WOOD WASTE TOOLKIT
FOR DIGITAL PRODUCTION LEFTOVERS

This open source 'toolkit' is a result of a nine month research pilot at Fiction Factory in Amsterdam. We dove into the digital production wood waste and looked at ways to make production more efficient to reduce the amount of leftover materials.

FICTION FACTORY

OPEN! NEXT   waag

WHO

Fiction Factory makes whatever you can imagine. Our professionals can make anything, from almost any material, with practically all techniques. Fiction Factory has it's own wood, metal, painting and upholstery workshop, but also a Science Fiction workshop with innovative techniques and a plastic recycling lab. With this we build B2B custom built interiors all around the world.

WHY

In Fiction Factory the wood workshop has been identified as the biggest producer of 'waste' (by weight and volume). At least once a week a 20m3 trailer of wood offcuts & sawdust and a 2 meter high stack of CNC milled plates is thrown away. All of this wood is plate material; including birch plywood, underlayment, arauco plywood, betonplex, MDF and other special order plate materials. Research at CBM showed that interior builders in The Netherlands have an average of 30% plate material waste.

To identify where the biggest problem was we looked more precisely at the numbers. Since we separate all of our waste, we could easily see how much of each type of material was thrown away. Out of the wood that is thrown away, 12% is sawdust, 20% is from tablesaw offcuts and 68% is from our CNC production. This means that 50% of all factory waste is being produced by our CNC machine so it was obvious to tackle the biggest problem first!

Scan or click the QR code to see our CNC Wood Waste Story:

WHAT - IT'S A MATERIAL WORLD

At Fiction Factory we have two CNC milling machines. These machines are responsible for 90% of the woodwork that is produced. CNC production has made producing more efficient, but it has also created a whole new kind of waste; skeletons of intricate shapes that are very difficult to re-use. According to research done by the TU Delft, an average of 28% of a sheet is left unused after milling.

The relatively cheap raw material costs and the very low cost of the disposal process makes efficient wood production unattractive. Since time = money, efficient wood production is not common practice.

We are already seeing an increase in prices due to the COVID-19 pandemic and political & ecological pressures. Delivery costs have also increased. We expect these increases to continue, and material pressures will continue to harm the planet, therefore their efficient use is extremely important for the future of production.

68% CNC leftovers *12% sawdust* *20% tablesaw offcuts*

WHAT'S NEXT/ COMING SOON

Changing from project driven production into material driven production we were able to see that if jobs were milled together according to material type and date, based on the shapes of the parts, the material could be used more efficiently. To make this change IAAC created a prototype software.

To proceed with the development of this software solution for digital waste, we applied for the Better Factory grant and are happy to announce that we have received it. Together with IAAC and a chosen artist, we are dedicated to develop a fully integrated workflow with new optimisation algorithms to reduce wood waste in CNC production.

HAVE THE SAME PROBLEM?

#1. SYSTEM / TEAM UP!

"The end is where we start from." T. S. Eliot

The best way to reduce and prevent waste is to start at the beginning. Coordinate design from the start. Sustainable construction goes much further than using sustainable materials. The best results can be achieved if the designers and customers apply sustainable design principles from the start.

To create awareness and to share our knowledge with our clients, we have developed 'Design Principles & Guidelines'. For example by consulting with designers at an early stage, we can propose both sustainable materials and communicate material dimensions, so that there is minimal waste.

#2. PRODUCT / LET'S MAKE STUFF

Can we be nesting buddies?

Is the simplest thing to do is to nest extra products in the sheets? What to make? An extra product for yourself or someone else? Or encourage clients to use the leftover space for related products?

When thinking about what product to develop or even when considering who to work with, it is important to consider the environmental impact. If the product is just more junk, is this spreading the right message? We decided to develop open source connectors for wooden structures. The connectors are not only made from leftover materials, but are intended to be used to connect other leftovers to create larger objects which can be disassembled again. And, being made from wood, they encourage and promote bio-based building. Promoting a change in the way things are designed and used.

#3. COMMUNITY / OPEN UP!

If you share knowledge it can only grow.

Our aim is to create a more sustainable business and to improve production to become more environmentally sustainable and carbon neutral. We believe in the power of sharing ideas and knowledge. It will not only help us achieve our goals, but hopefully also others; creating a healthier future for all.

Inspired by nature's eco systems we have decided to grow our own. In nature there is no such thing as waste; everything has a purpose. We start growing our eco system by looking locally for help and knowledge, to find partners to team up with in preventing waste.

Grow your ecosystem; team up.

- Start with already existing contacts, such as suppliers and clients.
- Find out what research already exists, from CBM for example.
- Speak to the people involved.
- Look locally for others who are finding solutions.
- Shout it out loud! There are lots of people working on circular material research.
- Join events.
- Work with other sustainable businesses.
- Organise feedback sessions and brainstorms.

#4. SOFTWARE / WHAT'S YOUR FLOW?

Time is money.

Nesting extra products in sheets can take up extra engineering and CNC production time. Since materials are so cheap this is not a good business move in the linear economy. Our challenge was to improve the system to reduce production waste.

The waste created with CNC production is already known before the wood is cut. So the possibility to digitally manipulate this leftover space seemed obvious. However we had no idea how to do it ourselves. So we initiated a software exploration with IAAC in Barcelona - a robotics and production fablab with years of software and open source experience.

To find the points of improvement in the system and existing software it is valuable to create a flow chart of how things actually operate in your company.

WHAT'S YOUR FLOW?

To find the points of 'weakness' in the system and perhaps existing software it is valuable to create a flow chart of how things actually operate in your company.

Who implements each phase of a project to see if there are existing procedures that are followed, software that is used and if everyone does and thinks similarly. See what we did here:
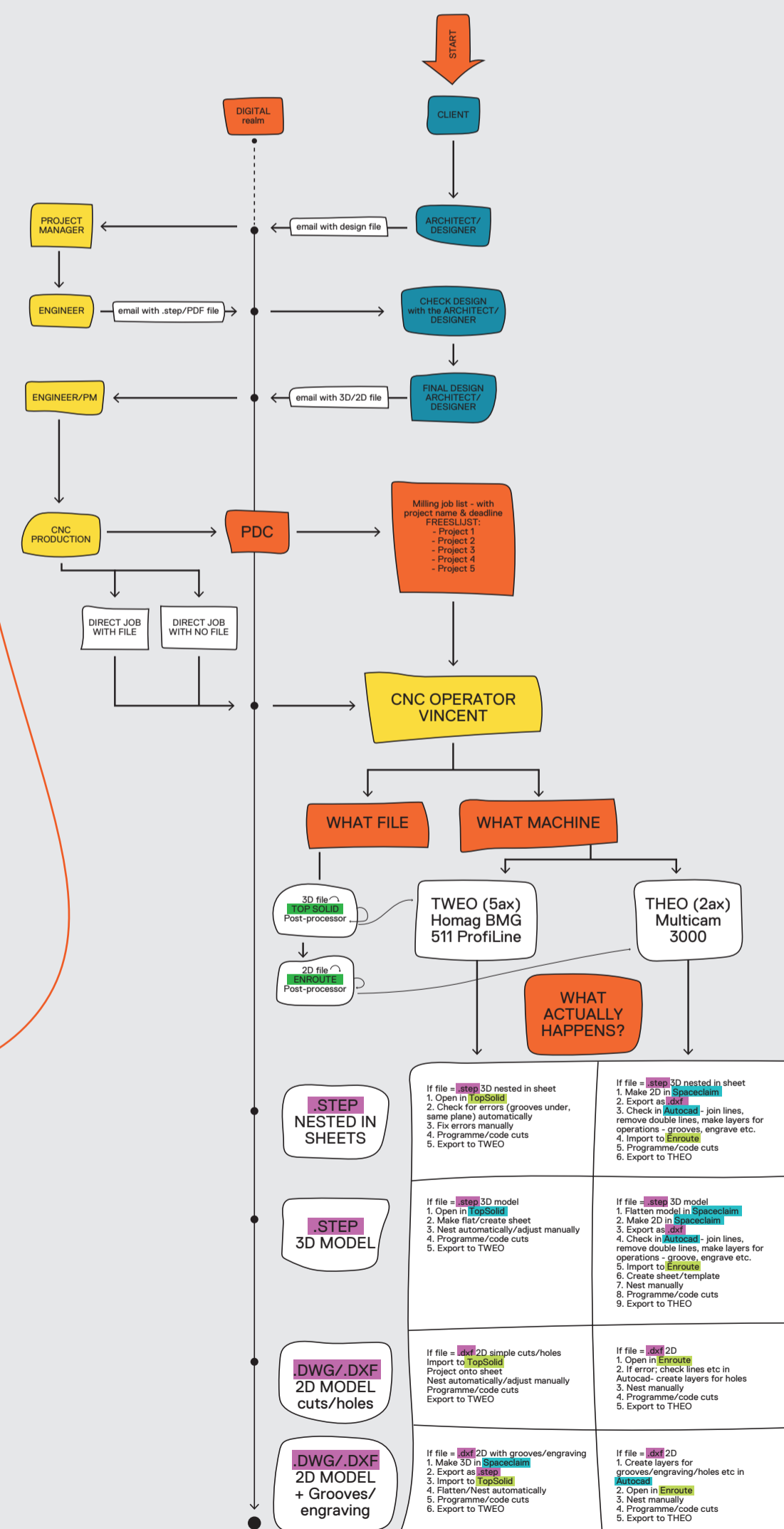
DO THE MATH

To save you some work we have come up with formulas to help you calculate your waste. Easy does it!

The wood you buy per kg
MDF / m3 kuub kg / sizes = kg per m2

The wood you throw away in kg
Buy - waste = wood used for production

At Fiction Factory this is 50%. This means that we waste 50% of all wood material that we buy!

We would like to see this pile reduced as much as possible!

OPEN SOURCE

We believe in the future of open source manufacturing. SME's and maker communities across Europe are coming together to fundamentally change the way we create and produce products. Fiction Factory is a partner in the OPENNEXT project funded by the European Union. Together with 18 partners we share, collaborate and document our projects to develop viable and user-centric open source hardware. A good example is our laser machine, which is engineered, prototyped and produced in house. The development is documented on Wikifactory, so we hope that other makers will follow and build the useful machine locally. Or even better, improve the machine and add this to the page to help others. We also participate in projects with the HvA, Impact Hub and Province of Noord Holland.

More info: wikifactory.com/+fictionfactory

HOW MUCH IS YOUR CNC WOOD WASTE?

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FOR DIGITAL PRODUCTION LEFTOVERS

WHAT ARE YOUR DREAMS/GOALS?

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DREAM!

Use less resources!

Clients want circular sustainable production, projects and products.

€'s and CO_2

WHO CARES?
- The planet
- Your boss

- Agile, lean & environmentally friendly
- Efficient workplace
- Co^2 reduction
- Less waste = less costs
- A positive company image

LET'S GET STARTED!

#1. SYSTEM / TEAM UP!

YOU NEED PEOPLE TO KEEP THE BALL ROLLING!

SUSTAINABILITY HANDBOOK

FICTION SUSTAINABLE FILES [COMING SOON]

4 PRINCIPLES

- **LESS IS MORE**
- **USE GOOD MATERIALS**
- **DESIGN FOR DISASSEMBLY**
- **ROUND IS NOT CIRCULAR**

#2. PRODUCT / LET'S MAKE STUFF

USE THE LEFTOVER SPACE
- Create an internal product for own use
- Produce for external designer
- Encourage clients to incorporate extra products

DESIGN

- Small sustainable products
- Design from waste
- Material driven design

WHAT WE MADE - FICTION STUFF

- Connectors
- Stools
- Clips

#3. COMMUNITY / OPEN UP!

- To get advice from experts internally & externally
- What research exist (check out CBM, Waag, the internet is your friend)
- Find funding/start research
- Grow your own ecosystem

SHOUT IT OUT LOUD!

EVENTS
- Wastebuild
- CEW

OPEN SOURCE
- Wikifactory
- Github

NESTING 1.2 - HUMANS VERSUS MACHINES

- How good is your nesting software?
- Can you nest better than the software?
- Can you nest quicker than the software?

#4. SOFTWARE / WHAT'S YOUR FLOW?

- ERP system?
- Database
- How are your jobs milled?
- What kind of programs & files are used?
- Who talks to the machine?

too much hassle

FAIL

too many headaches

too much time

HELP!

Where to improve?
- Training & updates on the software
- Open source software
- Software engineers

Is the software good enough?
Efficiency in digital prodcutions

FOLLOW US ON WIKIFACTORY AND STAY UPDATED!

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