TrainERGY project

Case Study - Template

Submission Date:	11/24/2016
Place:	Univesity of Sheffield

Sector Analysed:	Trade
Product Analysed:	Single Polyurethane Mattress

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1 Introduction

develop a supply chain carbon map and determine the total lifecycle emissions including direct and indirect emissions;
Identify the carbon hotspots;

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Define possible interventions to reduce carbon emissions and model the consequent emerging scenarios.

(Please indicate the main goal of the analysis and main benefits for business that the group has identified using Scenat tool)

2 Overview

2.1 Firm description

Falco Srl is an Italian SME located in Naples. The company processes a wide variety of products in different sectors:

- Mattress industry,
- Furnishing and lounges,
- Soundproofing,
- Naval Sector.

The core business is the processing of polyurethane foam for the realization of mattresses, pillows, sofas and chairs.
The company has twenty-five workers (one manager, six employees and eighteen workers) with a production of eight hundred Polyurethane mattresses a week.

Considering the mattress Supply chain, the role of the Falco SRL is to provide the mattress' filling starting from raw materials purchasing to making the filling available for the downstream companies producing mattress cover.

(*Please provide a description of the company you are assessing. Give an indication of the sector they operate in and estimated size (e.g. number of staff, location, products' portfolio etc. min. 100 words).* What are the roles of your company in the product supply chain?)

2.2 Product description

The main products of the Falco Srl are:
Mattresses, pillows and chairs fill. The product analysed is the mattress which is composed of a layer of polyurethane (a polymer composed of a chain of organic units joined by carbamate links; density: 25 kg/m^3) and a layer of memory foam (polyurethane with additional chemicals increasing its viscosity and density: 45 kg/m^3). The layers' dimensions are respectively 80x190x15 cm^3 and 80x190x5 cm^3.
The company produces about eight hundred mattresses per week which are distributed among several companies and private customers.

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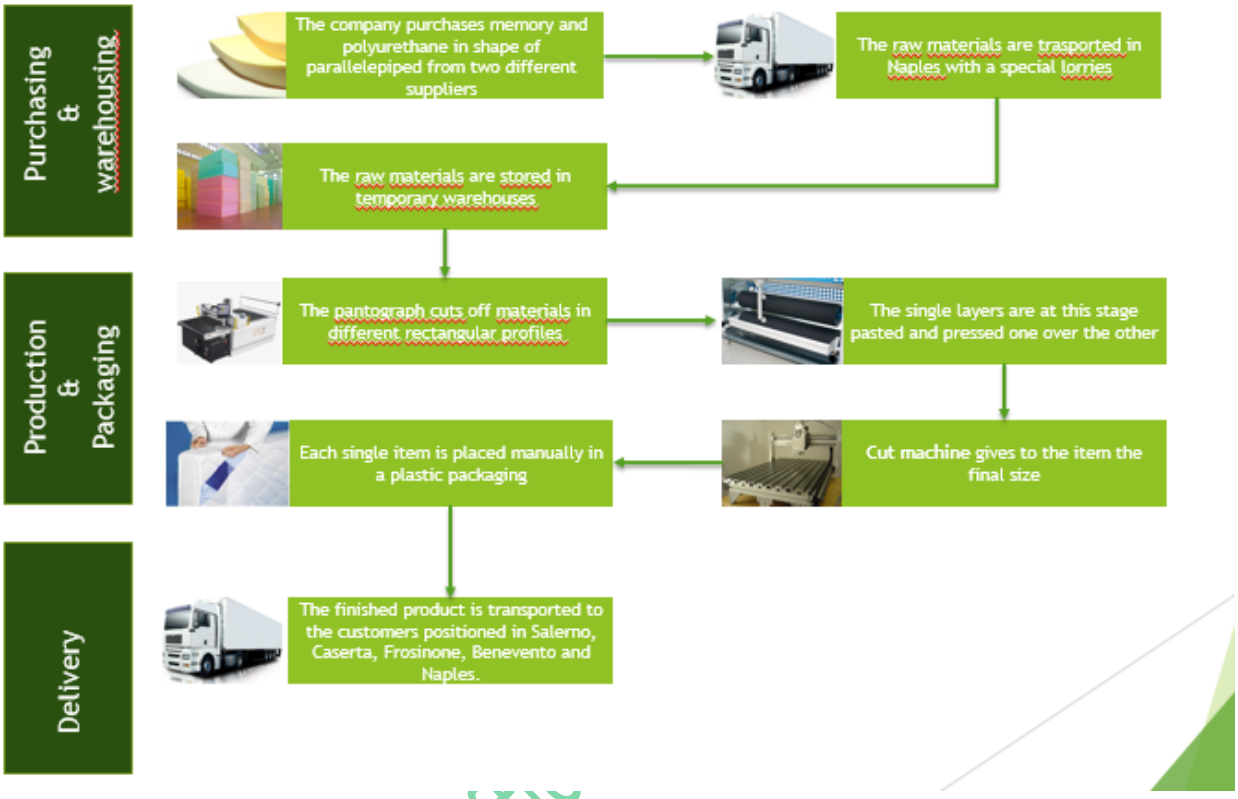
2.3 Supply chain of the product



The company purchases memory and polyurethane from two different suppliers (located respectively in Ostuni and in Milan). The materials are purchased in shape of parallelepiped (memory and polyurethane's dimensions are: 166x203x30 and 166x203x105 cm) and, after, are transported in Naples with a special lorry that enable the compression of the materials because of their light weighs and big employed space.Once arrived, they are stored in temporary warehouses and picked up when the internal process starts.
At the end of the production process each single item is placed manually in a plastic packaging and the finished product is transported to the customers positioned in Salerno, Caserta, Frosinone, Benevento and Naples.

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3 Main Analysis

3.1 Process approach

The first machine to process the raw materials is the pantograph that cut off materials per different profiles, designed by a computer. The output in this case is a rectangular layer of dimension 83x203x15 cm for the polyurethane and 83x203x5 cm for the memory. The second and the third machines are in line: they are the glued machine and the press machine. The single layers are at this stage pasted and pressed one over the other. The last machine is another cut machine that gives to the item the final size 80x190x20 cm.

Process	Input/Element/Material	Quantity (per single unit like kg, km etc.)	Physical Unit	Approximate/Average Cost Unit	Total cost
Direct Materials	Polyurethane	6.27	Kg	2.76	17.31
	Memory Foam	3.73	Kg	2.76	10.30
	Water Glue	0.328	kg	4.90	1.61
	Plastic Bag	1	Kg	2.10	2.10

Table 1. Resources and materials

3.1.1 Energy usage (per single unit of analysed product)

Process	Energy	Quantity (single unit like kg, km etc.)	Physical Unit	Approximate/Average Cost Unit	Total cost
First Cut	Electricity	1.46	KWh	0.082	0.120
Gluing	Electricity	0.097	KWh	0.082	0.008
Pressing	Electricity	0.222	KWh	0.082	0.018
Final Cut	Electricity	0.200	KWh	0.082	0.016

Table 2. Energy usage

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3.1.2 Packages (per single unit of analysed product)

Process	Sort of package	Quantity (single unit like kg, km etc.)	Physical Unit	Approximate/Average Cost Unit	Total cost
1……..					
2……...					

Table 3. Packages

3.1.3 Water Usage (per single unit of analysed product)

Process	Water	Quantity (per single unit of analysed product)	Physical Unit	Approximate/Average Cost Unit	Total cost
1……..					
2……...					

Table 4. Water Usage

3.1.4 Means of transport (per single unit of analysed product)

Process	Transport	Distance	Tonskilometers (km x the volume transported per month (in tonnes))	Approximate/Average Cost Unit	Total cost

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Inbound Transportation	Polyurethane	735	14747.04	0.304	33980.5
	Memory Foam	750	8952	1.40	12521.61
	Water Glue	5.00	5.25	0.00082	0.0043
	Plastic Bags	46	147.20	0.023	3.39
Outbound Transportation	Salerno	60	14747.04	2.30	33980,5
	Caserta	35	253.75	0.20	50.30
	Frosinone	144	1043.99	0.82	851.49
	Benevento	88	637.99	0.50	317.00
	Napoli	5	36.25	0.028	1.03

Table 5. Means of transport

3.1.5 Waste (per single unit of analysed product)

Process	Waste	Amount (per month)	Amount per single unit of analysed product	Approximate/Average Cost Unit	Total cost
Final Cut	Polyurethane	46	0.015	2.76	0.04
	Memory Foam	15.6	0.005	2.76	0.01

Table 6. Waste

3.2 Scenat analysis

3.2.1 SC Carbon Map

(Please define the main unit of analysis. Using Scenat tool and list of inputs from previous part of the analysis please generate the SC Carbon Map, For each input specify: the unit of measure, the quantity needed for the production of the considered unit of analysis, the unit cost (collected from the company); and unit carbon emission intensity (from Ecoinvent). Please show the data in a below table)

Main unit of analysis: the unit analysis is represented by a Single Polyurethane Mattress (size: 80x190x20 cm; weight: 10.5 kg)

A. Table of SC Carbon Map

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Input	Quanty	Unit	GHG Intensity [kg CO2eq/unit]	Unit Price [€/Unit]
Polyurethane	6,27	kg	4,8451	2,76
Memory Foam	3,73	kg	4,8451	2,76
Plastic Bags	1	kg	2,0083	2,1
Water Glue	0,328	kg	0,57083	4,9
Electricity	01,977	kwh	0,64234	0,082
Polyurethane transportation	4,60845	tkm	0,25783	2,304225
Memory Trasportation	2,7975	tkm	0,25783	1,39875
Plastic trasportation	0,046	tkm	0,25783	0,023
Water Glue trasportation	0,00164	tkm	0,25783	0,00082
Salerno	0,67968	tkm	0,25783	0,33984
Caserta	0,39648	tkm	0,25783	0,19824
Frosinone	1,631232	tkm	0,25783	0,815616
Benevento	0,996864	tkm	0,25783	0,498432
Napoli	0,05664	tkm	0,25783	0,02832
Polyurethane waste	0,014625	kg	4,8451	2,76
Memory waste	0,004875	kg	4,8451	2,76

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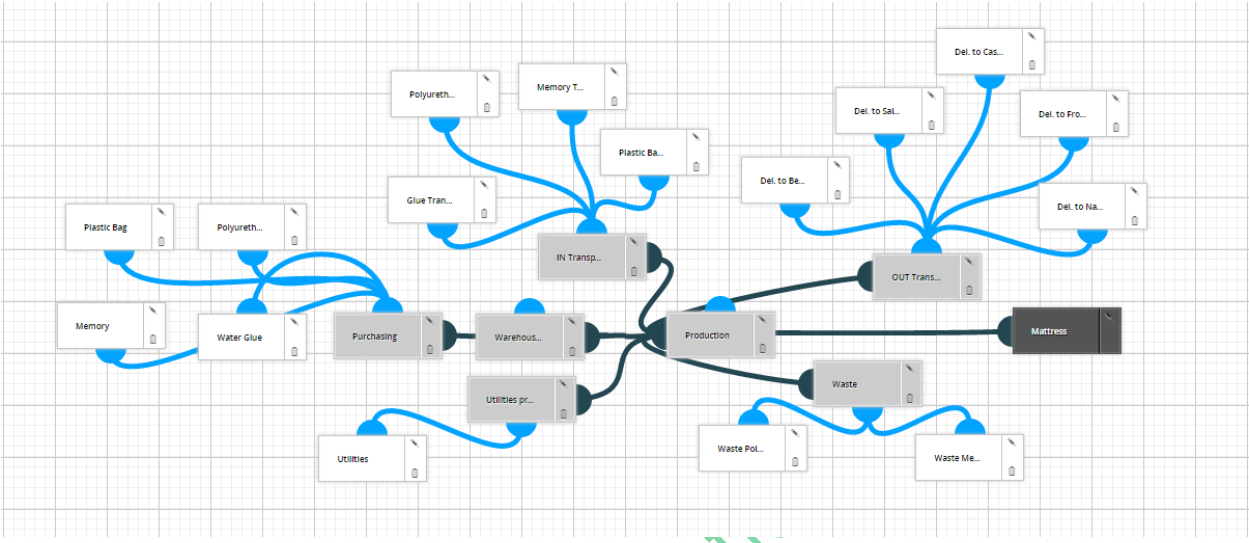
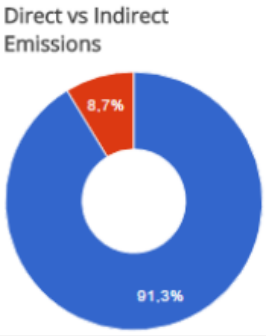
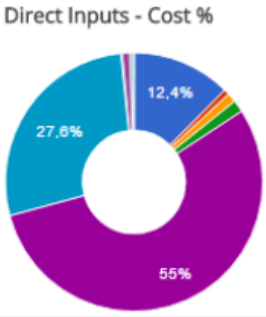
B. Picture from Scenat :

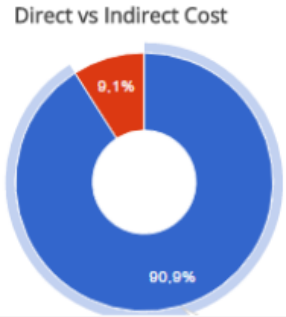


C. Missing Inputs selection, based on analysed product process description

D. **Direct and indirect emissions charts (please make a chart presenting % share of direct and** indirect emissions for the analyzed supply chain)







3.3 Results

The Scenat analysis shows that the total emission of assessed product is: **56,45 kg CO2-eq/unit**

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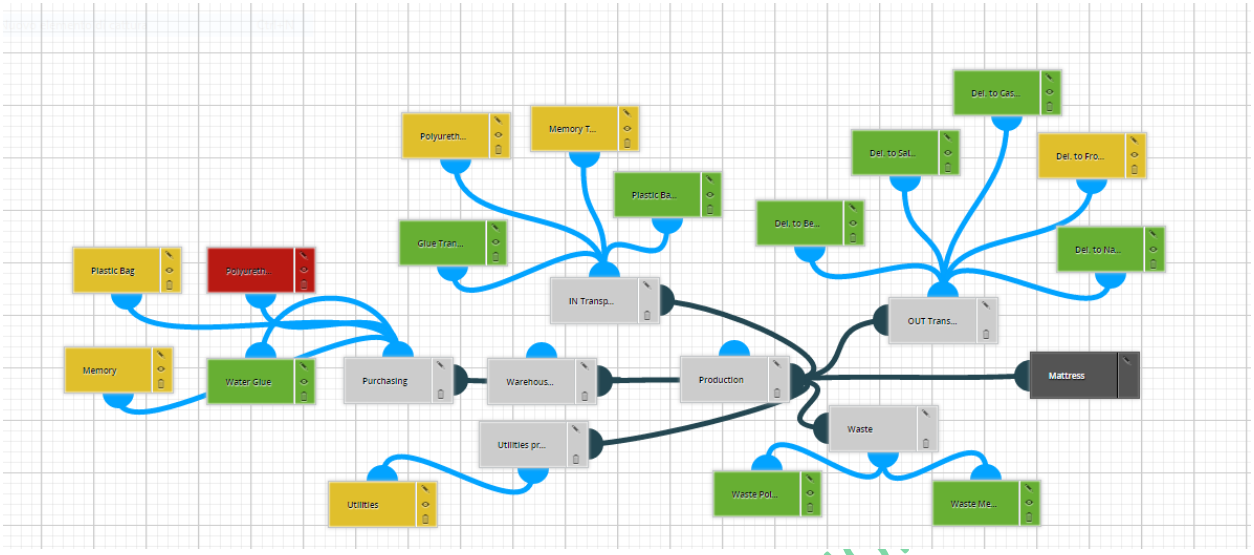

The Scenat tool marks the processes with four different colours:

- RED: for the processes having a percentage of C02 eq emission over 10
- ORANGE: for the processes having a percentage of CO2 eq emission beetween 5 and 10
- YELLOW: for the processes having a percetage of CO2 eq emission beetween 1 and 5
- GREEN: for the processes having a percentage of CO2 eq emission under 1

The highest environmental impact on the whole supply chain is due to the **Polyurethane production Process**. This process is the only one with a percentage of CO2 emission over 10, reaching the **55 %** of the total direct emissions (RED BOX).

Considering the aggregated processes the tool marks as critical the **inbound transportation process** too.

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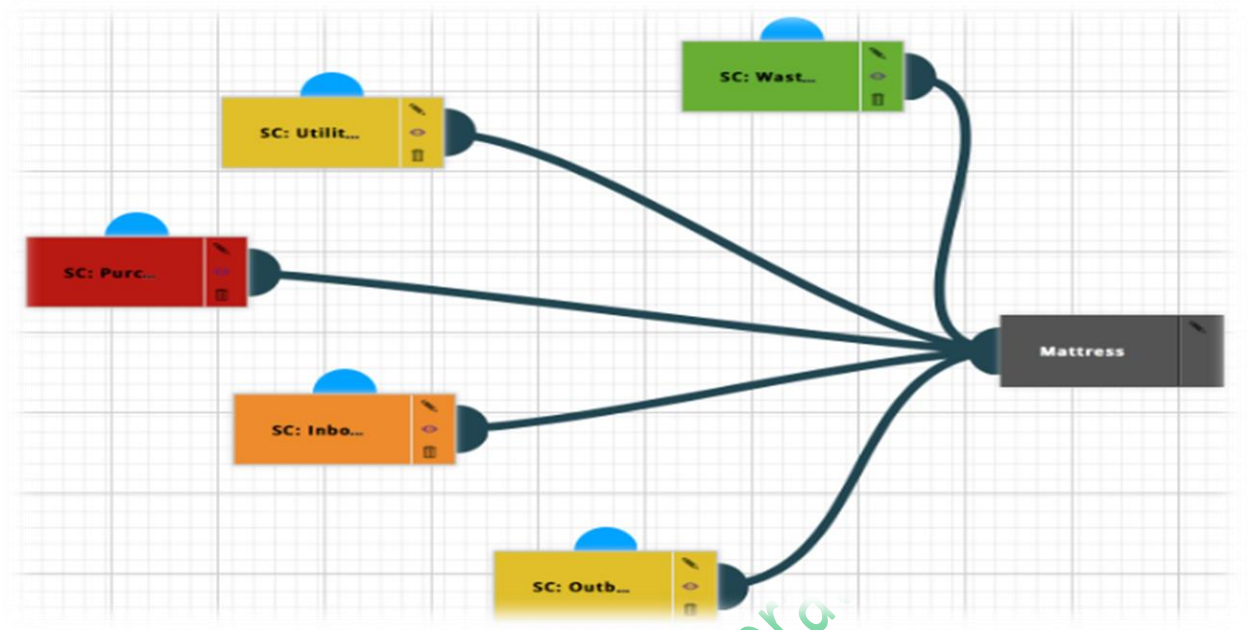

4 Possible improvements

To reduce the CO2 eq emissions two different scenarios have been proposed: one related to the raw materials input selection and another to the optimization of inbound transportation process.

4.1 Scenario 1

In the first scenario It has been decided to use a more friendly environmental material to fill the mattresses, so it has been selected the polyol CARDYON, a different kind of polyurethane produced with a lower percentage of CO2 eq emission (-20% compared to the one used in the original process).

The Scenat analysis shows that the total emission of assessed product is: **41,48 kg CO2-eq/unit**

Although the reduction of the CO2 eq emissions is quite relevant, this choice has to be applied as a long-term strategy due to the complexity of re-mapping the whole process developed with a different input material.

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4.2 Scenario 2

According to a green purchasing approach we decided to select a single and located supplier instead of the two different suppliers chosen for the original process. The supplier in this scenario, located in Matera (nearer to Naples), provides both polyurethane and memory foam. It allows to minimize the distances to cover for the inbound transportation process. This strategy can be applied in short-term avoiding the complex implementation due to raw materials switch.

The Scenat analysis shows that the total emission of assessed product is:: **54,27 kg CO2-eq/unit**

5 Final conclusions

Thanks to Scenat, providing to the tool all the CO2 eq emissions data for each process of the assessed product Supply Chain and developing its whole life cycle analysis, we have managed to focus our attention on the highest environmental impact aspects.

Starting from the original process, the critical CO2 hotspot was related to raw materials purchasing, two possible solutions have been provided. Appling the improvements considered in the developed Scenarios we have been able to obtain a significant reduction of CO2 emission. Several are the barriers that during the implementation of these good practices have to be faced besides, a specific economic analysis has needed in order to understand the application feasibility of the improvement various possible scenarios.

(Please summarize the whole analysis and results of proposed improvements, min 100 words)

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