

SIMPLIFYING SUSTAINABLE URBAN LOGISTICS INDICATORS: IS IT POSSIBLE?

Y A R I B O R B O N - G A L V E Z , P H D

CENTER FOR SUPPLY CHAIN, OPERATIONS &
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CRISTI-INCLUSIVE SCIENCE, TECHNOLOGY &
INNOVATION CENTRE, A.C.

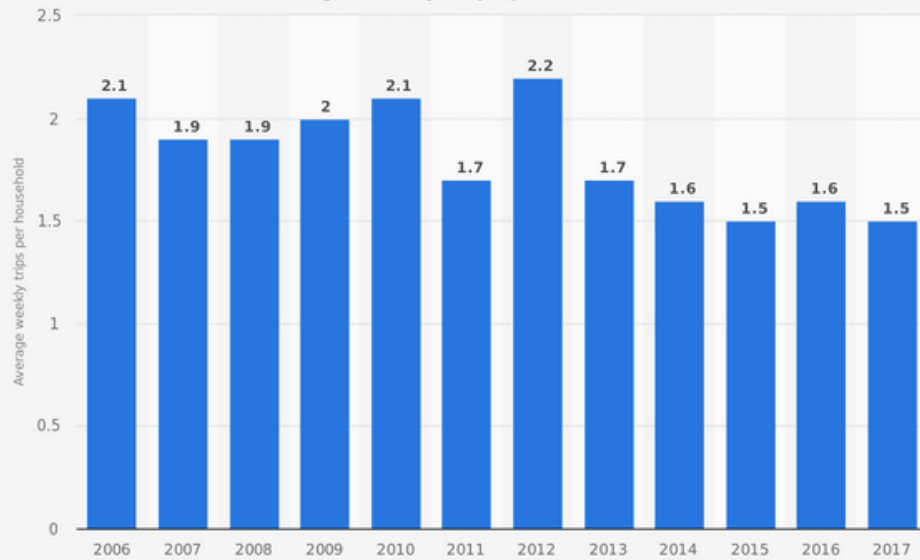
Workshop:
The Impacts and Methodology of Indicators and
Scoreboards

JRC-Ispira (VA), 22-23 March 2018

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WHY SUCH INDICATORS?

Consumers' weekly grocery shopping trips in the United States from 2006 to 2017
(average weekly trips per household)



Source

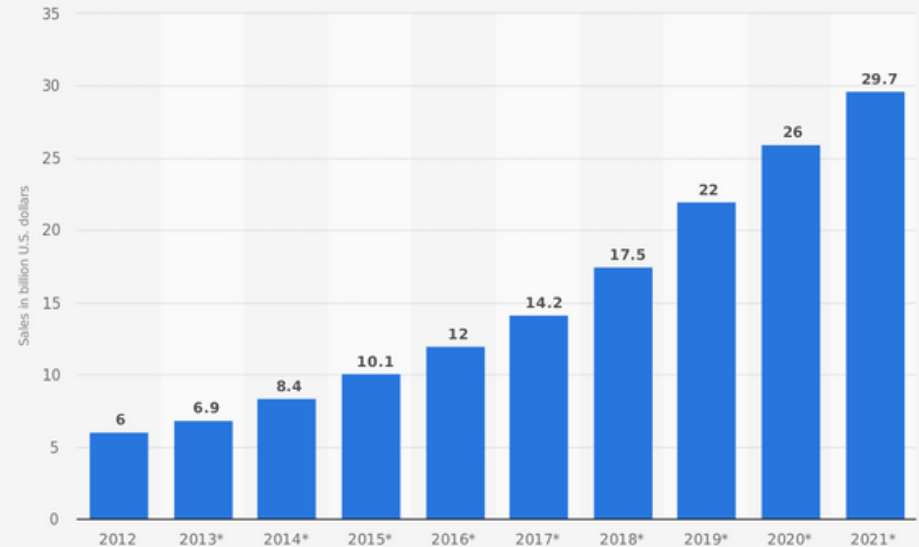
FMI
© Statista 2018

Additional Information:

United States; FMI; 2006 to 2017; 2,145*; 18 years and older; U.S. primary shoppers

statista

Online grocery shopping sales in the United States from 2012 to 2021 (in billion U.S. dollars)



Sources

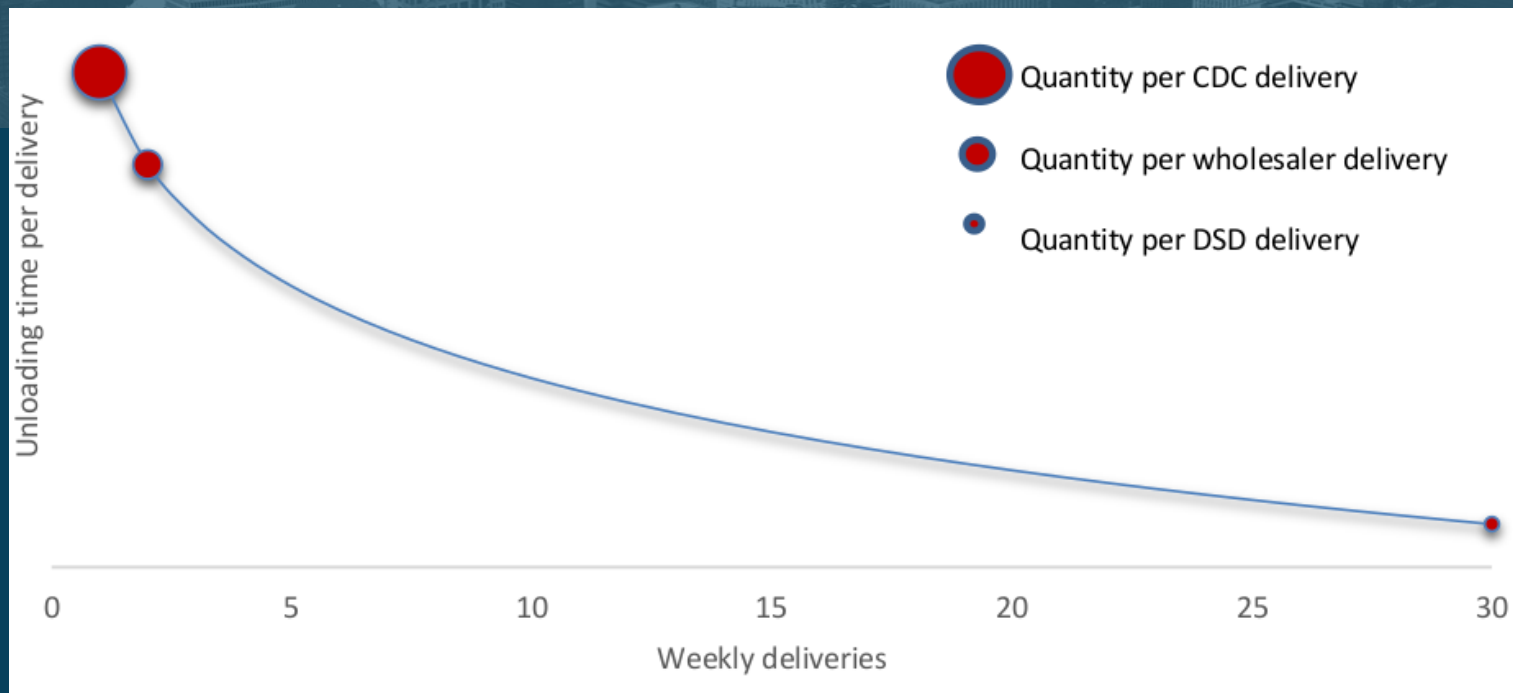
PitchBook; Morningstar; IBISWorld; Business Insider; Nielsen
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Additional Information:

United States; Morningstar; IBISWorld; The Hartman Group; Business Insider; Nielsen; 2012

statista

WHY SUCH INDICATORS?



Borbon-Galvez, et al., 2015

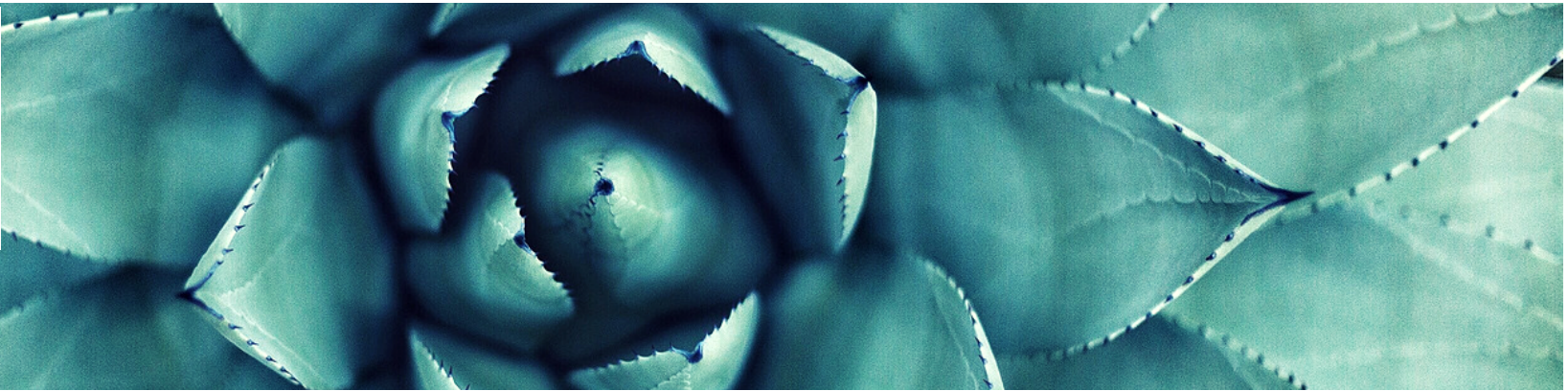


1.6 km is worth
over €25M*



1 minute of
idle time is
worth
€460K**

Haberkorn, K. (2018)

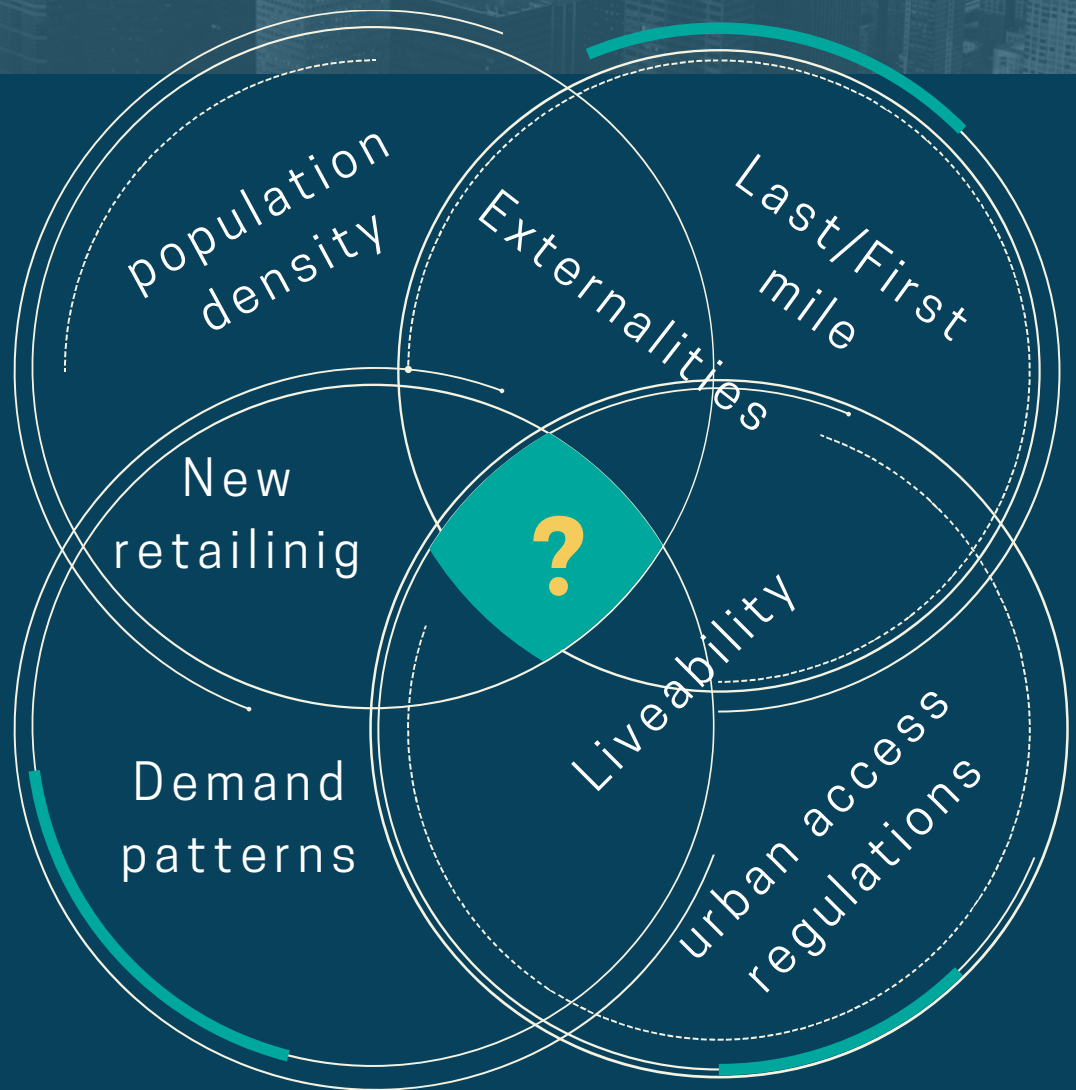


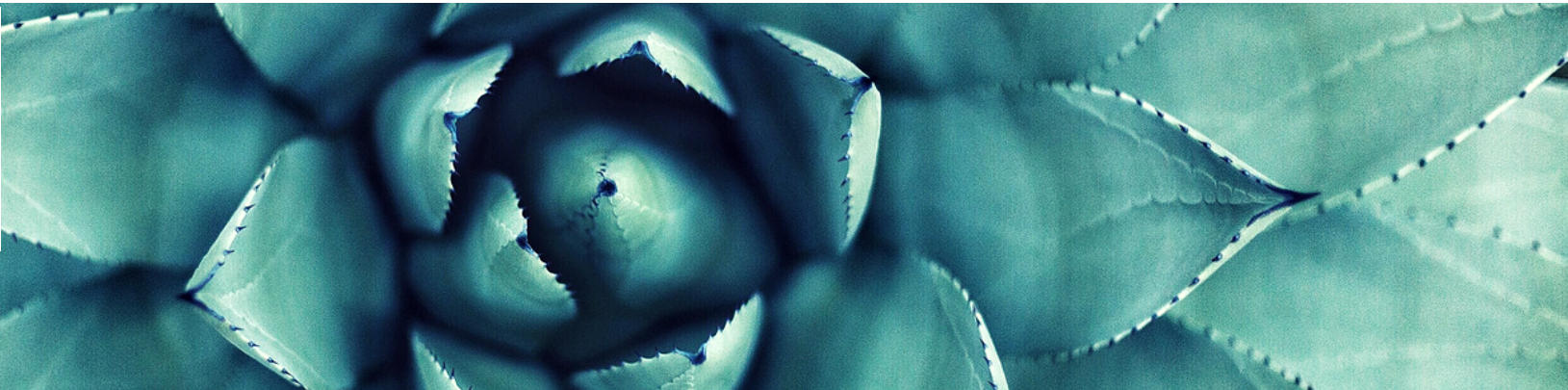
E-Commerce impacts per delivery option

| | Environmental | | | Economic | | | Social | | | Ø [%] |
|-----------------|---------------|--------------|-----------------|-----------------------|------------------|-----------------|-----------------|--------------------------|---------------|-------|
| | Re-source use | GHG emission | Other emissions | Long-term orientation | Investment costs | Operating costs | Quality of life | Impact on city structure | Data security | |
| Cargo bike | ● | ● | ● | ◐ | ◐ | ◐ | ● | ● | ● | 92 |
| Cargo tram | ◐ | ● | ◐ | ◐ | ◐ | ◐ | ◐ | ● | ● | 69 |
| E-mobility | ◐ | ● | ◐ | ◐ | ◐ | ◐ | ◐ | ◐ | ◐ | 75 |
| Dabba-wala | ● | ● | ● | ● | ◐ | ◐ | ● | ● | ◐ | 92 |
| Drone | ● | ● | ◐ | ◐ | ◐ | ◐ | ◐ | ● | ◐ | 67 |
| Crowd logistics | ● | ● | ◐ | ● | ◐ | ◐ | ◐ | ● | ◐ | 83 |
| Cargo tube | ◐ | ● | ● | ◐ | ○ | ◐ | ● | ◐ | ● | 67 |
| Pack-station | ◐ | ● | ● | ● | ◐ | ◐ | ● | ◐ | ◐ | 86 |
| Parcel box | ● | ● | ● | ● | ● | ● | ● | ◐ | ● | 97 |
| Tower24 | ◐ | ● | ● | ◐ | ◐ | ◐ | ◐ | ◐ | ◐ | 64 |
| Shop PUDO | ● | ● | ● | ◐ | ◐ | ◐ | ● | ● | ◐ | 89 |
| Freight village | ○ | ◐ | ◐ | ◐ | ◐ | ◐ | ◐ | ◐ | ● | 50 |
| Integrated mall | ○ | ◐ | ◐ | ◐ | ○ | ◐ | ◐ | ○ | ◐ | 47 |

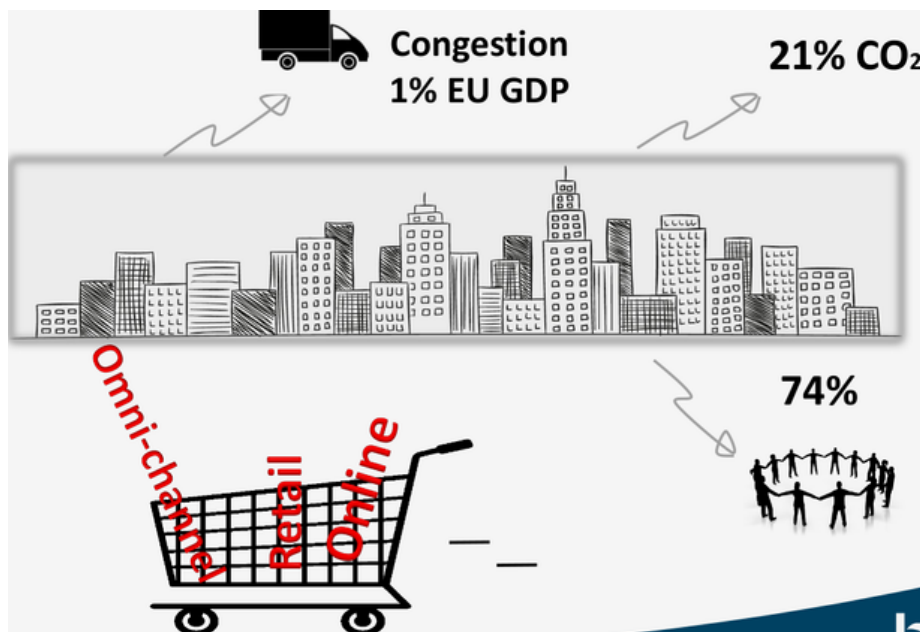
Hausladen et al., 2015

THE URBAN SPRAWL





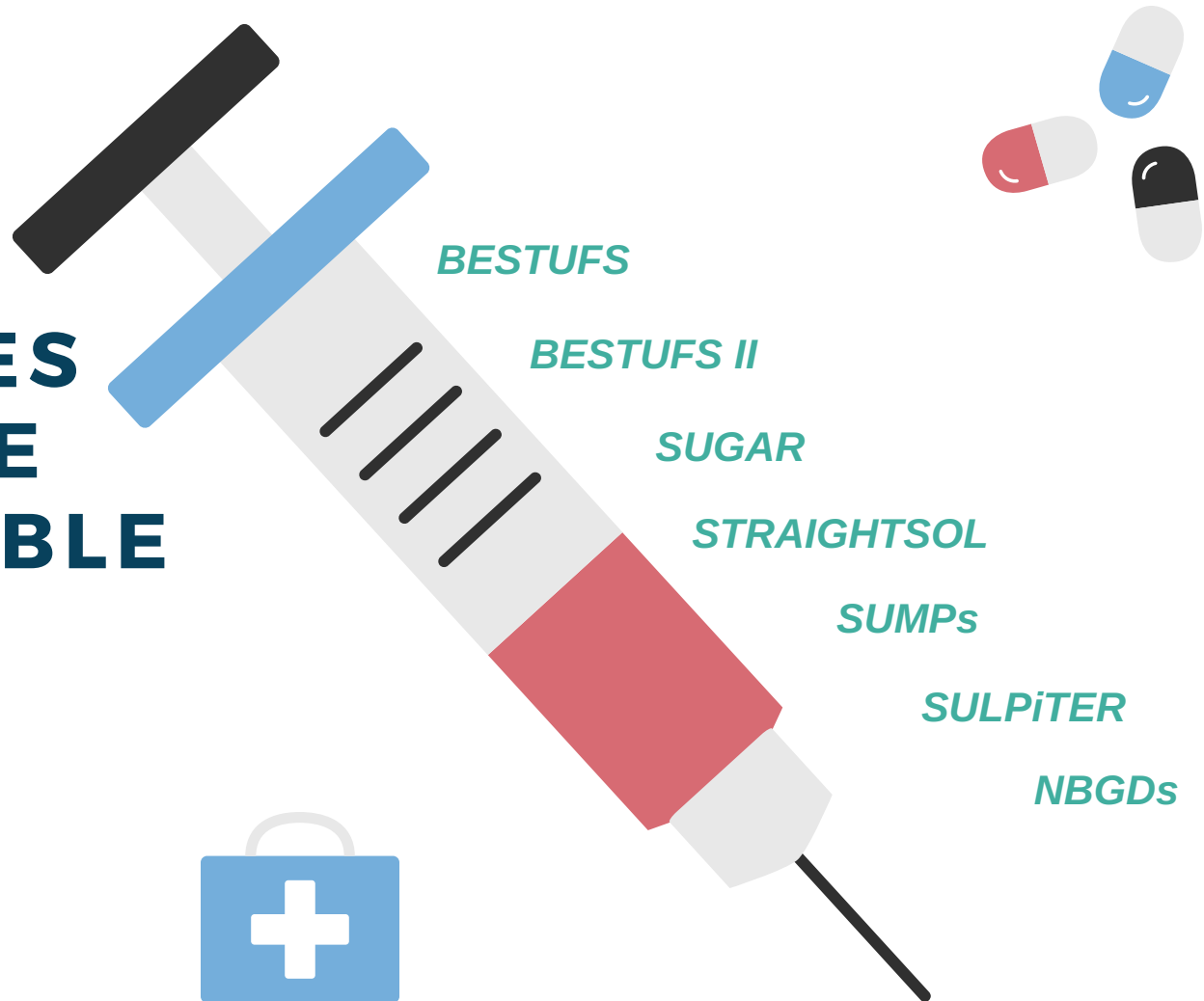
AN EC WISFUL THINKING



**LIVABLE AND CO₂-FREE
CITY LOGISTICS IN MAJOR
URBAN CENTRES BY 2030**



EC FUNDS INITIATIVES TO ENABLE SUSTAINABLE URBAN LOGISTICS



SUSTAINABLE URBAN MOBILITY PLANS (SUMPS)

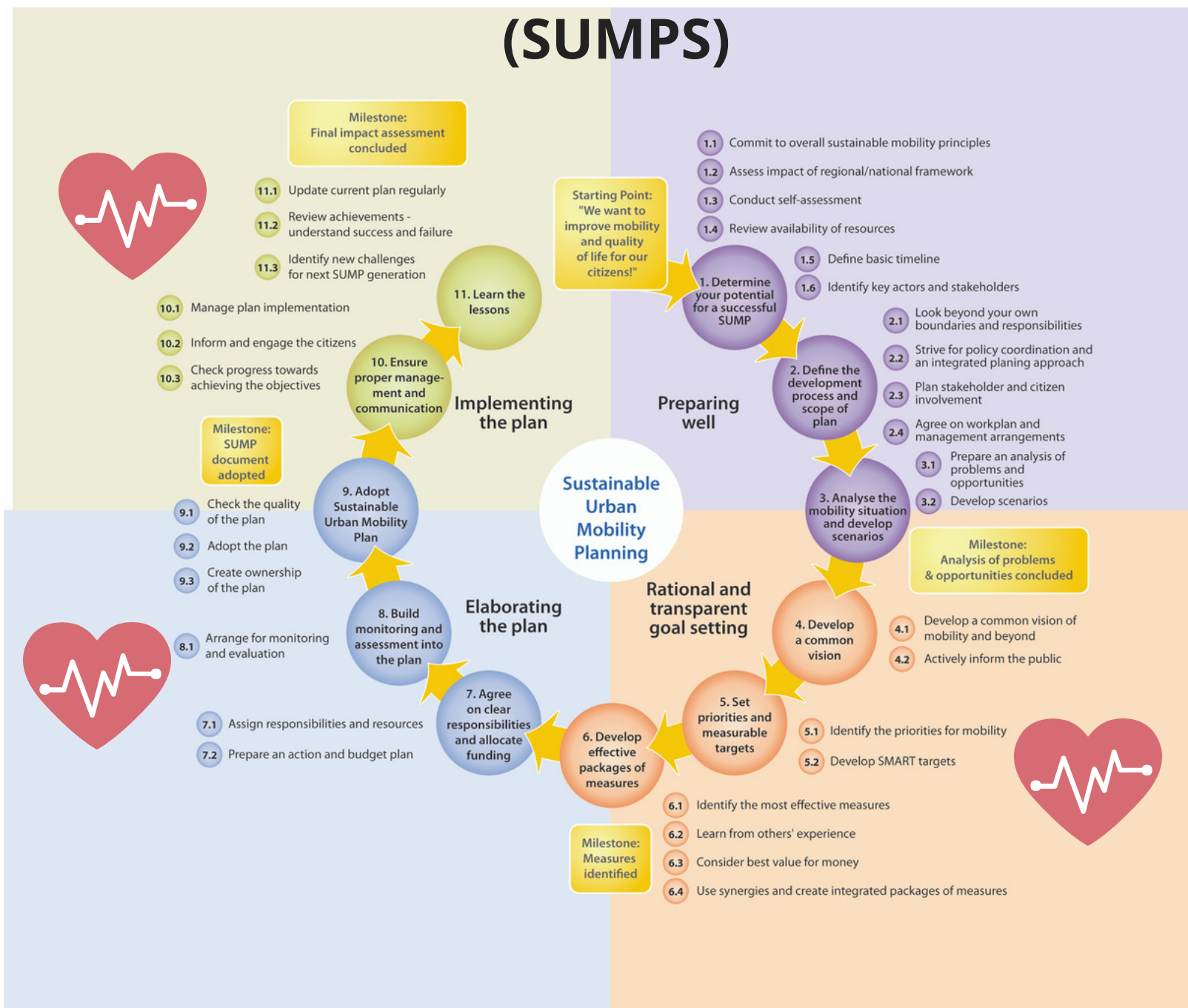
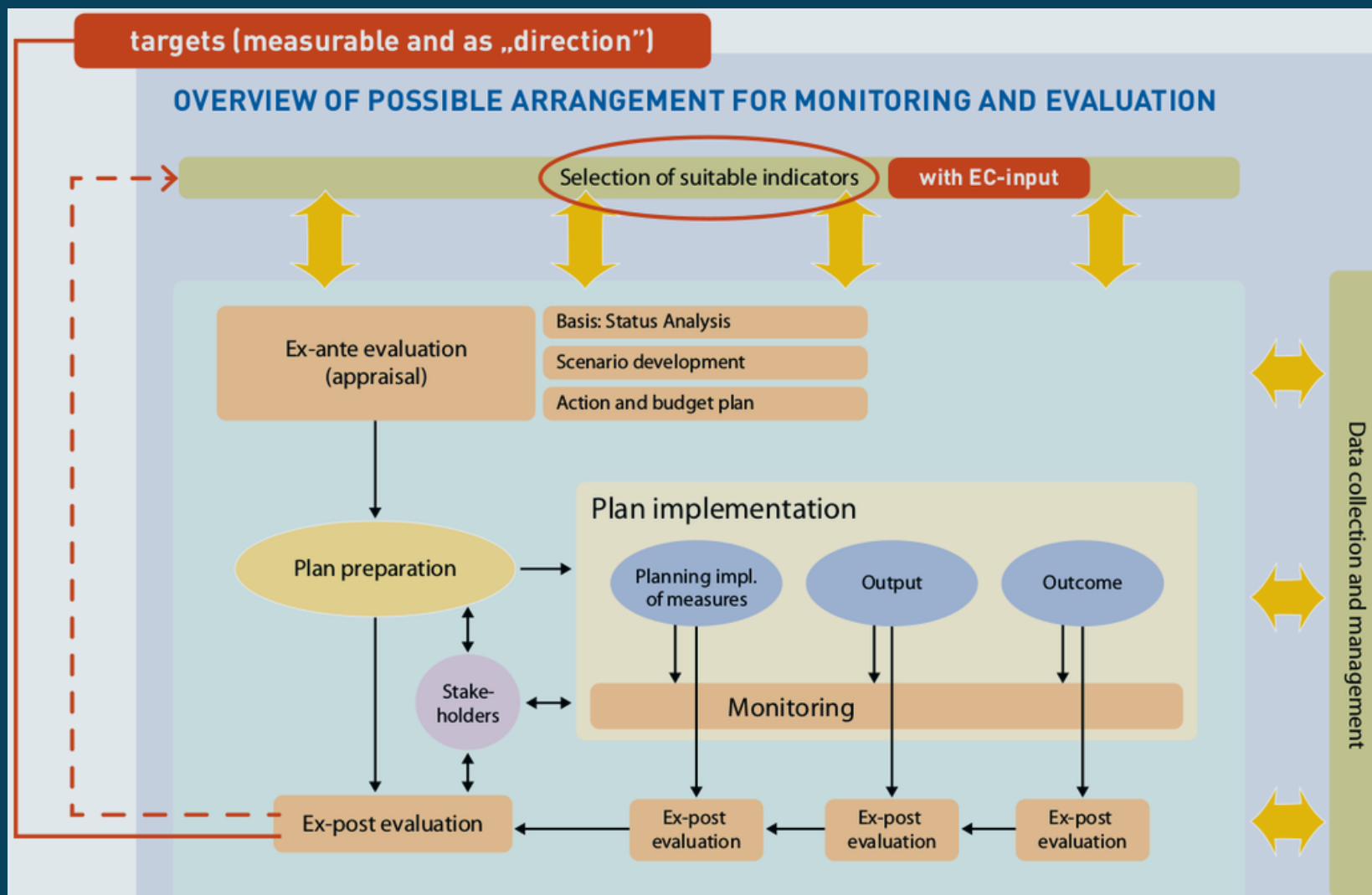


Figure source: Rupprecht Consult (2014), Guidelines - Developing and Implementing a Sustainable Urban Mobility Plan, p. 15



MONITORING AND EVALUATION (SUMPS)



Source: PILOT Manual – full version (for details see Mission 5), www.pilot-transport.org/index.php?id=48



SUSTAINABLE URBAN LOGISTICS PLANS (SUMPS) ENCLOSE PROJECT

The Sulp elements

E0: Setting the objective and target

E1: Urban mobility scenario and priorities

E2: Analyze the logistics context and processes

E3: Setting requirements and logistics baseline

E4: Identified measures and services vs. requirements

E5: Service design

E6: Organisation, business model and contracting

E7: Assessment and impacts evaluation

E8: roadmap di adopt the Sulp

E9: Responsibilities and implementation/ monitoring plan

E10: Promotion and Communication Plan

























Which indicators?

If we ask the industry, for instance
Carlsberg Italy

| | KPI | DEFINIZIONE | TARGET |
|---|---|--|---|
| A | QUALITA' (ORDINI) | Percentuale ordini correttamente inviati a cliente | 98% |
| B | QUALITA' POS (RIGHE ORDINE) | Percentuale righe POS correttamente inviate a cliente | 98% |
| C | AUDIT (score iniziale 100 punti + bonus 20) | Rispetto parametri audit CARLSBERG | 95 |
| D | PRODOTTO RESO DA CLIENTE | Rispetto del tempo massimo di messa a disposizione del prodotto a Deposito | 5 gg lavorativi da ordine di reso emesso |
| E | PUNTUALITA' CONSEGNE | Percentuale consegne on time (rispetto a data concordata /tassativa a cliente). | 98,5% per i destinatari TOP; |
| | | | 97% per gli altri destinatari |
| F | DOCUMENTAZIONE CLIENTE PER ORDINE RESPINTO | Rispetto del tempo massimo di messa a disposizione del documento a CARLSBERG | 5 gg lavorativi dalla data di prevista consegna |
| G | INVENTORY ACCURACY | Percentuale di differenze inventariali giustificate all'inventario (sulle SKU) | 98% |
| H | GESTIONE F.I.F.O. | Rispetto della rotazione dei prodotti nei depositi | 100% |

Which indicators?

If we ask the industry, for instance
Cameo

| # | Driver | Valutazione  | Valutazione  | Peso | Punti  | Punti  |
|--------|--|---|---|------|---|---|
| 1 | Livello di servizio in consegna |  |  | 15% | 0,30 | 0,45 |
| 2 | Customer service (verso cameo) |  |  | 15% | 0,30 | 0,45 |
| 3 | Referenze/mittenze gestite |  |  | 10% | 0,30 | 0,20 |
| 4 | Sub-fornitori utilizzati |  |  | 10% | 0,30 | 0,30 |
| 5 | Esitazione (tasso, timing, accuratezza) |  |  | 10% | 0,20 | 0,20 |
| 6 | Pluralità fornitori per cameo |  |  | 10% | 0,20 | 0,10 |
| 7 | FTE Magazzino (operatività) |  |  | 10% | 0,20 | 0,10 |
| 8 | FTE Uffici Logistica e Mag |  |  | 5% | 0,10 | 0,10 |
| 9 | Sistemi informativi |  |  | 5% | 0,05 | 0,15 |
| 10 | Gestione pallet |  |  | 5% | 0,10 | 0,10 |
| 11 | Relazione con management |  |  | 5% | 0,10 | 0,15 |
| TOTALE | | | | 100% | 2,15 | 2,30 |

Which indicators?

If we ask the industry, for instance
Royal Canin

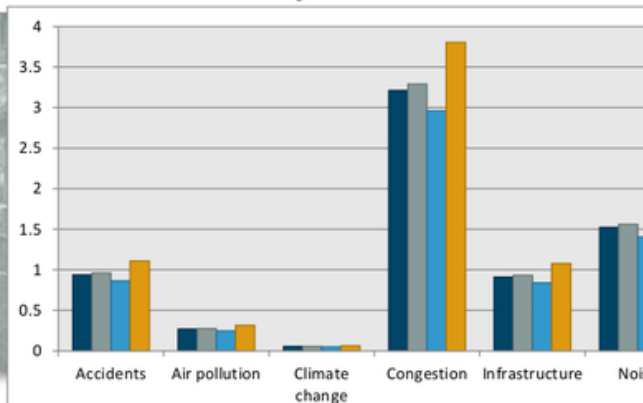
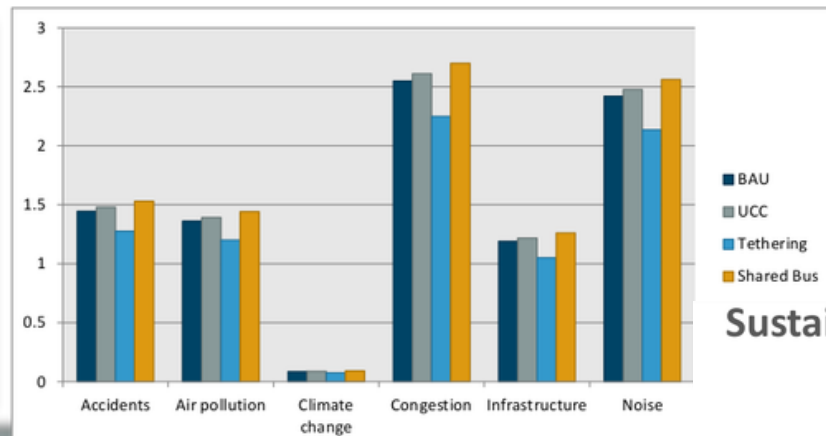
H: high, M: medium, L : low, ?: tbd

3PL Scorecard

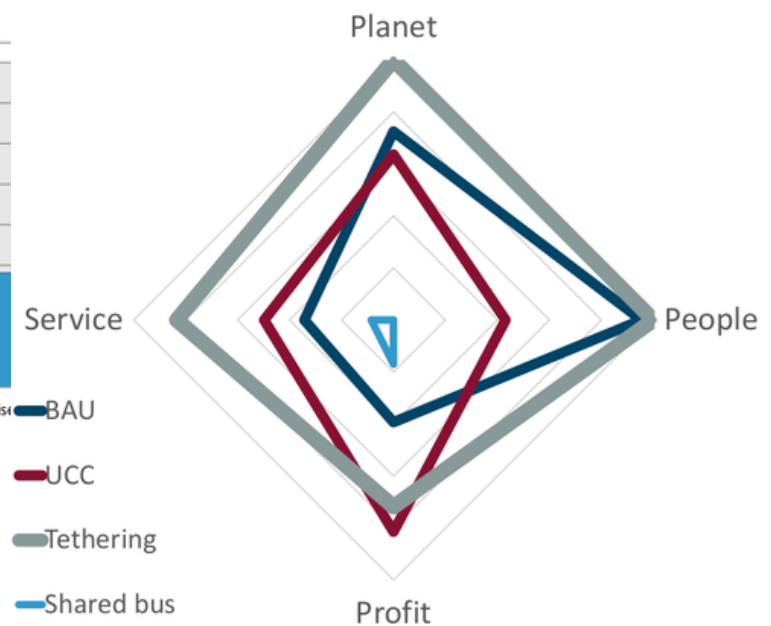
| | A | B | C | D | E |
|--------------------------------------|---|---|---|---|---|
| ▪ RC relevance | L | L | M | M | H |
| ▪ Warehouse Quality | ? | ? | H | M | H |
| ▪ Transp. Quality | ? | H | H | M | L |
| ▪ PetFood expertise | L | L | H | M | L |
| ▪ IT Flexibility | L | L | H | M | H |
| ▪ MKT Reputation (as integrated 3PL) | ? | M | H | H | M |

Which indicators?

If we ask the authorities, for instance at city level



Sustainability map of retail innovations in urban area



Borbon-Galvez, Y. et al, 2016

Which indicators?

If we ask the scientific community,
for instance Smartset project,

| SMARTSET Project Objectives | ID | Common Performance Indicators <small>3 For S20 required for the Strategic Long term Objectives, 15 For 15 Common Performance Indicators</small> |
|--|---------|---|
| P1. Reduce the energy and environmental impact of freight distribution. | CPI 1 | Energy consumption (GWh/year) from freight distribution |
| | CPI 2 | CO2 emissions (tonnes/year) from freight distribution |
| | CPI 3 | Use of conventional and clean energy vehicles (in vehicle-kms/year) |
| | S-CPI 4 | Average distance "of delivery" (vehicle-kms/tonne or unit) |
| | S-CPI 5 | Average cost "of delivery" (Euro/tonne or unit) |
| | S-CPI 6 | Amount of goods delivered (tonnes or unit / year) |
| P2. Develop business models and business cases for freight terminals for both last mile freight delivery and shift from road to rail for longer distances. | CPI 7 | Number of business models developed for market based terminal schemes |
| | CPI 8 | Identified barriers and success factors for market based terminal schemes |
| P3. Develop incentives and regulations which may shift transport demand in favour of UFT distribution schemes | CPI 9 | Number and type of regulation and incentive scheme implemented |
| | CPI 10 | Recommendations for political action on different levels (local, national, European) for stimulating coordinated freight terminal solutions. |
| P4. Increase the number of freight vehicles using clean and energy-efficient fuels. | CPI 11 | Number of sites in which clean vehicles of different kinds will be tested and evaluated for the freight distribution connected to the micro terminals during the project. |
| | CPI 12 | Number of freight vehicles using clean and energy efficient fuel |
| | CPI 13 | Number of sites in which test will be performed on stimulating <u>intermodal</u> shift from road to rail for freight distribution. |
| | CPI 14 | Number of sites where gas/hybrid cars and cargo bikes have replaced delivery fleet. |
| | CPI 15 | Number of project related freight working groups established. |

| | | |
|--|--------|---|
| P5. Capacity building within the consortium and creation of networks with stakeholders in the project and external actors to improve dialogue and acceptance of proactive freight schemes. | CPI 15 | Number of project related freight working groups established. |
| | CPI 16 | Number of stakeholders engaged in local network meetings. |
| | CPI 17 | Number of network meetings to promote efficient freight transport. |
| | CPI 18 | Number of thematic peer review meetings. |
| | CPI 19 | Number of representatives engaged in regional network meetings. |
| | CPI 20 | Number of representatives participating in national network meetings. |
| | CPI 21 | Number of web site visits during the project period. |
| | CPI 22 | Number of external links links to SMARTSET project website |
| | CPI 23 | Number of press releases during the project period. |
| | CPI 24 | Number of articles in magazines during the project period. |
| | CPI 25 | Number of reached practitioners in European cities |
| | CPI 26 | Number of presentations at major European conferences. |
| P6. Transfer of knowledge on various aspects of UFTs including business models to develop more sustainable distribution networks. | | |

Refers to page 14 of Annex I
when identifying the Strategic KPIs, where relevant, some of the C used to avoid repetition and double counting
S-CPI refers to those CPIs which are used to evaluate both strategi

| Strategic Objectives beyond the project | ID | Common Performance Indicators |
|---|---------|---|
| S1. Increase the use of clean vehicles for freight distribution in urban areas. | CPI 7 | Number of business models developed for market based terminal schemes |
| | CPI 12 | Number of freight vehicles using clean and energy efficient fuel |
| | CPI 3 | Use of conventional and clean energy vehicles (in vehicle-kms/year) |
| | S-CPI 4 | Average distance "of delivery" (vehicle-kms/tonne or unit) |

| | | |
|---|----------|---|
| i2. To identify and implement a more sustainable way of freight transports to and from the city that means less transports, to the same or lower cost and on time with the same amount of deliveries. Thus develop and adopt a sustainable business model for freight transports. | S-CPI 4 | Average distance "of delivery" (vehicle-kms/tonne or unit) |
| | S-CPI 5 | Average cost "of delivery" (Euro/tonne or unit) |
| | S-CPI 6 | Amount of goods delivered (tonnes or unit / year) |
| | CPI 1 | Energy consumption (GWh/year) from freight distribution |
| | CPI 2 | CO2 emissions (tonnes/year) from freight distribution |
| | CPI 11 | Number of sites in which clean vehicles of different kinds will be tested and evaluated for the freight distribution connected to the micro terminals during the project. |
| i3. Stimulate the introduction of clean vehicles for urban freight. | CPI 12 | Number of freight vehicles using clean and energy efficient fuel |
| | CPI 13 | Number of sites in which test will be performed on stimulating <u>intermodal</u> shift from road to rail for freight distribution. |
| | CPI 14 | Number of sites where gas/hybrid cars and cargo bikes have replaced delivery fleet. |
| | CPI 7 | Number of business models developed for market based terminal schemes |
| i4. Implement methods for operational train management that ensure reliability and freight path preservation (priorities) on mixed traffic lines. | CPI 8 | Identified barriers and success factors for market based terminal schemes |
| | S-CPI 30 | Freight carried on road (tonne-kilometres) |
| | S-CPI 31 | Freight carried on rail (tonne-kilometres) |

| Overall Objective | ID | Common Performance Indicators |
|---|---------|--|
| b contribute to the EU 2020 targets on energy efficiency and renewable energy sources | IEE CPI | Cumulative investment made by European stakeholders in sustainable energy (Euro) |
| | IEE CPI | Renewable Energy production triggered (toe/year) |
| | CPI 1 | Energy consumption (GWh/year) from freight distribution |
| | CPI 2 | CO2 emissions (tonnes/year) from freight distribution |

Which indicators?

If we ask the scientific community,
for instance Novelog project,

| Selected Indicators | Data Units |
|---|---|
| Working potential | Number of direct working positions |
| Business development | Number of indirect working positions |
| Local / Regional development | Likert scale {1 (lowest value) - 5 (highest value)} |
| Strength and diversification of local economy | Likert scale {1 (lowest value) - 5 (highest value)} |
| Consumer cost | EURO - € (or other monetary unit) |
| CO concentration | µg/m ³ |
| SO _x concentration | µg/m ³ |
| NO _x concentration | µg/m ³ |
| VOC concentration | µg/m ³ |
| NH ₃ concentration | µg/m ³ |
| PM ₁₀ concentration | µg/m ³ |
| CO ₂ | kg |
| CH ₄ | kg |
| N ₂ O | kg |
| Noise | dB(A) |
| Market response | Percentage (%) |
| Customer satisfaction | Likert scale {1 (lowest value) - 5 (highest value)} |
| Supply chain visibility | Likert scale {1 (lowest value) - 5 (highest value)} |
| Delays | Veh-hrs |
| Traffic throughput | Veh-km |
| Network barriers | Likert scale {1 (lowest value) - 5 (highest value)} |
| Green concern | Likert scale {1 (lowest value) - 5 (highest value)} |
| Perceived visual and audio nuisance | Likert scale {1 (lowest value) - 5 (highest value)} |
| Diffusion of information | Likert scale {1 (lowest value) - 5 (highest value)} |
| Extending the duration of the implementation of UFT activities due to | Likert scale {1 (lowest value) - 5 (highest value)} |
| Uncertainty of continuation of earlier activities | Likert scale {1 (lowest value) - 5 (highest value)} |
| Changes in consumer behavior society | Likert scale {1 (lowest value) - 5 (highest value)} |
| Large cultural diversity of society | Likert scale {1 (lowest value) - 5 (highest value)} |
| Perceived alternative mobility | Likert scale {1 (lowest value) - 5 (highest value)} |
| Quality of life | Likert scale {1 (lowest value) - 5 (highest value)} |
| Awareness level | Likert scale {1 (lowest value) - 5 (highest value)} |
| Different organisational cultures | Likert scale {1 (lowest value) - 5 (highest value)} |
| Lack of or insignificant number of UFT stakeholders | Likert scale {1 (lowest value) - 5 (highest value)} |
| Information flow problems | Likert scale {1 (lowest value) - 5 (highest value)} |
| Poor or lack of know-how | Likert scale {1 (lowest value) - 5 (highest value)} |
| Diversity of stakeholders | Likert scale {1 (lowest value) - 5 (highest value)} |
| Lack of cooperation | Likert scale {1 (lowest value) - 5 (highest value)} |
| Data sharing restrictions | Likert scale {1 (lowest value) - 5 (highest value)} |
| Lack of knowledge about stakeholders' requirements | Likert scale {1 (lowest value) - 5 (highest value)} |
| Public acceptance | Likert scale {1 (lowest value) - 5 (highest value)} |
| Social consciousness | Likert scale {1 (lowest value) - 5 (highest value)} |
| Adjustability | Likert scale {1 (lowest value) - 5 (highest value)} |
| Final user awareness | Likert scale {1 (lowest value) - 5 (highest value)} |
| City authority's popularity | Likert scale {1 (lowest value) - 5 (highest value)} |
| Decision making acceptance | Likert scale {1 (lowest value) - 5 (highest value)} |
| Stakeholder acceptance | Likert scale {1 (lowest value) - 5 (highest value)} |
| Stakeholder percentage | Likert scale {1 (lowest value) - 5 (highest value)} |

| Selected Indicators | Data Units |
|---|---|
| Strength and diversification of local economy | Likert scale {1 (lowest value) - 5 (highest value)} |
| Consumer cost | EURO - € (or other monetary unit) |
| CO concentration | µg/m ³ |
| SO _x concentration | µg/m ³ |
| NO _x concentration | µg/m ³ |
| VOC concentration | µg/m ³ |
| NH ₃ concentration | µg/m ³ |
| PM ₁₀ concentration | µg/m ³ |
| CO ₂ | kg |
| CH ₄ | kg |
| N ₂ O | kg |
| Noise | dB(A) |
| Market response | Percentage (%) |
| Customer satisfaction | Likert scale {1 (lowest value) - 5 (highest value)} |
| Supply chain visibility | Likert scale {1 (lowest value) - 5 (highest value)} |
| Delays | Veh-hrs |
| Traffic throughput | Veh-km |
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| Perceived visual and audio nuisance | Likert scale {1 (lowest value) - 5 (highest value)} |
| Diffusion of information | Likert scale {1 (lowest value) - 5 (highest value)} |
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| Lack of or insignificant number of UFT stakeholders | Likert scale {1 (lowest value) - 5 (highest value)} |
| Information flow problems | Likert scale {1 (lowest value) - 5 (highest value)} |
| Poor or lack of know-how | Likert scale {1 (lowest value) - 5 (highest value)} |
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| Decision making acceptance | Likert scale {1 (lowest value) - 5 (highest value)} |
| Stakeholder acceptance | Likert scale {1 (lowest value) - 5 (highest value)} |
| Stakeholder percentage | Likert scale {1 (lowest value) - 5 (highest value)} |

Which indicators?

If we ask the scientific community,
for instance NBGD project,

Table 3 Overview of urban freight indicators by sub-category

| Indicator | Method | | Example | Source | | | | | | |
|--|--|--|--|--|-------------------------------------|---|---|--|---|------------------------------|
| Analysis logistics rules | | | | | | | | | | |
| Environmental zones | Carrier survey, freight associations survey, local-decision maker survey | | London (2015), Berlin (2015) | [15], [16], [17] | | | | | | |
| Loading/unloading location of stops | Indicator | Method | Example | Source | | | | | | |
| | | Carrier survey, delivery space observation, driver survey, establishment survey, GNSS data collection, license plate | Antwerp (1995), Bordeaux, Dijon | [9], [12], [35], [37] | | | | | | |
| Noise emissions | | | | | | | | | | |
| Off-peak delivery | Indicator | Method | Example | Source | | | | | | |
| | Service time | Delivery space observation, driver survey, establishment survey, GNSS data collection, parking survey, traffic | Rome (2005-2006), Milan (2010), Livorno (2003) | [9], [12], [37], [38] | | | | | | |
| Possibility to find loading/unloading points | Indicator | | Method | Example | Source | | | | | |
| Road pricing | Location of the shop | Establishment survey, traffic counts | | Milan (2010), Lisbon (2015) | [34], [44], [50], [57] | | | | | |
| Size limitations (height) | Location of the shop | Indicator | Method | Example | Source | | | | | |
| | Number of deliveries | Storage space/(re)build plans | Volume of the shop | | | | | | | |
| Time windows | Type of transport equipment (e.g. pallets, foldable) | Number of employees | Transport profile | | | | | | | |
| | | | Average speed per round trip | Driver survey, GNSS data collection, urban goods | Gauteng (2008) | [9], [37], [38] | | | | |
| Urban consolidation | Number of loading operations per week/employee/area | Inloading equipment (e.g. fork-lift truck, transporter) | Number of inhabitants | Number of trips | Carrier survey, vehicle observation | [37], [43] | | | | |
| Weight limitation per axle | Number of pieces | Use of lorry equipment (e.g. loading bridge) | Order lead times | Carrier name | Number of vehicles | Driver survey, establishment survey, traffic counts | Antwerp (1995), London | [9], [12] | | |
| | | Presence/signature | Choice of distribution channels (e.g. logistics company) | Operation with < 5 employees in vehicle | Urban goods movement survey | Bordeaux, Dijon, Marseille (1997) | [14] | | | |
| Delivery profile | Parking infractions | Variation of deliveries (hour/ day/ during year) | Shop size | Driver characteristics (engine information, load, accidents, fuel consumption) | Package type | Long the route | Air pollution | | | |
| Delivery frequency | Parking location (distance) | Stakeholder analysis | | Drivers | Freight type (volume, lives) | Route duration | Environmental impact | | | |
| Loading/unloading own account | Ratio loading/unloading | Vehicle trip purpose (large transport and point or separate deliveries) | Local government | Fuel type & consumption | Route length | Vehicle capacity (volume) | Dis nuisance to the environment | | | |
| Load value | Reverse and waste collection | Shop (B2B) and receiver (B2C) | Local shopkeepers | Company and sector | Receiver (B2C) | Load factor | | | | |
| | Size of the shipment | Shipper | | | | Route type (trip) | Vehicle speed | GNSS data collection, traffic counts | | |
| | | Small operators | Location of distribution (number of stops per day) | Routing | Vehicle type | | Carrier survey, delivery space observation, driver survey, establishment survey, license plate matching, parking survey, traffic counts, roadside interview, roadside postcard survey, traffic counts, urban goods movement survey, vehicle observation | Antwerp (1995), Bordeaux, Dijon, Marseille (1997), Amsterdam, Groningen, Tilburg (1999), Budapest (1999), Copenhagen (2002-2004), Liège (2004), London (2002 & 2004), Breda (2008), Barcelona (2010), Milan (2010) | [37], [38], [64], [12], [35]-[37], [40]-[42], [44], [50], [53]-[56] | |
| | | | Share of load with vehicle | Vehicle movement | | | Weight of vehicle and freight | GNSS data collection, license plate matching, roadside postcard survey, urban goods movement survey | Bordeaux, Dijon, Marseille (1997), Rome | [38], [44], [55], [66], [67] |

Which indicators?

If we ask other stakeholders at city level, for instance

environmental advocacy groups



Women

families with small children

Cyclists

People with disabilities or accessibility issues

traffic managers

Temporal residents

urban/city planners

Which indicators?

Example, ENCLOSE project focused on main stakeholders and their goals

BOX 1 - Stakeholders – Main actors and their goals

| Actor category | Example | Goals and interests |
|---|--|---|
| Freight delivery services | Freight forwarders Shippers | More efficient delivery chain, less delays in delivery, increase delivery volumes, etc. |
| Freight transport services | Long-distance transport Express couriers, etc. | Less mileage, less delays, less operational costs, empty runs reductions, etc. |
| 3 rd Party Logistics providers (3PL) | Consolidation Centre Operators Added-value logistics service providers | Business opportunities, new customers Optimise service to reduce operational costs (e.g. increase load factor, decrease number of trips) |
| Retail system service providers | Shops, Retail associations, e-Commerce, HoReCa | On-time delivery, less storage, new services (packaging/waste collection, etc.) No increase of costs. |
| Local Authorities | City Council Mobility Dept. Urban Police City Council Commerce Dept City Council Traffic planners City Roads Authority, etc. | Less congestion Less emissions/noise Better living conditions Increased City attractiveness, etc. |
| Citizens | Consumers Residents Tourists and travellers, etc. | Better services (e.g. on-time delivery, information, etc.) Better urban environment, More safety (e.g. for pedestrians), etc. |

Which indicators?

Example, ENCLOSE project focused on main stakeholders and their goals

Data inputs (from surveys)

| Parameter | Data | Unit |
|-----------------|------|------|
| LIGHT VEHICLES | | |
| N of vehicles | 1024 | |
| Average trip | 6 | km |
| Working days/yr | 300 | |
| Deliveries/trip | 17 | |
| HEAVY VEHICLES | | |
| N of vehicles | 512 | |
| Average trip | 6 | km |
| Working days/yr | 300 | |
| Working days/yr | 17 | |

Almada baseline (Emission and Energy aspect)

| Parameter | Heavy | Light | Sum | Unit |
|--------------------------|-------|-------|------|--------------------------|
| CO ₂ Emission | 543 | 412 | 955 | tonCO ₂ /year |
| Energy consumptions | | | 3632 | MWh |
| Total distance | 3072 | 6144 | 9216 | km/day |
| CO | 1382 | 1843 | 3225 | kg/year |
| NOx | 719 | 922 | 1640 | kg/year |
| PM | 157 | 147 | 304 | Kg/year |

Assumptions for extrapolation

| Assumption | Value | Unit |
|-------------------|--------|---------|
| Vehicle tier | EURO 2 | |
| Heavy consumption | 16,67 | l/100km |
| Light consumption | 11,00 | l/100km |
| Trip/day/vehicle | 1,00 | |

Adopted parameters

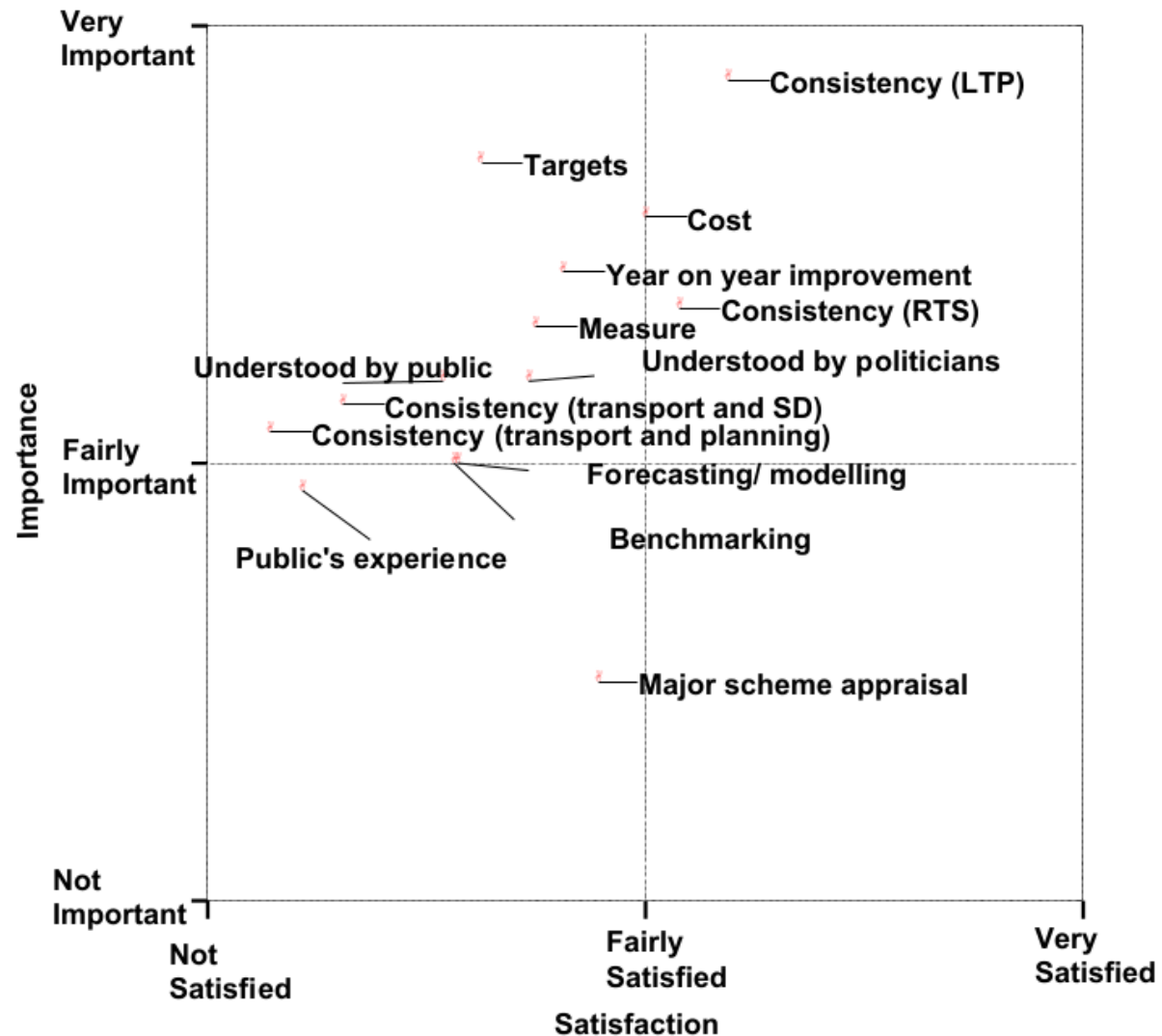
| Parameter | Heavy | Light | Unit |
|-------------------------------|-------|-------|---------|
| Diesel density | 0,835 | 0,850 | Kg/l |
| Diesel CO ₂ emiss. | 2680 | 2680 | g/lit |
| CO ₂ Emission | 447 | 295 | g/km |
| Kcal/kg | 10200 | 10200 | |
| Energy conversion | 11,84 | 11,84 | MWh/toe |
| Diesel CO emiss. | 1,50 | 1,00 | g/km |
| Diesel NO emiss. | 0,78 | 0,50 | g/km |
| Diesel MP emiss. | 0,170 | 0,008 | g/km |

WE CAN ONLY DESIGN A SUSTAINABLE URBAN LOGISTICS (COMPOSITE) INDICATOR WITH MULTISTAKEHOLDER ENGAGEMENT

Uhm... not much
evidence-based
nor theory-based,
but more
problem solving-
based



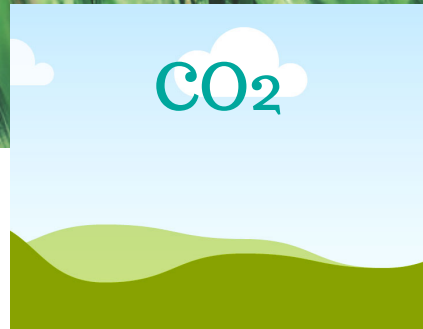
FILTERING OUT BASED ON INDICATORS CRITERIA





Problem significance

High



Medium



Low



Low

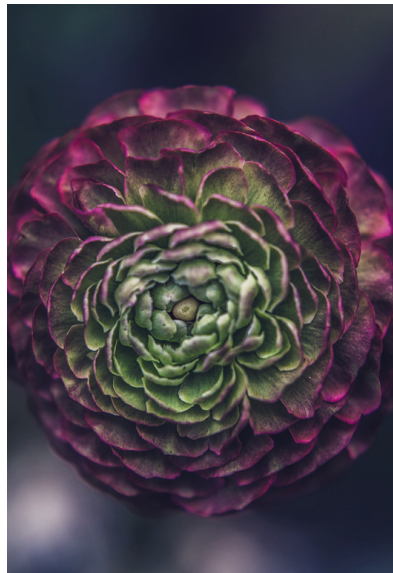
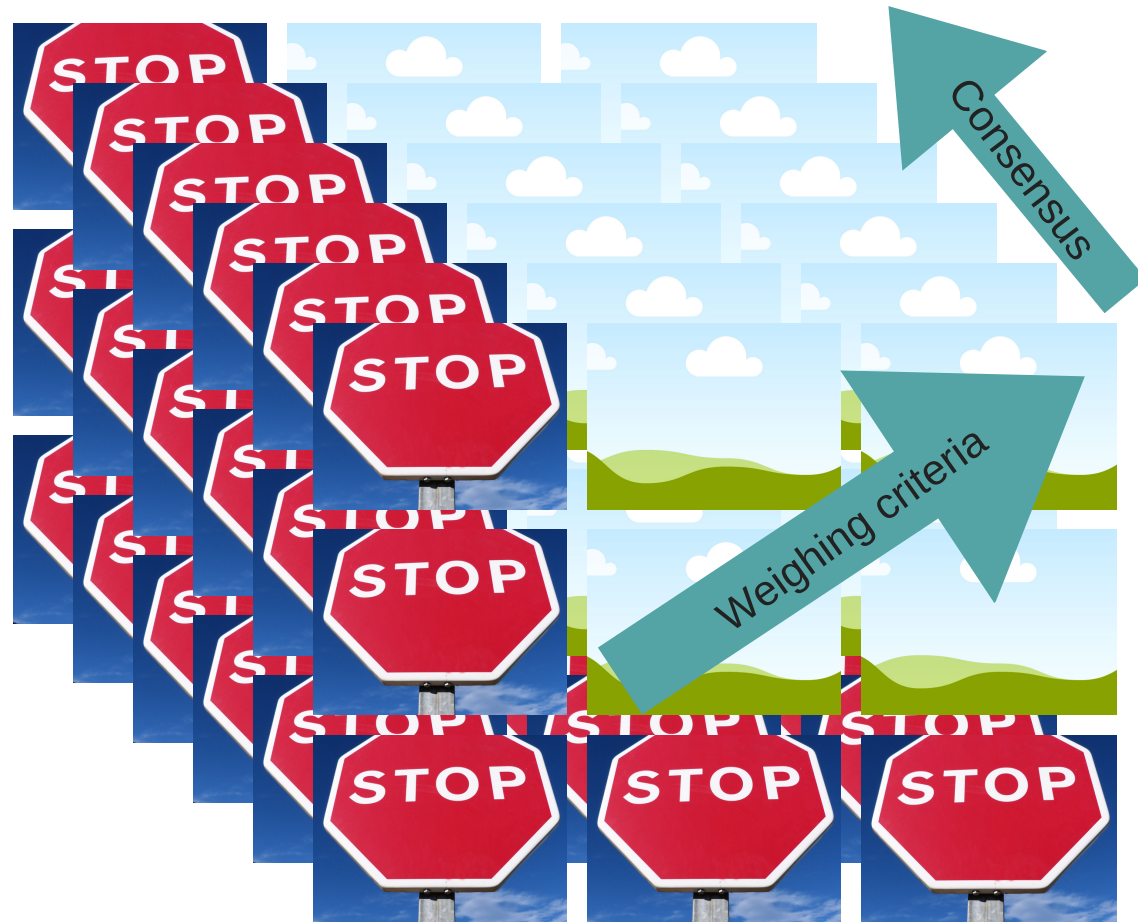
Medium

High

appropriateness

(Clearly defined, Controllable, Measurable, Elastic, Understandable)

INDICATORS CLASSIFICATION PER EACH TYPE OF STAKEHOLDER



THE COMPOSITE BUMPY ROAD

HOW CAN WE AGGREGATE?

&
[L,M,H]
&
LIKERT [1-5]
&
SCALE





**THANK YOU FOR
YOUR TIME!**

SIMPLIFYING SUSTAINABLE URBAN LOGISTICS INDICATORS: IS IT POSSIBLE?

Y A R I B O R B O N - G A L V E Z , P H D

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Workshop:
The Impacts and Methodology of Indicators and
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JRC-Ispira (VA), 22-23 March 2018

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