

SOCIAL LIFE CYCLE ANALYSIS AND LIFE CYCLE ANALYSIS

OF

3D PRINTED GARMENT

JAKE & TIFFANY



INTRODUCTION: Product

Design Company: **ThreeasFour**

Machine Company: **Materialise**

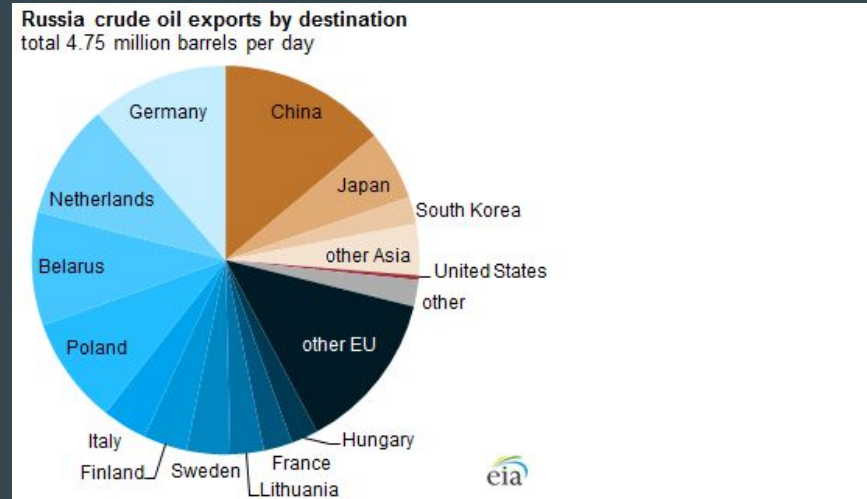
Joris Debo (MGX Director at Materialise)

Filament: **Polyamide** -- a plastic. Can occur both naturally and artificially. Wool and silk are considered polyamides. For the purposes of this LCA we will discuss only the artificial polyamide filament.

Raw materials

3 biggest petroleum extraction countries: (mil barrels extracted per month)

1. 10.5 Russia : 5,417 km
2. 10 Saudi Arabia: 5,384.5 km
3. 9.2 America: 4,882 mi



Manufacturing: 3D Printing

depreciation: use a machine around 5 years?

Expensive

Planned obsolesces? → Landfill

energy

0.05 kWh for a 1 hour print

main components:

Cooling fans and electronics: 15.7 watts

- Stepper motors for moving everything around: 10.7 watts
- PCB heatbed power usage: 129.5 watts

A hotend for melting the plastic: 28.3 watts

- Heated build platform for preventing curling and lifting.

Manufacturing: Filament

top filaments

ABS: Acrylonitrile butadiene styrene

PLA: Polylactic acid

HIPS: High Impact Polystyrene

PVA: Polyvinyl alcohol

Wood

“70% colorFabb PLA and 30% woodfibre.” ColorFabb Co.

BambooFill is made with a mixture of bamboo wood and

PHA/PLA

Nylon

Carbon Fiber

Interpretation & analysis

Environmental:

MANUFACTURE: creates nitrous oxide, a greenhouse gas 310 times more potent than carbon dioxide

ENERGY: uses large amounts of water for cooling, needs 90 degree heat for processing, and energy for machinery

ADDITIONAL CHEMICALS: lubricants as a source of contamination

Social:

- **ACCIDENT:** Marl facility, March 31, 2012: **Explosion** , 2 employee deaths, Gas tank containing highly flammable 1.3 butadiene exploded in the cyclododecatriene plant

- Evonik has a 'code of conduct' for their suppliers. They claim to be transparent, but even after research we are unable to find connections or list of suppliers.

Interpretation & analysis

Environmental:

- Bio filaments biodegradable → plastic like material that would eventually disappear, instead of stuck in landfill
- Many filaments are mixed with nonbiodegradable plastics/material: therefore not actually environmentally healthy.

Social:

- A lot of demand for engineers who can develop new filaments
 - New field/ industry of jobs
 - Decrease of need for labour workers as 3D printing gets more advanced and affordable.
-

Packaging and transportation

Standard packaging - polypropylene, Self-adhesive labels (siliconized carrier material), claims to use renewable materials like recycled paper, rapeseed and sugar.

7,857 km

Distance from Germany to United States



Interpretation & analysis

Environmental:

-

Social:

-

—

Consumption and usage

Sold to Materialise, among other materials.

- Dyes
- Finishes
- Other modifications (velvet)



Materialise offers standardized products (accessories, gadgets, educational toys, etc.), and tailor/customized products (specific requests of 3D printing method and material, e.g. PA12)

- Collaboration with ThreearFour → creates the dress → dress used in fashion week show → storage (at the store) → Manus x Machina exhibition →

Interpretation & analysis

Disposal and recycle

70% of polyamide goes to landfill and incineration



PA 12 **can** be recycled through extraction and transformed into plastic pellets. However quality will be damaged so it can only be recycled through this process once.



Interpretation & analysis

Environmental:

MANUFACTURE: creates nitrous oxide, a greenhouse gas 310 times more potent than carbon dioxide

ENERGY: uses large amounts of water for cooling, needs 90 degree heat for processing, and energy for machinery

ADDITIONAL CHEMICALS: lubricants as a source of contamination

Social:

- **ACCIDENT:** Marl facility, March 31, 2012: **Explosion**, 2 employee deaths, Gas tank containing highly flammable 1.3 butadiene exploded in the cyclododecatriene plant

- Evonik has a 'code of conduct' for their suppliers. They claim to be transparent, but even after research we are unable to find connections or list of suppliers.

The Future of 3D Printing & Potential Business Opportunities

The Overall Plan

W Power point
J ① Introduction

T ② 1st stage:

• Raw material

→ LCA

→ SCLA

- Extraction of raw materials
- Labour, worker rights
- Environmental impacts of oil extraction
- Bio material implications

T ⑤ Manufacture } 3D printing + filament: types, implications, 3D printing pro-cons

T ④ Packaging } transport -

J ⑤ Consumption } Fashion ^{consum} industry, consumerism, physical consumption of the clothes

J ⑥ End of life. } Disposal of material, clothes _{spec. for}, Recycling of material.

J ⑦ conclusion: potential business expansion, financial forecasts.

[Paper in paragraphs.]

→ usage of 3D clothes