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Successful online learning for sustainable last mile logistics

CHAPTER 2: LMD logistics operation and impacts

UNIT 1: Equipment & tools of urban logistics

Capsule 2.1.1

Introduction to transport modes available to LMD

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To be done prior to this capsule:	Capsules from Chapter 1, Unit 3 (Variety of products flows)
Capsule linked with:	2.3.4, 3.1.1, 3.4.1
Authors:	MLC ITS Euskadi & SUSMILE Consortium

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Objectives of the Capsule

The learner will understand the different transport modes used in Last Mile Distribution (LMD). Special focus will be done in road transport, but multimodal approach will be also included. Related to road transport, the six main indicators that LMD distributors or logistics operators consider when they plan their delivery will be explained. The relationships between the indicators and the category of vehicles will also be exposed. Customized vehicles will be also explained.

Category	E-learning	EQF		
		4	5	6
		X	X	X

Exercises included	YES

Effort for the capsule	Content 15 Min.	Exercises 3 Min.	Extra material 5 Min.

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Contents

1. Goods transport in urban roads
    - Indicators to be taken into account
    - L & N categories vehicles
    - Relationship between indicators and vehicle categories
2. Multimodal city logistics
3. “Customised” vehicles
4. Multiple choice exercises

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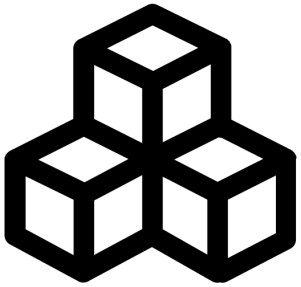
1. Goods transport in urban roads - INDICATORS

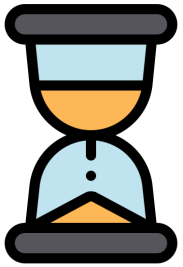
Freight distribution is planned according to 6 main indicators, and Last Mile Distribution also applies them*. There are:

LOADING CAPACITY



DELIVERY DISTANCE

DELIVERY TIME



ENVIRONMENTAL IMPACT

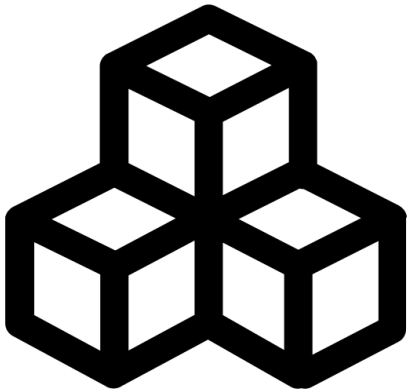
COST OF OPERATION

CUSTOMER SATISFACTION

* Other indicators will be also analysed in Chapter 3

1. Goods transport in urban roads - INDICATORS

Each vehicle has different loading capacity and delivery distance:



LOADING CAPACITY

DELIVERY DISTANCE

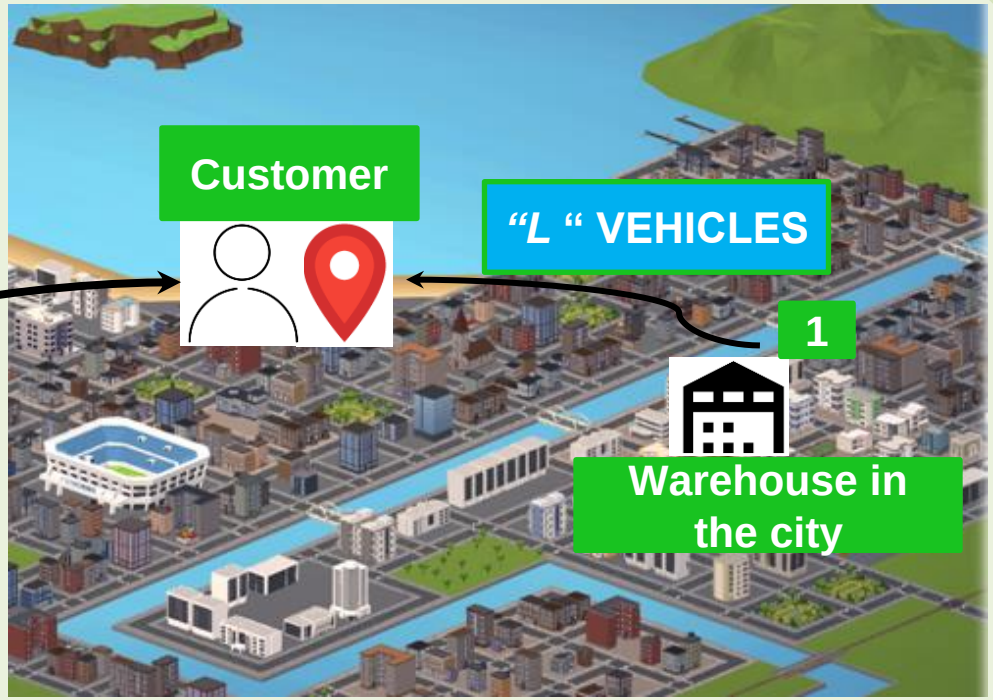
This means, that depending on the kind of loading goods to be delivered and the distance to travel from the point of origin, you have to decide which is the best vehicle for your distribution.

1. Goods transport in urban roads - INDICATORS

DELIVERY TIME

"N" VEHICLES

Warehouse outside the city



The warehouse, which is the point of departure of the goods, determines the **distance** to be traveled for the delivery and therefore the **vehicle** that could be used, in other words, the **delivery time**.

1. Goods transport in urban roads - INDICATORS

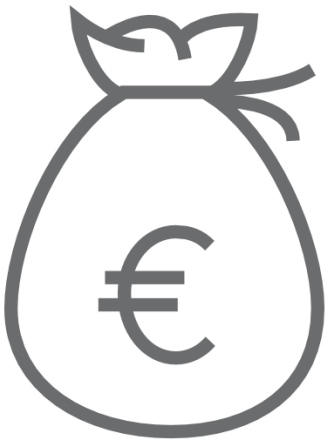
Vehicles have also different environmental impact, cost of operation, and even customer satisfaction, specially if the traffic congestions affects the delivery.

ENVIRONMENTAL IMPACT

COST OF OPERATION

CUSTOMER SATISFACTION

1. Goods transport in urban roads - INDICATORS



COST OF OPERATION

In LMD, the main operation cost, is the transportation cost.

TRANSPORTATION COST:

This cost includes the payroll for transportation staff, fuel use, insurance costs, the cost of the vehicle and its maintenance costs.

Dividing the total transportation costs by the total sales on the transported products the percentage costs for transportation will be determine.

Therefore, given an equal salary cost, the cost of the vehicle and its loading capacity will determine its operating cost.

1. Goods transport in urban roads - INDICATORS

Until de last decade, the LMD was planned according to operation cost indicator.

Nevertheless, currently, and because different regulation bodies are approving rules with the aim of reducing the environmental impact of unsustainable mobility, the urban freight distribution models and specially LMD are being planned prioritizing less environmental impact.

ENVIRONMENTAL IMPACT

IMPORTANT:: All this information will be critical in the Serious Game

1. Goods transport in urban roads - VEHICLES

2 main categories of vehicles can be used in Last Mile Delivery (1):

❑ **Category L**: 2- and 3-wheel vehicles and quadricycles: such us bicycles, cargo bikes, motorcycles…

"L" VEHICLES

❑**Category N**: vehicles carrying goods (2). In this case, there are 3 different subcategories:

1) Category N1: motor vehicles with a maximum mass not exceeding 3,5 tonnes.
2) Category N2: motor vehicles with a maximum mass exceeding 3,5 tonnes but not exceeding 12 tonnes.
3) Category N3: motor vehicles with a maximum mass exceeding 12 tonnes.

"N" VEHICLES

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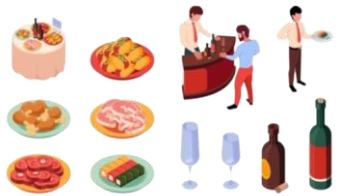
1. Goods transport in urban roads - VEHICLES

Category L:

- **2 WHEELS BICYCLES OR CARGO BIKES**
- **3 WHEELS CARGO BIKES**
- **2 OR 3 WHEELS MOTORCYCLES**
- **QUADRICYCLES**

Carried Products: mail and packages; retail products, catering products

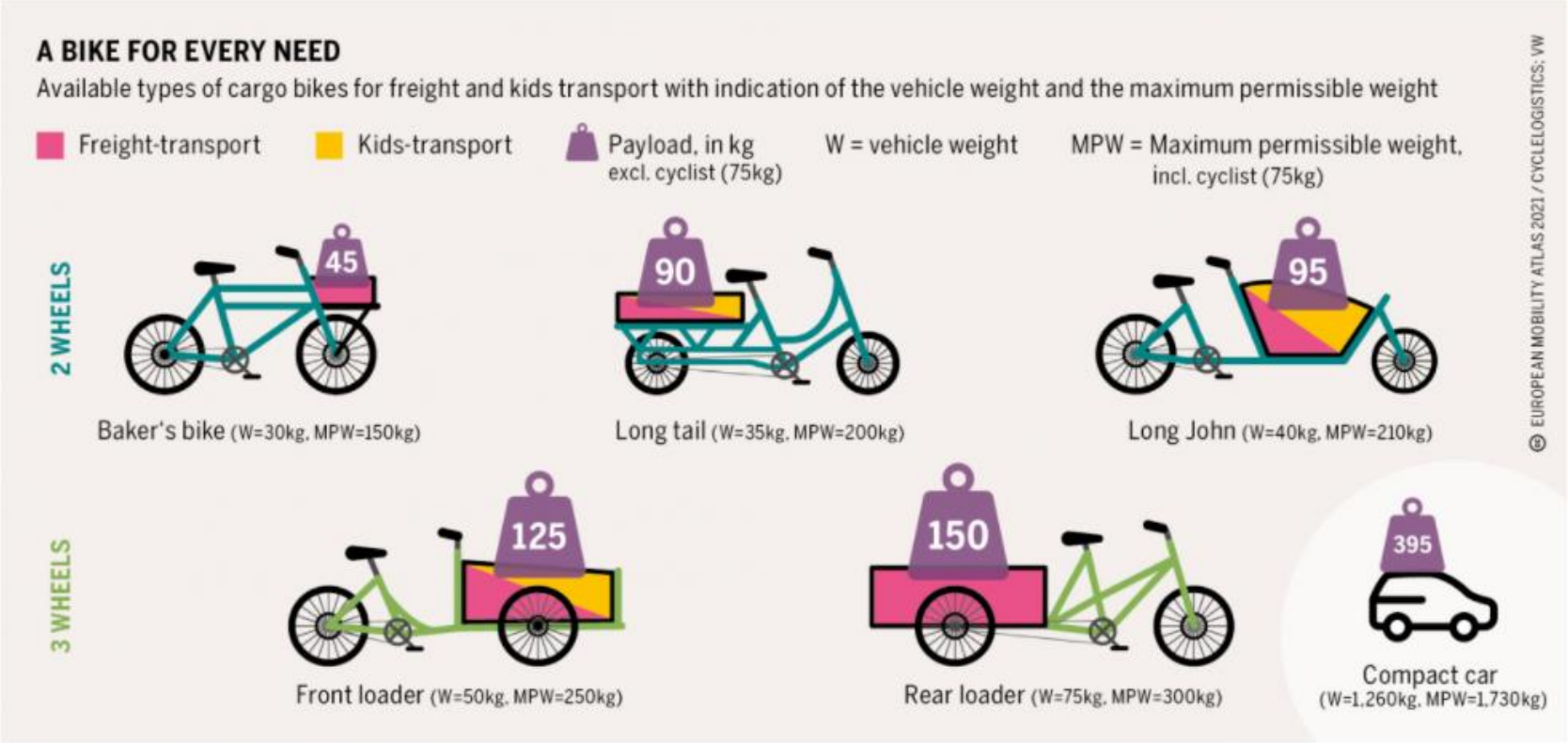




Payload:

				
according to the used chest	up to 150 kg (see next slide)	up to 350 kg	up to 350 kg	according to the capacity of the motorcycle chest

1. Goods transport in urban roads - VEHICLES



Source: Becker, S. and Behrensen, A. (2021, February 3). Cargo Bikes: Sustainable and Resilient Transport. https://eu.boell.org/en/cargo-bikes-sustainable-and-resilient-transport

1. Goods transport in urban roads - VEHICLES

Category N: Vehicles that belong to N category are classified as in 3 subcategories:

N1: motor vehicles with a maximum mass not exceeding 3,5 tonnes (light duty vehicles - vans)	
	
Capacity: min. 600 kg – maximum 800 kg Power options: Fossil fuels / alternative fuels (electric, gas) Products: generic; +/- cold	Capacity: maximum between 1200 kg and 1500 kg Power options: Fossil fuels / alternative fuels (gas, electric) Products: generic, +/- cold

1. Goods transport in urban roads - VEHICLES

Category N:

N2: motor vehicles with a maximum mass exceeding 3,5 tonnes but less than 12 tonnes	
	
Combustion options: Fossil fuels / alternative fuels (GNC specially. Electric options are appearing in the market) Products: generic, +/- cold, beverage	

In some city areas, trucks with more than 7’5 tonnes need special permission to Access to the city centre

1. Goods transport in urban roads - VEHICLES

Category N:

N3: motor vehicles with a maximum mass exceeding 12 tonnes	
	
Combustion: Fossil fuels / alternative fuels (gas, Electric options are appearing in the market) Products: generic, +/- cold	Power options: Fossil fuels / alternative fuels (Gas, electric, hidrogen) Products: Waste

Normally, trucks with more than 12 tonnes need special permission to access to the city

1. Goods transport in urban roads – INDICATORS & VEHICLES

Appling the indicators to different vehicles categories, this is the general scheme we could have for delivery distance, loading capacity, cost and environmental impact:

Longer distance

DELIVERY DISTANCE

"N" VEHICLES

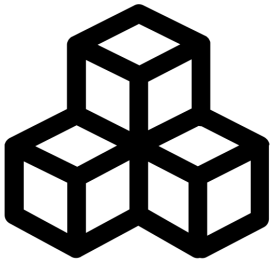
"L" VEHICLES

Shorter distance

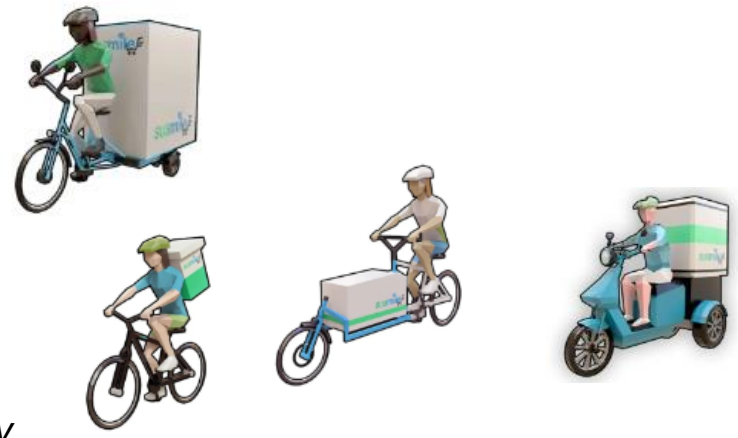
1. Goods transport in urban roads – INDICATORS & VEHICLES

More capacity

LOADING CAPACITY



"N" VEHICLES



"L" VEHICLES

Less capacity

1. Goods transport in urban roads - INDICATORS & VEHICLES

Depending on the combustion system used by the vehicle, the environmental impact of the vans, specially, could be much less. Even so, they will continue to occupy the same space in the city.

ENVIRONMENTAL IMPACT

More polluting




"N" VEHICLES




"L" VEHICLES

Less polluting

1. Goods transport in urban roads - INDICATORS & VEHICLES

According to the previous slide, **big vans or trucks**, as more polluting that small vans.

But in logistic, there is no never only a single option to deliver the goods in the most sustainable way.

Grouping loads as much as possible and using the vehicle that best suits the size of the delivery, even if it is a large truck, can also be a way to reduce the environmental impact. In this way, in some European cities the entrance of big trucks it is permitted, specially at night (**night delivery**), since they reduce the number of small vehicles that should access throughout the day.

ENVIRONMENTAL IMPACT

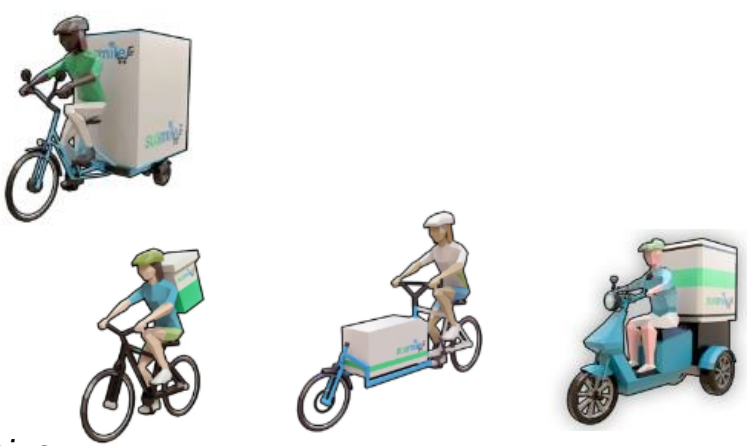
1. Goods transport in urban roads - INDICATORS & VEHICLES

The cost of the vehicles could be very different depending on the used combustion system. Nevertheless, the general structure is the next one:

More expensive

VEHICLE COST

"N" VEHICLES



"L" VEHICLES

Less expensive

1. Goods transport in urban roads - INDICATORS & VEHICLES

Bigger vehicles normally have less operating cost, if their load capacity is used to the maximum.

More expensive

COST OF OPERATION

"L" VEHICLES

"N" VEHICLES

Cheaper

1. Goods transport in urban roads – INDICATORS & VEHICLES

As a CONCLUSION of the previous schemes, we can say that:

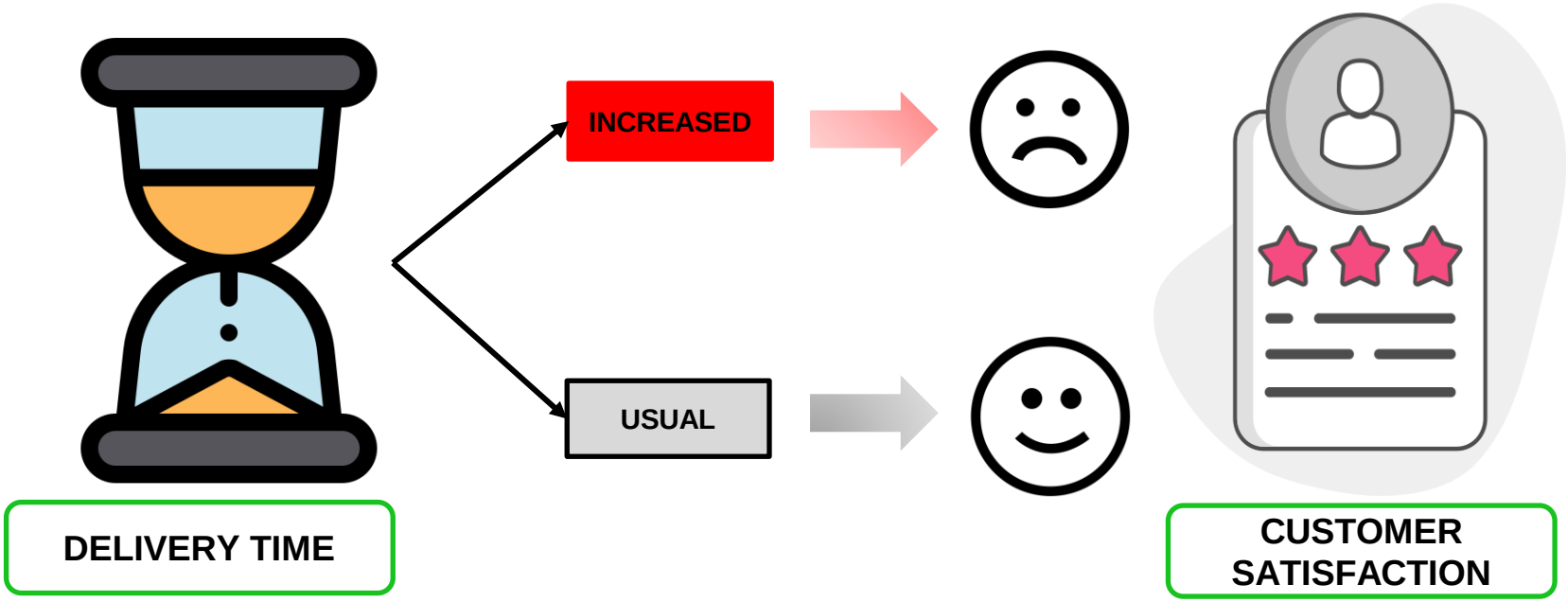
"L vehicles are LESS polluting and expensive, than N vehicles, but they also have LESS loading and delivery distance capacity than N vehicles, that directly affects in the operating cost.

Therefore, the exit point and the customer location will determine the vehicles to be used in the Last Mile Distribution, but also the cost of operation of the distribution model".

1. Goods transport in urban roads – INDICATORS & VEHICLES

Logistics operators and distributors, organise their urban freight distribution according to “usual” delivery times, that at the same time it assures high customer satisfaction.

But hazardous situations like traffic jams, bad weather, road works... can affect very easily the delivery time. **Therefore, these two indicators are dynamic and the delivery time directly affects the customer satisfaction.**



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1. Goods transport in urban roads - INDICATORS & VEHICLES

As motor vehicles operations can be more affected by traffic congestions in the LMD, the quality of the service provided to the customer can be much more affected, and therefore be more volatile.

More volatile

CUSTOMER SATISFACTION

"N" VEHICLES

"L" VEHICLES

Less volatile

2. Multimodal city logistic

DEFINITION

First of all, we should define the term MULTIMODAL transport or logistic, and not confuse it with INTERMODAL transport.

We propose you to browse in the web site of a logistic operator specialised in intra-European multimodal transport. Although it is out of the Last Mile Logistic scope, the explanations done are very useful to understand the terms:

Source (web site in EN): The CMA CGM Group. (2020, November 13). *Intermodal vs. Multimodal: What is the difference?*. https://www.containerships.eu/news/intermodal-vs-multimodal-what-is-the-difference

MULTIMODAL VS INTERMODAL

2. Multimodal city logistic

Summary:
Both intermodal and multimodal transportation involve moving cargo from origin to destination using more than one method of transport. But the difference is in the contract. In multimodal transportation, one contract covers the entire journey. In intermodal transportation, there is a separate contract for each individual leg of the journey.

Source (web site): The CMA CGM Group. (2020, November 13). Intermodal vs. Multimodal: What is the difference?. https://www.containerships.eu/news/intermodal-vs-multimodal-what-is-the-difference

Conclusion:
There will be multimodal city logistics when more than one means of transport and even categories of vehicles are used to deliver in the city, but when everything is done under a single contract.

2. Multimodal city logistic

ADVANTAGES:

- The best transport alternative it is used, for each distribution area
- Reduce CO2 emissions and GEIs
- Vehicle adapted to the characteristics of the product and service
- Bigger possibilities to use low carbon and zero emission vehicles
- Possibilities to reduce the number of lorries accessing to the city

DISADVANTAGES:

- A risk for the goods, as there is a load break
- New actors in the distribution chain, therefore, it is important to have a technology that helps having goods traceability
- Organization could have difficulties to change distribution models (retrain or fire workers, for example truck drivers)
- Is it economically advantageous?

2. Multimodal city logistic

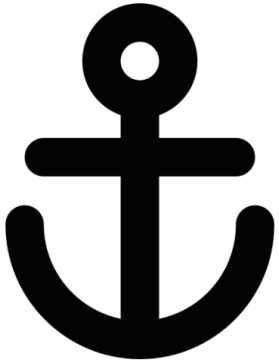
MULTIMODAL DISTRIBUTION SCHEMS AVAILABLE IN LAST MILE DISTRIBUTION

The multimodal distribution scheme applicable in the last mile distribution, depends on:

1) the **distribution model** that the distributor or fleet operator is using to get the products in the city.
2) the **product to be deliver and its delivery features**.

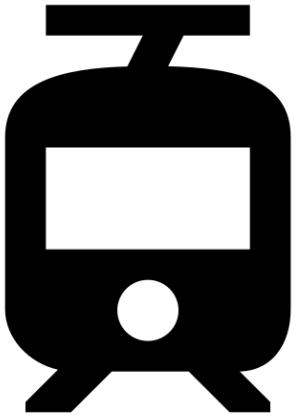
All of them have the same objective: use the most appropriate mode of transport, according to the point of origin and destination of the merchandise. And the distance from the origin to the destination will be the criteria on which the means to be used will be selected.

2. Multimodal city logistic



MULTIMODAL APPROACH, USING WATERWAYS:

One of the alternative ways of delivering freight in cities, is using waterways, especially in large cities, as roads are congested. Rivers and canals are being used more and more. Even, those combustion boats are being replaced by “pollution-free” boats or even autonomous.



MULTIMODAL APPROACH, USING TRAMS OR SUBWAYS:

The use of trams and subways for urban distribution of goods is an option that has been implemented in some cities and is being or has been studied in others in view of the increasing difficulty of accessing city centers.

More information in capsule 2.1.4

3. Customised vehicles

In some cities, operators or distributors are developing customized vehicles in order to carry out last mile distribution in the most sustainable and efficient way. Some examples are:

Utrecht (2)
The service perform efficiently last mile operations for local businesses, especially for tourist venues, restaurants and catering facilities.

Malaga (3)
A pilot project was launched for the distribution of packages in the old town of Malaga with electric vehicles.

Exercises

Select the correct answer for each question, only one:

1. Which are the six main indicators in Last Mile Distribution?

a) Loading capacity; hours in motion; fuel consumption; delivery distance and environmental impact

b) Loading capacity; customer satisfaction, cost of operation; delivery distance and environmental impact

c) Loading capacity; order accuracy, complaint details; delivery distance and environmental impact

Exercises

Select the correct answer for each question, only one:

2. Environmental impact indicator:

a) It is not an important indicator to be taken into account in Last Mile Distribution

b) It is easy to improve this indicator. You just have to replace a polluting vehicle with one that runs on clean fuels.

c) It is an indicator whose importance is growing, because in cities there are more and more access restrictions for polluting vehicles.

Exercises

Select the correct answer for each question, only one:

3. What happens with the cost of operation of light vehicles, such us bicycles, cargo bikes, motorcycles, when you need to deliver different goods, whose total weight is around 1.300 kg?

a) Although buying a vehicle with these characteristics is cheaper than buying a N category vehicles, given the same labor cost for drivers/cyclists, in each vehicle you deliver fewer goods, since their loading capacity is slower. Consequently the operating cost is higher.

b) As the price of L vehicles is cheaper than N vehicles, the cost of operation will be also cheaper, although you need several L vehicles to deliver the requested goods.

c) As they don´t consume fuel, or very few as it is the case of motorcycles, their cost of operation is lower.

Exercises

Select the correct answer for each question, only one:

4. In Last Mile Distribution, hazardous situations like traffic jams, bad weather, road works... can happen and

a) L vehicles, motors vehicles, can be more easily affected.

b) N vehicles, motor vehicles (where 3 different subcategories exist), can be more easily affected.

c) Both, L and N category vehicles can be equally affected.

Exercises

Select the correct answer for each question, only one:

5. When more than one means of transport and even categories of vehicles are used to deliver in the city, and all the delivery is done with a single contract.

a) This is synchromodality.

b) This is intermodal transport.

c) This is multimodal transport.

References

(1) European Commission. *Vehicle categories*. https://ec.europa.eu/growth/sectors/automotive-industry/vehicle-categories_en

(2) BESTFACT. (2013). *Electric freight vehicle with trailers: Cargohopper in Utrecht*. http://www.bestfact.net/wp-content/uploads/2016/01/CL1_078_QuickInfo_Cargohopper-16Dec2015.pdf

(3) Cadena de suministro. *Azkar pone en marcha un 'piloto' para la distribución en el casco antiguo de Málaga con vehículos eléctricos.* https://www.cadenadesuministro.es/noticias/azkar-pone-en-marcha-un-piloto-para-la-distribucion-en-el-casco-antiguo-de-malaga-con-vehiculos-electricos/