Sustainability Analysis

yoona.ai

Published by:
YOONA Ventures GmbH

Address:
Hönower Straße 34,
10318 Berlin
Germany

Email: info@yoona.ai
Website: https://yoona.ai

Author:
YOONA Ventures GmbH

April 2022

Title page & background photo by Alexey Marchenko

Foreword

My assignment? A clean fashion industry!

According to official studies, the fashion industry worldwide produces more than the nations of Germany, France and the UK combined, making it one of the biggest polluters in the world.

By taking appropriate measures, we can save up to 93% of CO_2 and 9 million tons of material, produce 36% fewer items that ultimately end up in landfills, and thus not only make a fundamental contribution to our planet, but also subject the fashion industry's justifiably poor image to a sustainable transformation.

I firmly believe that the solution can lie in technology. Holistic digitalization can close the gap between achieving sustainable goals on the one hand and economic ones on the other.

And that is my mission. I want to protect resources with the help of appropriate technologies. Otherwise, who but we, as industrial companies that know the processes, can drive the changes? That's why in 2020 I started working on a technological solution that implements processes in the design area efficiently, cost-effectively and sustainably.

With yoona.ai, we now provide the technology and tracking of the aforementioned factors: from idea to production - using AI, AR and neural networks. This saves time, costs and resources. And it protects our environment. It is our responsibility.

In this report, we highlight the potential contribution of the use of cutting-edge technologies to environmental protection in the fashion sector.

Let's create the future of fashion! Together!

Yours sincerely

Anna Franziska Michel
CEO & Founder of yoona.ai

Introduction

The fashion industry represents an industrial sector whose harmful impact on our environment has tended to be neglected in the public discourse on environmental protection, climate change, and economic sustainability in recent years. This seems all the more surprising when one realizes that **the apparel industry ranks second only to the oil industry as the world's largest polluter**[1]. When one takes into account the fact that garment consumption has increased by 40% over the past decade and that less than half of the textile goods that are no longer used are actually recycled, or only about 1% of them are used to make new garments, there is a growing understanding that urgent action is needed to increase sustainability in this important industry.

In this context, the fashion industry as a fundamental part of the textile economy holds enormous potential that needs to be exploited for the sake of sustainable production and consumption. In the following, it will be shown that in the development of collections, the first step in the value chain of the clothing industry, not only does the ecological context have to be thought of, but this is also accompanied by a substantial economic gain so that the drive to work sustainably offers advantages on several levels at once. Of course, the design process is only one step on the way to the garment. However, as a first step, enormous savings and sustainability potentials can already be realized here.[2]

To assess sustainability and efficiency, 6 criteria were established to measure the use of yoona.ai technology compared to conventional collection development processes.

1. **Energy expenditures**
2. **CO_2 consumption**
3. **Material consumption & waste generation**
4. **Water consumption & pollution**
5. **Time**
6. **Toxins & chemical contamination**

For better comparability and due to the greater availability of data, the available values for t-shirts were used. More costly and more material-consuming garments such as pants, jackets, or dresses can be estimated in the same way as less resource-consuming garments (underwear, socks, etc.).

[1] https://ellenmacarthurfoundation.org/a-new-textiles-economy
[2] https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/633143/ EPRS_BRI(2019)633143_EN.pdf.

1. Energy expenditures

Around 120 billion items of clothing will be produced worldwide in 2021. 10% of these will come from Germany, making **12 billion garments**.[3] In Germany, the energy consumption of the clothing industry is around 22,000 terajoules per year.[4] **This results in an average energy consumption of around 1.833 MJ per garment.**

This amount of energy is roughly equivalent to 0.51 kWh. Larger companies report that they create about 6,000 designs per month. Of these, on average about 30% move into the prototype phase, with about 4–6 physical prototypes produced from each of these prototypical designs. If we now conservatively take the lower limit, i.e. 4 prototypes, this results in a total number of about 7,200 shirts per month and thus an energy consumption of 3,672 kWh per month. Using the yoona.ai engine, about 300 assistants are trained for the 1,800 designs. One wizard consumes 300 W x 48 h = 14.4 kWh for training, resulting in an energy consumption of 4,320 kWh for the training phase alone. If we calculate for one assistant about 5 outputs, each taking half an hour of time and 300 W of power, we calculate for it

300 x 5 x 300 W x 0.5 h = 225 kWh

This results in a total energy consumption for the development of the 1800 designs with the corresponding number of prototypes of

4320 kWh + 225 kWh = 4,545 kWh

Now, at first glance, the use of yoona.ai technology does not result in any energy savings. At first glance, this does not seem surprising; after all, a computing machine based on artificial intelligence is used here, whose computing power primarily requires electrical energy. This contrasts with a production system of conventional machines that has been optimized over many decades and is now capable of producing textiles with comparatively low energy consumption. For the sake of completeness, however, it must be noted that **for conventional collection development processes, numerous quantities of energy that can hardly be scaled in a meaningful way must remain unconsidered**, starting with the energy amounts of the first drafts, which must be transferred by the designers from paper to electronic storage systems or other input devices, via sketches that are based on design software and must be stored, processed and transferred there accordingly, to the energy amounts that are based on logistics, mediation, communication and the like. Those quantities have to be disregarded due to lack of comparability and data availability. If one also assumes an optimization of the computing processes associated with the further development of the yoona.ai technology in conjunction with the improvement of the computing technology used, the additional consumption of electrical energy when using the yoona.ai software is likely to be even lower. In addition, the use of completely regenerative energy sources has no negative impact on the ecological balance.

1.8 MJ

The energy consumption per garment in Germany in 2021

[3] https://www.quarks.de/umwelt/kleidung-so-macht-sie-unsere-umwelt-kaputt/
[4] https://www.verband-textil-bekleidung.de/fileadmin/Daten/Rundschreiben-Wirtschaft/ RS-2017-economic-policy/numbers2017_web.pdf, Here page 56


Photo by Patrick Hendry

2. CO_2 consumption

The textile industry causes around 1.2 billion tons of CO_2 emissions annually[5], significantly exceeding the combined emissions of international air and sea transport.[6] The emissions correspond to about 5% of global CO_2 emissions. According to research conducted by the Massachusetts Institutes of Technology (MIT), a **CO_2 equivalent of about 5.5 kg for a synthetic shirt and about 2.1 kg for a cotton shirt** could be calculated.

For the approximately 7,200 prototypes produced each month, the CO_2 emissions are around 15.1t for a cotton T-shirt and 39.6 t for synthetic shirts. In the context of collection development, the use of yoona.ai technology results in significantly lower emission values, since **the complete digitalization of the process means that there is no need for physical pre-products.**[7]

For the same amount of prototypes, the 300 trainings of the yoona.ai engine consume only 2,661 kg of CO_2.[8] Approximately 5 outputs are generated from each training, each of which currently consumes an average of 0.09 kg CO_2.[9] This results in a CO_2 consumption of 135 kg for the resulting output and thus a CO_2 equivalent of 2,796 kg for the entire collection development process. These values could be even significantly reduced in some cases by selecting more suitable servers.

The following values can therefore be compared (based on the quantities produced each month):

Conventional factory:
Cotton shirts: 15,120 kg CO_2
Synthetic fiber shirts: 39,600 kg CO_2

yoona.ai technology savings:
2,796 kg CO_2 (Cotton: 81.5% Synthetic: 92.9%)

If we now take the comparative values of a small company and assume only 1,000 designs per year, then the 4 prototypes produced from

Up to 93%
less CO_2 emission through yoona.ai-technology

30% of the designs result in 1,200 prototypes produced with a CO_2 consumption of 2,520 kg (cotton shirt) and 6.600 kg (synthetic shirt). Using yoona.ai would require about 50 training in relation, resulting in a CO_2 consumption of 443.5 kg. Together with the 5 outputs per trained assistant, this results in total consumption of 443.5 kg + 22.5 kg = 466 kg. Consequently, this results in proportionally similar savings potentials (81.5% for cotton materials and 92.9% for synthetic fibers) for companies with larger collections. At the same time, significantly more designs and outputs can be produced under the same conditions with only minor effort. The same applies to large companies, where 30,000 or more designs per month can be expected.

---

[5] Global Fashion Agenda & The Boston Consulting Group, "Pulse of the Fashion Industry," (2017), 10, accessed 03/18/2019, https://globalfashionagenda.com/wp-content/uploads/ 2017/05/pulse-of-the-fashion-industry_2017.pdf and Ellen MacArthur Foundation, "A new textiles economy: redesigning fashion's future," (2017), https://www.ellenmacarthurfoundation.org/assets/downloads/ publications/A-New-Textiles- Economy_Full-Report.pdf.
[6] Ibid.
[7] https://mlco2.github.io/impact/ Ref.: Company information
[8] Model of Amazon Web Services
[9] Ibid.

3. Material consumption & waste generation

Naturally, material waste (offcuts and the like) is generated during the production of textiles and thus also their prototypes. In addition, **the majority of designs that are not used later are destroyed** or, to the extent possible, subject to a **recycling process in small quantities**. In most cases, such recycling processes are accompanied by high losses, or at least by further consumption of resources.

Up to 9M tons

of material could be saved during the production of t-shirts globally

In the course of the production of a shirt, depending on the design, size, and cutting technique, an average of between 20–25% of waste occurs. **For a shirt weighing 250 g, this means that a total of 312–333 g of cotton can be saved.** With 7,200 prototypes, that's up to 2.4 tons of material per month. This amount can be regarded as not inconsiderable, not least because the overwhelming majority of the prototypes produced are never used and are discarded. Initially, it only plays a minor role whether the material is subjected to energy- and resource-consuming recycling processor ends up in landfills.

The introduction of digital design processes, therefore, makes it possible here – apart from the prototypes commissioned later – to save almost all the material and thus avoid the corresponding waste. In addition, the use of yoona.ai's software improves the ability to plan, analyze and control market trends, so that production quantities can be adjusted to reduce overproduction by using more suitable parameters.
On average, about 30% of the garments offered by large textile manufacturers are not sold and end up in the garbage or have to be recycled at great expense to return the material to the production cycle.

Based on the 120 billion garments produced worldwide each year, this would theoretically result in a material savings potential of up to 36 billion garments. Based on the parameters for T-shirts (250 grams), **this would mean a saving of up to 9 million tons of material**. This is admittedly the upper limit of what is possible, but it does show the enormous potential for annual resource conservation, or rather, for saving energy. Waste avoidance through the sensible use of yoona.ai software. The quantities of water, dyes, and other chemicals relevant to the manufacturing process have not yet been included in the calculation.


Photo by Katie Rodriguez

Photo by Naja Bertolt Jensen

4. Water consumption & pollution

The production of a cotton T-shirt weighing about 250 grams consumes an average of 2500 liters of water. This takes into account that the cultivation of about 250 grams of cotton itself requires about 240 liters of water.[10]

Since the development of new collections and design lines is entirely digital with the use of yoona.ai technology, neither synthetic nor natural textiles are consumed at the end of the chain, eliminating production-related water consumption. If one calculates the production of around 7,200 garments per month for collection developments using conventional methods in parallel to the example given above, this results in a **potential saving of 18 million liters of water** for the corresponding period. Not only is this amount of water saved, but there is also no input of polluting chemical additives into the ecosystem for this amount of water.

In conventional cotton farming, 266 million liters of gray water are used for every ton of cotton. This was shown in a study conducted by the Water Footprint Network on behalf of the C&A Foundation. In short, the soils of cotton plantations are contaminated with chemicals. Concerning the resulting gray water, at least for cotton-based shirts, with the saving of 7,200 prototypes, we can speak of **about 635.7 million liters of water** that are not contaminated with chemicals, i.e. do not become gray water in the soil.

By comparison, in the Western world, each person uses about 130 liters of freshwater per day (without adding industrially consumed water). The amount of unpolluted water could theoretically supply about 13,400 people with fresh water for a year.

635 M liters

of water that could be saved on 7,200 prototypes

The comparison becomes more drastic if, by reducing overproduction by up to 30%, 12 billion fewer garments would have to be produced. This would make it possible to **prevent the pollution of 1.06 quintillion liters of water.**

[10] https://www.umweltbundesamt.de/themen/wirtschaft-konsum/industriebranchen/ textile-industry#the-environmental-impact-of-the-textile-industry-.

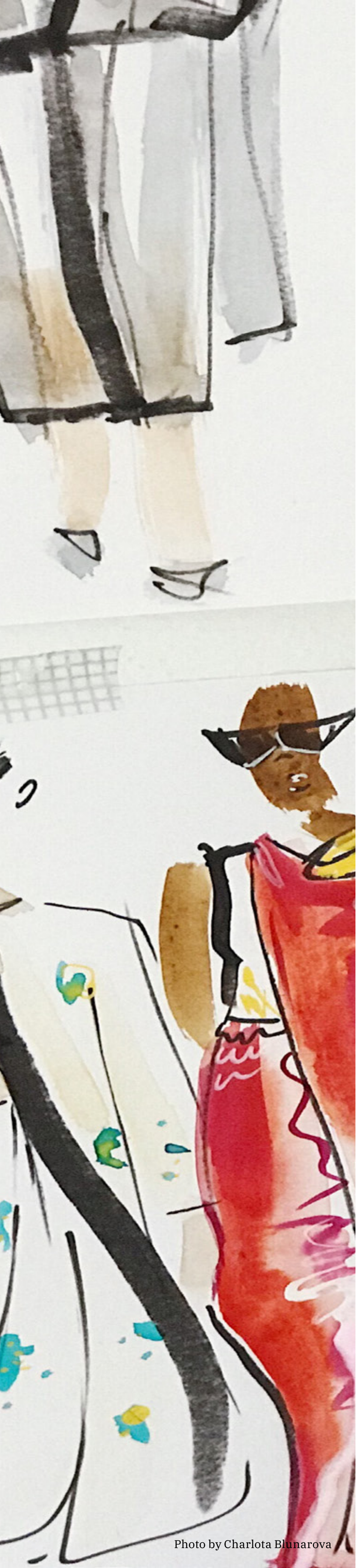

Photo by Charlota Blunarova

5. Time

The design development process carried out in conventional ways takes on average **between 3 and 12 months**. A significant disadvantage of this relatively long process, until the collection is sold, is the inertia toward trend developments. This results in serious ecological disadvantages as well as economic ones.

In contrast, the **training of an AI-based Yoona assistant about 48 h**. If we take the previously used quantities as the basis for calculation, i.e. 7,200 prototypes, and run the 300 assistant pieces of training on 20 computers, the development time for the training alone would be reduced to 300 x 2 d = 600 d / 20 = 30 d. With the output calculation taking about 30 min, the support of 20 computers for the 5 outputs carried out for each trained assistant, each taking about 30 minutes, would result in an additional time of 300 x 5 x 0.5 h = 31.25 d / 20 = 1.6 d, i.e. **a total of slightly less than 32 days**.

This period can, of course, be reduced even further through the appropriate use of computer technology, thus enabling enormous time-saving potential – using 300 computers, a reduction to just over **2 days for the entire collection development** is practically possible.

3–12 months

design development process carried out in conventional ways

Only 2 days

for the developmment of an entire collection is practically possible

6. Toxins & chemical contamination

About 43 million tons of chemicals are used annually in textile production.[11] Most of the chemicals used are highly toxic and cause massive environmental pollution.

Among the pollutants are mostly nitrogen oxides, formaldehyde, peroxides, alkyl phenols for dyeing and washing, PBDE (polybrominated diphenyl ethers) as flame retardants to reduce the flammability of materials, phthalates such as DEHP and DBP as plasticizers for plastics (polyester, etc.), heavy metals as pigments, and other chemicals.), heavy metals as pigment carriers in dyes, tributyltin[12], chlorophenols or chlorobenzenes as biocides to prevent mold growth in organic materials.[13]

In the process, **465 g of chemicals are used to produce one kilogram of synthetic fibers, and about 925 g of chemicals are used to produce one kilogram of cotton fibers**. For a T-shirt weighing about 250 g made of synthetic fibers, this results in the use of about 116 g, and for an equivalent cotton T-shirt, about 231 g of chemicals. Assuming the saving of 7,200 shirts during the collection development, this results in reduced use of about 835 kg of chemicals for synthetic textiles and about 1663 kg of chemicals for textiles made of cotton.

Adding to this the possible 36 billion garments that could be saved, as shown in point 3, there would be a **potential saving of 4.17 million tons for synthetic materials and cotton-based textiles, a potential saving of 8.31 million tons of chemicals is possible.**

Here, too, it must be stated that these are initially theoretical values. However, even with significantly lower production shortfalls, **the savings effects in terms of chemicals are likely to be enormous.**

8.31 M tons

of chemicals could potentially be saved

Ultimately, this is not only noticeable for the company in economic terms, but above all represents **a significant improvement in the environmental balance sheet**.

[11] “Measuring Fashion’s Ecological Footprint” https://www.commonobjective.co/article/ measuring-fashion-s-ecological-footprint and “A new textiles economy: redesigning fashion’s future” https://www.ellenmacarthurfoundation.org/assets/downloads/publications/ A- New-Textiles-Economy_Full-Report.pdf.
[12] https://www.greenpeace.de/engagieren/nachhaltiger-leben/gefaehrliche-substanzen- textile industry
[13] https://issuu.com/pan-uk/docs/cottons_chemical_addiction_-_update? e=28041656/62705601

Conclusion

The use of yoona.ai's technology enables companies based in the apparel industry to significantly **increase their sustainability**. This not only makes a fundamental contribution to **reducing pollutant and greenhouse emissions**, which can enhance **brand reputation** in the course of ever greater market orientation towards sustainable and environmentally friendly clothing production, but also results in considerable **financial savings** potential due to significant **time savings, greater flexibility** in collection development and the significantly **lower use of resources**, which ultimately lead to significantly **higher profit margins**.

The potential savings indicated in the course of the above considerations are, of course, initially only theoretical values based on the parameters available for T-shirts. Nevertheless, they also allow an estimate to be made for other items of clothing and enable textile companies to establish benchmarks that can be used to extrapolate resource and emission savings. Even under highly conservative scenarios, the savings, especially of CO_2 and environmentally harmful chemicals, are still significant.

The use of Yoona.ai technologies thus enables companies in the textile industry to use appropriate means in the **transformation process towards more ecologically sustainable production** of garments while increasing profit margins.

Photo by Casey Horner;