Circular economy business models in the clothing industry

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Abstract: Production, consumption and waste management of clothing is causing severe environmental damage and needs to be transformed. In this thesis the question of how circular economy business models can contribute to make the clothing business more sustainable is investigated. Two small companies in Jämtland, Sweden, are used as case studies. Case A, Rent-a-Plagg, is renting outdoor wear on a ski resort. By providing the possibility to get access instead of ownership they make their customers avoid an unsustainable consumption pattern. This decreases the resource flows through a displacement effect in avoided production. Case B, Saiboo is producing healthcare work wear and they run a research project that aims for developing new technologies to recycle textile fibres. If such technology comes out successfully enough to become realised in a large scale, that could be a big game changer for the clothing sector. These companies are circular in different ways and all forms of circularity will be needed in the future for improving all steps in the waste hierarchy and design out waste.

Key terms: Sustainable development, circular economy, business models, displacement effect, clothing industry

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Popular summary: In the western world, and also in many rising economies we buy much more clothes than we use. Fast fashion business models dominate and lots of clothes are either accumulating in wardrobes or being disposed. The research question in this thesis is how circular economy business models in general, and the companies in my case studies in particular, can contribute to make the clothing business more sustainable. In Sweden most of it goes to incineration after disposal and is therefore at least used for heating, but globally the majority end up on landfill which is the most resource inefficient option. None of these options are good though. Resources should be reused or recycled in order to move from linear to circular resource flows. But first and foremost the resource flows should decrease by us consuming less. Circular economy is a concept containing a lot of ideas, some which aim to make people consume less by sharing, everyone does not need absolute ownership. Access is enough. This gives incentives for making long lasting, durable products that can be shared by many people for a long time, instead of the current incentives to make low quality products that will soon need to be replaced. Another goal is to design out waste by using recyclable materials and make products easier to disassemble etc. Business models can adopt these ideas in different manners and thus contribute in the shift towards a circular economy and a sustainable development and in this thesis two different companies with circular economy business models are examined.

Case study A, Rent-a-Plagg is a company that is renting outdoor wear in a ski resort in Åre, Jämtland in Sweden. They target different customer groups that for different reasons find it better to rent than to buy. I have made assumptions about these customer groups and which consumption patterns that is being avoided thanks to Rent-a-Plagg. Based on these assumptions and the renting statistics from Rent-a-Plagg, I have calculated that the displacement effect in terms of avoided production which their business is resulting in is 192 garments, 114 kg textile per year. I also show a range of different possible results based on other assumptions about their customers’ consumption patterns. Hence the result is still that they do decrease the textile flows even if my estimate is not correct. Case study B, Saiboo is a company in Östersund, Jämtland in Sweden that is designing and producing workwear for healthcare and service related companies. After the clothes have served their purpose they are returned to Saiboo for recycling. Currently the recycling technology is not good enough for fibre to fibre recycling, but since that is what Saiboo wants to do with their worn out clothes, they are running a research project trying to develop better recycling technologies. They also developed a design tool for increased awareness in the design phase in order to prepare the clothes for disassembly and recycling. The clothes they produce and try to recycle are made of cotton and polyester and since that is a very common material mix the possible technology coming out of this project could be used to a large extent. They are not the only ones trying to develop such technology though, and therefore it could just as well be somebody else coming up with the winning concept, not necessarily Saiboos’ research project. But since they are communicating with the other research initiatives in order to investigate different methods and possible paths, they are still contributing with pushing this development forward even if they do not find the final solution to the current problems within recycling technology. In the future when a large scale re-collection system for textiles is in place, they will at least contribute by giving their disposed clothes, which is now approximately 8000 garments and 3600 kg per year. I.e. they will make sure their textiles are returned to a future recycling scheme.

Key terms: Sustainable development, circular economy, business models, displacement effect, clothing industry

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IV
1. Introduction

1.1 Problem background

Many of us, including myself, have a tendency to buy more clothes than we need and my seldom- or never used garments are accumulating in my wardrobe for a long period of time before I perhaps give them away to charity or second hand shops. My basic clothes, which I am wearing often, usually get worn out in a way that deprives them any second hand value and hence they end up in the rubbish bin to no use except for energy recovery through incineration. Something is very wrong about the way in which we treat clothes today. Clothing companies are like many other companies surviving in the market economy by making people want to consume more and faster. We are surrounded by advertisement telling us what we need and we are constantly encouraged to consume more, and that is also what keeps the wheels turning in the market economy. The clothing consumption has been increasing drastically due to elevated standards of living and fast fashion business makes consumers in in affluent regions buy more cheap clothes with low quality and having quick turnover wardrobes. This also illustrates the huge global inequalities very clearly, where our consumption largely depends on low-cost labour in developing countries (Simas et al. 2014). The production and consumption patterns of clothes are having severe environmental impacts in a number of areas.

The clothing business is a massive industry that is very unsustainable and resource inefficient, and just like other business it needs to transform in order to survive and meet the new sustainability requirements that can be expected in a not very far future. Clothes constitutes about 7% of the world’s total export and up to 10% of the world’s carbon footprint, one third is consumed in Europe and on third in North America (Allwood 2006) i.e. 60% is consumed by less than a billion people and 30% by the remaining 6 billion. Therefore, it should be some room for improvement here. In fact, we need to change in basically all areas in order to keep the planet inhabitable for us.

The severe environmental problems threatening our planet have for several decades been testifying about the need for smart regulation curbing the market economy. Donella H. Meadows and co-workers argued already in 1972 in The limits to growth that unlimited growth in a world with finite resources is impossible and has to come to an end, but that it is possible to find an equilibrium where the economy is stable. That has unfortunately not resulted in these problems getting solved and it is getting more and more obvious that economic growth as we know it, is on a collision course with nature.

Nevertheless, several voices have been raised which argue that we need a new economic system and rethink the way in which we do both financial politics and business in order to get away from our inefficient linear resource flows and encourage a behaviour where resource flows are circular, and materials are fully used instead of wasted, and where we consume services instead of products. This is often referred to as circular economy where one key point is to decouple economic growth from resource use (Preston 2012). Then perhaps an unlimited growth is possible? That question will not be answered in this thesis, and political ideas about circular economy on state level will not be further investigated.

The focus in this thesis will instead be on circular economy on a company level within the existing economic system. The fact that the economic system on the political level has not embraced the ideas about circular economy yet does not mean that circular economy business
models cannot be profitable within the current system. Circular resource flows indicate that resources are wisely used which indicates efficiency and high level of utilization. In some industries, the material cost stands for 40-50% of their expenses (Wijkman et al. 2015). Also other resource savings, like water and energy savings, are becoming a matter of course and has not just to do with improving sustainability performance. These measures could have been implemented as a management process simply to reduce cost (McDonough & Braungart 2013 p. 28). Efficient resource use therefore indicates that it is economically efficient too. Some foresighted companies are making a big effort to become more sustainable and are therefore also adopting many of the core ideas within circular economy. I will look at two different clothing companies operating through different, more or less circular, business models.

To help the reader to follow the reasoning in this thesis, the essentials in circular economy will be presented here at an early stage, with more coming up in the theory chapter.

Ellen MacArthur Foundation has summarised the philosophy behind circular economy in a few principles. The first one is to design out waste. Everything is designed for cycles of reuse, disassembly and remanufacturing. These tight component cycles distinguish them from common recycling where usually big amounts of the energy and labour embedded in the products are being lost. The second principle is the one that is introducing a stricter differentiation between durable and consumable components of a product. The increasing share of non-toxic biodegradable components are safely returned to the biosphere, while the durables are designed for reuse and kept in technical loops. Third, the energy required to fuel the cycles is renewable which decrease resource dependence and makes the energy systems more resilient. And for technical products, circular economy turns consumers into users who just need access and not ownership. (Ellen McArthur Foundation 2014)

Companies can address the above mentioned principles in different ways which makes them possible to categorise into different business models. Bocken et al. (2016) describes two main ways to incorporate circularity, the first one is slowing resource loops where you extend the product’s life time. This can be done through for instance repairing and remanufacturing or by intensifying the life time through increased utilization, which slows down resource flows. The second one is closing resource loops through recycling where the cycle between post-use and production is closed and resulting in circular resource flows. This is not the only way to categorise different circular economy business models, especially the first one of slowing resource loops can be further categorised. Accenture is a management consulting company that is also doing studies on successful companies with circular economy business models. Lacy et al. (2014) identified five different circular business models in a report from Accenture called Circular Advantage

1. “Circular Supplies: Provide renewable energy, bio based- or fully recyclable input material to replace single-lifecycle inputs
2. Resource Recovery: Recover useful resources/energy out of disposed products or by-products
3. Product Life Extension: Extend working lifecycle of products and components by repairing, upgrading and reselling
4. Sharing Platforms: Enable increased utilization rate of products by making possible shared use/access/ownership
5. Product as a Service: Offer product access and retain ownership to internalise benefits of circular resource productivity”

(Lacy et al. 2014, p. 12)

These five business models can of course overlap, but two of them will be examined further since the two companies that will be examined in this thesis can be categorised as number 2 and 5. According to this categorisation, Model number 5, Product as a service, increases the incentives to make high quality products that last for long since the value generates from the whole using phase and not just the selling of it. Model number 2, Resource recovery, means that recovery of embedded value at the end of one product life cycle is transferred into a new product. This business model has its roots in traditional recycling. Waste is transformed into new value through recycling or preferably upcycling (recycle with maintained or increased quality). The recycling business model are leveraging new technologies and possibilities to recover resource outputs. This is often made to an equivalent value to the initial investment, or even above. This model enables the company to eliminate leakage of materials and maximize economic value through return flows of products. This model is good for business with large volumes of by-products or where the waste can be both reclaimed, recollected and reprocessed in a cost efficient way (Lacy et al. 2014).

1.2 Aims and motivation

The purpose of this thesis is to investigate how circular economy business in general, and the companies in my case studies in particular, can contribute to a more sustainable clothing industry. This question is very broad and will be interpreted differently in the two case studies.

Case study A, Rent-a-Plagg, is a company that rents out outdoor wear in a ski resort, I ask what that company is currently contributing with directly through their own business, in terms of how they are making people avoid a consumption pattern characterised by resource inefficiency, and no effort will be put in answering how this can influence the clothing business as a whole.

Case study B, Saiboo, is a company that is providing healthcare workwear, which they later recollect for recycling. Saiboo is currently running a textile recycling research project that, if/when it succeeds, has the potential to influence not just their own company, but the clothing industry as a whole. Therefore, the focus in this case study is different from the focus in case A, and the question will be how they can contribute, not primarily by their own operations, but what contributing spin off effects this can have on the clothing industry as a whole if/when their research project succeeds. Thus the research question in this case can also partly be framed as: what can this research project result in?

It is interesting to see how alternative business is contributing to more sustainable practices and by studying two very different examples of circular business models, one gets to see the big range in which circularity can be put into practice. The initiative to this study was initially taken by Jegreliusinstitutet, an institute for applied green chemistry that works to stimulate the demand for and production of non-toxic products and to support green trade and business in the region of Jämtland and Härjedalen. The results of this thesis might be useful for Jegreliusinstitutet and also for the two companies if they want to market themselves as a more
sustainable alternative and also when spreading the word of the sustainability benefits with more circular business models.

The field of circular economy is very broad, and I will just be able to look at a tiny fraction of all different business models working with sustainable development and circular economy.

1.3 Outline of the study
I will start with some background information and statistics about the textile industry and the environmental problems associated with it, then give an overview of what is going on in terms of market trends and new research. After that the theoretical framework is being presented and concepts, terms and how they will be used are being described. The part about circular economy is also going to get the reader an idea of which the different possible ways are to decrease environmental impacts through circular economy business models. In the method chapter are some methodological approaches described and then the course of action for each case study.

In the literature review (in the background chapter and the theory chapter) will provide information concerning the first part of my research question - how circular economy business models in general can contribute to make the clothing business more sustainable. Then I will present my cases and how they operate and discuss their contribution in terms of decreasing resource flows and pushing a development forward, respectively. I.e. the second part of my research question - how these companies in particular can contribute to a more sustainable clothing industry.

Since the two investigated companies have little in common, the methodological approaches used are different, therefore many chapters have one A and one B part, referring to company A and B. The results of case study A and B will not be comparable. Company A is pretty new, and hence it is still hard to evaluate their whole current contribution. Company B is also relatively new, and is working to transform both itself and future textile recycling possibilities, and the investigation will in this case be more speculative about what might happen if their research project succeeds.

2. Background
This chapter goes through basics when it comes to environmental impacts of textiles, gives a review of what can be done in order to make the production, consumption and disposal of clothes more sustainable, and how different business models can address problems in different parts of the life cycle. These parts put this study in its context and will be used to answer the first part of my research question, i.e. how circular economy business models in general can contribute to make the clothing industry more sustainable.
2.1 The environmental impacts of the textile industry

In this section the biggest environmental impacts of the textile sector will be briefly summarised in order for you who read this to keep in mind what is unsustainable about the clothing sector and which the causes and effects are that should be avoided.

The environmental impacts related to the production and use of textile fibres vary a lot due to the different origins of different materials. Textile fibres are either natural (e.g. cotton, wool and linen), man-made out of cellulose such as viscose, or synthetic, polymers produced from fossil oil, such as acrylic, polyester and nylon. The demand for natural textile fibres has been relatively stable lately whereas the demand for synthetic fibres has increased significantly (Allwood et al. 2006).

The textile industry is therefore not a homogenous industry and it causes various sorts of environmental damage, but generally the textile industry is characterised by high consumption of fuel, water and chemicals. The extensive energy consumption is for example taking place in the production of man-made fibres, yarn manufacturing and finishing processes, and also for washing and drying in the use phase and direct emissions through transport in globally dispersed supply chains (Resta et al. 2016). Another huge problem is the use and release of toxic chemicals in cotton production and agriculture, and in most kinds of textile production, toxic chemicals are used in pre-treatment, dyeing and printing, resulting in polluted land and waters (Allwood et al. 2006). Extensive water use is especially associated with cotton cultivation which can lead to severe environmental disasters with drying lakes, salinization and lowered ground water table (Karlsson & Björklund 2009).

Cotton is the most important source of textile fibre in the world, and constitutes the basis of approximately 40% of the world’s textile fibre production. If the chemicals used in all stages of cotton production are added, it ends up at 0.6 - 1 kg chemicals for producing 1 kg cotton (Karlsson & Björklund 2009). Since cotton is a very thirsty crop and many irrigation methods are inefficient, it can take 2000 litres of water to produce 1 single T-shirt (Hoekstra & Chapagain 2007) or 2700 litres according to WWF (2013). Long term irrigation leads to salinization and draught, and the most famous example of this is probably the Aral Sea, where wasteful irrigation of conventionally grown cotton has led to an environmental disaster and only 10% of the lake remaining in 2007 compared to 1960 (Micklin & Aladin 2008), and it is still decreasing. The biodiversity loss has been huge in both terrestrial and aquatic life, approximately 85% has been lost, and all fish is gone in some parts of the lake (Karlsson & Björklund 2009). Moreover, agricultural practices are unsustainable in many other ways, such as the large use of pesticides that causes damage on both humans, vegetation and wildlife. In order to make the cotton production sustainable without destroying the land it is grown on, it would have to move towards organic cultivation methods.

The fast increase in demand for fashion the last couple of decades has led to increased cotton production in many rising economies like China, India, Vietnam and Bangladesh. About 36 million hectares are used for cotton cultivation, representing 2.5 % of the world’s arable land (WWF 2005). Cotton is grown in warm climates, and climate change will most likely cause draughts and extreme heat in these areas and the competition for arable land will increase in order to feed the growing population which will most likely affect the cotton production negatively (Hämmerle 2011). It is estimated that the global cotton production will not continue to increase, but stay around 28 million tonnes in 2020, while the demand for textiles
will continue to grow because of population growth and increased living standards (Eichinger 2012).

In EU25 clothing consumption stands for between 2 to 10% of the total environmental impacts from consumption, different studies showing varying results, but it seems to be the fourth biggest category after food and drinks, private transport, and housing. (Tukker et al. 2006)

2.2 The scope of the textile industry and textile flows
The Fig 3.1 flowchart shows the textile flows in Sweden. It is a translated copy of a flowchart from a report by Carlsson et al. (2011) from SMED, Svensk Miljö Emission Data, commissioned by Naturvårdsverket, the Swedish environmental protection agency.

Since then the consumption of clothes has been increasing even more. According to the annual consumption reports provided by the University of Gothenburg, Swedes’ consumption of clothes and shoes has been steadily increasing during the whole 21st century, between 1999 and 2009 it increased with 53% (Roos et al. 2010) and between 2004 and 2014 the increase was 27%. So even if the rate has slowed down, the consumption of clothes and shoes still increases with 2% each year (Roos 2015). This seems to be significantly lower than the annual clothing consumption in other western countries, according to Eichinger (2012) Americans consume 40 kg per person and year and according to Allwood et al. (2006) the annual British textile flow is 55 kg per person and year.

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1 The EU consisted of 25 member states before the two latest enlargements in December 2006 (Bulgaria and Romania) and July 2013 (Croatia).
2.3 Room for improvement at different life cycle stages

The Waste and Resources Action Programme, WRAP, is a registered UK Charity and Company limited that has a research institute working with sustainability and resource-efficiency. Research by WRAP shows that about 5% of the carbon and water footprint of the average British consumer is coming from consumption of clothes. An average wardrobe in the UK contains approximately 30% clothes which have not been worn for over a year, mostly because it no longer fits. If the lifetime of clothes were prolonged with just three months of active use per item that would lead to a reduction of 5-10% in both carbon, water and waste footprint (WRAP 2011).

WRAP has identified five main alternatives to save both money and resources along the life cycle of garments. (Note that this is in a British context, and not to be mixed up with the flowchart of the Swedish textile flows above)

1. Reducing the resource impacts in the processes from raw material to garment supply which now constitute one third of the waste footprint, three quarters of the carbon impact and most of the water footprint. Since these processes are located in Asia, the potential for the European consumers is to put pressure on retailers to put stricter requirements on their suppliers to adopt more sustainable and resource efficient practices. This also has the advantage to improve the reputation of the retailer in question.

2. Extending the life time of clothing by nine months extra would reduce carbon, water and waste footprints with 20-30% each and decrease the resource cost with about 20%. Hence this is one of the main opportunities to make a change, both when it comes to design for increased durability, but also use the clothes in the wardrobe more often, repair and re-use.

3. Both the supply and the demand for second hand clothes could increase. In the UK only 50% is reused and two thirds of that goes overseas for re-use.

4. Reducing the environmental impacts from laundry also has some potential since that requires a lot of energy. WRAP estimates that laundry constitutes one quarter of the carbon footprint of a garment’s life cycle in the UK. How big that share is elsewhere depends on the electricity mix of that place. In Sweden that quota should be lower due to the negligible share of fossil fuels in the electricity mix. (cf. the MIPS study at page 30 where laundry is by far the largest part of the MIPS).

5. Keeping the clothes out of landfill is the fifth and last step where a change is desirable. One third of the clothes of UK ends up in landfill (WRAP 2011).

This is not directly translatable to the Swedish context since a negligible share goes to landfill. Instead clothing waste is incinerated. In 2016 it became prohibited to send organic material to landfill so from now on that little negligible share should also be incinerated.

2.4 Positive trends and new business models

There are many positive trends. One is that the second hand market is growing, not just second hand shops, but also pages for private ads or buy/sell/give/share Facebook groups.

It is estimated that Sweden saves 1.6 million tonnes of carbon just by buying second hand in general, not just clothes, on the ad site Blocket. If it is assumed that every item that is bought
second hand replaces a newly produced one this corresponds to 170 kg per person (Blocket 2013). Blocket has not clothes as their primary category, so this is a positive trend that goes for most kinds of products.

Second hand shops have been around for a while, and so has the possibility to rent formal/evening wear and wedding dresses, but that is now expanding to more kinds of clothing, like one of the case studies in this thesis which is a company that rents outdoor clothes.

Many new innovative business models are also popping up, for example the so called clothing libraries which work just as it sounds like, a library but for clothes instead of books, one example of this is Lånegarderoben where you pay for membership and pick and mix clothes to borrow (Lånegarderoben 2016).

There are also new initiatives coming up in connection to internet platforms and social media. One of these initiatives is called ShareWear and some of Sweden’s most prominent fashion brands such as Fillippa K, Whyred, House of Dagmar, Weekday, NIKOLAJ d'ETOILES, Uniforms for the Dedicated and Hope have created the first collection. As a user of ShareWear you are also encouraged to share your own clothes that you do not use anymore, where you borrow clothes via Instagram and pass them forward through their hashtag after you’ve used them for a week (ShareWear 2016).

All concepts and initiatives mentioned above are aiming to change the way we use and consume clothes and increase the life time of clothing. Clothing producers or retailers however are rather focusing on improving the sustainability performance upstream in the supply chain than the consumption patterns downstream, which is also essential in making the clothing sector sustainable.

Supply chain management is becoming an essential part of companies’ sustainability work, mainly driven by demand of consumers (Brody 2016) and many companies are teaming up for making this job easier. One example of that is Sustainable Apparel Coalition, with members such as Nike, Marks & Spencer, Patagonia, Lewi Strauss, Walmart and many others. Together they can put more pressure on suppliers by requesting more sustainably produced materials. Designers and clothing producers are for example requesting organically grown cotton and recycled polyester to a greater extent, and they are also looking for new materials with lower environmental impact and material mixes that are both comfortable and functional and recyclable. Nike created an index called Material Sustainability Index, MSI in 2011, first available just for Sustainable apparel coalition members, where different materials’ sustainability performance from cradle to gate, i.e. from raw material to textile, is evaluated. This index was made public in 2012 in order for other designers to make conscious choices when picking their materials (King 2011)

A part of the life cycle that traditionally has been even more neglected than the using phase is what happens after disposal, the waste phase. But more and more is being done in order to develop textile recycling technologies and design re-collection systems.

H&M started their so called garment collecting programme in 2013 where customers can leave clothes they do not use. These clothes get sorted by the condition, the best ones are re-sold as second hand, others are turned into cleaning cloths or rags, and the worst ones become insulation material or are turned into textile fibres (H&M 2016).
2.5 Contemporary research and market trends

A number of research initiatives are trying to develop more efficient technologies, both to produce textiles more sustainably and also to recycle the existent textile materials.

In a couple of years, we might even see clothes made out of air (!) Even though this might sound too good to be true, a research project called From Air is currently doing research on how to bind methane gas into fibres, and thus capturing greenhouse gas which has a net positive impact on the climate (Smart textiles 2016).

One of the research initiatives that are in the front line of chemical recycling of cellulose based fibres is Re:newcell. Re:newcell is a technology company started by a group of researchers from KTH (Royal Institute of Technology) The technology they are currently working on is neither expensive nor in need of toxic chemicals and according to themselves it seems promising (Re:newcell 2016). Re:newcell is predicted to maybe have a recycling plant in demo scale by 2020 (Östlund et al. 2016)

Some mechanical recycling is already taking place, but in a down-cycling manner (recycle into a new product with lower quality than the first one). The fabric is cut, torn and carded and is used for padding in matrasses and car seats etc. The big challenge for researchers now is to find a way to spin new yearn with high quality. Even those materials that are recyclable with today's technology, like polyester, are not yet being recycled in Europe to any extent worth mentioning, while they are far ahead in Asia and recycle their polyester full scale (Östlund et al. 2016).

The technologies for recycling the fibres to spin new yarn is today not good enough to take it into practice in large scale. Furthermore, many clothes today consist of mixed materials which make it even more difficult to recycle (Östlund et al. 2015). It was actually known already in the Books of Moses in the Bible that mixed textile materials was wrong (Leviticus 19:19)! Well that was a joke, but it is true.

But the question of recycling of textile is becoming more and more topical and new research initiatives are trying to develop better technology for recycling fibre to fibre (Östlund et al. 2015).

On behalf of the Swedish government, the environmental protection agency, Naturvårdsverket wrote a report based on Swedish technological research institute’s summary and analysis of the technological and environmental challenges in connection to recycling of textiles (Östlund et al. 2015). In that report the research initiatives are being mapped and evaluated to get a clue about in what time scale we can expect recycling technologies possible to use on a larger scale.

The forecast in this report indicates that large scale collecting systems will be in place by 2030 according to Östlund et al. (2015), who also identified a few prerequisites for Swedish textile recycling becoming a large scale reality:

- “New and large-scale collection systems and the handling of the incoming material.
- Automatic sorting based on the molecular building blocks in the textiles.
• New separation techniques and purification processes on a molecular level. Especially for separation of synthetic and natural materials.
• To develop and deploy technologies that enable traceability of textile content, with respect to the chemical additives (such as surface finish, etc.) that remain in textiles at the end of the user “


We are already now seeing an increase in demand of cellulose-based textiles, which is a trend that seems to be here to stay. People want natural fibres rather than synthetic fibres for the sake of their comfortable breathability. In recent years, the production of synthetic fibres has increased while the increase of cotton production is stagnating, the production of man-made cellulose has consequently started to increase due to their similarities with cotton, but the production is not growing as much as the demand and therefore we are now entering a “cellulose gap” (Hämmerle 2011).

3. Theory and conceptual framework
3.1 Sustainable development
Since ‘sustainable’ is part of my research question, a definition of sustainability and a theory of sustainable development has to be acknowledged, and there are many approaches to this wide field. One of the most common ways to illustrate what sustainable development means in terms of management theory is the triple bottom line which is a term coined by John Elkington in 1994. It is based on the idea that sustainability has three pillars, a social, an ecologic and an economic pillar. All development has to take place in the intersection of those three pillars in order to be sustainable. This is also sometimes referred to as the 3Ps: people, planet and profit. This thesis, on the contrary, pay unequal attention to these three pillars. It might seem counterintuitive to ignore the economic pillar when writing about business models that apparently need to be profitable in order to survive in the long run, but this thesis will focus on how these business models affect resource flows and life cycles of clothes and the triple bottom line version of sustainable development does not help in analysing what is unsustainable in the life cycle of clothes or how alternative life cycles would improve the sustainability performance of a product or service. Social and economic sustainability will largely be left out from the story, and the biggest focus will be on the ecologic sustainability. Hence the triple bottom line sustainability theory will not be the predominant one in this thesis.

I intend to use the four sustainability principles that are used as theoretical framework by The Natural Step and was developed by Karl-Henrik Robèrt, John Holmberg and Göran Broman. (The formulation of these principles have changed slightly over the years and The Natural Step is currently using a slightly different formulation).

This definition of sustainability addresses the four root causes that all unsustainable practices can be derived from.
“In order for society to be sustainable, nature’s functions and diversity are not systematically subject to:

I. increasing concentrations of substances extracted from the Earth’s crust;
II. increasing concentrations of substances produced by society;
III. physical impoverishment by over-harvesting or other forms of ecosystem manipulation; and
IV. resources are used fairly and efficiently in order to meet basic human needs worldwide”

(Robèrt 2000, pp. 245)

This thesis has a focus on resource flows and life cycles, where one aim is to get an overview of where in the life cycle different unsustainable practices are taking place. Less emphasis is put on different environmental problems, impact areas or emission levels.

By applying the principles of The Natural Step’s theoretical framework on the life cycle of a product or service one can see where in each step of the life cycle which unsustainable practice is taking place and get a holistic overview without having to know exact emission levels. These principles will be applied on the life cycle of a common textile material mix, cotton/polyester, and make a version of life cycle assessment called sustainability life cycle assessment, SLCA. This will mostly be used to illustrate in an easy simplified way which unsustainable practices are being avoided if less is consumed, instead of stating the amount of avoided emissions.

3.2 Circular Economy

Circular economy is a term first coined by the environmental economists David W. Pearce and R. Kerry Turner in 1990. The concept is becoming increasingly popular as a new way of thinking when doing business. It is a response to the insight that the present economy, relying on a linear take-make-waste system, is unsustainable and needs to be replaced by a circular system where waste is being transformed into new products and useful resources (Witjesa & Lozano 2016). A central idea is that we should consume services rather than products, or become users rather than end consumers, hence business models should be designed in a way that makes us pay for the access to products rather than the ownership of the product. This will increase the incentives for producers to design high quality products that last longer instead of products with short life time in order to make consumers quickly buy new ones. Another central idea is that the producers also are responsible for the disposal and recycling of the product and hence they would get better incentives for designing in a way that facilitates the disassembling and recycling of the different materials or components (Ghisellinia et al. 2016).

Ellen McArthur foundation was founded in 2010 to promote circular economy and inspire people and business to think in new ways and start shifting from linearity to circularity in the way they do business. Our industrial economy is still characterised by a linear model of consumption, companies extract materials, add labour and energy, sell it to consumers who dispose it after a short while, when it no longer serves its purpose or just has gone out of fashion. This can be called a take-make-dispose model and this is what the Ellen McArthur foundation, among others, wants us to move away from. This desirable circularity should be
holistic and apply to raw materials, energy and the use of chemicals as well, and hence it also involves renewable energy (burning of fossil fuels is a linear activity since the recreation of oil, coal and gas is basically non-existing). Chemicals should preferably be non-toxic and within closed technical loops.

“A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the ‘end-of-life’ concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models”

Ellen MacArthur foundation 2013, p.7

In the circular economy waste management gets much attention. Circular economy depends on the 3R approach in waste management: Reduce, Reuse and Recycle. We may also refer to the 4R, Reduce, Reuse, Recycle and Recovery, referring to the recovery of the energy content of the material in incineration, or composting. Landfilling is the worst alternative and should be avoided. The disposal of a product in landfill means that all the residual energy is wasted, and when it is incinerated a small share comes to use. If it is recycled a little bigger share of the energy is recovered.

Below are descriptions of some terms used within the field of circular economy and some other concepts.

3.2.1 Cradle to cradle (C2C)
Cradle to cradle as opposed to the old linear concept of cradle to grave, is a concept coined by Michael Braungart and is a central part of circular economy. Together with William McDonough, Michael Braungart wrote Cradle to cradle – Re-making the way we make things, first published in 2002. Since then the concept has evolved and broaden itself and the authors of the book have a consulting and Certification Company called McDonough Braungart Design Chemistry (MBDC) that helps companies implementing the C2C concept in their business.

In this case concerning textile it would imply making new yarn out of old fibres to create new textiles.

3.2.2 Upcycling and down-cycling
Recycling could be straight, downcycling or upcycling. Upcycling is also a concept referring to the desirable scenario when one product turns in to a new product life cycle of the same or higher quality, as opposed to recycling, which could be seen as down-cycling according to this way of reasoning. When you break down a product to its basic material and create a new product, usually with lower quality than the original product, it is down-cycling, like paper for example where the fibres get shorter and shorter for each recycling step until they are only good for combustion.

3.2.3 Displacement effect
Displacement effect is the term referring to things that will not be bought or not produced as a result of efficient use of existing things (in this case garments).
3.2.4 Ecological Footprint
Ecological footprint is a measure of the human impact on ecosystems. The footprint is often compared to the biocapacity, i.e. the available supply of natural resources. This illustrates how big our overconsumption is. Globally we are consuming natural resources as if we had 1.5 planets, Europeans are consuming as if we had 3 planets and the US wins the consumption race with no less than 5 planets. Footprint values are usually categorised into different demands, like carbon, food, housing, or water, or to different environmental problems, such as climate change or water scarcity in terms of “carbon footprint” and “water footprint”.

3.2.5 MIPS-value
Material Input Per Service unit (MIPS) can be calculated for products or services. It is a value that relates the natural resources consumed during the product’s lifetime, to the overall benefit from it. It is a rough but still indicative estimation of the environmental impact of a product. The smaller MIPS value, the lower environmental impact because it is expressed as material input/service unit. In addition to the materials in connection with production it also counts materials involved in transportation, equipment and packaging. And during the using phase, it not just includes the washing detergents and energy used for each wash, but also the natural resources in the washing machine (Zbicinski et al. 2006: p. 235-240).

3.2.6 The waste hierarchy
Waste hierarchy is the order of preference for which actions to take in order to be resource and energy efficient and reduce waste. It is supposed to underpin the development of sustainable waste management practices (Price & Joseph 2000). It exists in different versions and can be formulated in slightly different ways. Here is a common waste hierarchy going from the most preferable to the least preferable:

1. Reduce/avoid creation of waste
2. Reuse
3. Recycle
4. Energy recovery
5. Disposal

According to the EU Waste Framework Directive from 2008 the member states in the European Union shall develop national waste management plans in accordance with a waste hierarchy of five steps (Directive 2008/98/EC), slightly different formulated from the one presented above. It is imperative to work on improvements as high up in the waste hierarchy as possible.

The Swedish government ordered the Environmental Protection Agency to assess the contemporary research in order to make a strategy to adjust the future re-collection system to what recycling methods that can be expected in the next coming years. They also come up with suggestions to decrease the amount of textiles being thrown away

3.3 Combining the four sustainability principles with circular economy
Circular economy cannot fully replace the idea of sustainable development. Circular economy does not itself address all aspects of sustainability, for example, it lacks a social dimension and therefore it gives no ethical guarantees (Murrey et al. 2015). Furthermore, it does not really answer how circular our resource flows need to be. A society within the frames of the
four sustainability principles has to be the goal, and circular economy can work as a means to get us there (Lundholm 2016).

For instance, by keeping materials within loops, less primary production of the same material will be needed, and all upstream environmental impacts in the supply chain of that material will decrease. And by keeping chemicals in closed technical cycles you do not increase concentrations of pollutants in nature. If more systems were transformed from linearity to circularity the development towards a future within the frames of sustainability would be facilitated.

4. Method

4.1 Measuring resource flows

In this thesis one of the biggest focuses is resource flows, which of course is closely related to sustainability performance. There are multiple ways to evaluate the environmental impact or sustainability performance of products’ life cycles, consumers, nations or the whole world. One of the most common measures of sustainability impact is the footprint concept which is sometimes used in this thesis even though I will not myself analyse the cases from a footprint perspective. Another way of monitoring the sustainability performance is by its material intensity through the life cycle, i.e. measuring MIPS-value. One existing calculation of MIPS-value is used and the term is sometimes used even when the absolute numbers behind are unknown. Case study A is primarily about measuring resource flows in terms of whole garments and not their components and different materials and therefore the results cannot boil down to any certain footprint.

4.2 Life cycle method

A very common way of monitoring is to do a LCA, life cycle assessment, where you have to describe the purpose of the study, chosen system boundaries and assumptions and you can choose how to present the result as inventory results of resource use and emissions or in different impact categories where the inventory results are aggregated into impact categories using weighting factors. LCAs of cotton and polyester have different system boundaries and use different assumptions and they present their results with different environmental impact categories and therefore they are not fully comparable. I take a qualitative approach to the sustainability impacts of the life cycle and therefore those concerns are of less importance. Due to the limited scope of this thesis I will not conduct LCAs of the product/services provided by the companies. Sustainability life cycle assessment, SLCA is an assessment tool used by The Natural Step that gives you a strategic overview of the sustainability impacts of the product in question (The Natural Step 2016). In case study B I intend to use a part of The Natural Step’s approach of applying the four sustainability principles in order to make a SLCA-matrix identifying where in the life cycle the sustainability impacts are taking place and in what way this business model effect the life cycle and decrease the unsustainable impacts.
4.3 Method in case study A
Case study A refers to the company Rent-a-Plagg. All information about this company has been gathered through a continuous dialogue with one of the founders Magnus Sellberg. The communication has been both via telephone, e-mail and a meeting. Rent-a-Plagg rents outdoor wear, and I have investigated how they contribute to increased sustainability by analysing how their business is causing a displacement effect. I.e. I have taken a quantitative approach and calculated the amount of clothes that does not have to be produced as a result of their lettings. Based on what Magnus Sellberg has told me about their costumer groups, I have made assumptions about which consumption pattern is being avoided because of the renting. Based on the yearly number of lettings and my assumptions about each customer group I have calculated the displacement effect in terms of avoided purchase and avoided production. The assumptions I had to make were essentially a. to which extent their lettings led to an avoided purchase and avoided production, and b. what the utilization level of these clothes that now do not have to be produced would have been compared to the utilization of garments at Rent-a-Plagg. This case will be analysed and discussed in terms of utilization and MIPS-value and decreased resource flows. Since there are many unknown variables and the calculations are based on assumptions, I have also made a simple sensitivity analysis to show possible outcomes if my assumptions are over- or underestimated.

4.4 Method in case study B
Case study B refers to a company called Saiboo and the information about this company is gathered through a continuous dialogue via telephone with the founder, Åsa Strandberg and also through their web page and TyttillTyg’s web page. My approach to this case is mostly qualitative, but the quantities are also outlined. The sustainability principles have been applied on the life cycle of cotton/polyester textiles and this is illustrated through a SLCA-matrix, (as mentioned in 4.2, a matrix showing qualitative information about the sustainability impacts on each life cycle step). I have also used the information about contemporary research and predictions about clothing recycling to discuss how Saiboo can contribute to make the clothing sector more sustainable. The SLCA-matrix will not show exact numbers of emission levels and should be seen as an overview of the root causes of unsustainable practices in each step of the life cycle, in order to understand what sustainability improvements are being made thanks to the company in question.

5. Empirical study: Case A: Rent-a-plagg
In this case study, the company Rent-a-Plagg and its business model will be presented. I will present their customer groups and analyse what difference Rent-a-Plagg makes, based on my assumptions of these customer groups’ avoided consumption behaviour. All information about this company has been gathered through a continuous dialogue with one of the Rent-a-Plagg founders, Magnus Sellberg.

The concepts of displacement effect and MIPS-value will be used to explain what kind of improvement they contribute with.
Rent-a-Plagg is a small company located in the ski resort Åre in Jämtland. They rent outdoor wear for skiing, skating and hiking etc. It was founded in 2014 by two students with the vision to create a business that promotes a more sustainable consumption pattern where you do not have to own garments that you seldom use. Since they just have existed for two years, many of their garments have not reached the end of their life cycle yet. Thus they have still not been able to find out what the average lifetime or utilization level or average number of service units will end up to be. And the average life time differ between different kinds of garments. That makes it hard to generalise and say how many times one would have to use a bought garment to make the resource efficiency higher than it is at Rent-a-Plagg. A few garments get worn out after only one or two lettings, whereas some garments have been rented out up to 40 times without end of life signs.

How much they contribute to make the clothing sector more sustainable is a broad and open question, one could go into describing indirect impacts such as raising awareness of unsustainable consumption and production patterns and inspire other companies to change or broaden their function etc., but the emphasis in my study will be put on the direct effects i.e. what they are achieving now through their own business.

Rent-a-Plagg is not producing their clothes but the companies they collaborate with are selected for their high quality clothes that can raise profits for a long period of time. These are the brands offered by Rent-a-Plagg and how big share they constitute of their range of garments (Table 5).

<table>
<thead>
<tr>
<th>Clothing brand</th>
<th>Share of Rent-a-Plagg’s assortment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bergans</td>
<td>50%</td>
</tr>
<tr>
<td>Gneis</td>
<td>15%</td>
</tr>
<tr>
<td>Woolpower</td>
<td>10%</td>
</tr>
<tr>
<td>Isbjörn</td>
<td>10%</td>
</tr>
<tr>
<td>Houdini</td>
<td>5%</td>
</tr>
<tr>
<td>Klättermusen</td>
<td>5%</td>
</tr>
<tr>
<td>Vaude</td>
<td>5% (about to increase)</td>
</tr>
</tbody>
</table>

Table 5. clothing brands in Rent-a-Plagg’s assortment

Bergans is not having a very impressive sustainability work at the moment, but they just came up with a new strategy with high and ambitious goals including having a majority of their products bluesign certified and shift towards more sustainable materials (Bergans 2016). Many of the other brands are more or less known as “sustainability leaders”, for instance, both Klättermusen and Houdini started their business with sustainability as part of their core vision. Klättermusen for example has a lot of innovative, more sustainable solutions in their materials, including polyamide made out of castor beans, and also recycled polyamide and polyester, organic cotton and merino wool (Klättermusen 2016).

Rent-a-Plagg has also made other specific choices due to environmental consciousness, like which washing detergents they use, and they opt out all Gore-tex clothes. Gore-tex has a very good water resistance and contain a membrane of polytetrafluoroethylene (PTFE) which is the same material as in teflon pans. These highly fluorinated substances are extremely persistent and some of them are mobile. They also have a negative impact on the environment due to the association to greenhouse gases, both in production and incineration, and despite these facts Gore-tex is frequently used in outdoor wear.
Clothes are also being sold by Rent-a-Plagg if the customer wants it after having rented it that is usually required by their partners, i.e. by the companies from which they purchase their clothes. Especially the latest season collection is being sold, whereas the basic neutrally coloured clothes are kept to a larger extent. These clothes have been with them from start since they still have not been worn out during these two years.

5.1 The customers of Rent-a-Plagg
Rent-a-plagg is trying to target as many different kinds of customers as possible according to Magnus Sellberg, and those can be categorised in to six groups which are renting for different reasons, in reality these groups are of course more complex and overlapping.

To know more exactly what difference Rent-a-plagg makes, one would have to ask all their customers what they would have done if this renting option did not exist. It has unfortunately not been possible to ask all their customers about that, and even if that would have been possible you can never know if people would have done what they say they would have done. My results are based on essentially two assumptions; that 50% of their lettings is causing a displacement effect in avoided production and that these clothes that is now not produced would have had a utilization level of 25% of the utilization level of garments at Rent-a-Plagg. To understand the reasoning behind these assumptions I will here describe their customer groups, based on information from Magnus Sellberg, and explain and how I came to these assumptions. (Those who are not interested in reading about the reasoning behind my assumptions can skip this part and instead look at figure 1 which illustrates a summary of the assumptions made about the different customer groups. That figure shows that 53% of the lettings is an avoided purchase, and I will later explain why I assume that only 50% results in avoided production)

5.1.1 Group 1. Beginners (or those who rarely ski/skate/hike)
This group constitutes about 30% of their customers and are people who do not own their own clothes because they normally do not ski/hike/skate, but want to try, perhaps for the first time. It can for example be people who comes along on a job trip for a couple of days and are hesitant about trying to ski, but since they can hire all equipment and do not need to buy anything, that lowers the thresholds for trying.

Assumption: Some of the beginners would not have bought clothes, they would not have skied at all if the opportunity to rent did not exist, alternatively they would have borrowed from someone. Hence maybe just one third of lettings to the beginner group lead to avoided purchase. Since this group constitutes 30% of the total amount of lettings, this contributes with 10% avoided purchase of their total lettings

5.1.2 Group 2. Tourists
Approximately 24% of their customers are travellers who are here without a lot of luggage. No matter if they are experienced skiers with a lot of equipment at home or not, they rather rent here because of convenience.

Assumption: Travellers is not a homogenous group either, thus the assumption is made that some would have carried their own equipment, and some would have decided not to ski at all, and some would have bought clothes, thus I assume that half of the lettings to the tourist
group leads to avoided purchase. Half of the lettings to the tourist group constituting 24%, is 12% avoided purchases in total.

5.1.3 Group 3. Children (or rather their parents).
About 20% of their customers are children families. Those are maybe one of the most obvious benefiters from renting since children are growing and hence have quick turnover wardrobes.

Assumption: Children families often include more than one child, and thus children’s clothing can be inherited, and it is also common to inherit/borrow from other families with children in other ages and sizes. If a family rents outdoor wear to all their children year after year while they grow, instead of buying for the first child and then let the younger(s) inherit, then all the lettings will not lead to avoided purchase, but quite many would. It will be assumed that half of these lettings will lead to avoided purchases. Half of the children group of 20% is 10% avoided purchase.

5.1.4 Group 4. Forgetful persons
15% are people who mistakenly forgot a garment at home and rather rent than buy a new.

Assumption: People who forgot things at home is a group where most likely most of them would buy new clothes, perhaps from a cheap brand with low sustainability performance. A few would manage to borrow or use something less suitable for the purpose in question. Thus I assume that 80% of these lettings cause avoided purchases, i.e. 12% in total.

5.1.5 Group 5. Fashionistas
10% are fashion conscious people who want the latest colours from the current season’s collection. These people would otherwise buy a new ski jacket every year to be fashionable in the ski slope. These people save money from renting every year in comparison to the consumption pattern they would have had otherwise.

Assumption: Fashionistas rent because they want the latest, but even fashion conscious people are sometimes short in money, and perhaps they would not always allow themselves to buy a new jacket every year even though they want to. I assume that 80% of the lettings to this group cause an avoided purchase. 80% of this group of 10% in total is 8% avoided purchases.

5.1.6 Group 6. Companies
There is also a small fraction of customers, ca 1%, that are companies who rent working clothes long term for whole seasons. That makes it simpler for them to rent a whole kit that changes over the seasons and washing and reparation is included which makes it a favourable service.

Assumption: Companies are usually required to provide working clothes and thus I assume that all of those lettings is avoided purchases. Hence this group constitutes 1% avoided purchases in total.

5.2 Calculation of avoided purchase with illustration
If these assumptions concerning avoided purchase are added it is: 10+12+10+12+8 +1= 53% of Rent-a-plagg’s lettings that mean an avoided purchase.
5.3 How big is their business?

Rent-a-Plagg is a small company with a turnover of approximately 770,000 SEK/year. They have an assortment of approximately 100 sets of clothes. The last year they had 205 lettings, 199 times short term lettings, 1-7 days, 1 day being the most common case. Additionally, they have 6 long term leasing subscriptions, from one season up to indefinitely.

25% of their lettings are single garments, 25% of 205 is approximately 51 garments. The remaining lettings are either sets or packages, approximately 50/50, thus 37.5% of 205 is app. 77 and therefore 77 lettings consist of two garments and 77 lettings consist of approximately 4 garments. $51 + 77 \times 2 + 77 \times 4 = 513$ lettings of single garments. Figure 2 illustrates this calculation.

Rent-a-Plagg has been expanding their business since they started two years ago, and this business model seems to have potential to survive (and grow) as more and more people get aware of the benefits with renting. WRAP has been investigating financial viability and resource implications for different circular business models within the clothing sector. Referring to a model that is providing hiring service of formal evening wear, they point out that when the focus is on a small segment of clothing, the displacement effect is relatively small compared to other business models, i.e. the environmental improvements are not huge,
but it is financially viable (Buttle et al 2013). This can perhaps be said about sport wear/outdoor wear too, but so far Rent-a-Plagg’s business has not been any huge financial success.

5.4 Calculations of total lettings

So far it is just the number of garments that have been calculated, now a weight unit will be added. Among their lettings of single garments and sets, the share of thin clothes/padded clothes are approximately 40/60 according to Magnus Sellberg. A padded jacket weighs 1000 grams, padded trousers weigh 865, thin jacket weigh 400 grams and thin trousers weigh 505 grams, all in size medium for women. To simplify I calculate padded clothes as 950 grams (a relatively high average is used here since they get heavier in larger sizes) and thin clothes as 450 grams even though there are differences between trousers and jackets and different sizes. Sets of underwear are basically just rented in packages, and a set of underwear weigh between 400 and 500 grams, so I will calculate all sets of underwear as 450 grams.
The results in figure 2 and 3 make it possible to calculate the average weight for one garment which have been used to calculate the weight of the resulting production of textile avoided in the sensitivity analysis further down. 303 900g/513 garments = 592 grams/garment.

5.5 How many lettings is causing a displacement effect?

As shown above, they rented 513 garments the last year (the same garments have been rented several times of course) and if 53% of those results in an avoided purchase, that means that approximately 271 avoided purchases of single garments. Since the research question is about how they contribute to making the clothing business more sustainable I cannot leave it like that. The number of avoided purchases does not answer that question. Some studies make no distinction between avoided purchase and avoided production, but in order not to overestimate the environmental benefits of this business model I will try to account for that as well even though it will be very simplified and many variables will be left out.

Displacement effect of avoided purchase does not necessarily mean the same thing as avoided production. Avoided production of clothes is a result of other clothes being efficiently used, and purchased clothes can also be efficiently used. Hence it has to do with the utilization of clothes, or MIPS-value, material input per service unit. The more service units, the lower MIPS-value. The lower MIPS-value due to increased number of service units, the bigger displacement effect of produced clothes.

Rent-a-Plagg is therefore making the clothing business more sustainable only if it actually increases the utilization of clothes. The ownership in itself does not matter; it is the how much the garment is used – the number of service units - that matters since that is what is lowering the MIPS-value of the product and causing displacement effects of clothes that are not used and thus not produced as a result.
In order to know more about what the displacement effect of *produced* clothes is, one would have to ask all customers who now constitute the avoided purchase group (the customers who would have bought clothes if the renting option did not exist) how much they would have used their garments that they would have bought. That possibility did not exist and even if it had one could never be sure that people’s predictions of future clothing use would be correct. The number of service units of the owned garment would have to be compared with the average number of service units of a garment at Rent-a-Plagg, which is still unknown because of the youth of this company.

It seems logical to assume that most of the people who do rent are those who do not think it is worthwhile buying, since they suspect that they would not use it much. If you would use that kind of garment often, you would probably not want the extra effort it takes to rent. The main exceptions I can see are the long term leasing customers who want this as a package of services, as a prescription, including laundry, repair and replacement if anything gets broken. In their case the long term leasing becomes a matter of convenience instead. They are probably using these garments during an equally long period of time and as much as if the clothes would have been purchased. Since the longevity of these garments is what decides the displacement effect of production I assume that these long term leasing and subscriptions are not increasing the utilization.

6 out of 205 lettings are long term leasing and subscription, which means that at least 3% of their lettings in total are causing a displacement effect in purchase, but not in production. If 3% is subtracted from the 53% of total lettings that is causing avoided purchases; that would mean that just 50% of their lettings are causing a displacement effect in production. (But there is a chance that they actually do increase the lifetime even in those cases, since they repair their garments, while those who do not bother repairing their clothes might just buy new ones when a seam break).

I therefore assume that 50% of their lettings are causing avoided purchase and displacement effect in production; that means that those 50% would have bought clothes that they would have used less than an average garment at Rent-a-Plagg. 3% are causing avoided purchase but not avoided production due to the same utilization and the same MIPS-value in the renting option and the owning option. The remaining 47% of their lettings are not causing any avoided purchase since those customers would have either borrowed clothes, used some less suited clothes, or decided not to ski/hike at all.
Based on these assumptions I draw the conclusion that every second letting is causing a displacement effect in production. I.e. that the purchases that is now being avoided would have been inefficient in comparison with the efficient use of garments at Rent-a-Plagg.

While you can simply put the unit 1 garment on displacement effect in avoided purchase, you cannot simply do the same thing for displacement effect in avoided production since that depends on the level of utilization. If 40 costumers rent the same garment during its lifetime, that garment is causing a displacement effect of \(40 \times 1 = 39\) in avoided purchase. But the displacement for avoided production would only be the same thing if the clothes that are avoided to be purchased would have been used only to an equal extent of 1 rental time before disposal. And that does not seem likely, but even if the garment would have been used 10 times, the displacement effect in avoided production is still 75% of the displacement effect in avoided purchase. (That is of course only valid if it is assumed that the garment in question is replaced with a new one after those 10 times) Thus displacement in avoided production refers to something gradual, the level of probable utilization of the garment that is avoided to be bought. The longer the use phase is the more seldom a new garment needs to be produced in order to replace the first.

As pointed out above, it seems likely that the people who decide to rent instead of buy generally are those who would not use their clothes much if they bought them, except from

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**Figur 5.5.1: Schematic view of which lettings lead to avoided production or other possible sustainability impact**

Rent-a-Plagg makes it more convenient for those who want a package of services and makes sure clothes are repaired and washed in an environmentally friendly way, can prolong the life time.

Every second letting increase the level of utilization and thus cause a displacement effect in production i.e. reduced unsustainability impact from production.

Rent-a-Plagg makes it easier for these people to try new sports and enjoy high quality garments to an affordable price. Happy, sporty and healthy people --> increased social sustainability!
the long term leasing customers. Rent-a-Plagg on the other hand, has both environmental concerns and economic reasons for taking good care of their garments. They try to make the life time as long as possible and the profit for each garment as big as possible. Therefore I will assume that the life time, or number of service units of the clothes that are now not bought, would be one quarter of the life time and service units of garments at Rent-a-Plagg. This means that of these 50% lettings that are causing displacement effects in avoided purchase and production, - where displacement in production is something gradual relating to level of utilization - 75% are avoided produced garments with the unit 1 garment.

As shown above they rent 513 garments each year (the same garments are rented several times of course) and 50% of 513 is 256.5. 75% of 256.5 is approximately 192. Hence I conclude that approximately 192 garments do not need to be produced each year thanks to Rent-a-Plagg. See figure 5.4.2.

Figure 5.5.2: Calculation of displacement effect in production due to higher level of utilization of garments at Rent-a-Plagg
As calculated above, the average weight for one garment is 0.592 kg, which means that 114 kg high tech-textile does not have to be produced.

5.6 Results
In summary, the results are based on renting statistics from this company and essentially two assumptions:

1. The share of lettings leading to a displacement effect both in terms of avoided purchase and production is 50%
2. What the level of utilization of these garments would have been if those 50% were not avoided purchases, in comparison with the level of utilization of a garment at Rent-a-Plagg. My guess was an average of 25% of the utilization level of garments at Rent-a-Plagg.

That leads to the result that 192 garments, 114 kg high-tech textiles, do not have to be produced thanks to Rent-a-Plagg’s business.

5.7 Sensitivity analysis
So what would the result be if I have over- or underestimated this? Table 5.5 is a sensitivity analysis showing a range of possible results based on other assumptions of displacement effect and utilization levels. (The highlighted yellow column is my guess)

| 1. Assumed displacement effect in both purchase and production | 25% | 25% | 25% | 50% | 50% | 75% | 75% |
| 2. Assumed level of utilization compared with Rent-a-Plagg | 75% | 50% | 25% | 50% | 25% | 10% | 25 | 10% |
| Resulting production of garment (number) avoided | 32 | 64 | 96 | 128 | 192 | 230 | 288 | 346 |
| Resulting production of textile (kg) avoided | 19 | 38 | 57 | 76 | 114 | 136 | 170 | 205 |

As shown above, even if my assumptions are not correct, they still cause displacement effect in avoided production to some extent since the number of garments or kilos of textile of resulting avoided production will be positive as long as assumption 1 is not 0% and assumption 2 is not 100% and I see that as most unlikely.

6. Empirical study: Case B: Saiboo and the TygtilTyg project
In this case study, Saiboo and its business model will be presented and analysed. Since their business consists of essentially two materials, cotton and polyester, some effort will be put on
explaining what is being avoided if these two materials can be recycled and consequently creating less demand on virgin material. This will be done by an SLCA which also provides an overview of how the life cycle of the fibres can be changed if their (or somebody else’s) recycling research project succeeds. Information about Saiboo has been collected through a continuous dialogue with the founder of Saiboo, Åsa Strandberg, and also their web page.

Saiboo is designing and producing workwear for healthcare and service related companies in the private sector and not to public county driven hospitals. The clothes are sold to health centres, elderly care, dentists, spas, hotels etc. and after the workwear have served their purpose, they do not have any second hand value. This is a big room for improvement and one of Saiboo’s core business ideas is to make all these white cotton/polyester textiles come to use in one way or the other. The clothes are therefore returned to Saiboo after they have been worn out. The reason for that is that Saiboo wants to use them for recycling. Some would rather call it remanufacturing (or upcycling) since traditional recycling implies some kind of downcycling, whereas Saiboo wants to use the old clothes to produce the same product again or with the same quality.

Saiboo has a turnover of 2 million SEK and they sell approximately 8000 garments/year in a material of 50% cotton and 50% polyester. They use conventionally grown cotton and polyester, and are not making any specific efforts to improve sustainability performance upstream in the supply chain. The garments weigh in round figures 300 grams (shirts) and 600 grams (trousers). Two thirds of the clothes they sell are shirts and one third is trousers and therefore the mass of their annual resource flow can be calculated in round figures:

5333,33 shirts x 300 grams =1600 kilos
2666,66 trousers x 600 grams = 1600 kilos
1600 kilos + 1600 kilos = 3200 kilos in total

This is a pretty new company, so their oldest clothes have just been in use for three years, and therefore they still have not gotten that much clothes back and therefore no recycling has been taking place so far.

The only possible recycling forms that they could use now today different forms of downcycling. That could be making different kinds of home textiles like mats and cushions or rags and padding. This is not what Saiboo is aiming for, they want to upcycle and therefore they also want to improve the recycling technologies for textile fibres in order to make high quality yarn for the manufacturing of new clothes. They aim for having closed material loops, but you are not closing any loops if the fibres from clothes do not go back to being fibres in clothes again.

In order to fulfil their dream business model of closed material loops they are running a research project called TygtillTyg in collaboration with universities/institutes of technology with the overarching goal to develop new technologies recycling textile fibres into new textile fibres. This involves separation of cotton and polyester and mechanical and chemical recycling of cotton fibres, in which the latter produce cellulose fibres like viscose and lyocell. That is already possible on a laboratory level but not yet on an industrial level. Polyester can already be recycled, the difficult part is to separate it from the cotton.
Previously TygtillTyg was focusing mostly on chemical recycling of cellulose based textiles, but since many others are doing the same thing they decided to focus more on mechanical recycling by trying to develop a gentler separation technology that does not destroy the fibres. If that succeeds and that can be enormously valuable since mixed materials are very common and at least the recycling technologies known today requires a high degree of material purity. Separation technologies is also one of the prerequisites for large scale recycling systems listed in the report by Naturvårdsverket. Since Saiboo’s own clothes are made of mixed materials, cotton/polyester, there is highly in their own interest to come up with a separation technology in order to put their desired business model into practice.

Saiboo has also been running a project for a new design method, which aims for making the clothes prepared for recycling already in the design phase. In order to close loops, the designers need to know what materials to mix for enabling separation and recycling in technical or biological cycles. This project resulted in a framework for a tool that is now called Återvinningsnyckeln (the recycling key) that works as a check list that designers should use when deciding on which materials and how to design. The purpose is that the designer should have a possible second life of their clothes/material in mind when designing. The overarching aim is to realise one of circular economy’s core ideas -to design out waste.

6.1 Sustainability impacts of cotton/polyester textile mixture

Cotton and polyester are very common materials and also problematic in a number of ways. As noted by Karlsson and Björklund (2009) if the cotton production is going to become sustainable, we need to move towards organic cotton cultivation, without pesticides and fertilizers and with smarter irrigation systems. Organic production requires at least 50% more land because the absence of fertilizers and pesticides usually results in lower yields. Since most arable land needs to be used for food production in order to feed the growing population, we have to conclude that the cotton production needs to decrease on a global scale. If cotton could be kept within loops that would lower the pressure on water supply and the ecosystems affected by cotton production.

Polyester is made out of petroleum or recycled from PET-bottles (which is also made out of petroleum of course) and therefore polyester is definitely a material that we better keep in loops. All combustion of petroleum-based things increases the amount of carbon in the atmosphere, which goes under principle 1, that we should not emit substances from the earth’s crust.

<table>
<thead>
<tr>
<th>Life cycle stage</th>
<th>Principle 1 Substances from the earth’s crust</th>
<th>Principle 2 Substances produced by society</th>
<th>Principle 3 Physical deterioration of the ecosphere</th>
<th>Principle 4 Human needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Raw material extraction</td>
<td>Fossil fuels used in machinery, transport and</td>
<td>a: Use of pesticides and herbicides</td>
<td>Acquisition of land, destruction of</td>
<td>Lack of labour rights. Poor working conditions.</td>
</tr>
<tr>
<td>Life cycle stage</td>
<td>Principle 1</td>
<td>Principle 2</td>
<td>Principle 3</td>
<td>Principle 4</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------</td>
<td>-------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>1. Raw material extraction</td>
<td>Fossil fuels used in machinery, transport and infrastructure surrounding the cultivation. Metals in machinery etc.</td>
<td>a: Use of pesticides and herbicides b: Emissions of chemicals from refinery processes</td>
<td>a&amp;b: Acquisition of land, destruction of natural ecosystems, a: Irrigation disturbing the natural water flows, causing draughts and salinization destroying ecosystems</td>
<td>Lack of labour rights. Poor working conditions. Exposure to chemicals</td>
</tr>
<tr>
<td>a. Cotton: cultivation and harvest</td>
<td>Fossil fuels and oil extraction. Metals in machinery etc.</td>
<td>Chemicals emitted from the dyeing process, lack of purifiers</td>
<td>Land used for industries and infrastructure surrounding</td>
<td>Exposure to chemicals</td>
</tr>
<tr>
<td>b. Polyester: extraction of oil and refining</td>
<td>Energy for washing</td>
<td>Polluting emissions from shipping etc.</td>
<td>Infrastructure</td>
<td>Poor working conditions</td>
</tr>
<tr>
<td>2. Production (Spinning weaving dying and finishing cutting and sewing)</td>
<td>Energy for washing</td>
<td>Polluting emissions from shipping etc.</td>
<td>Infrastructure</td>
<td>Poor working conditions</td>
</tr>
<tr>
<td>3. Shipping and other transport to retailers, distribution to hospitals</td>
<td>Energy for washing</td>
<td>Polluting emissions from shipping etc.</td>
<td>Infrastructure</td>
<td>Poor working conditions</td>
</tr>
<tr>
<td>4. Use</td>
<td>Energy for washing</td>
<td>Washing detergents</td>
<td>Infrastructure</td>
<td>Poor working conditions</td>
</tr>
<tr>
<td>5. Combustion</td>
<td>Energy for washing</td>
<td>Polluting emissions from shipping etc.</td>
<td>Infrastructure</td>
<td>Poor working conditions</td>
</tr>
</tbody>
</table>

The SLCA-matrix above shows the life cycle of conventional cotton/polyester-clothing plus the sustainability impacts associated. This is to be compared the following SLCA-matrix where the end of life part looks different (the changes in the life cycle is written in blue and the environmental benefits is written in green).
<table>
<thead>
<tr>
<th>2. Production (Spinning, weaving, dyeing and finishing, cutting and sewing)</th>
<th>Fossil fuels and fossil based energy in factories, Metals in machinery and equipment, Transports</th>
<th>Chemicals emitted from the dyeing process, lack of purifiers</th>
<th>Land used for industries and infrastructure surrounding</th>
<th>Poor working conditions, lack of labour rights exposure to toxic chemicals in dyeing process etc</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Shipping and other transport to retailers, distribution to hospitals</td>
<td>Fossil fuels and vehicles</td>
<td>Polluting emissions from shipping etc.</td>
<td>Infrastructure</td>
<td>Working conditions</td>
</tr>
<tr>
<td>4. Use</td>
<td>Energy for washing</td>
<td>Washing detergents and fabric softeners</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>5. Re-manufacturing</td>
<td>Energy input and machinery for remanufacturing</td>
<td>Possibly chemicals used in the recycling process</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>6. Second life as cotton or lyocell in another garment</td>
<td>Displacement effect → less of all impacts upstream except remanufacturing</td>
<td>Displacement effect → less of all impacts upstream except remanufacturing</td>
<td>Displacement effect → less of all impacts upstream except remanufacturing</td>
<td>Displacement effect → less of all impacts upstream except remanufacturing</td>
</tr>
<tr>
<td>7. Re-manufacturing</td>
<td>Energy input and machinery for remanufacturing</td>
<td>Chemicals used in the recycling process</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Etc.

A comparison of the two tables above illustrate a simplified overview of the changes in the life cycle of cotton if it at end-of life can be remanufactured into either new cotton thread through mechanical recycling, or lyocell/viscose through chemical recycling.

As mentioned earlier, sustainability performance can be discussed in terms of MIPS-value - material input per service unit. One MIPS analysis of a sweater described by Zbicinski et al. (2006) calculated the material input to 14.4 kg for a sweater made of 50% cotton and 50% polyester. The service unit can be either the amount of times a garment is used or washed, in
this case they choose the amount of times washed, and assumed it to be 50 Hence MIPS= 14.4 kg/50 washes= 0.288 kg/washing cycles.

Cotton has a relatively high material input so if the cotton was replaced with viscose for example, the material input would decrease from 14.4 to 11.9 kg per sweater. If it was made of cotton purely it would be 16.8 kg (conventionally produced cotton) (Zbicinski et al. 2006 p. 235-240).

As we can see from that material input values conventional cotton has higher value that both polyester and viscose. Viscose has the lowest value and is therefore the most environmentally friendly.

This ranking of materials sustainability performance is not totally comparable because different LCAs use different impact areas or system boundaries and can evaluate environmental damage differently. And when it comes to cellulose based fibres from wood the rankings in the MSI (Material Sustainability Index) vary a lot depending on whether it is lyocell or viscose and which wood the viscose is made out of and where it comes from. Cellulosic fibres environmental impact is therefore adjustable and can be quite sustainably produced.

6.2 Results
Since this case study is more qualitative and descriptive this result-chapter is just a short summary.

Saiboo is running a research project trying to find new technology to separate fibres of mixed materials and to recycle. If this succeeds they will be able to recycle cotton and polyester and thus cause a displacement effect in terms of virgin material that does not have to be produced. This will reduce the sustainability impacts connected to the production phase.

If their research project is not the project that will come up with a winning concept that will be put into practice, they are still helping in pushing this development forward and filling knowledge gaps in the research front of textile recycling.

When a recycling technology is being put into practice, no matter who found it, Saiboo is contributing by sending their worn out clothes to that recycling plant, which today is about 3200 kg cotton/polyester textile.

7. Discussion
7.1 How is Rent-a-Plagg contributing to sustainability improvements?
As mentioned several times, this is very simplified and the results are based on assumptions about these customer groups and their consumption behaviour. To know more exactly one would have to interview them all, and even if that was possible, those results would not be undoubtedly reliable either, since people are not always good at predicting their future behaviour. I think it is common to overestimate how much you will use a garment when you buy it. Maybe you buy sporty outdoor clothes because you plan on becoming a sporty
outdoorsy person, but then your motivation fluctuates, and the plan ends up not being put into practice. And the only function of these clothes become to work as a sad reminder of your incapability of changing your habits.

In theory, people might be positive to give clothes away to charity, second hand shops and friends etc. but as pointed out by for example Carlsson et al (2011), we are not very good at that, many of us seem to be very inefficient users. The biggest amount of our inflow of clothes are just being accumulated in our wardrobes. That supports my assumption that those in the avoided purchase group would have a smaller number of service units of their purchased garments.

These calculation has also just been concerning those 50% that I assume are causing a displacement effect in production. The remaining 50% that is not causing displacement effect in avoided production has not been taken into account. Those 3% long term leasing customers neither add nor subtract to the number of produced clothes. In the cases of those who would have borrowed clothes from someone and those who would have skied in less suitable clothes, the service units would add to the utilization of another garments and are not taken into account. But this group who would not have skied at all is actually users that would not exist without Rent-a-Plagg, hence they have increased the demand, which can be environmentally bad. It would be more (environmentally) sustainable not to ski at all, especially if ‘not ski at all’ meant that you were not taking your car to drive to Åre etc. On the other hand, it would be much worse if you instead used your vacation to fly to Thailand and so on. Therefore, it is very hard to make assumptions about that group of 47% that is not constituting any avoided purchase, hence those are left out from the calculation. One thing that is worth mentioning though, is that it is nice to ski and Rent-a-Plagg lowers the thresholds for people to come out in nature for recreation and sporty activities by providing this service. Therefore, they are probably doing the customers’ health a favour, which is a plus on the social sustainability side. In addition, it is also worth mentioning that it does not seem unlikely that these lettings instead would have been purchases of clothes with lower quality, shorter life time and with a lower sustainability performance, which makes it even more reasonable to conclude that Rent-a-Plagg is contributing to a less unsustainable consumption of clothes.

Making sure the garment is used by as many people as possible without all of them having to buy their own garment is their core business idea. And this is of course good if it actually increases the amount of service units of garments, i.e. if inefficient consumption pattern is being avoided as a result and the group of inefficient users are targeted. I argue that they succeed in doing that. My estimate is that roughly every second letting from Rent-a-Plagg is making people avoid inefficient consumption patterns and thus causing a displacement effect in terms of in production. It is not possible to say that “it is more environmentally friendly to rent a garment than owning it” because it depends on how much you use it. From the consumer’s perspective, that means I should ask myself: would I use this garment a lot? Then I better buy it. For anyone who is not a frequent outdoors sportsman or women, or did not bring their own equipment for a vacation to Åre, renting is the more environmentally friendly option. If you buy a garment that you wear until it is only lump and thread left, and keep repairing then that is more environmentally friendly because you keep wearing that instead of buying a new one.
But it seems likely that people who wear their clothes until it is only lump and thread left are not the people who rent garments, as mentioned in the case study. The efficient users are not the main target group of Rent-a-Plagg and also not the people whose consumption pattern needs to change. The bigger the displacement effect the better, no matter the ownership.

This business model is as you probably have realised by now, not circular in the way that it tries to close loops or upcycle, but in the sense that the customer get access instead of the ownership, they use instead of buy and dispose. This is the business model that according to Accenture’s classification is called Product as a Service. This is also sometimes referred to as sharing economy, which can be anything from car-pooling to sharing things online, and here it just refers to several people “sharing” the same item since it is rented time after time. This gives incentives for making products with long durability and high quality. Longevity is then no longer seen as a threat, but a prerequisite, for revenues (Lacy et al. 2014).

And if using Accentures five business models, Rent-a-Plagg can also partly be categorized as circular supplies, since some of their clothes are from companies with high sustainability performance who are trying to incorporate circular ideas and turn to more sustainable materials that are recycled, recyclable and/or biodegradable.

In this way they are not just causing a displacement effect in production, they also promote production of more sustainable clothes instead of production of clothes in a business as usual manner. Since they also have control over the end of life they can make sure that their clothes are reused/recycled according to the best available possibility.

7.2 How is Saiboo contributing to sustainability improvements?

Saiboo is taking initiatives and pushing this research field forwards, trying to fill the current knowledge gaps. If it is their research project, Tyg till Tyg that will come up with the solution that enabled recycling on a larger scale or if it is some other project will of course matter when it comes to how much credit one can give them, they can come up with a real game changer or just jump on the bandwagon when somebody else come up with a technology that enables large scale separation of mixed materials and recycling of cotton. If we are to believe the report by Naturvårdsverket, there will be recycling plants in demo scale already 2020 for chemical recycling of cellulose based textiles. If Tyg till Tyg or any other project succeeds in finding a new technology to separate synthetic and cellulose based fibres, then Saiboo can consequently send approximately 8000 garments (3200 kilos) each year, i.e. contribute with approximately 1600 kg cotton. Once a bigger large scale collecting system mentioned in chapter 2.5 contemporary research is in place Saiboo will probably just contribute by sending their clothes there, and that will be nothing particular, but just a question of business hygiene that all companies will do. Extended Producers’ Responsibility, (EPR) is since long implemented by law for many products like electronics, cars and batteries etc. This case is an example of the business itself introducing EPR for clothing, illustrating that proper waste management is an essential part of circular economy and taking responsibility as a company.

Lyocell is having a better sustainability score than cotton also when the cellulose is from virgin cellulose material (MSI-index, sustainable apparel coalition 2016). If lyocell got an even greater share of the common material mix, because of the new recycling technologies,
then all the environmental impacts that cotton production is having would decrease, less
virgin material would be needed, both in cotton and cellulose.

It needs to become more efficient and economically viable to produce lyocell out of cotton
than to produce lyocell out of wood, but hopefully/probably that will be a reality soon. Saiboo
is pushing this development forward, and trying to fill knowledge gaps and encourage
designers to think more circular when designing clothes.

8. Conclusions

8.1 A. Rent-a-Plagg
Rent-a-plagg is contributing to make the clothing business more sustainable because of the
displacement effect taking place when some of their customers avoid the purchase of a
garment that would have been used less than a garment spending its life in renting cycles at
Rent-a-plagg. This reduces the sustainability impacts connected to production of clothes
because less clothes need to be produced. They are doing this by extending the using phase in
the life cycle and they work at the top of the waste hierarchy since they reduce the creation of
waste.

8.2 B. Saiboo and the TygtillTyg project
Saiboo is making the clothing business more sustainable by pushing the research in separation
and recycling technologies forward. They address the third step in the waste hierarchy, which
is needed in their case since their clothes, in lack of any second hand value, inevitably reach
the end of life after a certain period of time. If all their clothes end up being recycled that
constitutes 8000 garments per year which is 3200 kg textiles that is being recycled.

The prerequisite for this being an environmental benefit is that these recycled materials
replace virgin materials and not just adds to status quo. It seems likely that they will replace
virgin fibres since resource scarcity is here to stay (and grow), and so are also hopefully
environmental regulations and awareness of customers.

Saiboo can possibly contribute with the recycling technologies enabling separation of cotton
and polyester and thus the recycling of each material, cotton becoming either new cotton or
lyocell/viscose. If cotton can be recycled that could obviously lower the demand on virgin
cotton, but that might happen even in case lyocell/viscose is becoming the main secondary
product. The incentives for designers to add more lyocell/viscose in material mixes in fabric
will most likely increase, which in turn can lower the demand on virgin cotton. In the future
the common composition of virgin cotton and polyester 50/50 might have changed to for
example 25% virgin cotton, 25% recycled lyocell and 50% recycled polyester. That could
lead to lower cotton demands which would lower the pressure on land for cotton cultivation
which enables organic cultivation and more sustainable agricultural methods.
8.3 General conclusion

So to the question about how circular economy business models in general can contribute to make the clothing business more sustainable, there are several answers. Circularity can and should be applied at different stages in the life cycle of clothes to either minimise resource flows or put resources in loops. All stages of the waste hierarchy should be worked with, Rent-a-Plagg works with the first two, avoid creation of waste and reuse, by displacement effect in avoided production and making the clothes be reused over and over again. Saiboo works with the third step, recycle, which is also very important since there will unavoidably be clothes that are disposed sooner or later, they cannot be reused forever, and some clothes, like work wear in this case, lack second hand value. Since resource scarcity is here to stay circular economy seems become something inevitable, companies cannot afford being wasteful, both due to material costs, but also for their brand image. In the future companies cannot afford a bad reputation as a company that does not care about shifting their business towards sustainable practices and resource management. Circular economy business models are something that we will see more of, both in the clothing sector and other sectors.
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