ethical silk
and its opportunities in the fashion industry

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Chapter 1: Introduction

Rationale

Silk manufacturing is one of the most ancient fabric processes, it is an important part of our history and it dates back to 2674 BC (Gallo et al. 2012). Nowadays its production process keeps its steps mostly unaltered. However, the topic is quite ambiguous. The Higg Index for classification of fibres created by SAC - Sustainable Apparel Coalition sees silk production relatively low at environmental impact and scores it at position 12th out of the 44 fabrics studied (Apparel Coalition, 2012), however, the Environmental Benchmark For Fibres (MADE-BY, 2013) created by Made-By ranks silk under the category Unclassified (Fig. 1). This leads us to ask ourselves why there is such little knowledge on silk and makes silk manufacturing an interesting research topic. Moreover, with today’s upward trends towards sustainability and awareness on animal cruelty, there’s the need to argue to what extent, a natural fibre such as raw silk, could be considered ethical and what alternatives the textile and fashion industry offers. A study on sustainable fabrics is indeed relevant nowadays since green fashion has been hugely growing its popularity over the past few years. Looking at 2005 London Fashion Week, where less than 5% of all designers were engaged sustainably, in 2013 there has been an incredible shift and one third of all designers participating were eco-focused (Kharpal, 2013). However, the path of producing garments which can be defined ethically-made often ends up being a struggle, mostly for small brands which just started their business and find themselves in an ocean of sharks. This is why I conducted interviews with the founders of companies, Indigo Handloom, Seidentraum, The Ethical Silk Company and Organic by John Patrick, and investigated their vision on ethical silk production and its related challenges.
The topic is relevant in terms that it shall give insight into the processing of raw silk in the textile industry, taking into account its positive as well as negative impacts. This report intends to perform as an informative and investigative essay, aimed to silk retailers as well as consumers, providing knowledge about silk production and awareness on the incorporation of possible alternatives to conventional mulberry silk both on a b2b and b2c relationship.

Aim

The aim of this essay is to investigate the positive and negative impacts of silk processing and to argue to what extent this process could be considered objectively ethical, organic, sustainable and healthy. In addition to it, this research will perform as a report on silk production and its related concerns on sustainability and animal cruelty, and will have a particular focus on silk greener substitutes, such as Tussah, Eri, Muga and Ahimsa silk, and how labels in the market introduce these. This research will be aimed at retailers and consumers. The outcome of this research shall conclude in an article for the magazine Ecotextiles News - an environmental magazine for the global textile supply chain which is available offline, online and as an app and is active on several social medias. Awareness on animal cruelty in silk manufacturing is still not spread as much as, for instance, angora fur production, this is why I decided to write about silk alternatives via an informative and provocative article meant to reach mostly consumers. The article is also meant to offer information to businesses which work with silk. The aim is firstly to recommend a direct selling model to young labels in order to keep the prices competitive with
regular silk companies and secondly to keep up with the growing demand for ethical behaviour and transparency. Technologies will enable costumers to know how and were their products are being made and businesses must take advantage of it and use it to create an inspiring narrative of their product's story. Thanks to the comments and insights given by the two industry professionals included in the article, opportunities and threats are revealed regarding the ethical silk market.

Questions

In order to reach this aim it is important for me to investigate each step of silk manufacturing and analyse the current alternatives to conventional silk. The following questions need to be explored in order to give an answer to the reasons of research.

1. How does standard silk manufacturing process work?
2. How could ethical be defined (argumentation) and what does (not) apply to silk manufacturing?
3. How are ethical procedures being implemented in the silk industry?
4. What are the current opportunities and threats?

Methodology

The research methods used to create the research report consist of secondary data from literature as well as primary data that have been collected through interviews with professionals from the industry.

1. How does standard silk manufacturing process work?

First of all, it is crucial to study and describe the steps of raw silk manufacturing. This section will comprehend analysis on silk processing, key definitions and production methods used to make silk fabrics. This information will be retrieved from secondary data taken from books, Internet, articles and reports.
2. How could ethical be defined (argumentation) and what does (not) apply to silk manufacturing?
At this point it is important to argue what ethical could mean in an objective manner and in the broader context. What argued will be applied to silk manufacturing and will highlight its positive and negative impacts. This information will be retrieved from secondary data such as literature and journals and will be treated as source of argumentation on the topic.

3. How are ethical procedures being implemented in the silk industry?
After having learned about all the procedures on the silk manufacturing process, there is a need to explore what greener options to conventional raw silk production exist in the textile industry. I will be taking this information firstly from own research on literature and web and secondly getting in contact with professionals in the field.

4. What are the current opportunities?
This section will be primarily dedicated to the elaboration and presentation of the primary data collected. There will be a gathering of opinions of professionals in the field and their views on the future opportunities of silk manufacturing. This part will lead my research to my final advice and conclusion.

**Structure**

The first chapter of the research report introduces the reasons behind choosing the topic and its relevance. I will provide information on the aim and the type of research that will be carried. In the second chapter the reader will be guided through the secondary data collected, which will consist of explanation of processes and multiple definitions of key terms used in the industry. The third chapter will report the observations drawn from the collection of primary data. The interviews will be presented, allowing me to compare the outcomes and come to conclusions. At last, I will draw final conclusions based on the secondary data researched beforehand and the primary data collected, taking into consideration and discussing the limitations to this research.
CHAPTER 2: Literature review

This chapter will be dedicated to the elaboration of the secondary data collected from literature. It will consist of explanation of processes and multiple key-term definitions used in the silk industry, which are necessary to understand in order to continue with the research.

Definitions & Explanations

Sustainability

"Sustainability is a buzzword. Everybody knows it, but nobody understands it. Actually, it means to be responsible for more than only yourself. Sustainability means meaningful action."
- Peter Kowalski, CEO Bionade

This graduation paper focuses on sustainable fashion and ethical processes - but what does it mean? These concepts are very difficult to define, and have actually quite ambiguous meanings. Notions such as ethical, fair and sustainable don't and presumably never will have a clear applicable definition. This is because there is always room for improvement and sustainable parameters will develop accordingly.

The Sustainable Society Index (SSI, 2014) states there are three determinants that are of relevance when discussing on sustainability: human wellbeing, environmental wellbeing and economic wellbeing (Fig. 2). Being the first two regarded as goals, the latter is the mean used to reach the goals. These three parts are autonomous and separated from each other; however, they could not operate without one another. This means that there has to be a balance that correlates these three parties, otherwise they would experience problems and complications.
This brings us to the theory that sustainable fashion should preserve human and environmental wellbeing in the first place and not be principally aimed at profit driving factors. However, we are aware of the fact that it is very difficult to build a highly profitable business that is considered sustainable and harmless for human and environmental wellbeing, being in this case workers, consumers and the ecosystem. In addition to this, with the settlement of fast fashion in our society and daily lifestyle, consumers' mindsets expect garments at lower and lower prices, a demand that sustainable fashion cannot supply nor fulfil (Irsfeld, 2015).

According to the Oxford Dictionary, behaving ethically means "avoiding activities or organizations that do harm to people or the environment" (Oxford Dictionary, n.d.). Several fashion designers and consumers are aware of the horrors of fur production and are strongly against it (Pozniak, 2016). Rabbits, foxes and minks are killed to provide humans with their skin. This is considered unethical. However, it is little known that silkworms are also killed to supply consumers with lustrous scarves or shawls. This leads to the actual topic of this paper, namely the investigation on how silk manufacturing could be argued in regard to sustainability and ethics, if there are alternatives to conventional silk and what opportunities and threats labels that produce ethical silk must face.

**Silk**

In order to fully understand silk and its uses, it is important to study the fibre and its physical properties.
Silk is a natural protein fibre, it consists of two fibroin-heavy chains and sericin, a gummy substance that cements the two filaments together (Fig. 3). Its triangular cross section has rounded corners and the flat surface of the fibrils reflects light (Gallo et al. 2012, pp.45-48).

Fig. 3 Microscopic view of silk

Source: (DERMA Silk, 2008)

Silk is one of the strongest natural fibres thanks to its chemical composition, which includes alanine and serine. It is resistant to mineral acids, except sulphuric acids, which dissolves it. Moreover, silk has a good moisture regain of 11% and thanks of its good absorbency, silk is comfortable to wear in warm weather and while active. Most important is that silk is biodegradable and will decompose gracefully in landfills. On the other hand, silk has several weaknesses too. It loses up to 20% of its hard strength and wrinkles easily when wet, and, if unwashed, it might shrink up to 8%. Moreover, it weakens when exposed to direct sunlight and may be attacked by insects if left dirty. If elongated it remains stretched, demonstrating moderate to poor elasticity (Kahn, 2014).

Silk has always been considered a luxurious fabric used for special occasion garments because of its lustre and soft texture, but also because its structure, primarily made of proteins, silk is in close composition to human skin, making it extremely comfortable to wear. Silk is hypoallergenic, therefore does not attract dust and is a natural fungal repellent (Power, 2015).

**Sericulture**

Silk farming, or sericulture, is the rearing in captivity of silkworms and it is aimed at the production of silk yarn and fabric. The most widely used and studied silkworms are the specie of *Bombyx Mori*. Raised by professional keepers in China on trays of mulberry leaves a thousand years before the Roman Empire, they have now been domesticated and cannot live without humans for their care and feeding (Gallo et al. 2012, pp.65-72).

Conventional raw mulberry silk is untreated silk as it is reeled from a cocoon. Its manufacturing process consists of several steps, which are illustrated below.
1. The silk moth *Bombyx Mori* lays thousand of eggs
2. The moth eggs hatch from larvae to caterpillar
3. The caterpillars are fed Mulberry leaves
4. After thirty five days and four moltings the caterpillars are ten thousand times heavier and ready to spin a cocoon
5. They start spinning moving their head in a eight-shape
6. Two glands produce liquid silk (fibroin protein) and this is coated with a protective gum (sericin)
7. After two-three days, the caterpillars will have produced 1km filament
8. The cocoons are boiled to kill the caterpillars and therefore prevent them to hole the cocoon and also to soften the sericin that holds the cocoon together leaving some moth free to breed and lay new eggs
9. The cocoon is brushed to find the end of the silk filament and it is unwound to produce a continuous filament

From here, the raw silk obtained could be treated according to the below processes.

**Scouring:** the degumming process which softens the sericin and prepares the silk for the dyeing phase, allowing the dyes to penetrate the fabric.

**Bleaching:** using sulphuric fumes to remove blemishes and leave the silk a uniform creamy colour.

**Dyeing:** using mild acid dyes and low impact fibre reactive dyes to colour the yarns.

**Weighting:** a textile manufacturing practice peculiar to silk, it involves the application of metallic salts to add body, lustre and physical weight to silk fabric.

**Finishing:** giving the fabric its final desired feel, appearance and care properties. E.g. calendering and decatizing at an earlier stage, but also crease resistance, antistatic effect, water and oil repellency, flame retardancy.
At this point, having investigated the meaning of sustainability and having studied the manufacturing process of conventional mulberry silk, I can move towards an objective argumentation of, to what extent, we can apply notions such as organic, sustainable, ethical and healthy to this process.

**Organic**

Raw silk fibres, like other protein fibres coming from living beings such as sheep and alpacas, can easily be created according to organic guidelines. Many silk fibres are already being produced in an organic environment, especially those produced in smaller local villages in Asia and in rural environments. The problems arise when, in order to boost production and improve efficiencies, large corporate farms will typically use heavy chemicals. Moreover, these chemicals could be carcinogens or could create problems for people with chemical sensitivities, and contaminate water, which will then require a cleansing treatment.

**Sustainable**

As argued on page 9, notions such as sustainable don’t and presumably never will have a clear applicable definition. This brought to the theory that something sustainable is anything that should preserve human and environmental wellbeing in the first place and not be principally aimed at profit driving factors. If we were to apply this to silk, we would say that the raising of domesticated silkworms and the life of wild silkworms could be considered, by nature, sustainable to the environment. Indeed, the breeding process is kept, in most of the cases, untouched and unmodified from nature (Lackman, 2013). However, there are cases in which mulberry trees are sprayed with pesticides to kill the many other insects who also think that they are tasty. Chemicals can also be used on the silkworms to increase the amount of silk produced. In fact, methoprene is an insecticide and hormone disrupter which may be applied to silkworms to slow their growth rate and extend the time they spin silk. The following step is the manufacturing of the actual fabric. When silk is produced by weavers who use handlooms, there’s a zero energy footprint and therefore zero impact on the environment. This mostly happens in rural villages in China and India. However, silk produced in large textile factories with power loom machines must be evaluated on a company-by-company basis to determine their energy consumption and verify to what extent they could be considered less or more sustainable.
Ethical

The domesticated insect, which we called "silkworm", in nature, goes through the same stages of metamorphosis that all moths do, i.e. egg, larva, pupa, and adult (Dalke, 2003). Silk is derived at the larva stage, when the moth finished spinning the long filament of silk around it. This means that most of the insects raised by the industry don't live past the pupa stage, as they are boiled or steamed alive in their cocoons (Cherry, 1993). Doris Lin, Animal Rights Expert states that approximately fifteen silkworms are killed to make a gram of silk thread, and ten thousand are killed to make a silk sari (Lin, 2016). One question then comes in mind: are insects, and in specific silkworms, sentient? Peta - People for the Ethical Treatment of Animals affirm that silkworms are sensate - they produce endorphins and have a physical response to pain. On the other hand, experts disagree over how much an insect can suffer pain: an insect's nervous system is different from mammal's, however, it is a nervous system that transmits signals from stimuli and causes the insect to respond to stimuli, which is exactly how a human nervous system does (Tomasik, 2009). Debbie Hadley, the About.com Guide to insects, concludes that insects do not feel pain, at least not in the same emotional way that humans do, however, she believes they are still deserving of humane treatment.

Healthy

Silk contains protein chains, and therefore it is an allergen for some people. Allergies varies: some are allergic to wild silk, some to domesticated silk and some to the micro-fine dust that can be given off by spun yarn. Other allergies can be traced down to the diet of the silkworm (i.e. mulberry leaves or others) and some other times it comes from the excessive sericin in the silk that has not been adequately degummed (Lackman, 2013). On the other hand, Professor Kim Thomas from the Centre of Evidence Based Dermatology at The University of Nottingham said that there have been some impressive claims recently promoting specialist silk clothing as a new treatment option for people with eczema (Brooke, 2016).

Mulberry silk is the most vastly silk used in the textile and fashion industry, however there are several other types and they differ according to specie of the silk worm and leaves they eat.
Tussah Silk

Tussah silk is produced from larvae belonging to the moth genus *Antheraea* and mostly collected in the wild forest in trees belonging to *Terminalia* species. Silk obtained from these cocoons will differ in colour depending on what leaves the larvae eats. What characterizes them is a rich texture and natural deep gold colour (Wildfibres.co.uk, 2016).

Eri Silk

Eri silk comes from the silkworm *Philosamia rinini* and it is only spun from domesticated silkworms. It is considered a "peace silk" because the caterpillars are allowed to emerge as moth and live a full lifecycle. Eri silk is fine and almost white in colour and since the fibres are
uneven and the cocoon damaged, it has the look of wool mixed with cotton (Seidentraum.biz, 2016).

**Muga Silk**

Muga silk comes from the *Antherea assamensis* silkworm. It is renowned for its durability and glossy fine texture. Muga silk fabric is naturally organic and untouched by chemicals and its natural golden amber glow increases with time and washing. Wild silk caterpillars secrete a different protein structure than the *Bombyx Mori*, therefore dyes or bleaches are not accepted (Utsavpedia, 2013).

**Spider Silk**

Spider silk is a protein fibre spun by spiders. It is widely recognized as the strongest, toughest fibre known to men. Its tensile strength is greater than steel and it is 25% lighter than synthetic, petroleum-based polymers (Howell, 2014). Kim Thompson, CEO of Kraig Biocraft Laboratories, Inc. a biotechnology company based in Michigan and focused on the development of spider silks, says: "Spider silk in nature has truly unique properties. If you think about a spider's web, it's designed by nature to intercept an airborne missile - a fly or another flying insect. If you do the mathematical calculation - the weight of the fly, its speed, and the size of the individual fibre you capture it in - the strength-to-weight ratio is off the scale". However, there is still no known way to produce spider silk in commercial quantities. Spiders are cannibalistic and therefore they cannot be raised and cultivated in concentrated colonies to produce silk (Hansel, 2016).

**Questions and Conceptual Framework**

The literature above describes the silk manufacturing process and objectively argues its positive and negative impacts on the environment. Several questions arise when thinking of the next step in the silk industry. Silk fabric reaches the customer thanks to vendors, wholesalers and retailers. While some of these are uncommitted on ethical issues and therefore decide to offer silk garments without imposing sustainable guidelines, others choose to be responsible and to limit their silk offering to only certain silk variants. The latter choice is definitely a brave move, it certainly is difficult for labels to push a sustainable production at the moment, but the future might recognize them as pioneers once the need for green products will be stronger and stronger.
The overall study shall result in an investigative overview and provide deeper knowledge into the advantages and disadvantages of using other silks instead of conventional mulberry silk in the fashion industry. It will further present and elaborate insider opinions from professionals who have been working in the sustainable fashion industry for several years.
CHAPTER 3: Primary Data Analysis

This chapter will provide a debate on the correlation between fashion and sustainability, two terms that contradict each other and share opposite values: fashion aims for continuous change whether sustainability aims at preservation. Yet at the same time, time brings them closer and closer and lots of improvements are being achieved from brands and manufacturers to consider sustainable production no longer only a future trend but a very serious issue to incorporate in their business model. In addition to this, the primary data collected through the interviews to professional companies operating in the ethical silk industry will be discussed and evaluated. The interviews have been conducted in order to get answers and insights from the perspectives of professionals. I chose to reach out for companies which differ in their business models and place themselves in different stages of the production process, this gave me a broader idea of the several diverse problems they are facing and the solutions they are proposing.

Fashion Industry: Consumerism vs. Sustainability

As a matter of fact, a need for sustainable products and a green lifestyle is spreading more and more in today’s society. This urge that a few years ago converted us into recycling rubbish and now convinces us to bring a tote bag when we go grocery shopping to avoid an extra plastic bag, is caused by our fear of disasters such as melting glaciers, shortage of water, soil or clean air, climate change and rising temperature. All industries are trying to make an effort in changing what’s bad and in developing what’s good and fair in their processes. The textile industry is making this effort too. Manufacturers are in constant search for new natural materials to use, for new resources and they also look for innovations that could improve they’re businesses. Producing garments in unethical working conditions could be potentially damage a brand’s public image and consumer trust. On the hander hand, each business has to make a profit, and, if there is a shortcut to help, for example, maximizing your revenue or reducing your production costs, it is difficult not to take advantage of it. Unfortunately, shortcuts are always damaging someone in the business chain. The same thing could be said about the
average customers, as they too show interest towards greener and eco-friendly products and ideas, but often do not shop accordingly. In fact, consumers are discussing about sustainability all the time, about how to reduce our footprint and how to take care of our planet, but at the same time they are not willing to change their lifestyles. In fact, research suggests concern does not always translate into buying decisions (Moulds, 2015). Therefore, we can individuate a major contradiction between our thoughts and the actions that we undertake on a daily routine: in general people like to stick to their habits and are not open to change. In addition to this, it seems that the average consumer has not completely understood the importance of a sustainable change in their lifestyle and is still brainwashed by the quick change of styles and trends: fast fashion giants are restlessly growing and increasing their profit. Clear example which describes this phenomenon is Primark, which revenue surged 30% in 2014 comparing to the previous year (Rankin and Butler, 2014). When we talk about sustainability we cannot limit ourselves to environmental issues, but humans and therefore workers are also regarded as a goal in determining something sustainable. For instance, damages have already been done in April 2013, when 1,134 people died when Rana Plaza building collapsed in Bangladesh. The tragedy was not caused by an earthquake or a terrorist attack, but by a growing global desire for more cheap fashion and by poor construction (Westervelt, 2015). Tragic events like this one increase our actions on ethical and sustainable matters, the consumers often only start acting differently after something tragic has happened. Stephanie Hepburn, founder of the ethical fashion site GoodCloth.com, says about Rana Plaza tragedy: "... it caused policy shifts, but it also caused a really noticeable shift in consumer awareness". For example, it lead to the creation of Fashion Revolution week, a movement which believes in "an industry that values people, the environment, creativity and profit in equal measure", and which, in 2015, involved tens of thousands of people in over 70 countries (fashionrevolution.org). Regarding the industry, it is very hard for the market to completely change from one day to the other, there is indeed too much competition going on. On the other hand, already from the first decade of the 21st century, we can see increasing sustainable fashion designers emerging in the industry and slowly making good attempts in improving the current situation (Payton, 2013).
Companies interviewed

The Ethical Silk Company

The Ethical Silk Company produce and sell 100% eco-friendly and ethically made mulberry silk products where no silkworms are harmed or killed in the production process. All the products are tailored in fair trade tailoring units located in India such as the Himalayan Tailoring Centre and Mehera Shaw. It is located in Ireland. I have been able to speak with Eva Power, the founder of The Ethical Silk Company.

Indigo Handloom

Indigo Handloom produce hand woven fabrics and scarves which are made without any electricity. This way, Indigo Handloom team aims at creating low impact jobs, preserving the handloom craft and reducing environmental damages. It is located in the US. I have been able to speak with Smita, the founder of Indigo Handloom.

Seidentraum

Seidentraum distribute textile goods with the focus on silk and sustainable and fair traded products. Their vision is the enlargement of the variety of organic (certified) silk and non-violent silk. Seidentraum is also a wholesale partner for B2B clients. It is located in Germany. I have been able to speak with Dr Matias Langer, founder of Seidentraum.

Organic by John Patrick

Organic by John Patrick is a sustainable fashion label born in 2004 that prioritize organic materials, fair labour practices and ecological awareness. It is located in the US. I have been able to speak with John Patrick, founder of Organic by John Patrick.

Interviews

1. What does ethically produced silk mean to your company?

As examined in chapter one, defining something ethical or sustainable is very difficult and vague. Not only there are not clear and defined standards to stick to, but also each of us might give importance to some specific ethical issues more than other ones. That is why it is relevant for my research to understand what ethically produced silk means to the different companies interviewed and to ask for their values. The interviews carried on show indeed that the responses to this specific question vary. According to Indigo Handloom, for instance, their main
ethic focus is the method they employ - low impact dyes and low impact weaving. Also, how they treat their weavers plays a big role in their mission towards a sustainable business model: they advance money so the producers are not burdened financially and they pay approximately 20% above the local rate. Their focus really lies in the dynamics of the work and on creating low impact jobs that reduce the environmental damages of the fashion industry and preserve the handloom craft. They do work with several different kinds of silk, other than the well-known mulberry silk also wild silk such as muga and tussar, but ethically produced silk refers to more than just that for them. On the other hand, Eva Power, founder of The Ethical Silk Company believes that silk produced ethically means the silk has been produced without the silkworms being killed in the process. John Patrick from Organic by John Patrick agrees to her vision, and Dr Matias Langer establishes the most round interpretation including organic silk rearing, social acceptable work, no use of chemicals or processes that impact men or nature, fair trading and sustainable acting.

2. What obstacles/challenges are found in ethically produced silk?

Brands active on sustainable issues face several and diverse challenges. For my research it is important to highlight the obstacles relative to silk fabric production. In order to find a solution and a piece of advice on how to spread ethically produced silk it is significant to realize what holds this from happening and understand at best the key points to improve and work on. First and very important concept highlighted by John Patrick is that the public and the consumer should be educated so that they comprehend the value and real meaning behind “peace silk”. Indeed, if the customer is not educated nor aware on issues such as animal cruelty or exploitation of labour, he will not find a reason why, paying a little extra money for a silk scarf, does make a huge difference. Dr Langer indeed states: "Handwork and handcraft products are more expensive than conventional silk fabric". This statement stimulates a further research into the pricing of conventional and non-violent silk. First of all, thanks to the cooperation of silk wholesalers such as Ahimsasilk.com, Seidentraum.biz, Globalsources.com and Exoticsilk.com, the price of several silk fabrics has been obtained and a total average has been calculated. The result of the calculus has led to a ratio of 3.7 to 1 between non-violent silk and conventional silk (see Process Book). Indeed, Eva form The Ethical Silk Company confirms this saying that ethical silk is in fact more expensive, and that, as a result, she only sells direct as it means she can keep the prices competitive with regular silk companies. Moreover she affirms that she used to produce on handloom, but this lead to occasional marks on the silk. Compromise on quality is not acceptable to really be able to grow a business, therefore, although customers love the idea
of ethical silk hand spun, she had to move on to use auto loom. Smita from the Indigo Handloom links to this issue stating that the biggest obstacles are making sure weavers understand the standards and requirements of western companies and at the same time, managing expectation of western companies.

3. What impacts your company’s ability to work sustainably?
Having analyzed the obstacles and challenges of ethical silk production in the previous question, my interest shifts on the ability of a given company to work sustainably as a whole. From the interviews, three shared difficulties emerged as barrier in working sustainably. First of all is the request of the consumers for cheapest textiles, and therefore for cheapest clothes in the stores. As mentioned at the beginning of the chapter (pp. 15-16) fast fashion giants such as Primark are restlessly growing, reducing our common understanding of what it is fair to pay for a certain item for it to be produced honestly. In addition to this, another big challenge is cash flow. It is difficult to get company to understand the consequences of not paying an advance or helping finance their production. This is mainly related to the cultural difference of western and eastern countries and would most likely happen in any scenario of clothing production in an Asian country. Least, another key factor, which impacts a company to operate sustainably, according to Eva Power from The Ethical Silk Company, is logistics. Unfortunately the distances the products need to travel involve a significant carbon footprint on the environment.

4. Can the designer have a positive role not just on the product, but also on the innovation process, and a brand’s services and systems?
With this question I am interested in understanding if the professionals interviewed believe that part of the solution towards sustainable innovation and implementation of a company could start from the designer, or if, there are other considerations involved too. The position of a designer is a very critical place: they are the inventors of a company’s products, but, in certain cases, somehow cannot reach or influence the company’s service and system. Said this, we need to keep into consideration the fact that the bigger the company, usually the less weight a designer carries within that company. Smita from Indigo Handloom, for instance, is achieving a lot in terms of support to Indian villages. Her company support more than 500 weavers and their families - they created a market where there was not one before. All this, she says, helps the weaver to continue to live a decent life, surrounded by his family and community. Without her work, many weavers would be forced to leave their homes and take jobs in the cities. She continues: "Being mostly unskilled (beyond weaving) and having an average of a 4th grade
education and no safety net, they would become part of the highly vulnerable migrant population, many of whom end up working in factories that cater to fast fashion." This is a great success that can be used as example for ethical woven textile production, and it is certain that designers should always try to work out solutions to bring to the brand that they feel are important. However, it really depends on the set up of the individual company to estimate how a designer's positive initiative can affect the company's sustainable service and system.

5. Have you ever considered producing silk garments where no silkworm is harmed or killed in the production process? Why?
At this point, it is relevant for me to understand if, ethically involved labels such as Indigo Handloom and Organic by John Patrick, have or have not considered working with ethical silks fabrics and what is the logic behind their strategy. I will then be able to identify the weaknesses and threats of the usage of peace silk in the fashion industry. Indigo Handloom worked with ahimsa silk in the past, however, achieving a variety of textures with ahimsa silk it is very difficult, and in addition to this, unfortunately it doesn't have the sheen that silk is valued for. To overcome this, they started working with a product called mutka silk, which is made with the ends of silk cocoons - the parts that are usually discarded or burned. This decision is part of their effort to have less waste in their process. On the other hand, Organic by John Patrick decided to completely drop their production of silk garments and instead using the regenerated cellulosic fibre cupro, which feel is very similar to silk.

5. How do you see peace silk production developing in the next 10 years?
On the other hand, it is important to the development of this research to understand why the other ethically involved labels interviewed choose to work with peace silk. In order to indentify the strengths of such fibre and its opportunities in an external environment I investigated what the future of peace silk may look like. Dr Matias Langer confirms the fact that ethical silk production will increase because of the changing of consciousness of consumers. Indeed consumers have moved beyond just convenience when shopping. Conscious consumption, a movement of people who make positive decisions about what to buy and seek out for a solution to the negative impact consumerism is having on the world, is a growing tribe. Research show that a third of UK consumers claim to be very concerned about issues regarding the origin of products. A study from YouGov and the Global Poverty Project revealed that 74% of those surveyed would pay an extra 5% for their clothes if there was a guarantee workers were being paid fairly and working in safe conditions. If you think that 5% is not a lot, consider the fact that
research show that the fashion industry could take 125 million out of poverty by adding only 1% of its profits to workers' wages (Baker, 2015). This reconnects to Eva Power's response too. In the next ten years there will be a huge drive towards peace silk. With transparency along the production line ever increasing, people like to know how and where their products are being made, and by whom. The digital age is facilitating this phenomenon: as access to information grows, companies are starting to be held responsible for their production line. For instance, The Ethical Silk Company's producer is always trying out new weaves so the product line can grow.
CHAPTER 4: Limitations and Conclusions

Limitations

This research report is constrained by involuntary and self-imposed limitations. These limitations and boundaries are as follow.

First to mention is that since this research is ultimately focused on the textile and apparel industry, this reduces or eliminates the relevance of certain topics, issues and companies that would be relevant to the general silk industry. For example, there are issues and innovations that are highly important in the scientific field, such as the experiments of lab produced silk or transgenic silkworms whose genetic makeup is stronger and more elastic than conventional silk (Kraig Biograft Laboratories, 2015). This could be evaluated as an opportunity for silk; however, it is unrelated to the silk used for apparel and textiles.

When talking about how the silk industry functions it is difficult to give a general description, since processes vary between countries, companies and functionalities involved. Therefore, it has been described in the most conventional matter, by means of the main procedures that form the basis for silk production in all countries.

Providing more time, primary research would have been more extensive in order to get a broader overview and to be representative of the whole fashion industry. Additionally, more structured interviews might have yielded more in-depth answers. Nevertheless, this was not possible since the interviews have been completed via email. This is also why this research will serve as stimulation for later research topics.

The focus on this paper is on ethical silks, which is why it does not cover or target substitute materials. Hence, the research done can be seen as inspiration for future studies in the field of sustainability and further academic work.
Conclusions

This thesis has been designed in order to find out more on silk manufacturing, its impacts and its ethical alternatives, and to investigate how these are incorporated in the business strategy of different companies which are environmentally active under different aspects.

Concluding from the data collected during the research, it is to say that giving a clear definition of something ethical or sustainable would not be precise or applicable in every case. It is indeed very vague to establish a set of guidelines. It is important to keep into consideration several factors and objectively argue the impact of each step of silk production. Silk is a natural fibre, coming from a living being, which makes it organic, however, problems arise when companies, in order to boost production, use power looms and heavy chemicals: this makes the process not environmentally friendly. Another important aspect is that in the majority of cases silkworms are boiled alive in order to obtain a longer silk filament. It's been scientifically proven that caterpillars produce endorphins and have a physical response to pain. This fact brings silk manufacturers to increase their interest in alternatives to conventional mulberry silk, and, as a result, to opt for non-violent silks such as Tussah silk, Eri silk, Mutka silk and Muga silk. These alternative silks are more obsolete in the apparel industry because of several reasons.

Weaknesses have been investigated with the four interviewees and thanks to the development of a SWOT analysis (see Process Book). The biggest obstacle identified is the understanding between company and weavers - western and eastern culture, in terms of expectations. Moreover, as the majority of businesses are profit driven, it is not surprising that most companies and retailers chose for regular silk instead of non-violent handcrafted silk: the price difference between those two products is hardly comprehended by the consumer who is not yet deeply educated on the topic. What is threatening the growth of ethical silks in the fashion and textile industry is also the request of consumers for cheaper and cheaper textiles. On the other hand, there is a big contradiction to this: a big portion of today's consumers is more and more conscious on sustainability and require transparency on the manufacturing process. Therefore, fabrics that are also ethical and sustainable are becoming more desirable and garments being produced in unethical conditions could potentially damage a brand's public image and customer trust.

Overall this research leads to the assumption that sustainable fashion and the incorporation of ethical silk in the textile industry might have the potential to increase and to become popular among customers. Ethical silks, if spun with handlooms, have zero energy footprint on the
environment, no animal cruelty and allow weavers in rural villages to have their own market and live decent lives surrounded by their families. I strongly believe that information about supply chains, about materials and process can be an inspiring part of a brand and product's story and could change the game. This is the start of a long journey and if we are going to accept the enormous impact our current production levels are having in the world, we have to start by understanding where our products come from. In order to get closer to achieve this, an effort should be made in executing and promoting engaging campaigns, in writing informative articles, in open data, mobile tech and social networks. This could enable transparency in supply chains and will bring consumers to a deep comprehension and education on the positive aspects of ethical silk production. Consumers' shopping behaviour might then not be driven only by price and hence, ethical silks production may arise.
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