

**SUSTAINABLE AGRICULTURE: EXAMPLE OF A
STRAWBERRY FARMER IN GERMANY**

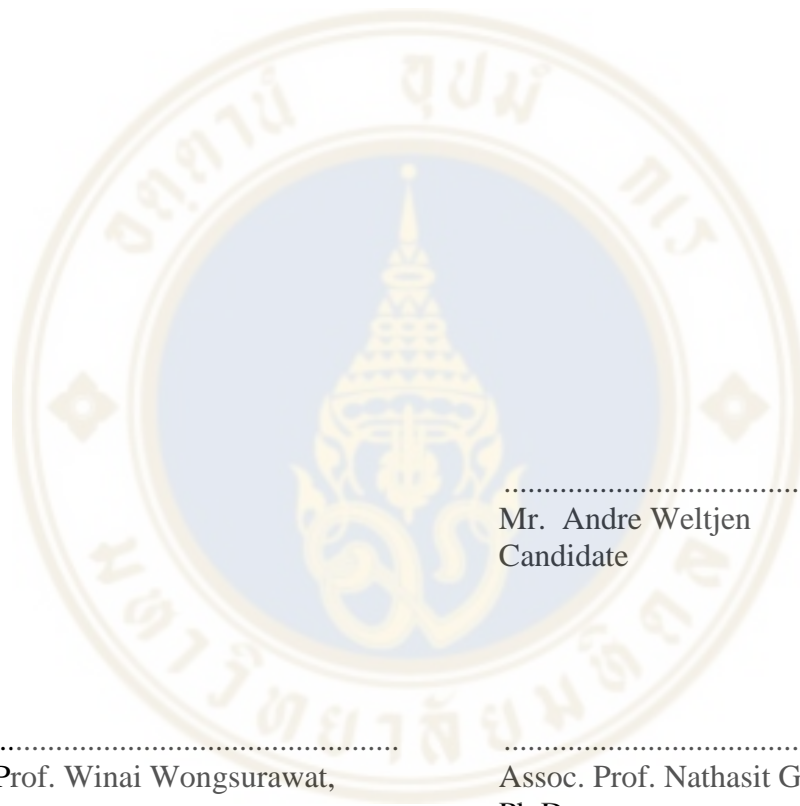


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**SUSTAINABLE AGRICULTURE: EXAMPLE OF A
STRAWBERRY FARMER IN GERMANY**

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SUSTAINABLE AGRICULTURE: EXAMPLE OF A STRAWBERRY FARMER IN GERMANY

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ABSTRACT

The population of the world is constantly growing and therefore the amount of needed food, as well. Producing food is connected to a huge amount of emission and there are a lot of waste around the whole world regarding the food production. This paper aims to analyze how a strawberry farmer in Germany can produce strawberries more sustainable. At the end there are three main findings which are deeply explained. Yet, there were more findings found and could be found, but they extend the amount of this paper. The research was conducted in three months on a real project of a farmer who is currently constructing plastic sheet green houses for his strawberry growing. Furthermore, he still has the classic outland growing, so that an observation and comparison of both principles was possible. The data collection was conducted through two qualitative interviews, own observation as well as academical references from different university libraries. However, the plastic greenhouse was not finished during the research period, so that the farmer only could explain how it will work in the future. Sketches from the future greenhouses are attached in the fifth chapter.

KEY WORDS: Sustainability/ Agriculture/ Green IT/ Corporate Social Responsibility
28 pages

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CHAPTER I

INTRODUCTION

Agriculture is the production of food and cultivation of economic plants as well as animals for production for the nutrition of the human beings. The word agriculture descended from the Latin word “ager” which means “field” and the Latin word “cultura” which means growing. Before professional agriculture was developed the neanderthal were looking for the fruits such as berries and vegetables such as mushrooms in the forest and collected them in their natural habitat. Animals were not bred, but hunted in the nature, therefore if the hunters were not successful on their haunt, the people had only the vegetables and fruits to eat. With time the agriculture in connection with new systems and technologies developed more and more, so that there is a huge diversity in fruits, vegetables, and animals nowadays. Agriculture can be divided in six main sectors: arable farming, fruit-growing, market gardening, cattle breeding which is further divided in milk and egg farming. In the following, this paper will define the different sectors with some examples, which do not include all the different kinds of vegetables, fruits, and animals, because the examples only shall help to give an introduction of agriculture and its diversity. Arable farming is separated in grains such as wheat, pulse such as peas and beans, and root crops such as sugar beets. Next, the fruit-growing includes all fruits such as strawberries, blueberries, bananas and many more. Continuing with the market gardening, which also has a huge diversity. We can find different kinds of salads, herbage, and cabbages in the market gardening. At the cattle breeding we will find the breeding of animals for slaughtering such as cows and chicken, whereupon cows also are used for the milk and chickens for their eggs.

The world population increased immensely in the last couple centuries. In the year 1500 the world population added up to 0.5 billion humans and grew until

2020 to around 7.79 billion people (Statista, 2019). *The more people on earth, the more food* and therefore agriculture is needed. With the developing technologies and growing world population, the harmful substances resulting from the industrial livestock farming increased immensely, as well. For this reason, sustainability is becoming more and more important to reduce the harm to the environment and the people itself. Firstly, the term sustainability was used in the forestry and books and people have different definitions for it, however it leads in the same direction. The interviewee, which will be introduced in the third chapter in detailed is an experienced professional farmer who described sustainability as described in the following paragraph. In the second chapter, this paper will define sustainability more in detail and more accurately.

Sustainability is the ability to be able to live in the future, an equilibrium state between the usage of the world's resources and his recovery, as well as a responsible acting for the environment and all the human beings on earth. Another term the interview used was to be cautious about your acts and simply to "do the right". In addition, if something is enduring, we can say that it is permanent, reasonable, good for the environment and long-lasting. Nowadays, sustainability is prevalent in all industrial sectors: ecology, economy, and in the social sector. Based on that, there are several different sustainability concepts and techniques. This paper will focus on "Green IT" and "Corporate Social Responsibility", which are defined and described in the second capital and linked to the research results in the fourth chapter. Yet, there are many more concepts which could be linked to the topic of this paper, but the author chooses the mentioned one in the process of the research and interviews, since both can be linked easily to the fruit farmer and his new project of the plastic sheet greenhouse to grow strawberries. The general process of growing strawberries will be described in the next paragraphs. The description will include all necessary processes regarding facilities and resources which are needed to grow strawberries and to understand the research and analysis of this paper.

The first thing you need to grow strawberries is a field where you can plant your seedings. In our case, the farmer buys them from the Netherlands and plants

them in Germany. Those specific seedlings are without a root, therefore they have to grow for one year until they have their own roots and then they will be stored in a cold store for one year after they can be planted again to grow strawberries then. There is also the possibility to buy plants with roots already, but those are more expensive. On one hectare (10.000 m²) field, the farmer can plant 20.000 -25.000 plants. During the growing time the plant needs water, fertilizer, sun, and plant protection. Firstly, the sun cannot be controlled in the outdoor, so that the farmer always has a risk of too little or too much sun. Then, the field in the outdoor contains sixteen different nutrients such as phosphorus, magnesium, calcium, and nitrogen. Those nutrients are needed by the plant to grow and flourish. However, depending on the weather and the natural ecosystem, the field will not always deliver the nutrients in the right amount, for this reason the farmer needs to use a fertilizer mixture to provide the plants with the needed substances. If the nutrients are insufficient the plant will not grow, and the crop will be less. The fertilizer has an unpleasant smell and prohibits other plants to grow in their natural habitat as well as the plant cannot absorb all of it and some fertilizers are washed out by the rain. Depending on how much rain falls during one season, the farmer must irrigate the plants with subterranean water. Yet, if there is too much rain, the plant will get diseases such as fungal attacks. Next, to protect the plant from other plants such as weeds and acarian, the farmer needs to sprinkle plant protection. He uses a tractor with a special machine and plant protection mixture to put it on the field and the plants. In this connection, the plant is protected, but also all animals and plants, which are not dangerous for the strawberry, will be killed, as well. In Germany, there are less and less plant protection mixtures which are allowed to sprinkle as well as only a certain amount of it. The same law applies for the fertilizer. Lastly, when the strawberries are ready to harvest, the employees have to gather the strawberries among the plant lines on their knees or while hunkering down, place them into boxes and carry them to a euro-pallet. The pallet will be placed into a transporter and then delivered to a middleman. One worker is usually able to harvest up to 10 kilos in one hour. The process describe as above involves many things which are harmful for the environment and the worker. This paper therefore is going to analyze the question how

a fruit farmer in Germany may grow strawberries more sustainably. Since this paper is limited, not all aspects can be analyzed and mentioned deeply. It will give more an overview of the main things and mention the main obvious aspects from it.

Motivation for research:

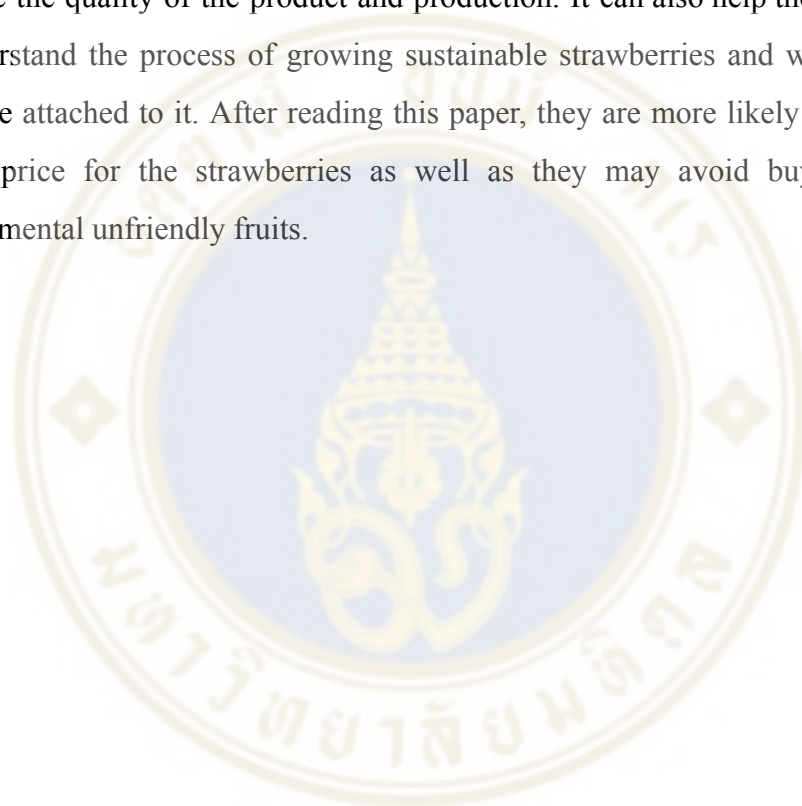
Primarily, the motivation for this paper is to seek a deeper understanding about the practical use of sustainable technics in Germany in the strawberry agriculture as well as which benefits the farmer, and the environment receives by using them. For further investigation, research, and for farmers who want to use the same techniques, this paper may help as a foundation. Since the author works part-time in the investigated company, he has access to more and deeper information about the whole growing process and can use a variety of research techniques to provide a more accurate result. In addition, the project is in the middle of its process, so that we could observe a little bit of the progress over 10 weeks. When the project is done, a paper in the future could investigate the findings of this paper and dig even deeper.

Secondarily, whereas there are only on google scholar more than one million findings with the term “sustainable agriculture in Germany”, there exist not one research about the observed company and the chosen project, which makes this paper exclusive and unique. While most research papers in the agriculture field are more about sustainability in general, this paper aims to be as narrow as possible and provides results from a real-life project.

Lastly, another motivation for this paper was the participation in a leading for sustainability class and the curiosity awakened with it. The learned academic management tools in this class should be proven as more than a theoretical framework, but a practical help to reduce waste and improve efficiency. The chosen project shall be the real-life proof as well as linkage between the theory and praxis. Based on these theories, the investigation was created and conducted. However, there are far more sustainability theories, which we could have linked to the project, yet this paper is limited to the two mentioned.

Industry value of the research:

This paper is valuable for all fruit farmers, especially for those who want to be more sustainable, but doubting its effectiveness and efficiency. The example from this paper will show them, that not only them can benefit from it, but also the environment and the end consumer. It may be useful for all people working in agriculture to show them how easy it is to save resources and how simple it is to protect the environment without losing a high-quality product. Indeed, they can even improve the quality of the product and production. It can also help the final consumer to understand the process of growing sustainable strawberries and which efforts and costs are attached to it. After reading this paper, they are more likely willing to pay a higher price for the strawberries as well as they may avoid buying cheap and environmental unfriendly fruits.



CHAPTER II

LITERATURE REVIEW

Sustainability:

Sustainability concepts were firstly founded in the biology and ecology area as a measure how fast regenerative raw material source could be used or harmed by pollution excluding jeopardizing the ecosystems around it (Vos, 2007). Then, economist, politicians, managers, and engineers started to use the term in their field in their own way. For this reason, nowadays, there are more than hundreds of definitions of sustainability, therefore you will find sustainable related terms in different industries and work areas such as sustainable societies, sustainable development, and sustainable agriculture. Yet, all of them have some common factors. First, all industries consider environmental problems in correlation with economic and social factors. Second, other industries and business planning have a shorter forward-looking organization compared to sustainability planning with a larger time scale. Lastly, another shared core part is to outperform governmental laws and regulations instead of reaching the minimum. Normally, businesses perform in the way that they reach the regulatory requirement just like that to get an advantage (Vos, 2007). In 2015, Portney strengthen the mentioned variety of definitions of sustainability as well as that it became more and more popular in the mid-1980s and has developed in several directions since then. In addition, he refers to the most used definition from 1987 by the World Commission on Environment and Development, which says that present sustainable actions do not threaten the fundamental requirements of human in the future, but still satisfy the current needs. Next, Portney (2015) pointed out that sustainability is not the same as environmentalism or maintenance of resources in the nature, however, it looks more at the world's biophysical environment especially regarding the usage and inaction of it. Further, sustainability is a concept to look for a

balance between supporting the world population as well as growing economy without damaging all creatures on the planet because the natural resources cannot be utilized unendingly.

Green IT:

For different people, green IT (information technology) has a different meaning. For some, it is the use of a certain product and technology until it is not usable anymore and that it is appropriately recycled. For others it means we utilize technology to reduce the environmental harm with pollution by doing a video conference instead of traveling around the world. Then, for others it is creating an online system center that needs less energy compared to in house data centers (BCS, The Chartered Institute for IT [BCS], 2012). Therefore, we can say that all three mentioned definitions have similar core factors regarding saving energy and reducing waste to damage the environment less and improve your carbon footprint.

Generally, IT was used to improve the life of the society in the sense of production, communication, economism, and the social welfare. However, whereas keep providing beneficial economy, IT more and more shall help to design an environment which is more sustainable. There are hardly any industries which do not use or require IT currently, but IT is also using a lot of energy and is part of the problem (Gangadharan & Murugesan, 2012). In an earlier book, Murugesan (2008) describes green IT, which is also known as green computing, as developing, and using electronic devices such as computers, printers, as well as networks and communications systems in an efficient and effective way, so that the cause to the nature is not existential or at least at a minimum. In 2012, Gangadharan and Murugesan report that reducing the greenhouse gas emissions and increasing the performance of energy is due to the advantage of employ green IT. According to this, it incorporates three main areas: the whole charge of ownership such as disposal and recycling, ecological sustainability, and economics of energy efficiency.

The background behind using green IT has different reasons. The cost for energy is rising in combination with higher needs for it, the reputation in society is

more depending on goods and services, which are more environmentally compatible, the responsibilities of organization regarding the environment are huger by the society, and tighter governmental and compliance requirements (Gangadharan & Murugesan, 2012). All mentioned reasons can affect a company directly and indirectly and cause a decrease in revenue or a penalty in case of not following the law, therefore all companies should consider using green IT in their own and public interest. Another example is the point of view from investors, which keep more an eye on the sustainability of a company before investing in it. Besides, investors are getting an increasing interest in supporting product and services with a high sustainability. Furthermore, consumer spending more attention to the carbon footprint of companies and their products and services, as well (Gangadharan & Murugesan, 2012). The main factors for using green IT are summarized in the chart below:

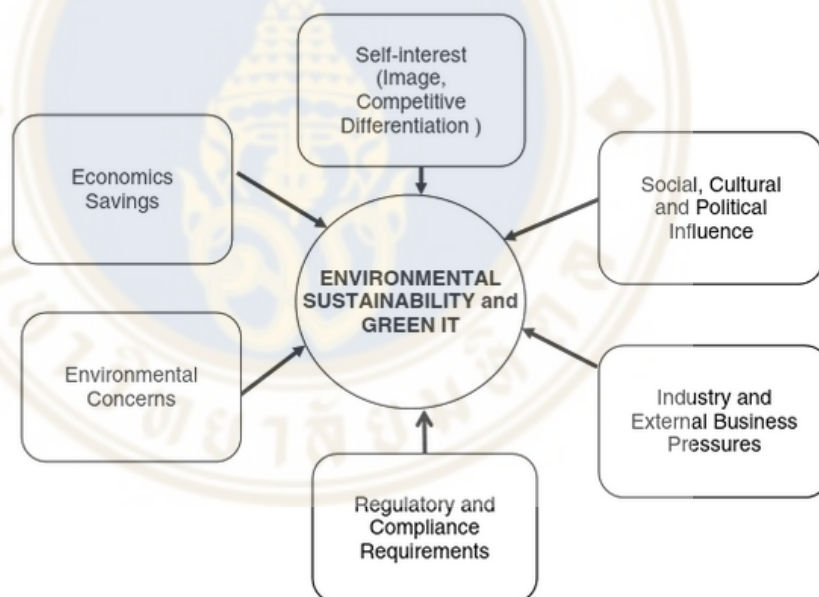


Figure 1.1 Drivers of environmental sustainability and green IT

Source: Gangadharan & Murugesan, 2012

All mentioned factors were already listed in the definition in the current chapter. The chart is a help to have all influences from all areas in a simple overview.

In addition, with this chart it is even more clear, how many factors are including green IT and strengthen the reasons to deal and use it in a company.

Corporate social responsibility:

The basic understanding of corporate social responsibility (CSR) is that the responsibility of company owners protrudes beyond the main intention of earning money to all stakeholders included in the business. Customers, workers, and the natural environment, for instance, are some of those stakeholders. It does not matter how small or big a company is, the concept of CSR concerns all organizations, yet huge firms are more investigated, because their carbon footprint is larger compared to small companies (*SAGE brief guide to corporate social responsibility, [SAGE], (2012)*). First attempts of CSR can be found in the 1930s, but the concept and the usage of it became more popular in the last 50 years. Mostly, we will find the transformation of the concept in developed countries and the United States of America, however the concept also became more and more popular among Europe in the last couple years (SAGE, 2012). As mentioned, it can be used for all company sizes and does not differentiate the type of organization, this paper will use corporate social responsibility as one of the management theories to link with the findings in chapter four.

Dashwood and Hevina (2012) came to the same result in their book by saying that organizations have spent more attention to CSR in the areas of employees, human rights, and the environment, in the last twenty years. In addition, they also define CSR as the process or actions which companies must take behind the governmental laws and regulations. However, this is only one way of describing it, because there is not one specific definition of it. Back in the days, there was an understanding of companies, actions and behavior is fine, as long as it is legal the first priority should be maximizing the revenue. Because of this thinking, countries introduced more regulations which protect the employees, human rights, and nature. CSR can be understood as the voluntary actions of a company, which puts efforts in environmental arrangements even if it is not required by the law. Beyond, the concept of corporate social responsibilities wants companies to commit to a few general

regulations combined. The terms mentioned by Buchholtz and Carrol in 2014 are a kind of self-regulation, spending attention to the general wants and needs, accountability for their stockholders, and awareness of the community and environment. All referred terms are in accord with the terms mentioned by other authors in this paper.

Lastly, this paragraph will explain some of the real-life practices which a company can conduct to be seen as a company with high attention to CSR. One example could be the hiring of a certain number of female workers, older workers, or workers from a minority, although the law does not require a certain percentage of woman employees. Another example could be the reduction of cars with a diesel engine or the investment in expensive technology or facilities compared to cheaper and less environmentally friendly options. Regarding the prices on the market for a certain product or services, some companies use the “fair trade” thinking, so that they pay certain trade partners more than the average price on the market (SAGE, 2012). To summarize, this paper only alludes to some of the practices covered by CSR, because there are too many practical examples which would exceed this short research. The definition and showing of practices examples intended to get a basic understanding of the concept and to understand the linkage between the lesson learned in chapter four and the concept of corporate social responsibility, which will be defined deeply there.



CHAPTER III

RESEARCH METHODOLOGY

The primary research of this paper was conducted through two qualitative semi-structured interviews with a fruit farmer who has his own business in Germany. This type of interview allowed me to ask open-ended questions and the responder could answer openly and fluently. Sometimes the business owner tended to answer the questions in a too wide-spread direction as he is super passionate about it, so that I had to interrupt him and made sure that we kept our focus on the topic of the paper. In addition, when he spoke too general about something I asked further questions such as “Can you delve a little bit deeper on that, please?”. Yet, because of this fact I could tell that he is a good choice for the interview, since he loves his job and has a deep knowledge about it, which I will prove in the next paragraphs. Since the project has

firstly started, there was no real chance for direct observations, although the field is close to my house.

I have worked in his company for more than a year in the blackberry area, where similar techniques are used as in the new sustainable plastic sheet greenhouse, therefore I could use some of my own experience for the analysis as well as for the creation of the questions. Lastly, the interviewee suggested to me some German magazines and newspapers to get more general knowledge. In addition, I watched a thirty-minute documentary about the general strawberry cultivation farming to get a base for this paper. At the end, I brought all gained information together, to answer the research question on how a fruit farmer in Germany can be more sustainable with examples of three main resources.

This paper only includes three interviews of one person of the company, because all employees besides me are Romanian unskilled worker who do not have knowledge about the process of strawberry crop growing. Furthermore, the farmer's wife would have been a potential interviewee, but her knowledge about the new plastic sheet green house is not as deep as from her husband according to her own statement. Alongside, there are no other employees in his company, which made the decision to have a few deep interviews with the business owner himself. Another reason for this decision was time management. In the current season of the year, he is super busy and has many things to do and normally he would not have time to help with such an intensive paper. Fortunately, I could offer him to work more than usual to get him some free time, which he thankfully spends to listen and to answer to the question of this research.

The fruit farmer, let us call him Mr. Peter, has worked in the agriculture his whole life. His grandfather started to work in this field and founded his own business over 60 years ago. The father of Mr. Peter worked in the company since he was a child, as well. The interviewee did the same, hence we can say he has over 25 years of experience in the agriculture business with an age of 31. Mr. Peter and I went to the same middle school to the same class and with the age of 16 he successfully finished a three-years education as an agriculturist. Then, he did an internship in fruit-growing

including a stay in Canada. Afterwards, he went to a university to become an agricultural business economist. In the whole time, except the time in Canada, he worked in the agrarian company from his father and gained even more experiences. In 2015, Mr. Peter and his wife decided to open their own business with blackberries in a greenhouse. Unfortunately, his father and mother died already, so that he owns the whole family business, now. The whole company owns 250 hectares, which is a lot according to him, since the average farmer owns 60-70 hectare. In those hectares are included sugar beets, wheat, barley, chicory, rhubarb, strawberries, blackberries, apples, pear, cherries, mirabelle, black and red currant, and gooseberries.

The first step was to ask Mr. Peter if he would be willing to help with this paper. I started the research project when I was in Norway, hence I had to call him. The call was made on the 3rd of June around 12pm. I explained the project to him and that my interest is in the field of sustainability, and he gave me some suggestions, which topic I could choose for his company. He mentioned a new plastic sheet greenhouse, which they are planning to build and started to prepare already. After the talk it was clear that the mentioned project is a good choice for this paper, thus my preparation and research could take the next step.

Then, after I researched some sustainability topics with the help of several academic websites and the class “Leading change for sustainability” at my university in Bangkok, I started to prepare the qualitative questions. Due to my exchange in Norway, I had also access to their library and online library as well as I used google scholar for a widespread research of references. The first interview was conducted on the 14th of June around 1pm at his office at his company. With the answers to my questions, I could think more about it and which lessons learned I will have and can link to the sustainability concepts. The next step was to phrase more questions to get a deeper understanding about the whole process and different areas. Mr. Peter was willing to take time for a second interview, which took place on the 21st of June around 11am in his office at his company. Lastly, if something has been unclear or I needed more knowledge about it I could call him to ask for clarification, which I did twice.

The questions below were the base for the interview. It is separate into the two interviews, which have been conducted.

Table 1.1 Interview questions

Topic	Questions
Strawberry cultivation	<ol style="list-style-type: none"> 1. How is the whole process of growing strawberries? 2. How many different kinds of growing strawberries exist? 3. Which kind of strawberry growing do you use in your company? 4. How many hectares of strawberries do you have?
Sustainability	<ol style="list-style-type: none"> 1. What do you know about sustainability? 2. Which sustainability concepts do you know? 3. How important is sustainability to you?
Plastic sheet greenhouse	<ol style="list-style-type: none"> 1. What is a plastic sheet greenhouse? 2. Why do you choose to build a plastic sheet greenhouse? 3. What are the drawbacks of a plastic sheet greenhouse? 4. How much time and how much money do you need to build a plastic sheet greenhouse? 5. How big is your plastic sheet greenhouse going to be and how many strawberry plants will be planted there?

Table 1.1 Interview questions (cont.)

Second Interview	
Topic	Questions
Plant protection	<ol style="list-style-type: none"> 1. How do you use plant protection in the plastic sheet greenhouse and how much kilogram/liter do you need for 20 plants? 2. How do you use plant protection at the outland growing and how much kilogram/liter do you need for 20 plants? 3. Which governmental laws do you must follow regarding plant protection use?
Employees	<ol style="list-style-type: none"> 1. How do your worker harvest strawberries in the greenhouse? 2. How do your worker harvest strawberries in the outland growing?
Fertilizer	<ol style="list-style-type: none"> 1. How do you use fertilizer in the plastic sheet greenhouse and how much kilogram do you need for 20 plants? 2. How do you use fertilizer in the plastic sheet greenhouse and how much kilogram do you need for 20 plants? 3. Which governmental laws do you need to follow?

The interview was really comfortable for both sides because the interviewer and the interview knew each other for a long time. For this reason, Mr. Peter could speak absolutely freely without being nervous. The obtained qualitative data was given in speaking words and written down on a paper. All information from the interviews, online research, and own experiences in the sustainability class and the fruit farm were taken together to do the analysis in the next chapter.

CHAPTER IV

FINDING ANALYSIS

The following chapter will analyze the findings from the semi-structured interviews with Mr. Peter. The main point is a plastic sheet greenhouse, which will firstly be described and afterwards the main aspects will be linked to three main points including the different facilities and recourses included in the strawberry grow. The three main findings regarding the plastic sheet greenhouse are divided into business aspects, environmental aspects, and the personal fulfillment. Several aspects can be linked to more than one or to all of the main findings with a different approach, which will be explained in the following, as well. Unfortunately, the plastic sheet greenhouse was still at the beginning under construction, so that the author could not provide pictures of it. For the analysis, the interview, general knowledge, and personal experiences were included. After the plastic sheet greenhouse and the main points are explained, the findings will be linked to the sustainability theories Green IT and Corporate Social Sustainability. The concepts and terms were already described and defined in the second chapter.

Plastic sheet greenhouse:

The plastic sheet greenhouse is a construct where fruits can be grown with the help of technology. The first step is to buy scions of “mother plants”. Those plants are put in “tree” plates on the floor. Although the plastic greenhouse is not building the growing process started already. The plants need to grow until they are bloom. Then the plants including the plates will be put in a cold house for one year and then put back in the plastic sheet greenhouse. The plants are put close next to each other, so that on one hectare plastic sheet greenhouse are 80.000 – 85.000 plants compared to the outland on one hectare of 20.000 – 25.000 plants only. The house consists of metal

bars where a specific plastic sheet is built around, so that the plants are covered and cannot be influenced by the weather as in the outland. Along the plates where the plants are planted, recline pipes for the water and fertilizer, which can be added manually and with the help of the specific technology. The plant protection is given through beneficial organisms and some chemical plant protection. In the future, the farmer will plant certain trees around the plastic sheet greenhouse, where beneficial organisms colonizing. Those animals will find their way to the plastic sheet greenhouse by nature and through the smell. Acarian and spiders whose are jeopardize the strawberry plants will be killed by those beneficial organisms. The computer attached to the greenhouse analyses the salt value in the water and the pH value. The pH value describes the condition of the water. It is sour, neutral, or alkaline. With the results of it, the farmer can change the value of the water and fertilizer given to the plants. In addition, if the plants are getting some diseases, the farmer can change the instruction through the technology to heal them. In general, the owner can instruct the computer to keep the substrate to a certain amount. Through sensors the computer measures it. Depending on the warmth and the light of the sun, the computer automatically adapts the water and the fertilizer. Then, next to the greenhouse is a huge tank to save the rain for the period when the water is needed. Lastly, the berries are always grown to the way in between, so that the employees can walk through the lines with a little barrow and harvest them while standing, because the plants are attached to pots and those are located one meter over the ground. In the following are shown two sketches of the plastic sheet greenhouse.

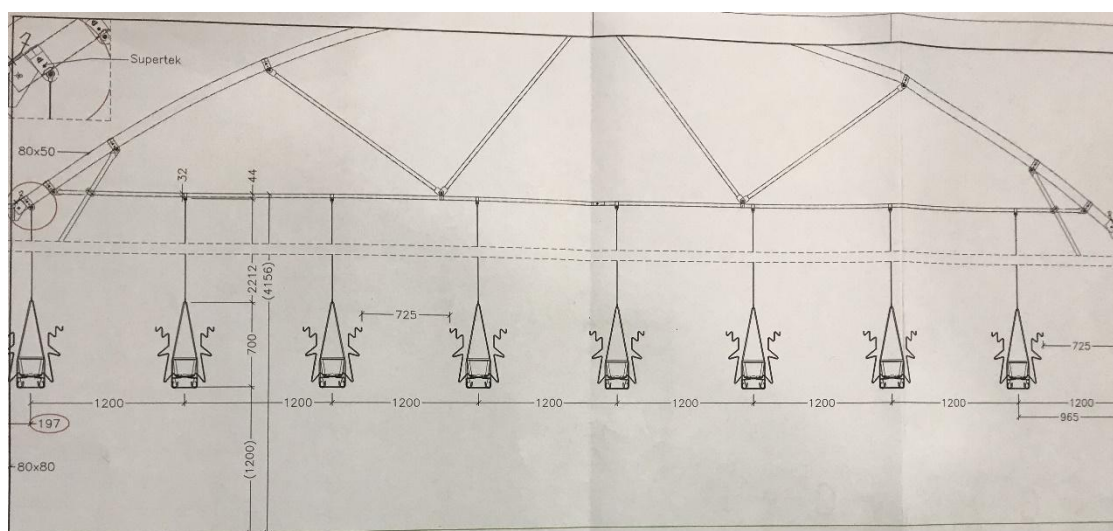


Figure 2.1 Side view of the plastic sheet green house

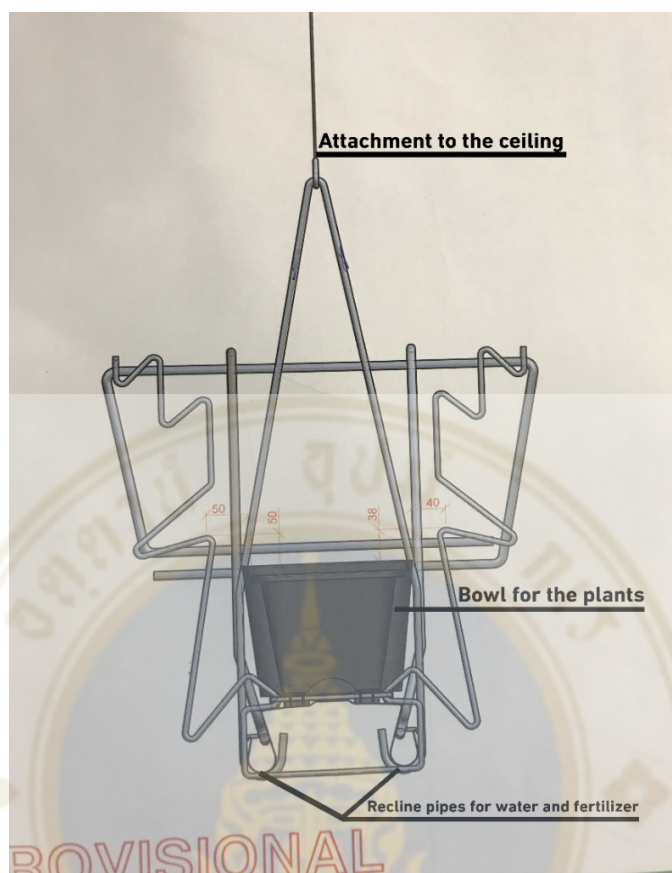


Figure 2.2 Side view of a plant attachment

Business benefits:

Regarding the view on the business itself and the cost and reward we can find some key points in the different facilities and resources. Starting with the water usage in the greenhouse. Firstly, it seems like a disadvantage that the greenhouse is completely roofed, since the natural rain will not reach the plants, but because of the tank, water from the winter is saved and can be used later. Further, the water in the greenhouse is in an endless circle until it is used by the plants. All the water which the plants cannot be used is going to a cored hole and will be used again. In addition, the water which evaporates is also caught by the cored holes, as well. For this reason, the farmer does not need to pay for any other water. 1000 liter are around 14 cents in Germany. The outland plants need around 565 mL/m² and the plants in the greenhouse

only 210mL/m², although there are more plants per square meter. The reason is, that they are closer to each other, and the water can be used more efficient and effective. The rainfall in the outer is around 250 mL/m², so that the farmer has to buy around 315 mL/m², so 3.150.000 l per hectare, which is around 441€ per hectare per year in the outland. The greenhouse does not involve those costs, because all the water is saved during the whole year, which is not possible in the outland. The greenhouse needs less space with less water but produces more crop as mentioned before.

Looking at the fertilizer, the farmer needs only the half amount for the greenhouse compared to the outland growing. The fertilizer in the outland is sprayed with a tractor and machine, so that also spaces where it is not needed are covered. As well as the plant can only absorb a certain amount, hence some of it is lost in the ground. The greenhouse has more plants per m², the fertilizer is spread better and the amount, which is lost, is absorbed by the pipes and will be used again. For one hectare the price of fertilizer is 10.000€, that is why the greenhouse saves the farmer 5.000€ per hectare.

Continuing with the plant protection, the outland growing needs four tons more chemicals as the greenhouse does. The outland is directly affected by the weather, while the greenhouse is not. If it is too warm or too cold the beneficial organisms do not kill all the enemies, which are attacking the plants, because they are not outside but looking for comfortable places. The greenhouse can be closed, so that the beneficial organisms will stay inside as well as the animals around the greenhouse will come inside, because they can smell their food. Thus, the greenhouse needs less chemicals, so that Mr. Peter saves more money.

Lastly, analyzing the impact of the employees, we can say that Mr. Peter needs less workers and finds workers more easily. In the outland growing, hardly someone wants to do the job, because it's physically hard work and the weather conditions can be hard, as well. Average workers harvest 10 kilos in an hour, while in the greenhouse a worker is able to harvest 35 kilos an hour. The employees can work while standing and the strawberries are growing all on the same side. In the outland the strawberries are growing in all directions, so that it takes more time and sometimes

the worker has to search for more. In total the farmer has only half of the salary in the greenhouse compared to the outland.

Environmental benefits:

As already mentioned in the business benefits, Mr. Peter needs less resources in all aspects, therefore we can say that it is in general more environmentally friendly and more sustainable. First, the water usage is less, and he is not using any of the ground water, so that the water stays in the ground or in waterworks. The water he is not using can be used by all the other humans or the nature itself and biological circle regarding water is not really affected by him. Furthermore, he can use some of the water over and over again, because it is caught by the system, hence he saves even more than a normal fruit farmer without a plastic sheet greenhouse.

Next, the fertilizer he needs is also way less and it does not affect any other life forms, because the greenhouse has its own little circle. In the outland growing, the usage of fertilizer is not efficient and all plants around the field are automatically affected. With the greenhouse he only includes the strawberry plants and is not killing plants in their natural habitat. For this reason, the fertilizer does not affect the environment at all.

After that, the plant protection as describe in the business benefits is less in the greenhouse compared to the outland growing. In numbers, the greenhouse needs four times less than the outdoor as well as only animals are killed, which are really dangerous for the strawberries. In the outland growing the plant protection kills everything which is covered from the plant protection, but in the greenhouse only those animals who are trying to eat the plants are killed. The same for other plants in the outland, which are killed. In the greenhouse are no other plants besides the strawberry plants. For this reason, the diversity of plants and animals is not affected and the greenhouse regarding the plant protection is more sustainable, as well.

Personal fulfillment:

The personal fulfillment from Mr. Peter is the sustainable growing and the less harm for the environment, the healthier product, and the less harm for his employees. With all mentioned facts, we can see that he needs less chemicals, which are affecting the environment. Thus, he has a good and self-confident feeling, since he is trying to impact the environment as little as possible. Secondly, the strawberries are healthier, because he is using less chemicals and through the technology, they are growing more natural. Lastly, the employees must not be on their knees all day or are affected by the weather, which makes them feel better. They have less pain, and the work is easier to do, so that he has not to worry about their health as much as he has with the outland farming.

Green IT:

With the plastic sheet greenhouse, Mr. Peter is using a kind of technology that helps him to be less harmful to the environment. As describe in the second chapter, that is one of the definitions which is totally fulfilled. The computer supports his work and makes it easier for him as well as he needs less resources and facilities. This fact can also be linked to the figure 2.1, where it mentions economic savings, environmental concerns, and the self-interest. We already explored that the farmer saves a lot of money for one year and will save even more in the view of the long-term. Next, the environmental concerns are given, because with the plastic sheet greenhouse he harms the environment less than with the outland growing. If he had no concerns, he could keep the growing the same. Lastly, the interviewee said that it is also in his self-interest to be more sustainable and produce healthy foods for the humans. He is concerned about others and his image in the society, as well. Although the greenhouse uses a lot of electricity it is less harmful than the outland growing based on all the mentioned facts in this paper so far.

Furthermore, in the outland growing he must use tractors and a lot of fuel for all fields. With the greenhouse, he does not need the tractors and fuel. Further, he gets support by the government to act more sustainable, hence the concept of Green IT

is fulfilled even more, because of the political influence, which can also be found in figure 2.1.

Corporate Social Responsibility:

CSR as describe in the second chapter has many definitions. To sum it up shortly, they are the actions a business owner takes beyond the governmental law and the actions beneficial for workers customers and the environment. With the greenhouse, Mr. Peter fulfills all of them. Firstly, in Germany there are rules regarding the usage of fertilizer and plant protection. Many farmers use exactly as much as they are allowed to, to increase their rewards. The farmer is wide under those regulations as describe before. Next, Mr. Peter builds a greenhouse, which costs him 900.000€ per hectare and involves a lot of work, as the author has seen while working for the company. Mr. Peter starts working around 6am and sometimes works until 11pm, because besides the building of the greenhouse, he also has his usual business. We can clearly say that he puts a lot of effort in to benefit the workers, environment, and the customers. The workers have a way easier job to do and are less likely to be injured due to being on their knees for hours for days. The environmental benefits are already explored on the last two pages, yet we can link them to the CSR model and concept. Lastly, the customer benefits on the hand of the healthier product and on the other hand indirectly with an environment that is less harmed. Putting all the mentioned things together, we can surely say that Mr. Peter has a high corporate social responsibility.

CHAPTER V

SUMMARY

This paper has analyzed and compared the normal outland growing of strawberries to the plastic sheet greenhouse growing of strawberries regarding the usage of water, fertilizer, plant protection and the conditions for the employees. The literature review and the introduction gave the reader a good impression of the topic and to get the basic knowledge about strawberry growing. This paper does not include all aspects of the growing and further research could be delved even deeper to get more accurate numbers of the savings and describe the advantages even more.

The different interviews and phone calls were the main source of the analysis and the introduction of Mr. Peter showed that he has a lot of experience in this field and is a good and trustworthy person for the interview and research. Moreover, the authors experience in the company in connection with his theoretical knowledge about sustainability, build a good connection to analyze the topic. During the interviews it was clear that Mr. Peter knows and has more information than this paper could include, for this reason the author limited the analysis to water, plant protection, employees, and fertilizer. A deeper and longer research could for example have involved the distribution of the strawberries, the possibility to grow strawberries all year or the more efficient and effective use of arable soil. However, the interview showed that there are no disadvantages in building a plastic sheet greenhouse.

The analysis of the mentioned facilities and resources have shown that a fruit farmer in Germany can be more sustainable by using a plastic sheet greenhouse, so that the main research question is answered. The paper gave several examples how each of the resources is used less in the greenhouse compared to the normal outland growing. The additional water usage besides the rain is not existential in the

greenhouse, the plant protection is four times less, the fertilizer usage is half as much and the employees can work faster, healthier, and more efficient and effective.

For the analysis this paper used the sustainability concepts of Green IT and Corporate Social Responsibility, which are explained and describe in detail in the second chapter. There are more books and definitions as covered in this paper, but the main idea is explained in both cases. In addition, the paper could have included different concepts and theories, since sustainability is becoming more and more popular, and more and more concepts are developed and used. The author assumes that we can link the findings to several concepts, because the result is that the farmer is more sustainable than before and that is the base of all sustainability concepts. Even the findings in this paper could have been analyzed deeper and further, but the main question is answered with the current one.

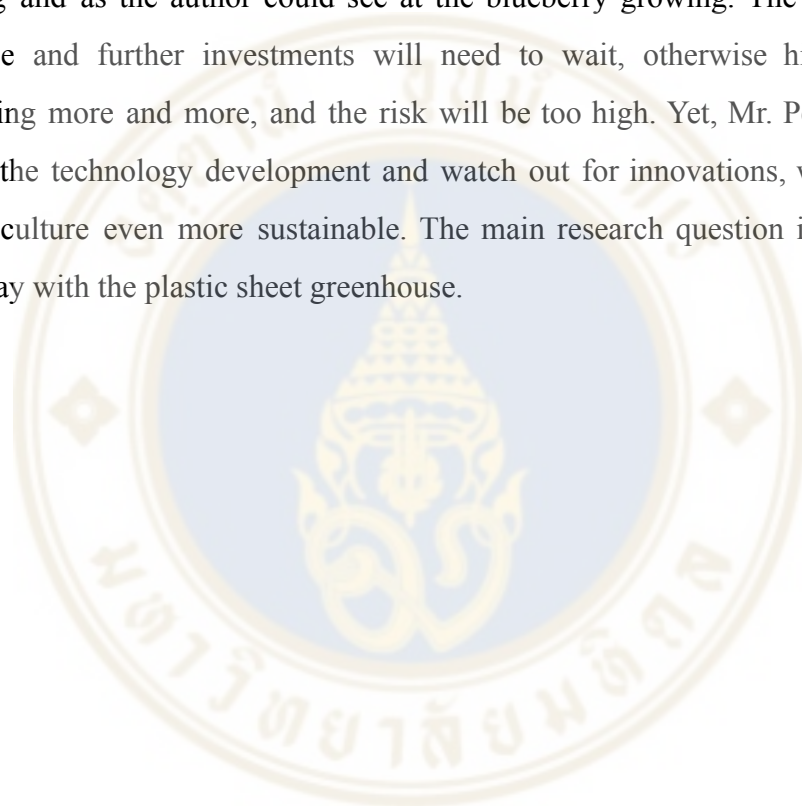
Lastly, we critically have to say that although the effort is huge and the building of the plastic sheet greenhouse costs only for the building and technology itself 2.7 million euro, not included all the fuel and working hours, in the long-term, Mr. Peter will have less work, more crops, as well as a higher reward. Mr. Peter will be more sustainable, but we carefully can doubt that he would put all this effort and money in the company, if he only would be more sustainable, but the reward would be the same or even less. Those questions could be asked in further research with an anonym questionnaire to get an honest answer from other farmers.

Future recommendations:

In the future, Mr. Peter could involve sustainability in all of his agriculture areas. As mentioned in his introduction he owns a variety of vegetables and fruits. For different processes he can use different concepts and theories, depending on which is the most suitable for which are. As soon as the plastic sheet greenhouse is ready and he is successful with it, he could build another one on his other strawberry fields or increase the current one. After that, he also could try to convince other farmers to build a plastic sheet greenhouse in his area. With this action he would even raise his

corporate social responsibility even more. Next, Mr. Peter could try to use even less plant protection regarding the chemicals, which are still needed in a smaller amount. He could observe the development of the plants and the corps to see if he can save even more. However, this process is combined with a risk of losing his corps so he probably will not consider it, since he is already far more sustainable than other strawberry farmers who do not own a plastic sheet greenhouse.

Finally, to sum up, Mr. Peter is already sustainable at his strawberry growing and as the author could see at the blueberry growing. The investments are immense and further investments will need to wait, otherwise his liquidation is decreasing more and more, and the risk will be too high. Yet, Mr. Peter can keep an eye on the technology development and watch out for innovations, which will make his agriculture even more sustainable. The main research question is answered in a short way with the plastic sheet greenhouse.



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