

CONCEPT PAPER

Team Name (please do not include the name of the school or the city you come from):

Team 3

Team members:

Names:

SHORT DESCRIPTION OF YOUR SOLUTION (Maximum three sentences)

We have designed an unconventional platform project, suitable for an e-commerce business that allows managing a distribution network of items in an eco-sustainable way.

Our system is designed to limit energy expenses, processing waste, packaging involved and transportation emissions by analyzing each stage of the product's journey with the aim of radically minimizing the overall ecological footprint, from obtaining the raw material to making the item itself, from the departure to its final arrival at the destination.

EXECUTIVE SUMMARY

Executive summary – very brief summary of the most important points of the Concept Paper: what will your plan deliver, why is your solution the best at meeting the selection criteria? (*Maximum 200 words*)

The idea we thought up ensures both the quality of the product and a quick delivery service, which makes the entire cradle-to-grave journey as eco-friendly as possible and at the same time simplifies transport networks for better city mobility and ensures decarbonisation.

In this way, where investments and financing are insufficient to guarantee a zero ecological impact, the advantages of the linked phases of carriage, storage, packaging and delivery of the products will bring the environmental sustainability report closer to an overall neutral balance.

The customers are satisfied because the risk of damage to packs is minimized, the products arrive in a short timing because of the reduction of traffic; plus, they are aware that the choice they have made damages the environment as little as possible and uses the planet's

resources intelligently.

All the transports involved make use of hybrid or cutting-edge technologies and biofuels, biodiesel, or sustainable sources of energy.

At the end of the life of the vehicles used (vans, drones, bicycles, cargo ships, trains and airplanes), the materials from which are made can be entirely recycled or turned into a "second life" object.

SOLUTION

Detailed description of your solution (design/function, features/benefits, creativity/innovation) (*Maximum 300 words*)

The online platform accessed by the buyer is divided into:

Zero level: a customer buys a chosen product

First level: the manufacturers create the goods for the commercial cycle using renewable energies

Second level: primary sellers (head companies) manage the intra/international contacts. Intercontinental transport by air and water uses crafts/planes powered by e-fuel (e.g. e-jet) and ships likewise powered (e.g. e-ammonia). For movements inside the continent, electrified or hydrogen trains travelling on overland routes reduce motorized traffic.

An important duty for the main offices is to minimize the amount of packaging used by proportioning it to the size of the product (resulting in an advantage for transport and logistics). The following choices are preferred: completely biological or recoverable plastic/paper, reusable containers, recycled pallets; lighter and thinner materials, especially cloth/fabric bags and corrugated cardboard (it prevents damages and is ergonomically adaptable).

Third level: department stores offer different kinds of delivery:

1. Urgent orders are fulfilled through "Express" new vans built with organic materials (sugar beet and flax) and powered by biofuel or electricity.

2. A net of collection points satisfies orders for which customers can wait slightly longer. When a box reaches the collection point (locker), the customer receives a notification (email/message) and can choose to collect it in person or to pay for a home delivery (which is possible thanks to vans similar to those previously described, drones powered by solar energy or bike riders, each method designated for a type of parcels: voluminous, compact or directed to nearby neighbourhoods).

With a view to a circular economy, the customer can unpack the received product: its packaging and waste materials will be collected for free by the delivery man and returned to

the departure branch for reuse/recycling.

Impact of your solution – use your Science-Technology-Engineering-Math skills to estimate or calculate the impact of your solution. Explain why your solution is the best way of making e-Commerce as efficient as possible. (*Maximum 300 words*)

All the materials we chose were made in a sustainable way.

- **DRONES:** equipped with built-in organic photovoltaic panels (thin foils formed with organic and polymeric components) to increase the duration of the flight. They are more sustainable than traditional photovoltaic and they are able to produce energy even when it's cloudy. Ex: for a "Mavic 2 Pro" drone-type, let's assume an Electric Propulsion Motor of about 12 N, a maximum peak power of 95 Wp, it would have 30 minutes of autonomy but, thanks to the panels and the emergency battery, it will increase.
- **BIOFUELS:** In 2013, commercial vehicles generated 46% of the total nitrogen oxide emissions in the EU: with our project these emissions will drop sharply. The WHO estimated there have been more than 3 million premature deaths due to air pollution caused by road vehicle emissions: our project would also have long-term health benefits. Every year in Italy about 30 million tons of waste are collected: with the spread of Waste to Fuel plants (based on the thermal liquefaction process) we could obtain \approx 1 billion liters of bio-oil every year \cong 6 million barrels of crude oil/year. We could make a great contribution to the country's energy security and reduce the amount of waste and greenhouse gas emissions, transforming waste that has a disposal cost into bio-oil.
- **PACKAGING:** the reduction of plastic wrapping and the use corrugated fiberboard could:
 - save € 38 billion/year in the industrial sector;
 - reduce CO₂ emissions by 30-50% and allow savings of over € 500,000 and 450 plastic tons/year;
 - avoid the introduction into the atmosphere of up to 418,000 kg of CO₂eq per 100,000 kg of material.

Our pilot-scheme will strengthen e-Commerce, lead to massive economic savings and reduce pollution significantly.

FEASIBILITY

Uniqueness – compared to other solutions: what is special about yours? Why should the jury select your solution? (*Maximum 300 words*)

We critically approached the problem from several directions and also concerned with the customer's needs and happiness without only focusing on being eco-friendly.

We weren't afraid of trying new things, such as vans made of organic materials or drones powered by solar energy (that today are just highly futuristic but by 2030 will probably become popular), even though we always used technologies already tested, like AI and robotics, in an original way by making them sort the products according to their characteristics and by choosing the best vehicle based on distance, object's size and customers' needs.

Our project is well-planned in every little detail and cleverly combines several energy fields and sectors: we thought about different sustainable solutions from the production and the departure of the products to their final destination.

Every strategy our prototype adopts is a win-win solution for both sellers and customers.

All the links of the chain can be completed in a variety of ways. Therefore, if there is an issue of any kind during the evolution of the product journey, quick and easy problem solving is already arranged and obtainable without additional or unexpected costs.

Traceability is highly guaranteed: no item undergoes neither long waiting times in the sorting centers nor extended journeys, so customers can know in real time where their orders are and, upon arrival, have direct feedback with an operator who is trained for assistance if necessary.

All the proposals we have planned, even if they have not yet been implemented up to now, are in any case concretely achievable in the near future with the proper financial support and do not represent utopias as they are supported by solid technical certainties or reliable estimates.

Technology - What technology or scientific knowledge does your solution require? (*Maximum 300 words*)

Our solution requires the use of many innovative technologies:

- 1) For each item, the site recommends outlets and stores affiliated with the manufacturer, located in the immediate vicinity of the buyer's location, where the product of interest can be found. This service incentivizes local purchases and encourages customers to make more sustainable choices without interfering with company's profits.
- 2) Manufacturers offset CO₂ emissions through processes such as Carbon Capture and Storage (CCS) and invest in renewable energy (wind, solar, photovoltaic...)
- 3) The production of ecological fuels partially derives from reusing municipal landfills waste, in order to recover space within the city area that can be used to build new

infrastructures.

4) A sophisticated artificial intelligence through databases, navigators, robotization tools and mechanization of internal and external organization processes (AMR sorting), makes each order correspond to the most convenient type of transport, according to the characteristics of the item itself (weight, size, volume) but also to the customers' needs.

5) Another logistical solution aimed at ecological sustainability is to establish in advance the delivery times of the package, in order to avoid empty runs. A similar organization involves an application or an additional computer-based system.

6) Customers can find further information about the environmental cost of purchasing thanks to a detailed service offered by the platform: a software calculates what impact has the entire life of each item.

7) The pallets are made of polypropylene or non-virgin wood (deriving from agricultural pruning, maintenance interventions, separate waste collection...) and also bioplastics are involved, so it is necessary to produce them combining various sources (food waste, household waste...)

Economy - use your Science-Technology-Engineering-Math and Economic skills to estimate or calculate the cost of your solution. Explain why your solution is inclusive and affordable. (Maximum 300 words)

• DRONES: Our e-commerce will deliver 350,000 parcels/day. If each drone is capable of making 40 deliveries daily, about 9,000 drones are needed. Solar panels count 50-100 cells each, and a single one has a power of 2 Wp (the cost will be 2 €/Wp). A drone (4 m²) supports 2 photovoltaic panels (each occupies ≈ 1.70 m²), so 500 € should be added to the average cost of a drone (1,000 €) as well as maintenance costs. The balance reaches ≈ € 20 million. A supplement of < € 5 guarantees customers a cheap, prompt last mile delivery.

• TRAINS: 1 hydrogen train ≈ € 5 million

• BIODEGRADABLE VANS: € 20,000 (€ 10,000 in 10 years)

10,000 vans used → € 100,000,000 total

• FUELS:

Petrol: € 1.5/liter → Hydrogen: today € 6/kg, in 2040 € 2-3/kg

Petrol cars 100 km: € 10 → Electric vehicle 100 km: € 4. Savings of € 6 per 100 km

• AMR:

Average cost per AMR: € 30,000 + € 6,000 Annual Maintenance; we need at least 30 robots
→ € 900,000 + € 180,000 so in 5 years it is ≈ € 1,800,000

Annual Labor Savings at 3x productivity: € 700,000 → 1.5 years to recover from the investment

• AI:

Custom AI solution: € 6,000 to € 300,000/solution (including development and rollout);
Third-party AI software: € 0 to € 40,000/year

• PACKAGING: The green choices will result in significant economic savings

Material	Price per ton
Aluminum	15,00 €/t
Paper	55,00 €/t
Wood	9,00 €/t
Plastic	From 150 to 660 €/t (lower costs for recycled, bio or recovered plastics)