

## TrainERGY project

### Case Study – Auxa s.r.l.

Submission Date:	19/05/2017
Place:	University of Naples

Sector Analysed:	Food
Product Analysed:	Walnuts

## Table of Contents

<b>1</b>	<b>INTRODUCTION .....</b>	<b>3</b>
<b>2</b>	<b>OVERVIEW .....</b>	<b>3</b>
2.1	FIRM DESCRIPTION .....	3
2.2	PRODUCT DESCRIPTION .....	3
2.3	SUPPLY CHAIN OF THE PRODUCT .....	3
<b>3</b>	<b>MAIN ANALYSIS.....</b>	<b>5</b>
3.1	PROCESS APPROACH .....	5
3.1.1	Resources and materials .....	6
3.1.2	Energy usage (per single unit of analysed product) .....	6
3.1.3	Packages (per single unit of analysed product).....	7
3.1.4	Means of transport (per single unit of analysed product) .....	7
3.2	SCENAT ANALYSIS.....	8
3.2.1	SC Carbon Map .....	8
3.3	RESULTS.....	10
<b>4</b>	<b>POSSIBLE IMPROVEMENTS .....</b>	<b>10</b>
4.1	SCENARIO 1: WALNUTS SUPPLIERS CHANGE .....	10
4.1.1	SC Carbon Map .....	11
4.2	RESULTS.....	13
4.3	SCENARIO 2: ABOLITION OF SODIUM HYPOCHLORITE .....	13
4.3.1	SC Carbon Map .....	14
4.4	RESULTS.....	16
<b>5</b>	<b>FINAL CONCLUSIONS .....</b>	<b>16</b>

# 1 Introduction

The main goal of the following analysis is to calculate and evaluate GHGs emission related to the walnuts supply chain using Scenati (Supply Chain Environmental Analysis Tool). According to the results provided by Scenati tool, Auxa s.r.l. can implement green strategies in order to improve its environmental performances through the development of two different intervention scenarios.

## 2 Overview

### 2.1 Firm description

AUXA Srl is an Italian SME operating in the sector of dried fruit, with headquarters in Rome and a single production plant located in Naples. It counts twenty-one permanent employees and ten/twelve seasonal workers (from September to January).

### 2.2 Product description

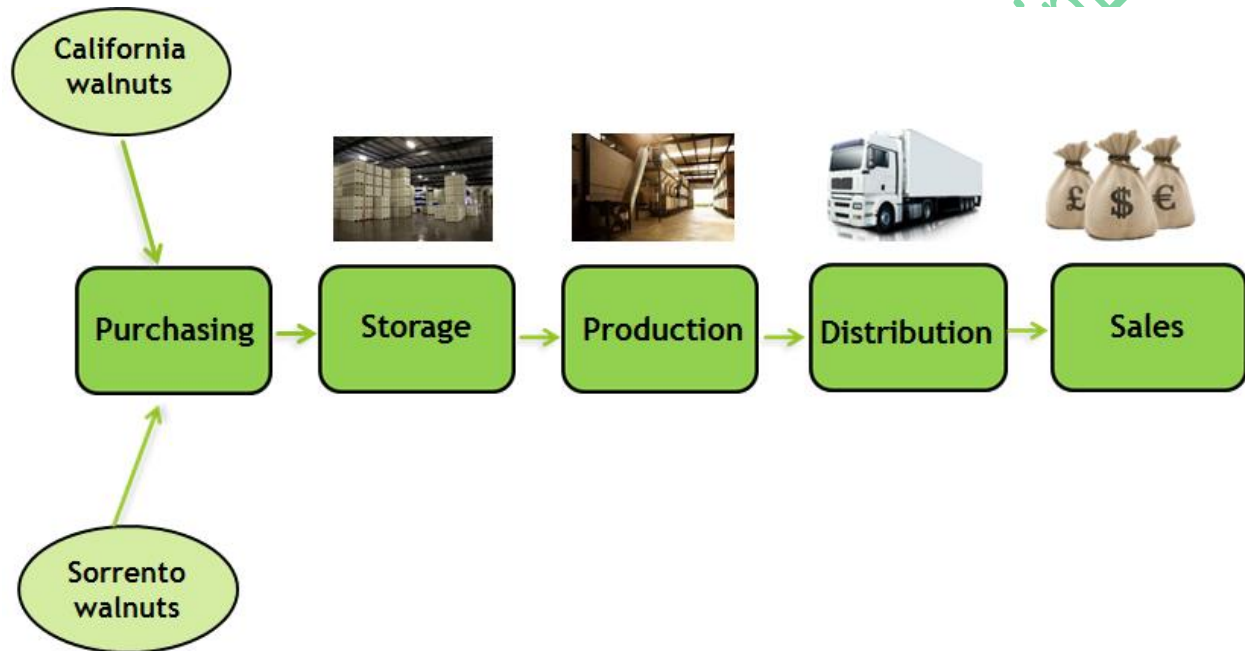
The core business of the company is the processing of many kinds of fruit: walnuts, cashew, peanuts, chestnut, almonds, hazelnut, pine nut, pistachio nut, pumpkin seed, sunflower seed, chickpea, corn, pineapple, apricot, grapes. One of the most popular products of Auxa s.r.l. is the pack of walnuts weighting 350 grams.

The products are sent to all customers, mainly two distributors located in Naples and Rome.

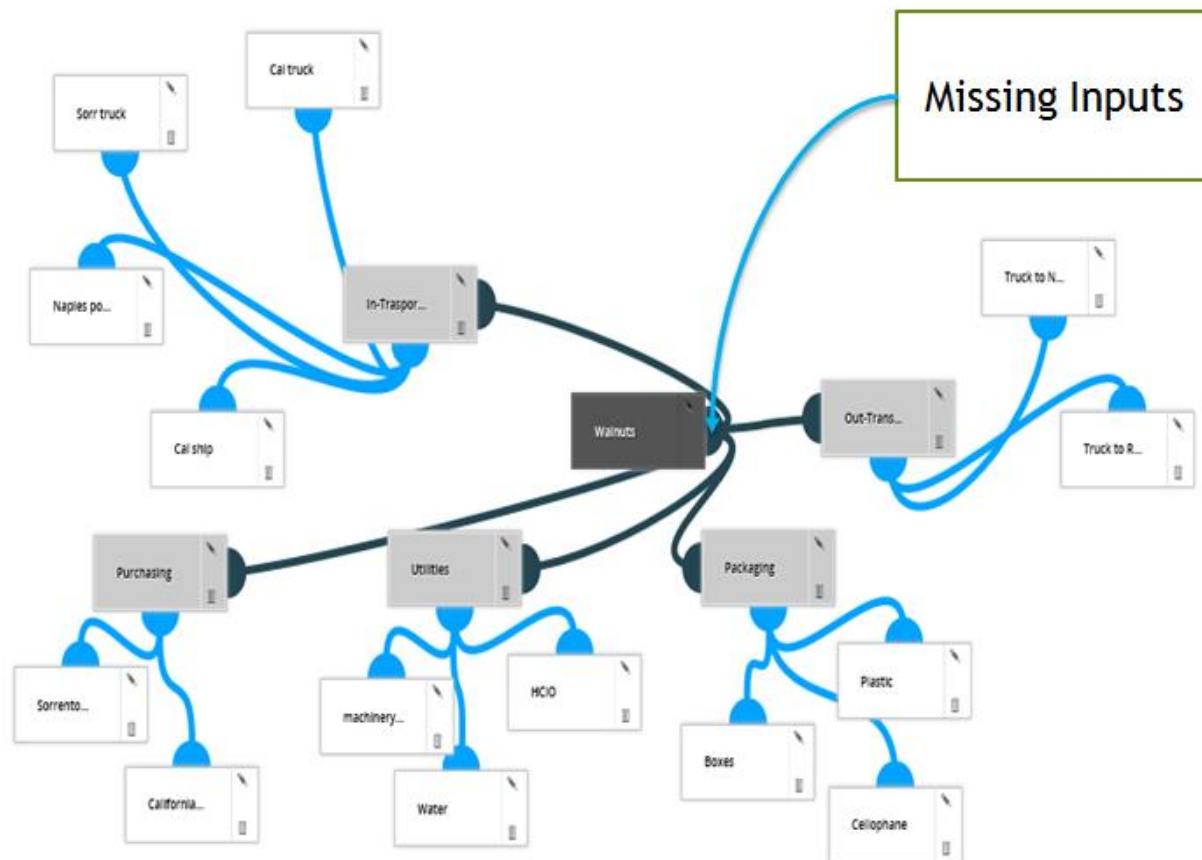
### 2.3 Supply chain of the product

The company purchases two kind of walnuts: the first from California (USA), moved in Italy (at the harbour of Naples) in containers by ships in a trip lasting about twenty days, and the second from the Campania region. The California walnuts arrive at the port of Naples and after they are transported at the production plant with a lorry. Once arrived at the production plant, they are temporary stored in a warehouse. The production process consists of four fundamental steps: the walnuts selection, the walnuts washing, the walnuts drying and the packaging. The selection step is made by means of two automated machineries: a General Machine, that move the walnuts flow toward the Calibration Machine, that check the walnuts size, discarding those not meeting predefined requirements. The washing step is performed by a Bleaching Machine that, thanks to a mixture of sodium hypochlorite (80% water and 20% sodium hypochlorite), whitens the walnuts, and by a further machinery, composed by a conveyor belt, on which the walnuts are subject to splashing of water in order to remove sodium remained. The walnuts moves along the conveyor belt to the Oven to be dried (the oven's temperature is about 40 grades Centigrade). After that, a conveyor belt moves the walnuts toward a metallic box, in which they are dried for further 48 hours.

The packaging is performed by an automated machine (only an initial setting of parameters is required, as: the weight of the finished product), after which the single boxes are placed manually in a cardboard box on a pallet. Then, there is a Second Packaging Machine that put the cellophane around the pallet. Finally, the finished product is sent by direct shipping transportation mode towards two distributors located in Naples and Rome.



1. Walnuts supply chain



2. Supply chain map

### 3 Main Analysis

#### 3.1 Process approach

Once arrived at the production plant, walnuts are temporary stored in a warehouse. The selection step is made by means of two automated machineries: a General Machine, that move the walnuts flow toward the Calibration Machine, that check the walnuts size, discarding those not meeting predefined requirements. The washing step is performed by a Bleaching Machine that, thanks to a mixture of sodium hypochlorite (80% water and 20% sodium hypochlorite), whitens the walnuts, and by a further machinery, composed by a conveyor belt, on which the walnuts are subject to splashing of water in order to remove sodium remained. The walnuts moves along the conveyor belt to the Oven to be dried (the oven's temperature is about 40 grades Centigrade). After that, a conveyor belt moves the walnuts toward a metallic box, in which they are dried for further 48 hours.

Finally, the packaging is performed by an automated machine (only an initial setting of parameters is required, as: the weight of the finished product), after which the single boxes are placed manually in a cardboard box on a pallet.

### 3.1.1 Resources and materials

The single unit of analysed product is 0.350 kg of walnuts. Resource and material analysis is done based on single unit of the product.

Process	Input/Element/Material	Quantity (per single unit like kg, km etc.)	Physical Unit	Approximate/Average Cost Unit	Total cost
Purchasing	Sorrento walnuts	0.175	Kg	5.00 €/Kg	0.875 €
	California walnuts	0.175	Kg	4.00 €/Kg	0.700 €

Table 1. Resources and materials

### 3.1.2 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
Utilities	Electricity	0.0455	KWh	0.18 €/KWh	0.00819 €
	Water (with sodium)	0.0028	m3	2.12 €/m3	0.005936 €
	Sodium hypochlorite	0.777	kg	0.60 €/kg	0.462 €
	Water (for washing)	0.0014	m3	2.12 €/m3	0.002968 €

Table 2. Energy usage

### 3.1.3 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
Packaging	Plastic	0.001	Kg	25.00 €/Kg	0.025 €
	Boxes	0.035	Kg	0.10 €/Kg	0.0035 €
	Cellophane	4,46429E-05	kg	1.97 €/kg	8,79464E-05

Table 3. Packages

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

Process	Transport	Tonokilometers [tkm]	Approximate/Average Cost Unit	Total cost
Inbound transportation	Truck-Ship-Truck	0,878888889	0.10 €/tkm	0.088 €
	Truck from port	0,114138889	0.50 €/tkm	0.055 €
	Truck from Sorrento	0,055611111	0.50 €/tkm	0.028 €
Outbound transportation	Truck to Rome	0,114138889	0.50 €/tkm	0.055 €
	Truck to Naples	0,114138889	0.50 €/tkm	0.055 €

Table 5. Means of transport

## 3.2 Scenati analysis

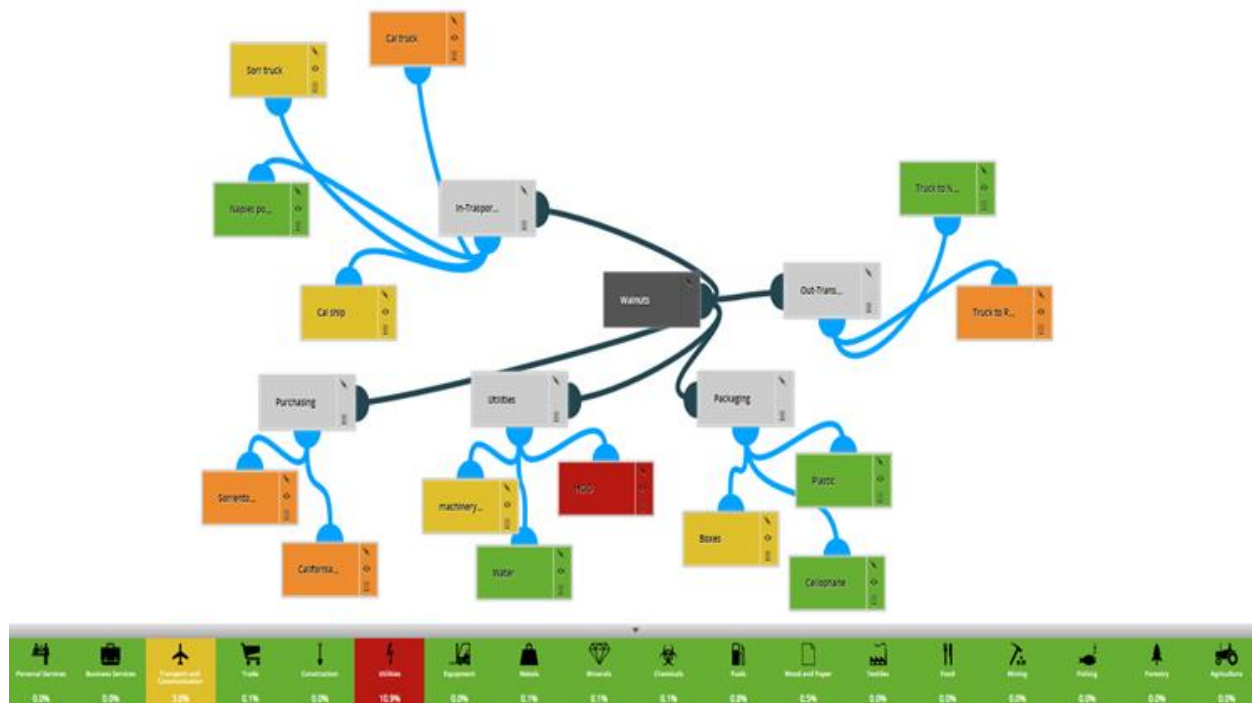
### 3.2.1 SC Carbon Map

A. Table of SC Carbon Map - **unit of analysis: 0.350 kg of walnuts**

Process	Input	Quantity	Unit	GHG Intensity [kg CO <sub>2</sub> eq/unit]	Unit Price [€/Unit]
Purchasing	Sorrento walnuts	0.175	Kg	0.073819	5.00 €/Kg
	California walnuts	0.175	Kg	0.073819	4.00 €/Kg
Inbound transportation	Truck - ship - truck	0.878888889	tkm	0.009	0.10 €/tkm
	Truck from port	0.114138889	tkm	0.015	0.50 €/tkm
	Truck from Sorrento	0.055611111	tkm	0.007	0.50 €/tkm
Utilities	Electricity	0.0455	KWh	0,0237965	0.18 €/KWh
	Water (with sodium)	0.0028	m3	4,69112E-07	2.12 €/m3
	Sodium hypochlorite	0.777	m3	0,68815782	0.60 €/kg
	Water (for washing)	0.0014	m3	2,34556E-07	2.13 €/m3
Packaging	Plastic	0.001	Kg	0,00052402	25.00 €/Kg
	Boxes	0.0025	Kg	0,00327825	0.10 €/Kg
	Cellophane	4,46429E-05	kg	1,64192E-05	1.97 €/kg
Outbound transportation	Truck to Rome	0,114138889	tkm	0.015	0.50 €/tkm
	Truck to Naples	0,114138889	tkm	0.015	0.50 €/tkm



B. Picture from Scenati



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

(D) -Paper & Paper Products: includes publishing, printing and reproduction of recorded media	X
(D) -Electronic Equipment: office, accounting and computing machinery, radio, television and communication equipment and apparatus	X
(D) -Other Transport: road, rail ; pipelines, auxiliary transport activities; travel agencies	X
(D) -Water: collection, purification and distribution	X

#### D. Direct and indirect emissions charts



### 3.3 Results

#### Calculation Summaries

Your total emissions are:  
**1.41 kg.**  
There are currently no matching Interventions within the tool.

From the analysis of the carbon map, the various elements in the boxes get different colours according to the percentage of emissions on the total amount. In particular, elements are represented in green, yellow and orange if their emissions are respectively negligible, moderate or tolerable. Red boxes are elements with a percentage over 10% and represent a carbon hotspot that needs to be monitored and, if possible, an intervention and improvement plan has to be developed.

According to Scenati tool calculations, the total emissions of Auxa s.r.l. supply chain for single unit of product (0.350 kg of walnuts) are 1.41 kg CO<sub>2</sub>eq/kg. In particular, sodium hypochlorite results being the element that has the biggest impact on final emission, followed by the transportation.

## 4 Possible improvements

### 4.1 Scenario 1: Walnuts suppliers change

Once established that sodium hypochlorite represents the major carbon hotspot, and transportation represents the second major carbon hotspot, according to a green external operations management strategy, a possible intervention is the change of suppliers. In particular, from an accurate study of European walnuts suppliers, it results that the most convenient one to choose in terms of distance and

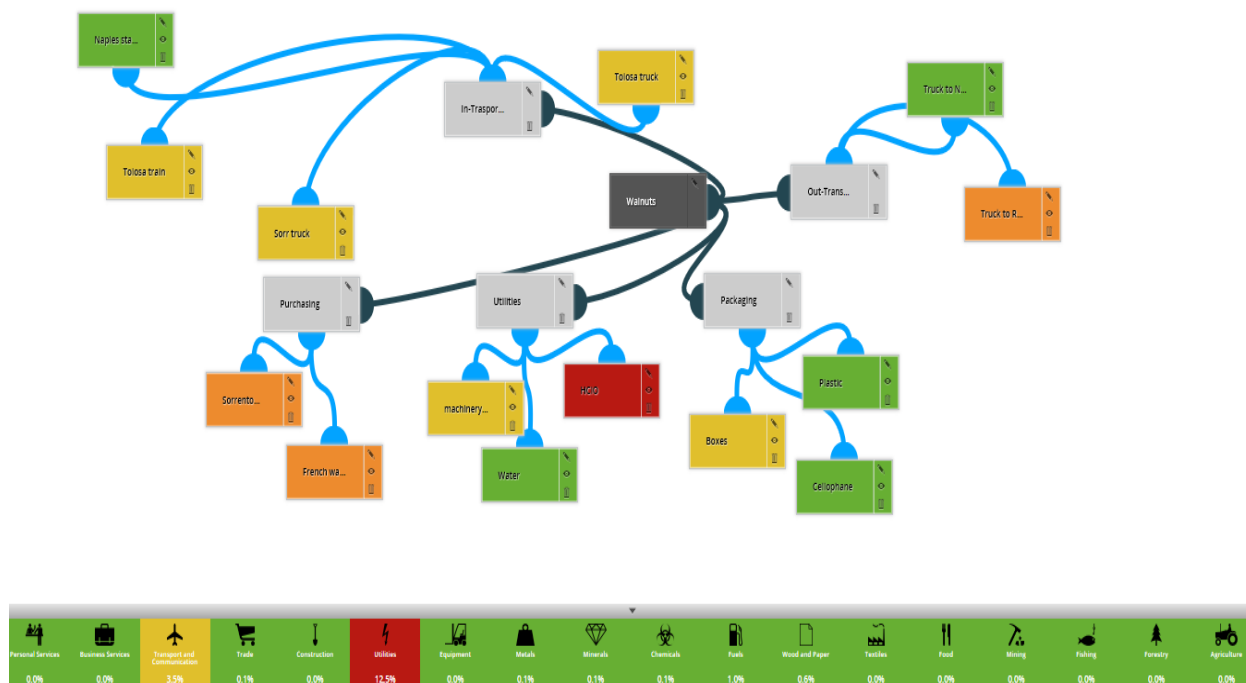
quality of rough product is located in France, even if French walnuts are more expensive than Californian ones.

#### 4.1.1 SC Carbon Map

*E. Table of SC Carbon Map - unit of analysis: 0.350 kg of walnuts*

Process	Input	Quantity	Unit	GHG Intensity [kg CO <sub>2</sub> eq/unit]	Unit Price [€/Unit]
Purchasing	Sorrento walnuts	0.175	Kg	0.073819	5.00 €/Kg
	French walnuts	0.175	Kg	0.073819	4.20 €/Kg
Inbound transportation	Truck - ship - truck	0.878888889	tkm	0.009	0.10 €/tkm
	Truck from port	0.114138889	tkm	0.015	0.50 €/tkm
	Truck from Sorrento	0.055611111	tkm	0.007	0.50 €/tkm
Utilities	Electricity	0.0455	KWh	0,0237965	0.18 €/KWh
	Water (with sodium)	0.0028	m3	4,69112E-07	2.12 €/m3
	Sodium hypochlorite	0.777	m3	0,68815782	0.60 €/kg
	Water (for washing)	0.0014	m3	2,34556E-07	2.13 €/m3
Packaging	Plastic	0.001	Kg	0,00052402	25.00 €/Kg
	Boxes	0.0025	Kg	0,00327825	0.10 €/Kg
	Cellophane	4,46429E-05	kg	1,64192E-05	1.97 €/kg
Outbound transportation	Truck to Rome	0,114138889	tkm	0.015	0.50 €/tkm
	Truck to Naples	0,114138889	tkm	0.015	0.50 €/tkm

F. Picture from Scenati

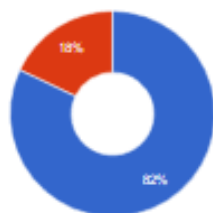


G. Missing Inputs selection, based on analysed product process description

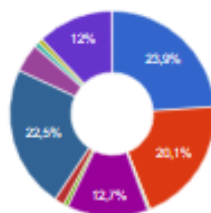
(D) -Paper & Paper Products: includes publishing, printing and reproduction of recorded media	X
(D) -Electronic Equipment: office, accounting and computing machinery, radio, television and communication equipment and apparatus	X
(D) -Other Transport: road, rail ; pipelines, auxiliary transport activities; travel agencies	X
(D) -Water: collection, purification and distribution	X

#### H. Direct and indirect emissions charts

Direct vs Indirect Emissions



Direct Inputs - Cost %



Direct vs Indirect Cost



## 4.2 Results

### Calculation Summaries

Your total emissions are:  
**1.35 kg**  
There are currently no matching interventions within the tool.

According to Scenati tool calculations for this scenario, the total emissions of Auxa s.r.l. supply chain for single unit of product (0.350 kg of walnuts) are 1.35 kg CO<sub>2</sub>eq/kg (-4.2% than current situation).

## 4.3 Scenario 2: Abolition of sodium hypochlorite

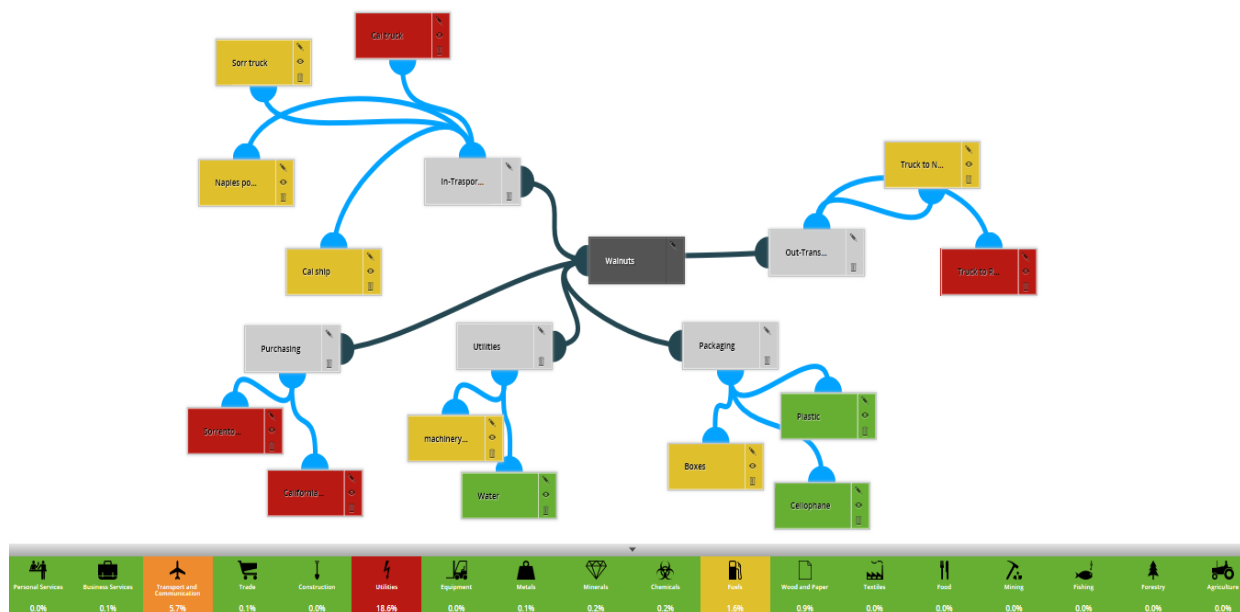
According to a green policy concerning production process, a possible intervention could be the abolition of sodium hypochlorite, using a larger quantity of water to wash the walnuts compared to the current situation. This makes the product 'BIO' so it can attract a larger number of clients.

### 4.3.1 SC Carbon Map

I. Table of SC Carbon Map - unit of analysis: 0.350 kg of walnuts

Process	Input	Quantity	Unit	GHG Intensity [kg CO <sub>2</sub> eq/unit]	Unit Price [€/Unit]
Purchasing	Sorrento walnuts	0.175	Kg	0.073819	5.00 €/Kg
	California walnuts	0.175	Kg	0.073819	4.00 €/Kg
Inbound transportation	Truck - ship - truck	0.878888889	tkm	0.009	0.10 €/tkm
	Truck from port	0.114138889	tkm	0.015	0.50 €/tkm
	Truck from Sorrento	0.055611111	tkm	0.007	0.50 €/tkm
Utilities	Electricity	0.0455	KWh	0,0237965	0.18 €/KWh
	Water	0.0034	m <sup>3</sup>	5.69636E-07	2.12 €/m <sup>3</sup>
Packaging	Plastic	0.001	Kg	0,00052402	25.00 €/Kg
	Boxes	0.0025	Kg	0,00327825	0.10 €/Kg
	Cellophane	4,46429E-05	kg	1,64192E-05	1.97 €/kg
Outbound transportation	Truck to Rome	0,114138889	tkm	0.015	0.50 €/tkm
	Truck to Naples	0,114138889	tkm	0.015	0.50 €/tkm

J. Picture from Scenati



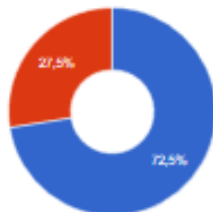
K. Missing Inputs selection, based on analysed product process description

(D) -Paper & Paper Products: includes publishing, printing and reproduction of recorded media	X
(D) -Electronic Equipment: office, accounting and computing machinery, radio, television and communication equipment and apparatus	X
(D) -Other Transport: road, rail ; pipelines, auxiliary transport activities; travel agencies	X
(D) -Water: collection, purification and distribution	X

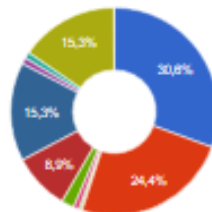


## L. Direct and indirect emissions charts

Direct vs Indirect  
Emissions



Direct Inputs - Cost %



Direct vs Indirect Cost



## 4.4 Results

### Calculation Summaries

Your total emissions are:  
**0.70 kg**  
There are currently no matching Interventions within the tool.

According to Scenati tool calculations for this scenario, the total emissions of Auxa s.r.l. supply chain for single unit of product (0.350 kg walnuts) are 0.70 kg CO<sub>2</sub>eq/kg. At the same time, total cost is reduced by 14.5%.

## 5 Final conclusions

Starting from the current situation of Auxa s.r.l., an analysis in terms of GHGs emissions has been made with Scenati tool. The resulting carbon map highlighted some hotspots in the different processes and areas of the whole supply chain. From this analysis, it emerges that the biggest contribute to the total amount of emission is due to the use of sodium hypochlorite, and another great contribute is due to the transportation. For this reason, two different scenarios have been proposed in order to reduce the impact of these hotspots. In particular, in the first proposed scenario, Californian walnuts have been replaced with French walnuts. In the second one, the use of sodium hypochlorite in addition to water to wash the walnuts has been abolished. The results of these scenarios, in terms of global emissions, are reported in the following table:



Scenario	GHG Intensity [kg CO <sub>2</sub> eq/kg]	Total cost
Current situation	1.41	3.44 €/kg
Suppliers changing	1.35	3.79 €/kg
Abolition of sodium hypochlorite	0.70	2.94 €/kg

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