main sectors which include: alternative and renewable energy technologies, resource efficiency technologies and environmental service and technologies.

While 3i group is a private equity firm that invests across europe, asia and north america. As a firm, it targets distinctive consumer business with strong growth potential. It focuses on buyouts, growth capital, and infrastructure and quoted private equity. The firm's portfolio is quite broad, ranging from Healthcare to general industry to oil, gas and power. The firm has its headoffice in london.

The other phone interview was with Berit Gullbransson from Swentec. Berit is the director of Swentec (Swedish environmental technology council) which is an organisation that deals with issues such as the strategies, initiatives and measures for Sweden's environmental innovations and environmental technology.

Last but not there was an email interview was Michael Wood the former US ambassador to Sweden and also a strong advocate for environmental issues.

5.2.2 Perceptions of Cleantech

It was interesting to note that each individual had a different definition of Cleantech. However despite the differences in definition, there were also many similarities and the common perception was that Cleantech was a positive concept in terms of environmental sustainability.

According to Amol Deshpande, Cleantech means making better use of resources and being a good Stewart of the environment. He also added that Cleantech products reduce climate

change, reduce waste and they are produced with efficient use of material input, at the lowest cost possible. Furthermore he stated that even though energy technology is emphasised the most as Cleantech, it is not the only Cleantech sector. However it is the most famous because of the huge market demand and huge opportunities for investors.

For Hank Habicht of sail ventures, the concept of Cleantech is related to an efficient production process. That is for any product, getting the same or better production output with fewer inputs such as energy, water, toxic chemicals. He added that the products must produce less waste and less green house gases.
He also mentioned that it was not enough for a company to only have an efficient production system, but rather it should reduce costs for customers if it has to be a successful Cleantech company worth considering for investment. Furthermore, a Cleantech company is one that not only benefits the environment but also is profitable.

While a representative of zouk who wished to be anonymous, added that the concept of Cleantech was quite broad. He mentioned the following examples of what could be considered as Cleantech: renewable energy, efficiency technologies, environmental services related to water, solar sector, recycling processes which are among others. He further stated that any company can be Cleantech as long as they own a technology that saves energy or other resources.

Christer Nillson of 3i conquers with the zouk ventures limited representative that Cleantech is quite a broad and diverse concept. He added wind energy and clean energy to the above sectors pointed out. However he further mentioned that the first thing that comes to his mind when he thinks of Cleantech is clean energy for cars with zero CO_2 emissions. Being familiar with HTC AB, Christer Nilson also added that HTC was ahead of its competitors in being environmental conscious. However he also stated that in order for HTC to be Cleantech, there was need to consider scrutinising all the components used in the machines produced. According to him, it all starts with the specifications made by the R&D department.

Berit Gullbransson from Swentec added that the concept of Cleantech means doing things better for the good of the environment. She further stated that she follows the Etap definition of Cleantech which is also interchanged with environmental technology. According to Etap (The EU Environmental Technology Action Plan), Environmental technology comprises products, systems, processes and services that give clear environmental advantages in relation to existing or alternative solutions, as seen from lifecycle perspectives. The endeavour shifts the focus from products to systems, resource efficiency and sustainable development.

For Micheal Wood, Cleantech refers to products that replace old, dirty technologies, like cars with internal combustion engines, with new clean technologies that reduce harmful emissions, like cars with electric engines or engines that run on biofuels. Other than cars, wind and solar generation of electricity, combined heat and power in industrial facilities, and more efficient air conditioning/heating (geothermal) and other products for homes and buildings are good example of Cleantech.
He also adds that Cleantech emphasises more on energy technology firms due to the fact that existing technologies for the generation of heat and electricity are major sources of the CO_2 emissions that cause climate change. People are hunting for cleaner solutions.

Below is a summary of the main characteristics that have been pointed out to be part of the concept of Cleantech by Investors and selected people who are familiar with Cleantech.

5.2.3 Investor Cleantech Characteristics

- Better use of resources
- Being a stewart of the environment
- Reduce waste
- Reduce climate change/GHG
- Efficient use of material input(less energy, less water, less toxic chemicals)
- Efficient production processes
- Reduce cost for customers
- Profitable
- Renewable energy
- Efficient technologies
- Recycling
- Replacing old dirty technology with clean technology
- Clean energy(biofuel, wind, solar power)

6 Result Analysis

Considering the interview results from both HTC AB and investors in the previous chapter, it is clear that there are more similarities as compared to differences when it comes to the perceptions of Cleantech.

As can be seen in the figure below, HTC AB interviewees and the investors seem to have a good understanding of the concept of Cleantech. This is with reference to the theory on Cleantech.

The figure below represents the perception of Cleantech according to HTC AB, the investors and also what theory describes as aspects of Cleantech.

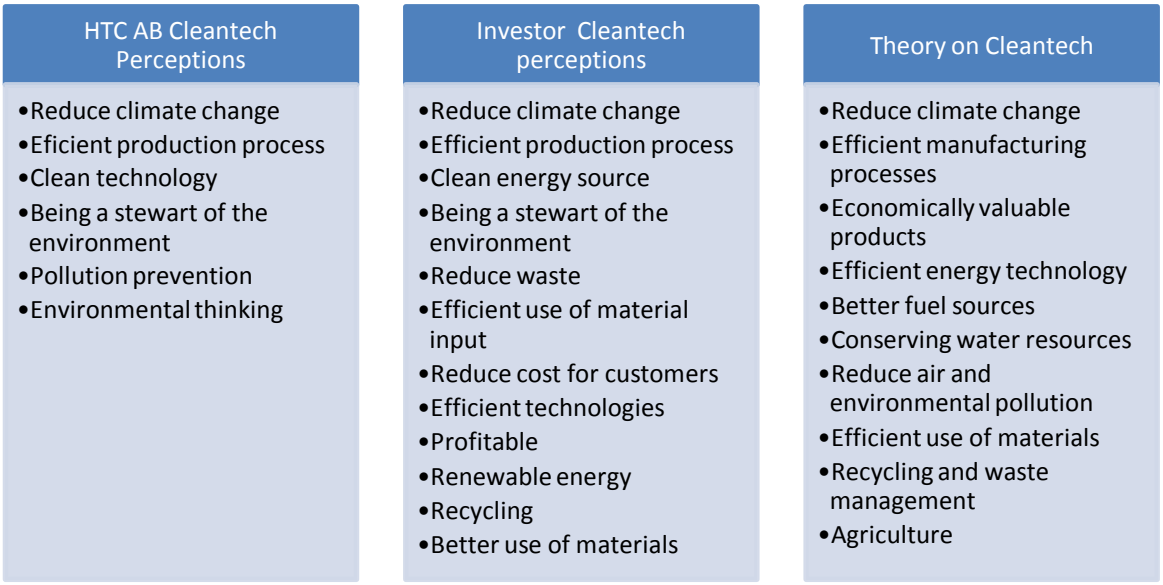

Figure 5.Cleantech Perspectives

As can be seen in the figure above, HTC AB´s perceptions of Cleantech are in line with both the investors perceptions and theory. In fact when all the columns are compared, they all lead to the same understanding of Cleantech, and that is that it is a concept that affects the environment positively by promoting the reduction of climate change.

The figure also indicates that in as much as HTC AB seems to have a good understanding of the concept of Cleantech, it is not as broad as the investors or the theory. This could be explained by the fact that Cleantech investors work with Cleantech and hence they have a broader knowledge of the concept.

While comparing investor Cleantech perceptions and the actual aspects of Cleantech as presented in the theory, shows also significant similarities. Hence this proves that Investors have a good understanding of Cleantech.

Looking back at HTC interview results, it is obvious that HTC AB is an innovative company. This statement can be backed by the fact that the company has over 350 patents. The question however remains whether or not HTC AB can be classified as a Cleantech company.

According to the interview results, all interviewees mentioned that HTC AB has products that have a positive impact on the environment and hence it is an environmental conscious company. In particular the Twister™ was referred to as an environmental friendly product that eliminates the use of chemicals in floor cleaning. Sten Jeansson added that the Twister™ has both economic and environmental benefits in the sense that the user can save money that could have been used on chemicals and the same time avoiding the use of chemicals reduces environmental hazards such as acidification and eutrophication.

In reference to investor interview results, Twister™ could be classified as a Cleantech product in the sense that it fits in the descriptions of Cleantech given by individual investors. Such as:

- Limiting the use of toxic chemicals (by not using any chemicals at all in its use phase), as stated by Hank Habicht.
- Reducing costs for customers (by eliminating the need for floor cleaning chemicals), as stated by Hank Habicht.
- Saving resources (Twister™ pads are produced from 15% recycled material), as stated by all the investors.

Furthermore, HTC AB is found in one of the eleven segments of the Cleantech concept which is manufacturing/industry and its Twister™ product has positive economic and environmental aspects.
The other HTC AB product that has a positive impact on the environment is the Superfloor™ concept. The environmental benefits of the Superfloor™ concept have been discussed earlier in the company background.
The Superfloor™ concept saves energy input during installation, global warming effect is less than other floors, there is less acidification and eutrophication compared to epoxy flooring.

Also in line with what investors consider to be Cleantech and also the definitions of Cleantech, the Superfloor™ concept can be considered as Cleantech because it positively affects the environment and it is also economically viable. (Ngen partners Cleantech definition)
Superfloor™ as a Concept could be classified as Cleantech, however for the concept to become a reality, machinery such as grinding machines and Vacuum machines are used.
HTC AB produces these machines in-house by assembling various components from different suppliers. These components are designed by the R&D department and latter sub

contracted to various suppliers. The company production team follows the concept of lean manufacturing to ensure process efficiency. This has helped them reduce waste significantly by not overproducing. Otherwise the waste incurred is handed over to Allren AB a waste management company. Furthermore REACH is used to evaluate suppliers and the type of chemicals they use in their products. However HTC AB can only have so much control over its component suppliers. As a company they can only control the use of toxic chemicals in components but they do not have much control over how the components are produced.
Hence whether or not the machines produced by HTC AB are Cleantech is hard to determine.

HTC AB is a company that is innovative and its continuous growth is expected due to the fact that it is an immature business whose high profit margins are yet to be gained. So far the company's biggest market is in Sweden and that only accounts for 10% of the swedish market (according to the interview with Sten Jeansson). Hence HTC AB is most likely to have Cleantech investment interest potential in the sense that Cleantech investors are interested in firms that have economic and environmental benefits as well as future growth potential.

7 Back casting at HTC Sweden AB

7.1 Introduction

Seeing that Backcasting starts with the identification of a desired future, i started by analysing what HTC Sweden AB wanted for the future. Having already conducted seven interviews, it was possible to determine what the interviewees considered as the most desirable future for the company by analysing the interview responses.

Furthermore, empirical data on the concept of Cleantech elaborates more on the characteristics of Cleantech companies from which aspects of a desirable Cleantech future were synthesised.

7.2 Application of Backcasting at HTC Sweden AB

For HTC Sweden AB, the desirable future that was pointed out by the respondents and for which this project was undertaken, was that the company would be globally recognised as a Cleantech company. And being globally recognised as Cleantech comes with it continuous growth, international market share, profitability and of course being among the companies that have been listed as Cleantech.

While some desirable future scenarios are analysed for feasibility (Mander et al ,2008) in the case of HTC Sweden AB this was not necessary. This is due to the fact that being Cleantech is feasible in the sense that there are some companies in existence that are already globally recognised as being Cleantech and they are part of Cleantech company lists. The development of the desirable future can be seen in figure 6 and 7.

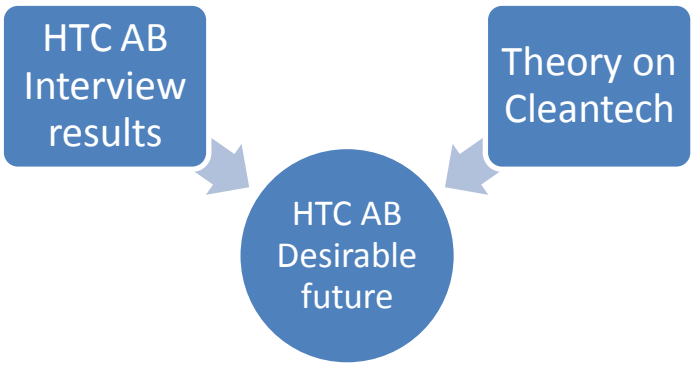

Figure 6, Development of HTC AB, desirable future.

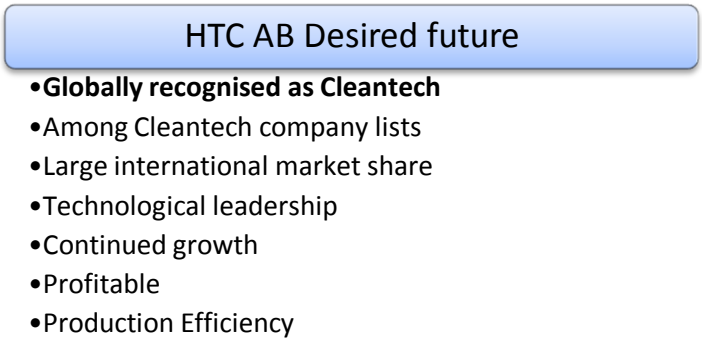

Figure 7, HTC AB desirable future.

Having identified the desired future for HTC Sweden AB, the company present position was also identified using the HTC interview responses and documents provided. Furthermore, direct observation was also incorporated in defining HTC Sweden AB´s present position.

The development of the company's present position is illustrated in figure 8 and 9.

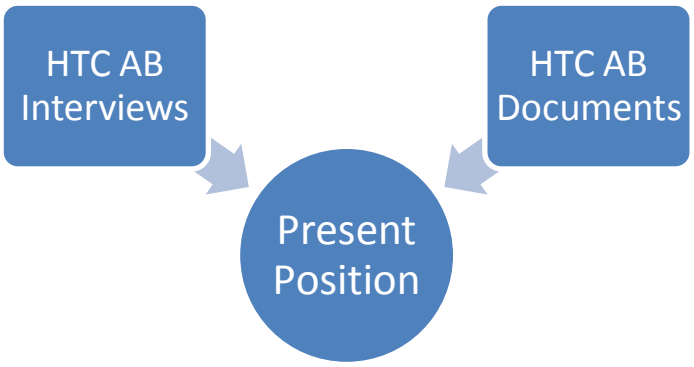

Figure 8, Development of present position

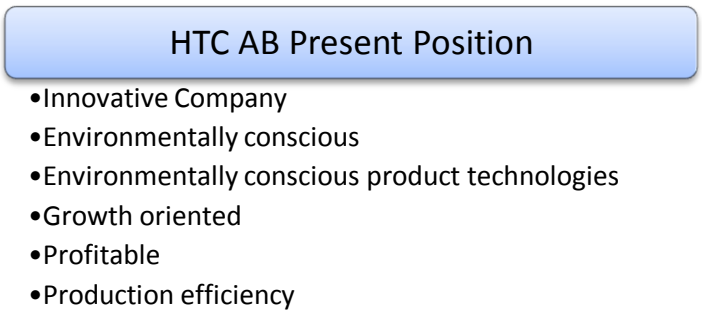

Figure 9, HTC Present position

With a clear understanding of HTC Sweden AB´s desired future and present position, it was necessary to undertake a gap analysis in order to come up with strategies for attaining the

desired future. Gap Analysis is used to compare between actual performance and potential performance. In this case, the gap analysis was undertaken in such a way that both the desired future and the present position of the company where put into consideration in suggesting the strategies to be undertaken.

Having looked at HTC Sweden AB´s present position in comparison with the ideal future, what was missing between the two was easy to identify or rather the gap between the two was identified. The development of the gap can be seen in figure 10 and 11.

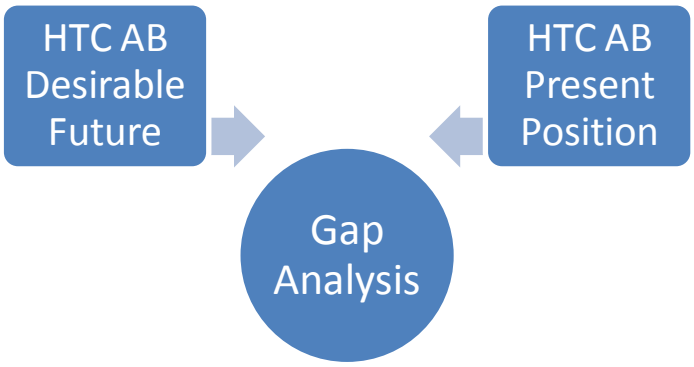

Figure 10, Comparrison for Gap Analysis.

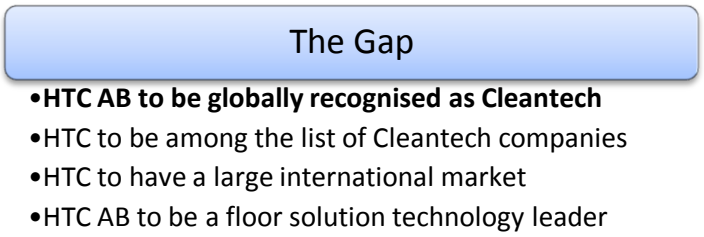

Figure 11,Gap analysis results.

The comparison between HTC Sweden AB´s desired future and present position indicated that:

- HTC SWEDEN AB was not globally recognised as a Cleantech company
- HTC SWEDEN AB was not among any Cleantech company list
- HTC SWEDEN AB had not much international market share

These three points represent the gap between the desired future and the present position.

With the gap identified, the strategies to be used in attaining the desired future from the company's present position were suggested. These suggestions were made by:

- Analysing empirical data on the concept of Cleantech

- Analysing investor interview results in terms of their understanding of Cleantech

The development of the strategies and the strategies developed can be seen in figure 12 and figure 13 below.

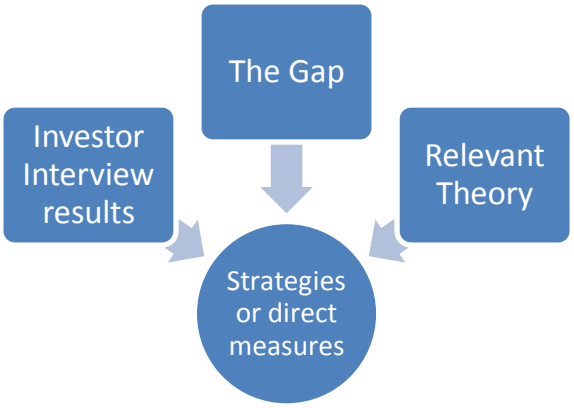

Figure 12, Development of strategies for improvement.

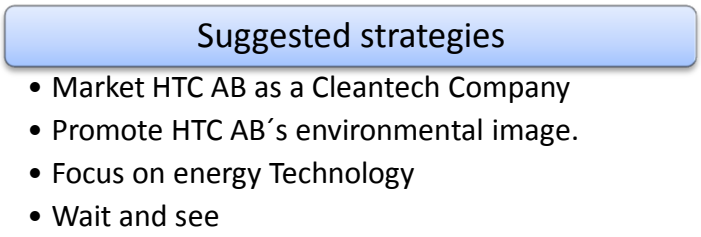

Figure 13, Suggested strategies for HTC AB

The strategies listed in figure 13 will be discussed in terms of their pros and cons. Furthermore it will be elaborated how they could be implemented in enabling HTC Sweden AB´s shift from its present position to its desired future position.

7.3 Suggested Strategies

7.3.1 Market HTC AB as Cleantech

From the investor interview results and HTC AB company information, HTC AB qualifies to be globally known as a Cleantech company. Among the aspects that qualify the classification of HTC AB as Cleantech are that it has environmentally conscious technology which saves chemical resources, the Superfloor™ concept reduces eutrophication, acidification and it is energy efficient compared to other solutions just to mention but a few.

Hence in order to meet the desired future, HTC might have to market itself as a Cleantech company. This can be done by stating that HTC AB is Cleantech in company advertisements and promotions.

However this strategy has its merits and demerits. The merits are such that when HTC AB classifies itself as Cleantech and it has the technology to back that classification, then this will be a way of informing its customers who otherwise would have no idea. On the other hand, classifying itself as Cleantech may not be considered valid by some customers due to the fact that some firms use Cleantech just as a marketing tool and they cannot justify it with their products. In this case, the merits outweigh the demerits because HTC AB would not only use Cleantech as a marketing tool, it would also be able justify it.

7.3.2 Promote HTC AB´s Environmental Image

It is one thing to be Cleantech and another to be known as Cleantech. Cleantech is a broad concept which is known by many investors. Despite being broad, energy technology is the most commonly and widely accepted as Cleantech. However other sectors that are Cleantech have also been recognised. This means that it is a matter of being known by Cleantech investors and other relevant stakeholders.

Hence it is upon HTC AB to make known the environmentally conscious technologies that it has through extensive advertising. In particular making presentations at Cleantech forums would be very beneficial.

7.3.3 Focus on Energy Technology

Change advertising focus from floor technology that eliminates the use of chemicals to more efficient energy technology**.** As can be seen from investor interviews and investment companies, energy technology seems to be considered as the real Cleantech compared to other sectors. Hence for HTC to be recognised as a Cleantech company, it might have to

strengthen its current technologies that are more energy efficient by further research and development.
By changing focus to more energy efficient technologies, HTC AB will be almost instantly recognised as Cleantech without having to extensively advertise itself. Furthermore, in comparison to other floor solutions, HTC´s Superfloor™ is already more energy efficient. Hence this strategy is just a matter of capitalising on the strength that the company already has.

7.3.4 Wait and see

This strategy calls for HTC to be patient enough to wait and see where the concept of Cleantech is going. Since the concept is fairly new, it is possible that there are many companies in different industries that have not been recognised as being Cleantech and yet they are actually Cleantech. Hence with time and as the concept grows and becomes globally well understood in practice as it is in theory, it is likely that many more companies will be recognised and become labelled as Cleantech. This means that to "wait and see" might be on option for HTC to consider in their quest of being seen as Cleantech.

7.3.5 Change focus of desirable future from Cleantech to Greentech.

By comparing HTC AB´s present position to investor perceptions of Cleantech, it is clear that HTC AB is a Cleantech company. However in as much as HTC AB is a Cleantech company, it has been overshadowed by the energy technology sector which is receiving more of investor attention. Hence even if HTC AB manages to be classified as a Cleantech company, it will still be under the energy technology sector shadow. To stand a better chance of being recognised, HTC AB might have to settle for Greentech instead of Cleantech.

Greentech is often interchanged with clean technologies. It encompasses products, services and utilities that help to minimise the negative impact of human activities on the environment (Greentech consulting,2009). Most Greentech industries are based on high technology and they are future oriented.(ibid) Greentech and Cleantech are interchanged because they are both buzzwords that refer to industrial activities that aim at reducing climate change and positively affecting the environment. The main difference between the two is that Greentech was introduced before Cleantech.

The benefits of using this strategy is that HTC AB will be easily accepted by all investors and other stakeholders as a Greentech company. The reason being that Greentech is as broad in practice as it is in theory. (List of 100 innovative Greentech companies). Furthermore, as a company HTC AB will not have to use huge amounts of resources to be seen as Greentech because it already qualifies as Greentech.

Having discussed the Backcasting methodology for HTC AB, in terms of all the elements that were incorporated, the full Backcasting methodology is represented in the figure 14.

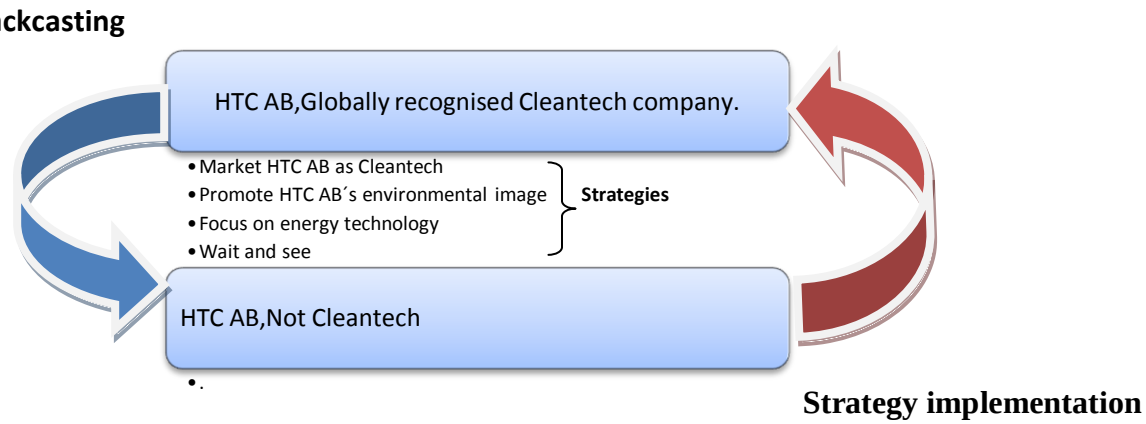

Figure 14.HTC backcasting methodology

As can be seen in the figure above, only four strategies have been included in the diagram. This is due to the fact that the last suggested strategy is not in line with HTC AB ´s desirable future. However it is among the suggested strategies as an option that the company can choose if the desirable future proves to be irrelevant.

7.4 Recommendations

Hence a summary of the recommendations for HTC AB are:

- Market HTC AB as a Cleantech company by stating in all its forms of advertising and promotion that the company is Cleantech.
- Promote HTC AB´s environmental image by putting emphasis on the environmental benefits of its products.
- Focus on energy technology by further undertaking research and development of more energy efficient products, or by focusing more on advertising the energy efficiency aspects of their products.
- The concept of Cleantech is fairly new, while some companies have already been branded as Cleantech, it's probably possible that there are many other companies that have been left out and they are yet to be recognised. Therefore it's only a matter of time before the next wave of Cleantech companies are recognised. Hence one option would be to wait for that time.
- Change focus from Cleantech to Greentech. By classifying themselves as Greentech they have a better shot at being among the top Greentech companies rather than among the top Cleantech companies.

If HTC AB manages to be classified as a Cleantech Company, among the benefits it will reap include:

- ✓ Having a positive company image
- ✓ Increased market share
- ✓ Financial support from Cleantech investors
- ✓ Profitability and continued growth from increased market demand

Hence the last but not the least recommendation for HTC AB would be to weigh the benefits of being Cleantech against the effort required in terms of time and money in implementing the Backcasting strategies.

8 Discussion

Cleantech has been discussed above as a broad concept which is understood differently by different stakeholders. In as much as Cleantech is mostly associated with the energy technology segment, both the theory on Cleantech and the investor Cleantech perceptions show that Cleantech is broad.

Even though investor interview results show that the investors consider Cleantech to be broad, it is quite contrary to their actions. This is because when one considers the investments made by many Cleantech investors, they are related to energy technology more than any other sector (sail venture partners, kleiner perkins caufield and buyers, zouk).

One would wonder why the energy technology sector has received so much attention. Well according to literature, energy technology is very popular due to the benefits involved. Energy technology is at the core of most of the country's economic development and furthermore most of the environmental pollution is attributed to energy technology. Hence energy technology has both economic and environmental benefits that are attractive to investors (O´Brian,2008; Amol Deshpande and Micheal Wood interview response).

However the fact that energy technology seems to attract more investor attention because of its economic benefits does not mean that other sectors that are not as economically viable as energy technology should be ignored. In fact, if the concept of Cleantech should succeed then all the other sectors must equally receive investor attention as energy technology. Besides the overall aim of Cleantech is to reduce climate change and global warming; hence the environmental benefits must outweigh the economic benefits for the Cleantech concept to succeed.

For as long as a company is found in one of the 11 segments (energy generation, energy storage, energy infrastructure, energy efficiency, transportation, water and wastewater, air and environment, materials, manufacturing/industry, agriculture, recycling and waste) that are part of Cleantech and they benefit the environment one way or the other then they must be recognized as Cleantech (Cooke, 2008). That is if we go by a broad definition such as Cleantech is economically valuable products and services that positively affect the environment (Ngen Partners).

Therefore, it is the responsibility of firms that have products that positively affect the environment to stand out and make known of their technologies.
This could be done by attending Cleantech forums and presenting their products to various investors and also as discussed in the literature marketing and advertising being powerful tools that are used to inform customers can be used to make stakeholders aware of the companies Cleantech portfolio.

However being Cleantech is not as easy as just having the right product or technology that has environmental benefits. It is also about taking into consideration the entire life cycle of the product or technology. As mentioned by Hank Habicht, it is about having an efficient production system; where fewer inputs (inputs such as energy, water, toxic chemicals) are used for the same or increased output. While Amol Deshpande mentioned that it is about having the right materials as inputs.

In other words, a product can be Cleantech, but it should also have been produced under environmental conscious production practices, using environmental conscious materials for it to benefit the environment.
The main aspects of Cleantech are that it should be good for the environment and help in fighting against climate change issues.

There are various practices that can be used by manufacturing firms in order to have more Cleantech products. Promoting process efficiency in the production is one of the practices that can be used. This can be done by following the practice of lean manufacturing. As discussed in the literature, lean manufacturing eliminates waste among other things which is positive from an environmental sustainability point of view (Haque & james-moore, 2004).

Incorporating environmental thinking in the firms innovative processes also promotes the introduction of Cleantech products. This can be achieved by numerous ways. For instance having an environmental expert in the R&D team or by designing all products for the environment using designing for the environment (DFE) promotes Cleantech product production. Designing for environmental manufacturing, designing for environmental packaging and designing for disposal and recyclability are the three major elements of DFE which must be put into consideration (Crow, 2002).

Literature also points out the use of an organic organizational structure to encourage creativity and innovation (Daft, 2007). As discussed earlier, Cleantech is a concept that involves the introduction of new and better products from an environmental perspective. Hence Cleantech is closely related to innovative practices.

With reference to the strategies suggested for HTC to be seen as a Cleantech company, the strategies can also be used by other companies in general.

For instance companies that are found in anyone of the eleven Cleantech industrial segments and they have products that positively affect the environment with efficient production methods can market themselves as being Cleantech in order to be known by the right stakeholders. By calling themselves Cleantech, these companies will be noticed by Cleantech investors and customers.

Another strategy that can be adopted by other companies is the “wait and see” strategy. As already discussed in the Backcasting chapter, Cleantech is a fairly new concept which is still growing and developing. The fact that there is a gap between the definition of Cleantech in theory and in practice may be explained by the reasoning that the concept is quite new and still in its development stages (O´Brian, 2008). Hence one would assume that given time, the concept of Cleantech will be as broad in practice as it is in theory. This means that companies that are not seen as Cleantech yet can patiently wait for the time when they will be acknowledged as also being Cleantech.

The use of another buzzword such as Greentech can also be adopted as a strategy that companies in general can use. This is for those companies that may not have the patience of waiting to be seen as Cleantech. Greentech is a buzzword that has been known for a longer time than Cleantech, and that makes it easier for companies to market themselves as Greentech other than as Cleantech. Furthermore the reason why it is easier for companies to market themselves as Greentech is because Greentech has already been accepted to represent a vast number of industries that positively affect the environment (List of 100 Innovative Greentech companies)

In summary, companies in general that would like to be classified as being Cleantech must ensure that:

- ✓ They belong to the eleven Cleantech industrial segments
- ✓ They not only have the right product but also the right production processes that affect the environment positively

Furthermore these companies can adopt the following strategies:

- ✓ Market the company as Cleantech.
- ✓ Wait and see.
- ✓ Use another buzzword such as Greentech.

9 Conclusion

The concept of Cleantech has been discussed in terms of some of its aspects. It is a broad Concept which spans 11 industrial segments. These segments include:

- Energy generation,
- Energy storage,
- Energy infrastructure,
- Energy efficiency,
- Transportation,
- Water and wastewater,
- Air and environment,
- Materials,
- Manufacturing/industry,
- Agriculture,
- Recycling and waste.

Cleantech involves the promotion of technologies that reduce or eliminate emission of green house gas (GHG) effects. In other words, Cleantech is aimed at reducing pollution to the environment while at the same time coming up with technologies that help global economic development.

The thesis has emphasized the fact that Cleantech is broad in terms of its definition in theory but narrow in terms of its practical application. Therefore, it has been recommended that in order to bridge the missing link between the two, it is up to the companies to ensure that they market themselves and show that they are Cleantech. That is if they fit the required criteria for being Cleantech.

The Criteria for companies to be seen as Cleantech is such that

a. They should belong to any of the 11 segments mentioned above.
b. They should have the right technology that eliminates pollution.
c. The right product that eliminates pollution.
d. The environmental benefit of the products must be defined from a life cycle perspective.

Hence Cleantech is not only about producing less to zero green house gas (GHG) emission products but also having less to zero GHG emission Raw materials, better product development processes, better product end of life procedures. In addition, for a manufacturing firm to be seen as Cleantech they must consider incorporating environmental aspects in their work practices. Examples being: designing for the

environment and having a life cycle assessment of their products to determine their products impact on the environment compared to others.

Once any company meets the criteria for being classified as Cleantech and they become Cleantech, they stand the chance of reaping certain economic benefits such more demand for their products, good company image and increased market share However these benefits can also be achieved whether a company is Cleantech or not. For investors the economic benefits are that they can profit from investing in Cleantech companies that are growing and have a better chance of expanding in future and increasing in their market share. Also the fact that Cleantech companies deal with new technologies, these technologies are still in their early stages and they still have a chance of being the future dominant design which makes them even more lucrative.

In terms of environmental benefits, Cleantech allows for the introduction or promotion of products and technologies that are better for the environment. Hence Cleantech reduces the long term environmental degradation.

Hence the real benefits of Cleantech in general are more environmental than economic

The research also took an in depth investigation of innovation in order to make a comparison between innovation and Cleantech. It was observed that innovation is at the core of Cleantech firms. This is due to the fact that being Cleantech is about coming up with not only new environmental friendly products but also new technologies that are better for the environment. Moreover a manufacturing firm cannot be Cleantech without having innovative practices and also encouraging creativity within the firm. However being innovative does not come easy. It is a choice that manufacturing firms have to make and work hard at making it work for the organization. Having an organic organizational structure is one way in which some organizations strive to be more innovative. It is also important to note that a company can be Innovative but not Cleantech and that a Cleantech company is always innovative.

Finally, several strategies were suggested on how HTC Sweden AB would be seen as a Cleantech company using a backcasting methodology. These strategies include:

- Marketing HTC Sweden AB as a Cleantech Company,
- Promoting the companies environmental image,
- Focus on energy technology.

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11 APPENDIX 1:Environmental benefits of Superfloor™

The environmental benefits of Superfloor™ compared to epoxy coated concrete floors when installed and over a 20year period covering Acidification, Eutrophication and global warming are illustrated below:

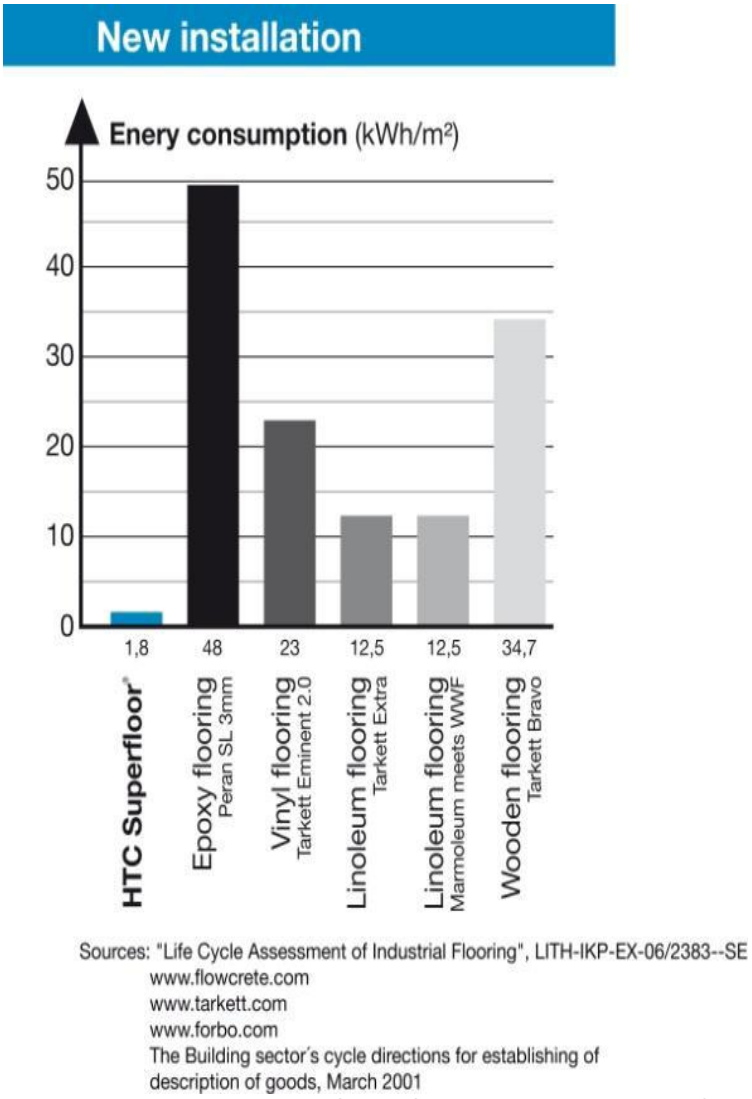

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Figure 15.Energy consumption of Superfloor as cited by HTC Superfloor beneficial summary

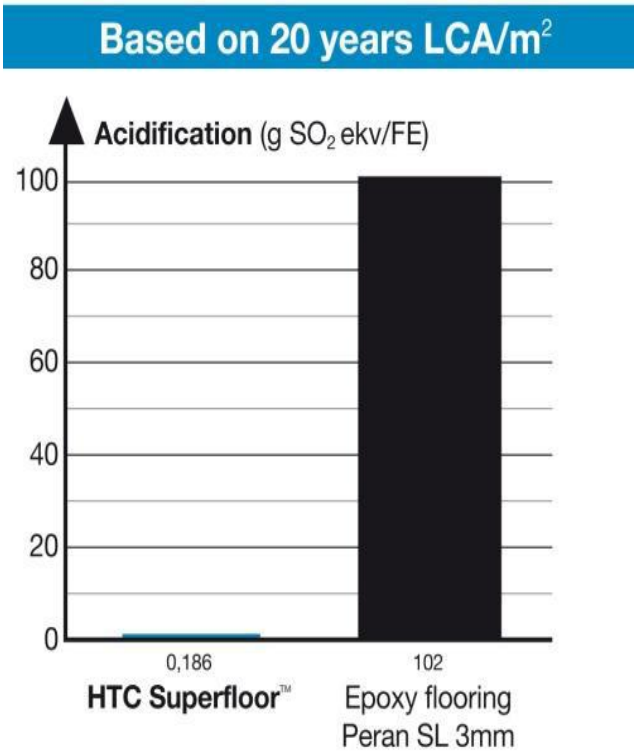


Figure 16.Acidification as cited by HTC Suerfloor beneficial summary

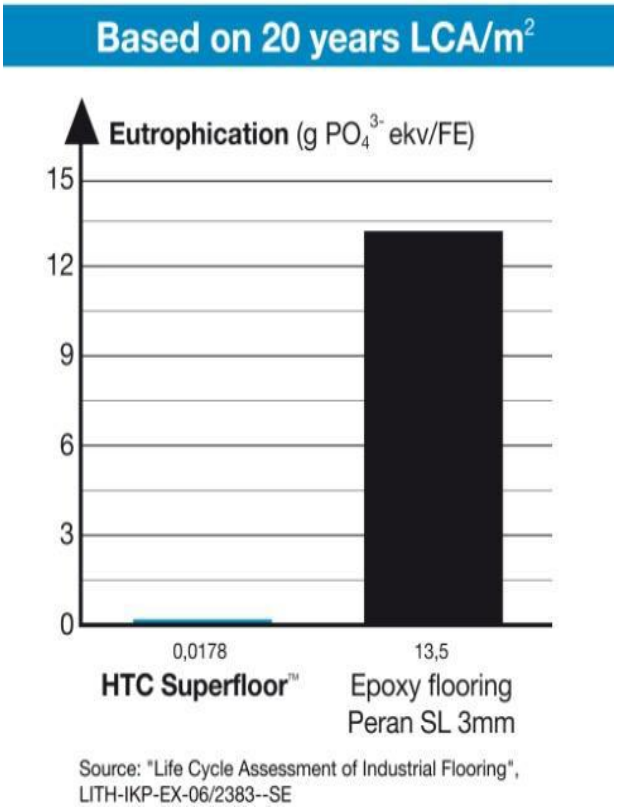


Figure 17.Eutrophication as cited by HTC Superfoor beneficial summary

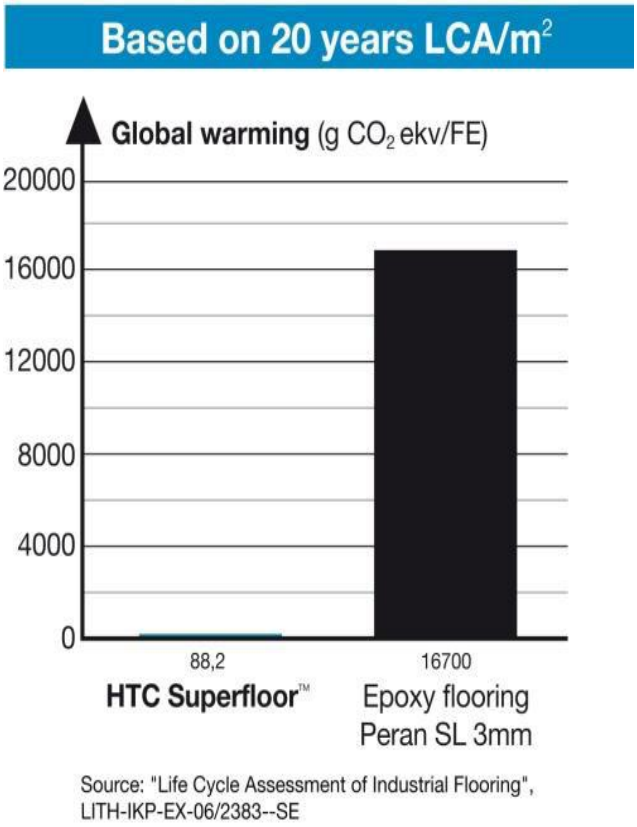
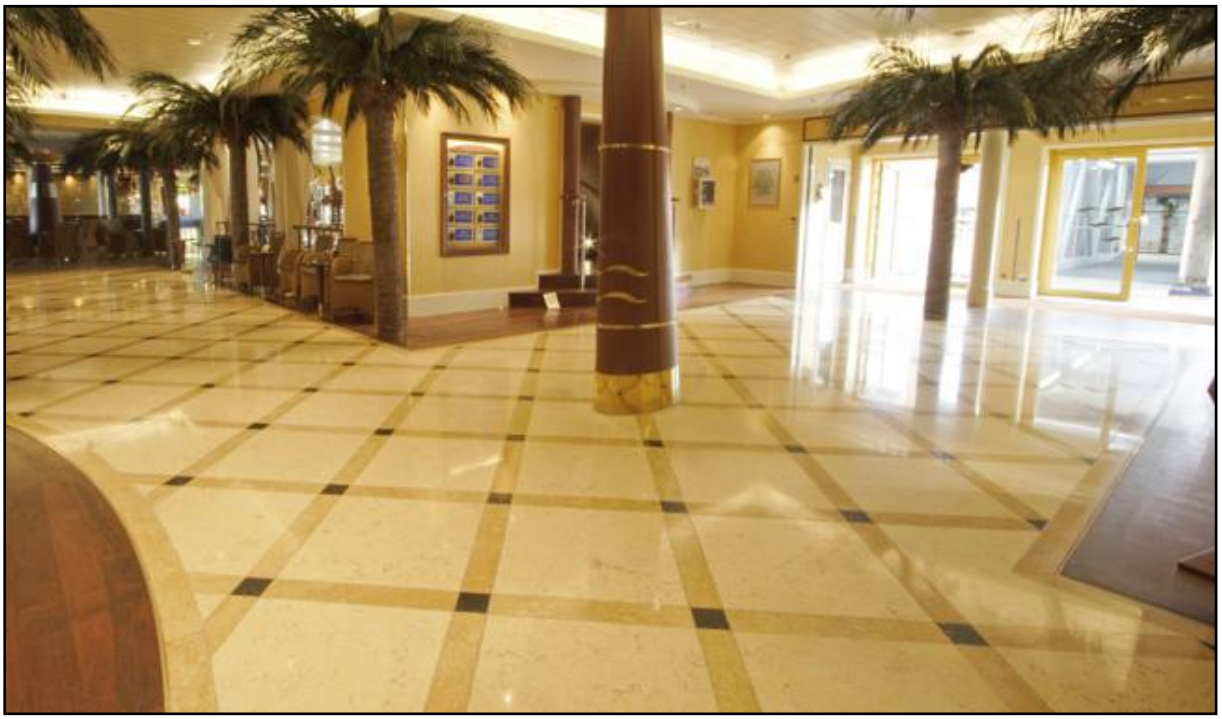


Figure 18.Global warming as cited by HTC Superfloor beneficial summary

12 APPENDIX 2. Superfloor™ and Twister™ pads.



Figur 19.Superfloor

Figur 20.Twister pads

13 APPENDIX 3:Development of interview questions

What do I want to know from HTC to understand its current position?

- Is the company innovative
- What drove the innovation(Is it economic or environmental reasons
- How is waste minimized in production
- Do they use renewable material at all
- How much resources are needed for their products
- Is it a growing company
- What is their marketing strategy
- Is the company contributing to emission control (how and how much?)
- What is the company´s environmental policy

What do I want to know from Investors and Venture Capitalists

- What does Cleantech mean to them
- Requirements for company to be Cleantech
- Which Cleantech companies are they interested in investing in
- How do they know about these companies

Possible Questions for HTC

1. How many products does the company manufacture?
2. How many patents does HTC have?
3. What was the main reason for developing the Twister™?
4. Elaborate the production process of the Twister™
5. How is waste handled in the production process of various products?
6. What are the main materials used in HTC product production (i.e Twister™)?
7. How much resources are required in the production process (i.e Electricity and raw materials)?
8. What are the most significant changes that have happened within HTC over the last years?
9. Does the company have any environmental policy?
10. How is the company contributing to eliminating climate change problems?
11. What environmental effects do HTC products have?
12. How is the Twister™ promoted or advertised to its customers?

Possible Questions for Venture capitalists

1. What is Cleantech to you?
2. How do you know which companies are Cleantech and which ones are not?
3. What do you consider to be the most important requirements for a company to be seen as Cleantech?
4. Are all Cleantech companies good for investment?

14 APPENDIX 4: Case study Interview Questions

Håkan Thysell –Innovation
Interview questions

Tell me something about yourself

- Personal background?
- When did you decide to start the company and why?
- What did you work with before?

Tell me something about the company history

- What were the main products?
- Why was it founded?

Tell me about any significant changes that have taken place in the company from its inception?

- Positive /negative changes?
- Any new products?
- Different Strategies?
- How has HTC developed?

Tell me about HTC´s Product Innovations

- What led to the innovation?

Tell me about HTC new product development strategy

- Who is involved in coming up with new products?
- How are employees encouraged to come up with new ideas/ any incentives offered?

What do you think about HTC from an environmental perspective

- Is it an environmental conscious company/ how?

What does Cleantech mean to you

- Would you classify HTC as being Cleantech?
- Benefits of being Cleantech?

Where do you see the company 5-10years from now?

- Growth?
- Innovation?
- Number of Products/Number of customers

Sten Jeansson –Business development
Interview Questions

Tell me something about yourself

- Personal background?
- When did you join HTC?
- Why did you come to HTC?
- What did you work with before?

Tell me about any significant changes that have taken place in HTC from the time you joined

- Positive/negative changes?
- Any new products?
- Different Strategies?
- How has HTC developed?

Tell me something about how HTC has developed in its business areas

- What led to the growth?

Tell me about HTC´s Product Innovations?

- What led to the innovation?

Tell me about HTC´s Sales and Marketing strategy

- How are products promoted/ advertised?
- Why is the particular strategy used?

Tell me about HTC new product development strategy

- Who is involved in coming up with new products?
- How are employees encouraged to come up with new ideas/ any incentives offered?

What do you think about HTC from an environmental perspective?

- Is it an environmental conscious company?

What does Cleantech mean to you

- Benefits of being Cleantech?
- Would you classify HTC as being Cleantech?

Where do you see the company 5-10years from now?

- Business Development?

Kåre Kilgren-Product Management
Interview questions

Tell me something about yourself?

- Personal background?
- When did you join HTC
- Why did you come to HTC
- What did you work with before

Tell me about any significant changes that have taken place in HTC from the time you joined?

- Positive/negative changes?
- Any new products?
- Different Strategies?
- How has HTC developed?

Tell me about HTC new product development strategy

- Who is involved in coming up with new products
- How are employees encouraged to come up with new ideas/ any incentives offered?

Tell me about HTC´s Product Innovations

- What led to the innovation?

What do you think about HTC from an environmental perspective

- Is it an environmental conscious company

What does Cleantech mean to you

- Benefits of being Cleantech
- Would you classify HTC as being Cleantech

Where do you see the company 5-10years from now?

- Growth?
- Innovation?
- Product development?

Charlotte Uhrbom-Quality and Environmental assurance
Interview Questions

Tell me something about yourself?

- Personal background?
- When did you join HTC
- Why did you come to HTC
- What did you work with before

Tell me about any significant changes that have taken place in HTC from the time you joined?

- Positive/negative changes?
- Any new products?
- Different Strategies?
- How has HTC developed?

Tell me about HTC´s Product Innovations

- How has it been innovative?
- What led to the innovation?

What do you think about HTC from an environmental perspective

- Is it an environmental conscious company
- How ?

What does Cleantech mean to you

- Benefits of being Cleantech
- Would you classify HTC as being Cleantech

Where do you see the company 5-10years from now?

- Growth?
- Innovation?
- Number of Products/Number of customers

Karl Thysell-IT,R&D
Interview Questions

Tell me something about yourself?

- Personal background?
- When did you join HTC
- Why did you come to HTC
- What did you work with before

Tell me about any significant changes that have taken place in the company from the time you joined?

- Positive/negative changes?
- Any new products?
- Different Strategies?
- How has HTC developed?

Tell me about HTC new product development strategy

- Who is involved in coming up with new products
- How are employees encouraged to come up with new ideas/ any incentives offered?

Tell me about HTC´s Product Innovations

- How has it been innovative?
- What led to the innovation?

What do you think about HTC from an environmental perspective?

- Is it an environmental conscious company
- How ?

What does Cleantech mean to you

- Benefits of being Cleantech
- Would you classify HTC as being Cleantech

Where do you see the company 5-10years from now?

- Growth?
- Innovation?
- Number of Products/Number of customers

Robert Kreicberg-HTC Floor Solutions
Interview Questions

Tell me something about yourself?

- Personal background?
- When did you join HTC
- Why did you come to HTC
- What did you work with before

Tell me about any significant changes that have taken place in the company since you joined?

- Positive/negative changes?
- Any new products?
- Different Strategies?
- How has HTC developed?

Tell me about HTC´s Product Innovations

- How has it been innovative?
- What led to the innovation?

Tell me about HTC´s Sales and Marketing strategy

- How are products promoted/advertised
- Why is the particular strategy used

What do you think about HTC from an environmental perspective

- Is it an environmental conscious company

What does Cleantech mean to you

- Benefits of being Cleantech
- Would you classify HTC as being Cleantech

Where do you see the company 5-10years from now?

- Growth?
- Innovation?
- Number of Products/Number of customers?

Tobias Linden-Production Director
Interview questions

Tell me something about yourself?

- Personal background?
- When did you join HTC
- Why did you come to HTC
- What did you work with before

Tell me about any significant changes that have taken place in HTC from the time you joined?

- Positive/negative changes?
- Any new products?
- Different Strategies?
- How has HTC developed?

Tell me about HTC new product development strategy

- Who is involved in coming up with new products
- How are employees encouraged to come up with new ideas/ any incentives offered?

Tell me about HTC´s Product Innovations

- What led to the innovation?

Tell me about your waste management strategy in production

- Twister™ production
- Superfloor™ Machine production

What do you think about HTC from an environmental perspective

- Is it an environmental conscious company

What does Cleantech mean to you

- Benefits of being Cleantech
- Would you classify HTC as being Cleantech

Where do you see the company 5-10years from now?

- Growth?
- Innovation?
- Product development?

15 APPENDIX 5:Annual greenhouse gas emissions by sector

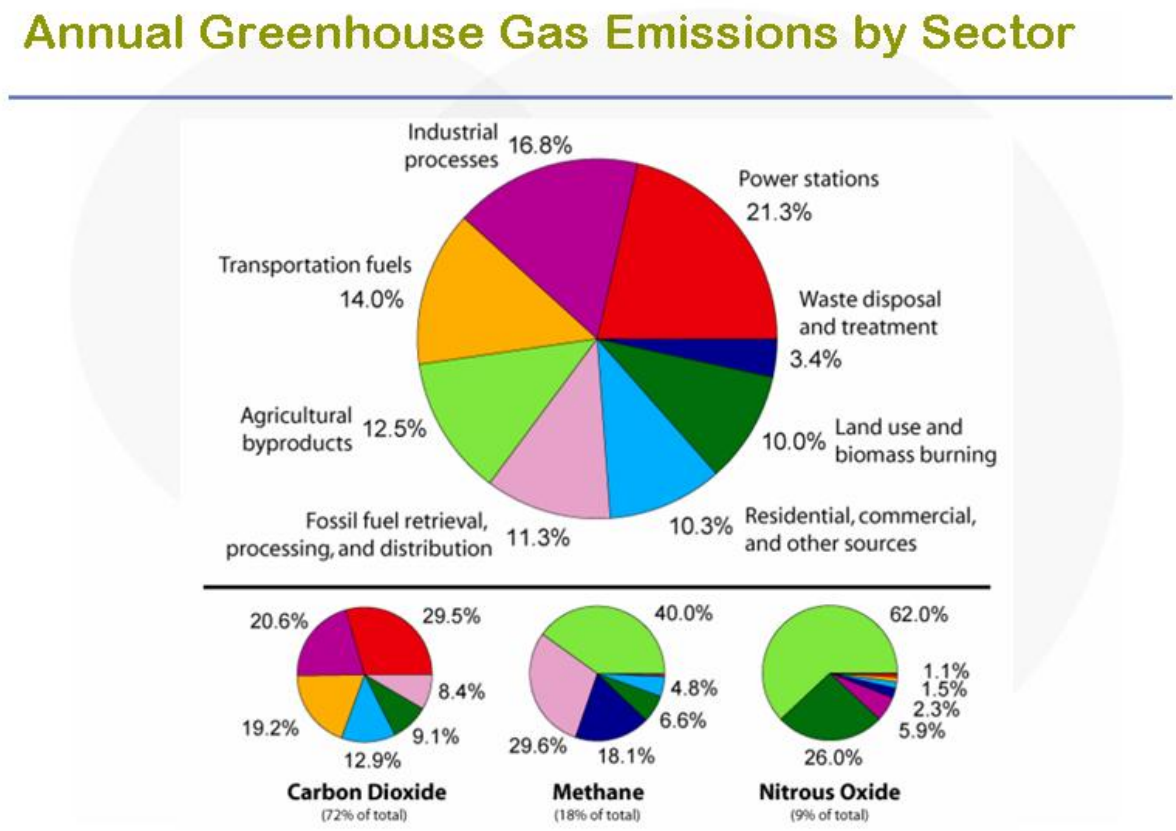


Figure 21.Annual Greenhouse gas emissions by sector as cited by Tanyalynnette Rosmarino