# City logistics in Italy: success factors and environmental performance*

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## 1. Introduction

Some 80% of the population in Europe is living in urban areas and the economy and industrial production is also concentrated in urban areas. ECMT (1997) estimates that at least 20% of the trips made by urban population is performed for shopping and retail goods procurement purposes; Also that urban freight traffic performance (in tonne-km) weights for 30% of the total freight traffic and that equivalent-vehicles used for urban distribution accounts for 20% of the total urban road congestion. These data claim for an active management of urban freight flows. Among the several approaches to address this issue, city logistics has now gained vast consensus among policy makers. According to OECD (1996), city logistics is defined as "measures for maximising the loading factor of vehicles and at minimising the number of vehicles per km, aiming at making goods distribution in the cities more environmentally sustainable". As from this definition, city logistics implies the existence of a series of interconnected transport policies and measures aimed to reduce atmospheric pollution and congestion and increasing accessibility of cities. All those measures should in general aim to improve the quality of life in the cities.

In other words, urban centres should be to attractive for inhabitants and city users (employees, business-persons, tourists, etc.). Shops have to be granted with the possibility to receive consumer goods with specific frequencies (according to the type of goods, e.g. drugs have to be distributed in pharmacies up to 4 times per day, supermarkets and groceries must receive fresh/perishable goods once per day, etc.). On the other hand, residents have to find goods at a reasonable distance from their houses. This situation is common to all cities, however, it is complicated by several factors such as:

- the characteristics of urban centres and the presence of de-urbanisation and re-urbanisation processes in the inner zones;
- the characteristics of the population, e.g. the rate of elderly people, which attitude is less oriented to shopping in big peripherical malls, if they are far from home;
- the city attractiveness for tourists, which implies a higher density of tourist-oriented shops, and a higher seasonality of the demand of goods distribution in the inner zones;
- the segmentation of products and the increase of seasonal catalogues, e.g. clothes for which the traditional two seasons have been replaced by a continuous turnover of collections during the year;
- the increasing cost of commercial areas in the inner urban centres, which implies the maximum exploitation of the shop surface, and the minimisation of the storage surface;
- the success of *just-in-time* production, which is strongly linked to the two previous trends.

City logistics incorporates a number of activities and specific goals which different actors aim at. The frame for city logistics is given by local and regional economy, the transport infrastructure, the surrounding environment, legal and regulatory conditions.

In this paper, we focus on Italy, a country which is experiencing dramatic problems due to deteriorated conditions of the urban environment and in which several cities are experimenting city logistics integrated policies to govern urban freight flows.

In particular, we will present a comparative analysis of the main city logistics systems in Italian cities and an in-depth cost-benefit analysis of the case of Padua. The case study of Padua will show the environmental and social effectiveness, measured in terms of social benefits vs. costs, of the most successful and lasting city logistics experimentation in Italy.

In the next chapter, a brief sketch of "city logistics actors" and their goals will be given. Afterwards, a comparative panel survey of the main features of the most relevant city logistics cases in Italy will be given. In the final part of the paper the main characteristics of Padua case study, together with the results of the Cost-Benefit Analysis (CBA) made will be described.

## 2. Freight transport, city logistics and sustainability

Specific goals can be listed in relation to "city logistics actors" (Table 2.1), assuming that some goals may lead to potential conflicts between actors.

**Table 2.1: "City logistics actors" and goals**

| Actors | Goals |
|---|---|
| Retailers, traders, manufacturers | • Fast deliveries and known schedules<br>• Acceptable costs<br>• High frequency of deliveries |
| Consumers | • Accessibility of shops<br>• Affordable prices in urban centres |
| Transport operators (on own account) | • Freedom of self-provision<br>• Freedom of hawking<br>• Freedom of supply services in urban centers |
| Transport operators (3PL) | • Freedom of provision of efficient and effective distribution services, with minimum restrictions<br>• Participation in the decision process for issuing restrictions for most polluting vehicles<br>• Recognise the organisational effort to keep loading factors high. |
| Logistics, terminals, real estate operators | • Involvement in city logistics programming<br>• Supply of areas for Urban Distribution Centres (inside and outside the city centre)<br>• Supply of logistics services |

*Source: CERTeT-Bocconi*

Hence, city logistics policies have to be bound to the achievement of the social and environmental goals, taking into account specific goals brought by different stakeholder categories. Of course, the main role in this process is played by the Public Administration (Municipality or similar), which keeps the most important asset for any policy for urban distribution: the power to issue regulations.

As a broker of different specific goals of the "city logistics actors", the Public Administration is:

- Public body representative of inhabitants and city users;
- Regulatory body for urban access, loading and unloading, issuing of Limited Traffic Zones (LTZ), timetables, etc.;
- Owner of areas and buildings to be exploited as cross docking platforms, Urban Distribution Centres and loading/unloading parking areas
- Owner and manager of ICT tools for traffic management and monitoring;

In the recent years, the debate towards urban mobility issue in Italy has extended its scope including the goal of rationalising the freight distribution in the cities.

The following sub-sections describe the main features of "city logistics" in Italy, starting from defining the scope of the survey, then evidencing success factors and detailing the main "city logistics systems" implemented in Italy.

## 3. City logistics in Italy

The aim of rationalising urban freight distribution can be achieved by the implementation of (Dasburg, Schoemaker, 2009):

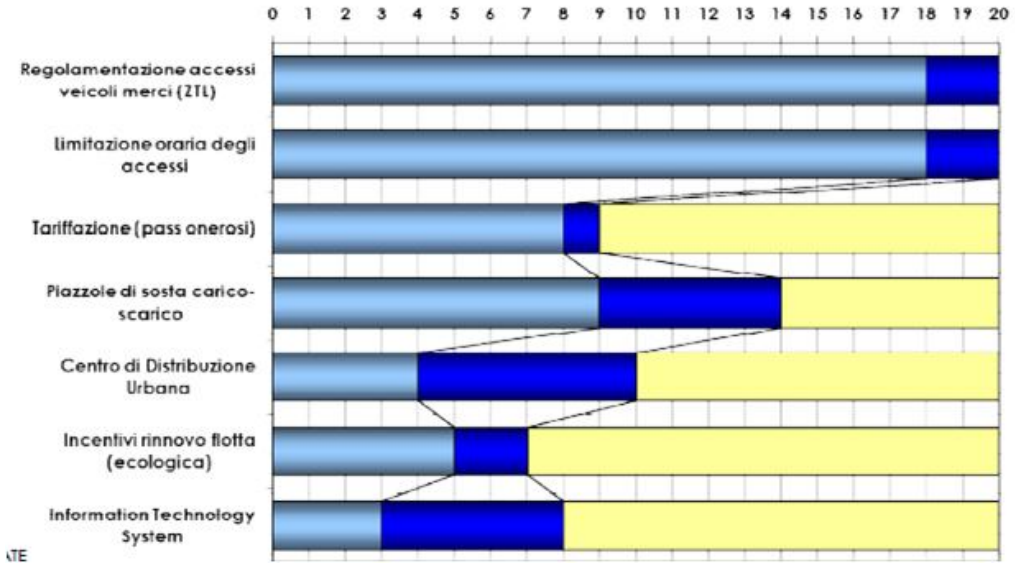
- "Single measures": policies classified under one of the following four categories:
    - Infrastructure, technology & equipment
    - Restrictions & incentives
    - Logistics & transport organisation
    - Accompanying measures

- "Multiple measures": a coherent and shared combination of more "single measures", implemented simultaneously by the Public Administration or equivalent local Government or by a public or private promoter.

The clustering of "city logistics systems" in Italian literature has in several cases resulted in a table survey of single measures implemented by cities. The survey is often completed by a benchmarking with the main European city logistics experiences[1].

A recent survey promoted by ATAC and Clickutility (Noia, Silva, 2009) demonstrated that almost all medium sized towns and cities have issued policies and initiatives for managing urban distribution. Moreover, on a sample of 20 Italian cities (see Figure XXX), almost all have issued limitations to freight traffic (time windows, LTZ). The adoption of more complex measures (charges, ICT tracking, UDC, etc.) is nevertheless increasing.

**Figure 3.1 – City logistics measures in Italian cities, according to ATAC-Clickutility survey – 2009**




*Yellow: not issued; Dark blue: ready to be issued; Light blue: issued*

*Source: Noia, Silva, 2009*

[1] See Da Rios, Gattuso (2004), Maggi (2001), Ministero delle Infrastrutture e dei Trasporti (2006), Conti, Urgeletti (2004).

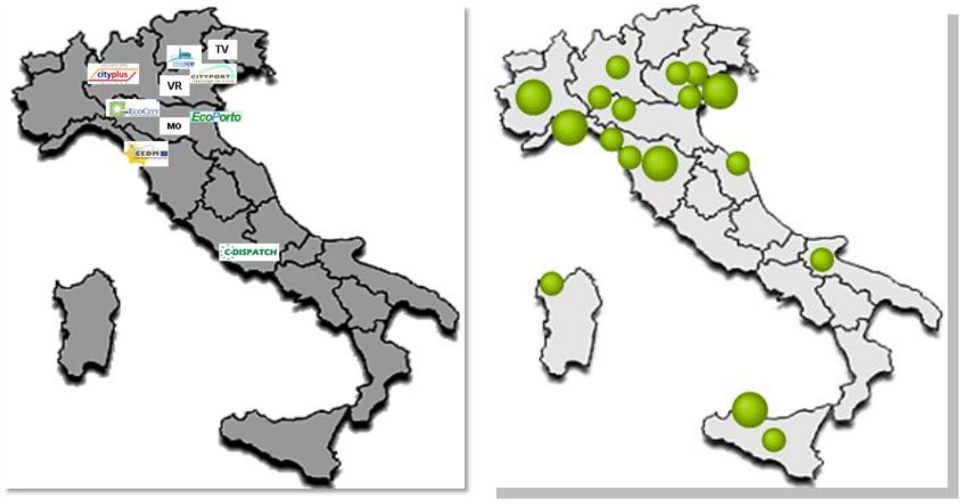
A mere list of city logistics measures adopted by Municipal Administrations risks to be hardly meaningful, since they tend to eligit as "city logistics system" even the implementation of a single measure. More often, the benchmark with city logistics experiences is often made taking into account also outdated systems, however this is useful for verifying success and failure factors. In any case, those surveys often do not specify which "city logistics projects" have resulted afterwards in the implementation of a real "city logistics system", i.e. in the adoption of a coherent combination of measures for rationalising urban freight distribution.

In 2006, the Italian "City Logistics Association" (Spinedi, 2006 and Vaghi, 2008) recorded 28 "city logistics projects", of which only 7 already gone into operations, and one – Genoa – dismissed due to the end of public financing. Eleven cases out of 28 were recorded in Emilia Romagna Region, mainly due to the high number of studies triggered by European cooperation projects[2].

CERTeT-Bocconi, in a survey of the actual status of city logistics in Italy (Bologna, 2010), assesses 40 “city logistics” studies and projects developed in the last ten years, and 10 operating "city logistics systems", defined as a bundle of regulatory, infrastructural and ICT measures, and a presence of a “recognised” operator for the last mile distribution. The operating systems are concentrated in Northern Italy (see Figure 3.2). Other similar initiatives are about to start, whilst some services, once considered as “best practices” are closing down[3]. A funding programme issued by the Ministry of Environment in 2007[4] has boosted further studies/initiatives: 8 existing systems have received additional funding and 10 cities got funds for new projects, also in Centre-Southern Italy. The total funding of city logistics initiatives is estimated 47 Meuro up to 2008, with a big role of European projects and Ministerial funds (see Figure 3.3).

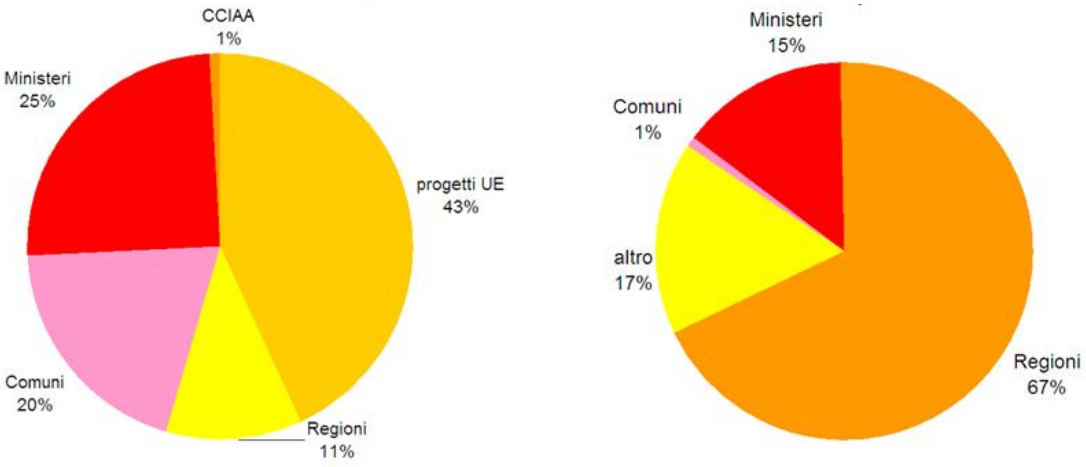
[2] CITYPORTS and MEROPE Projects, among others.
[3] E.g. CITYPLUS in Milan, organised by ATM, the local public transport operator. Cityplus was presented as "best practice" in a BESTUFS II Workshop in 2006 (Decio, 2006).
[4] Ministero dell'Ambiente, "Programma di co-finanziamento diretto alla riduzione dell'impatto ambientale derivante dal traffico nelle città con l'obiettivo di giungere ad un sostanziale miglioramento della qualità dell'aria", 2007

**Figure 3.2 – Operating City Logistics systems in Italy (left) and new projects funded after 2007 (right)**




*Source: CERTeT-Bocconi 2010*

**Figure 3.3 – Funds spent for city logistics by sponsor; projects (left) and operating systems (right)**




*Source: CERTeT-Bocconi 2010*

## 4. Main business models and success factors

The number of Italian active cases allows the definition of some recurring logistic schemes and models of interaction between the local Administration and the other actors that participates in the definition of the "city logistics system".

Firstly, it has to be recognised that almost all successful cases rely on the presence of a logistic platform, or UDC[5], where freight to be delivered in the inner city shops is sorted by destination and carried on LEV or ZEV[6] vans.

The business models described below are the main ways through which the main stakeholders involved in the city logistics process agree upon:

- Freight traffic regulation (time windows, issuing of LTZ, exemptions for vehicles participating in the "city logistics system", other fostering policies);
- Reciprocal supply of peculiar assets (regulatory power, logistic platform, infrastructure, expertise in logistics and cross-docking, etc.)

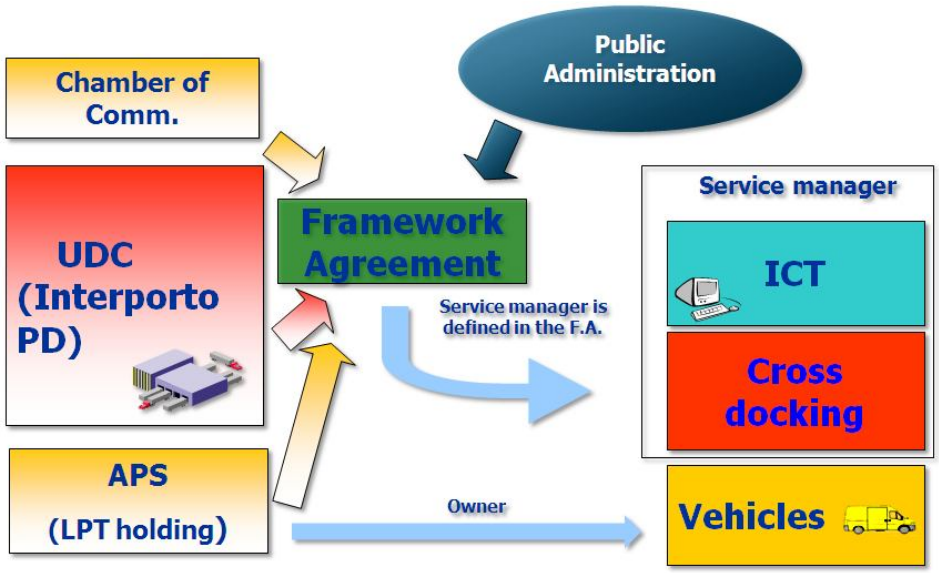
Three main business models can be recognised (Bologna, 2010 and Vaghi, 2006):

- "Padua model" (Figure 4.4): the main public and private stakeholders (e.g. the Municipality, the Provincial Administration, the local Chamber of Commerce on one side, Associations of couriers and transport operators, on the other side) agree – through the signature of a Framework Agreement[7] – on regulations (implicitly accepted by all stakeholders while signing the F.A.), and reciprocal supply of specific assets. The specific "fostering policy" consists in the exemption of those vehicles from any time window or limitation of loading/unloading in a Limited Traffic Zone, issued in the city centre. The UDC is provided and managed by a in-house logistic operator[8];
- "Venezia-Mestre model" (Figure 4.5): the UDC-based logistic concept is the same as in "Padua model", but the UDC and last-mile transport service manager is selected through a public tender. The service manager is endowed by its own UDC, and vehicles are owned (or granted) by the Municipality;

[5] Urban Distribution Centre. A complete definition of UDC (or UCC – Urban Consolidation Centre) is given in Huschebeck, Allen (2005), pg. 3-5. Here also Italian cases of Padua, Vicenza, Ferrara are quoted.
[6] Low Emission Vehicles or Zero Emission Vehicles.
[7] The reference model of Framework Agreement is the one signed in Padua before the starting of "Cityporto" service (see Comune di Padova, 2004).
[8] Interporto di Padova S.p.A. – the local freight village manager – in Padua case (see www.cityporto.it ).

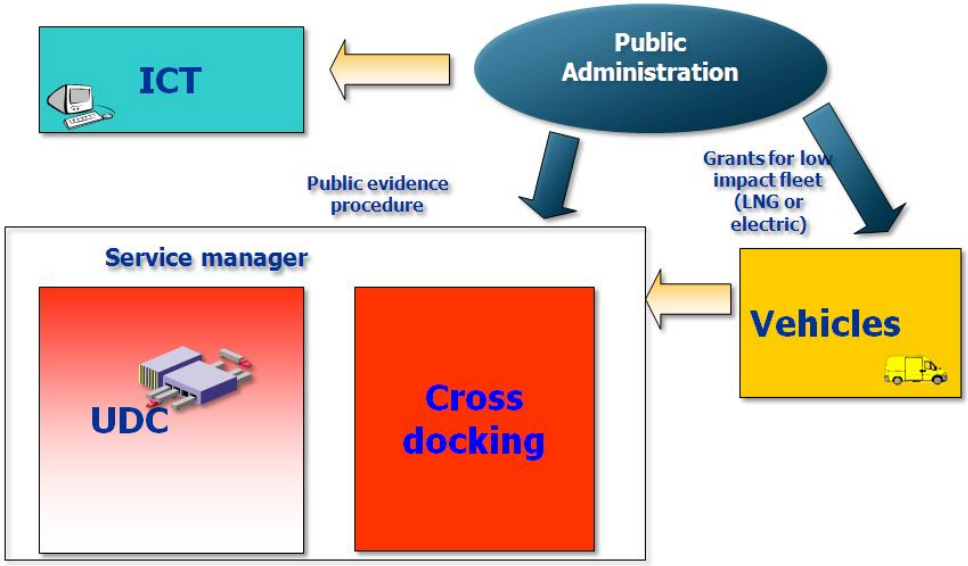
- "Vicenza model" (Figure 4.6): the UDC-based logistic concept is entirely managed by a NewCo, created as a public-private partnership between the Municipality and private stakeholders[9].

**Figure 4.4 – City logistics business models – "Padua model"**




*Source: CERTeT-Bocconi - 2010*

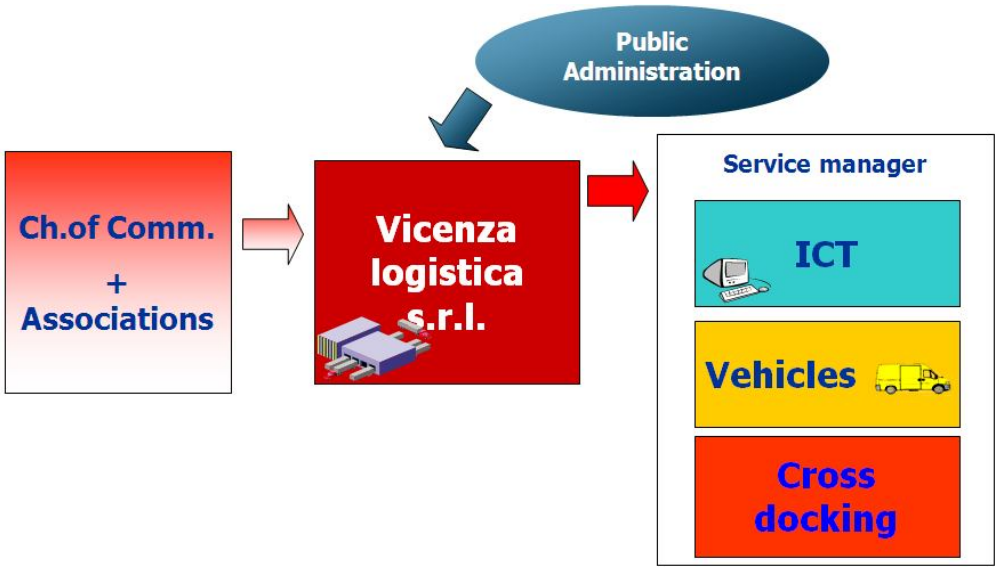
**Figure 4.5 – City logistics business models – "Venezia-Mestre model"**




*Source: CERTeT-Bocconi - 2010*

[9] Chamber of Commerce and Associations of Craftsmen and Shopkeepers, in "Veloce Logistics" case of

**Figure 4.6 – City logistics business models – "Vicenza model"**




*Source: CERTeT-Bocconi - 2010*

Some preliminary conclusions can be drawn upon the preferred city logistics models adopted by Italian cities:

- The total performance of city logistics systems active in Italy sums up to a 22-25,000 deliveries per month, depending on the month surveyed. 32 vehicles are deployed, 12 of which are electric powered (Bologna, 2010 and Vaghi, 2008). Those figures are rapidly increasing, in line with the growth of the active systems.
- Almost all systems include the use of a peri-urban UDC (Urban Distribution Centre) as cross docking platform. Nevertheless, 93% of feasibility studies of city logistics services concerned the economic sustainability of a new UDC (Spinedi, 2006 and Vaghi, 2008);
- The UDC is always an already existing infrastructure (existing warehouses or cross-docking surfaces in logistic platforms, underused depots, etc.) except in one case (Lucca), where an effective fund raising made the building of a new dedicated "city logistics centre" economically feasible;

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Vicenza (see www.velocelogistic.it )

- The "Padua model" is the most adopted model. "Cityporto" brand has been exported from Padua to other medium-size cities. A unique “city logistics manager”, responsible for the cross docking at the UDC and for the last-mile delivery, is identified, either by Service Level Agreements between Municipalities and their in-house companies, or by public evidence procedures in which private logistic operators were allowed to participate;
- Low or zero-emission vehicles and ICT platforms are almost entirely funded by public grants;
- A lengthy and accurate concertation process between the Public Administration and all the stakeholder representatives (associations of shopkeepers, third party transport operators, etc.) is always a pre-requisite for the acceptability of the new system;
- City logistics is more diffused in medium-sized cities: the complexity and the wider dimension of the commercial areas in big cities make the implementation of a city logistics service more difficult.

The success of a "city logistics system" is almost linked with the presence of “fostering policies”, regulatory incentives issued by the Municipalities, giving more favourable traffic rules to the city logistics manager, in order to make participation of operators to the city logistics system more attractive, and in turn aiming at ensuring the economic and financial feasibility of the experience. The most effective fostering policy is the creation of a LTZ in which loading/unloading operations, or even the access, is allowed to specific vehicle categories only. A legal debate[10] is open on the possibility to reserve “fostering policies” to vehicles identified by licences or logos, without extending those policies to all vehicles having the same technical characteristics (e.g. fuel, emission regime).

City logistics is often a peculiar aspect of traffic regulation programmes issued by the cities. The connection with info-mobility policies is more and more relevant, since the access to LTZs is controlled by the same equipment used for controlling car traffic. Moreover, some city

[10] See AGCM (2009).

logistics systems (Parma, Bologna) foresee the assignment to drivers of hand-held computers where information on traffic, congestion and preferred routes for deliveries are shown.

## 5. The main Italian city logistics systems

The following tables describe the main features of the most relevant "city logistics systems" in Italy. Figures on operating vehicles, deliveries performed are shown, with indication of the business model and the "fostering policy" adopted. Some aspects raise the peculiarity of a couple of cases:

- Vicenza is the only city having issued a total restriction to access, loading/unloading in the (narrow) LTZ, exempting Velocelogistic vans only. The measure was object of legal debate[11], although the claim against the measure, issued to Italian Competition Authority (AGCM) by some express couriers, was not successful.
- Parma is the only city having issued a restriction to vans with a loading factor lower than a definite threshold. The measure entered into force very recently, and there is no evidence that it has been applied with effective results.

[11] See footnote 10.

**Table 5.2 – "Cityporto Padova"**

| **CITYPORTO PADOVA** | |
|---|---|
| ***Manager*** | Interporto di Padova S.p.A. (managing company of the local freight village), entitled after a Framework Agreement signed between the Municipality and the Province of Padova, the Chamber of Commerce, and APS Holding (multi-service in-house company owned by the Municipality) |
| ***Main features*** | Urban Distribution Center (Interporto)<br>Last-mile delivery performed by natural gas powered and electric vehicles<br>Limited Traffic Zone (ZTL)<br>Time windows for loading/unloading in the city centre |
| ***Vehicles*** | 8 natural gas powered (2 of which equipped for temperature controlled goods);<br>1 electric vehicle |
| ***Period*** | From March 2004 |
| ***Deliveries performed*** | About 60000 per year (2008) |
| ***Fostering policy*** | CITYPORTO vehicles (owned by the public holding APS) can enter reserved lanes with no limitations (such as buses) and have no time windows for loading/unloading. |
| ***Main customers*** | 33 couriers/forwarders/3PLs + 2 operators on own account outsource the distribution to VELOCE. |

**Table 5.3 – "Veloce Logistic Vicenza"**

| **VELOCE VICENZA** | |
|---|---|
| ***Manager*** | Vicenza Logistic City Center s.r.l., NewCo owned by the Municipality of Vicenza (55%), by local freight transport operators and entrepreneurial associations (45%) |
| ***Main features*** | UDC<br>Low emission vehicles<br>Total traffic restriction in historical centre, even for LEV (no limitations for transport of perishable goods) |
| ***Vehicles*** | 5 (electric) |
| ***Period*** | From January 2005 |
| ***Deliveries performed*** | 5000 per month |
| ***Fostering policy*** | VELOCE vehicles only (identified by logo) can enter limited traffic area and use reserved lanes (such as buses) |
| ***Main customers*** | 14 logistics operators outsource the distribution to VELOCE |

**Table 5.4 – "Ecoporto Ferrara"**

| **ECOPORTO FERRARA** | |
|---|---|
| ***Manager*** | Coopser (local logistic operator, specialised in the distribution of perishable goods) |
| ***Main features*** | UDC (private)<br>Low Emission Vehicles (natural gas powered)<br>Restrizioni al traffico (ZTL e aree pedonali)<br>Road pricing (in fase di implementazione) |
| ***Vehicles*** | 51 (natural gas powered) |
| ***Period*** | From 2002 |
| ***Deliveries performed*** | 140000 per month[12] |
| ***Fostering policy*** | Discount (80%) on road pricing tariffs are issued for LEV and electric vehicles |
| ***Main customers*** | Main manufacturers of milk and other perishable goods |

**Table 5.5 – "LIFE-CEDM Lucca"**

| **LUCCA (LIFE-CEDM)** | |
|---|---|
| ***Manager*** | Municipality of Lucca |
| ***Main features*** | UDC (peri-urban platform, under costruction)<br>Electric vehicles<br>ICT platform for route planning and tracing of deliveries<br>ZTL and progressive restriction to the access for more pollutant vehicles |
| ***Vehicles*** | One electric vehicle paylod 1,6 tonnes.<br>One electric vehicle paylod 3,5 tonnes. |
| ***Period*** | From 2007 |
| ***Deliveries performed*** | Average 110 per day (April 2008)[13] |
| ***Fostering policy*** | To be implemented: ZTL with access reserved to electric vehicles and vehicles with loading factor > 60% |
| ***Main customers*** | More than 30 couriers and logistic operators |

[12] Source: Coopser.
[13] Source: LIFE-CEDM

**Table 5.6 – "Ecocity Parma"**

| **PARMA ECOCITY** | |
|---|---|
| ***Manager*** | Centro AgroAlimentare Parma (PPP), supported by the Municipality of Parma |
| ***Main features*** | UDC: peri-urban platform at Centro Agroalimentare (food and vegetable general docks)<br>Natural gas powered vehicles<br>ICT platform for route planning and tracing of deliveries<br>Implementation of a ZTL |
| ***Vehicles*** | Natural gas powered |
| ***Period*** | From March 2008 |
| ***Deliveries performed*** | n.a. |
| ***Fostering policy*** | Transport operators have the opportunity to ask for authorisation to load/unload and access the ZTL, if their vehicles are compatible with performance standards of Ecocity vehicles:<br>• Emission class not lower than Euro 3<br>• Max. payload 3,5 tonnes<br>• Ecocity tracing devices applied on the vehicle<br>• Loading factor higher than 70%.<br>Strong marketing action, with opportunity to "Ecocity-label" also for shops. |
| ***Main customers*** | n.a. |

## 6. The environmental performance of city logistics: "Cityporto Padova" case

The economic and environmental performance of measures for rationalising urban logistics is a key issue. The main problem is the scarcity of active and successful cases, and the narrow operating period on which they can be monitored. Nevertheless, CBAs made in feasibility studies for new city logistics systems have the usual degree of uncertainty of ex-ante evaluations.

CERTeT-Bocconi performed in 2006 – on behalf of Interporto Padova, the service manager - the environmental performance evaluation of "Cityporto Padova" city logistics system (Vaghi, Pastanella, 2006). The approach included the use of elements of Cost-Benefit Analysis, and the exercise is the first CBA *ex-post* made on a city logistics system in Italy.

### 6.1 "Cityporto Padova"

The city logistics service "Cityporto-consegne in città" is a urban distribution service operating in the urban area of Padua, focusing on the local LTZ, having a size of 830000 sq.m. (Stefan, 2009[14]). The manager is Interporto di Padova S.p.A., which also manages the local freight village, as a in-house company controlled by the Municipality. The deliveries are performed by 8 LNG-powered and one electric vans; two of them are equipped for the delivery of temperature-controlled goods. The UDC is a 1000 sq.m. wide cross-docking platform located within the freight village. The service is operating since 2004; it is undoubtedly the most relevant and successful city logistics system in Italy, recognised as one of the European best practices (Dasburg, Schoemaker, 2008). After the successfully overcome start-up phase, Cityporto now performs almost 60000 deliveries per year (see Figure 6.8), for 45 customers (the major part of couriers and forwarders operating in the city, but also SMEs that usually delivery its produce on own account).

The service was granted in the start-up phase (2004-2007) by the City and the Province of Padua, and the local Chamber of Commerce, as stated in the Framework Agreement[15] (Comune di Padova, 2004). The amount of grants agreed was decreasing year by year, and the service reached in 2008 (Dasburg, Schoemaker, 2009 and Vaghi, 2008).

Cityporto resumes the success factors listed in 4, and the model is nowadays replicated in other medium-sized Italian cities. However, Cityporto shows some peculiar success factors, such as the location of the UDC within the freight village, operating since decades, renowned among operators, near their logistic platforms and sufficiently far from shops of the inner city[16]. Cityporto customers have been convinced about the neutrality of the service provided: no courier have priority in cross-docking operations and in delivery routes. The "*loss of the direct*

[14] See also http://www.cityporto.it/

[15] Signed by the City and the Province of Padua, the local Chamber of Commerce and APS Holding S.p.A., the local public transport holding. See also 4.

[16] Many city logistics pratices demonstrate how a peri-urban UDC is more efficient, attractive for transport operators, and environmentally effective than a platform located near the delivery area (see Allen, Thorne, Browne, 2009, pg.72).

*interface between suppliers and customers*", stated by Allen, Thorne and Browne[17] as a potential failure factor for a UDC-based city logistics model, is caught up by Cityporto. Drivers delivery to the receiver the bill of lading issued by its "usual" supplier, unless the latter trusts its freight to Cityporto for the last-mile.

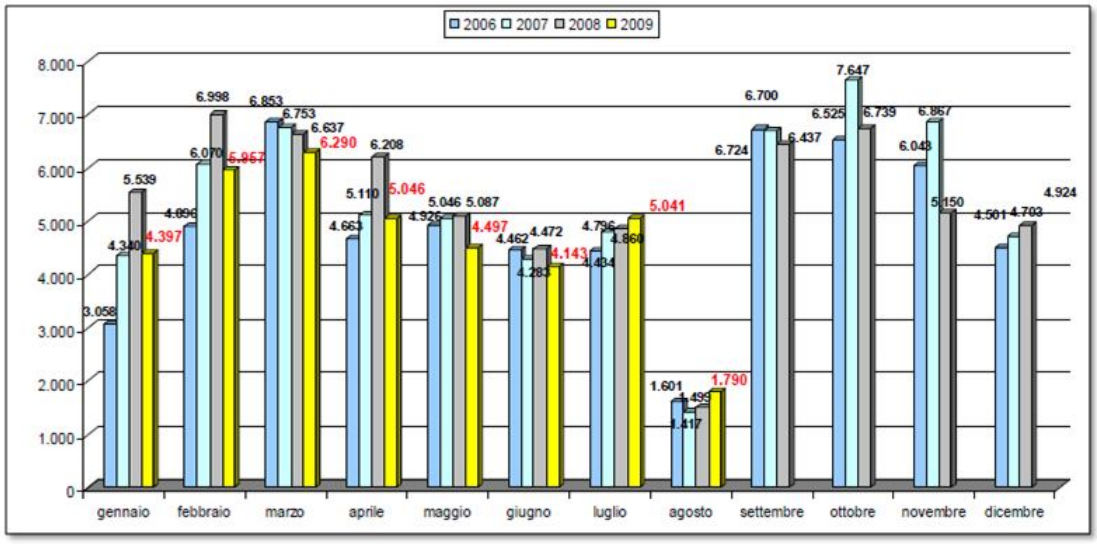
**Figure 6.7 – "Cityporto Padova" – pictures describing the main features**


*Source: Cityporto and CERTeT-Bocconi*

[17] Allen, Thorne, Browne, 2009, pg.71.

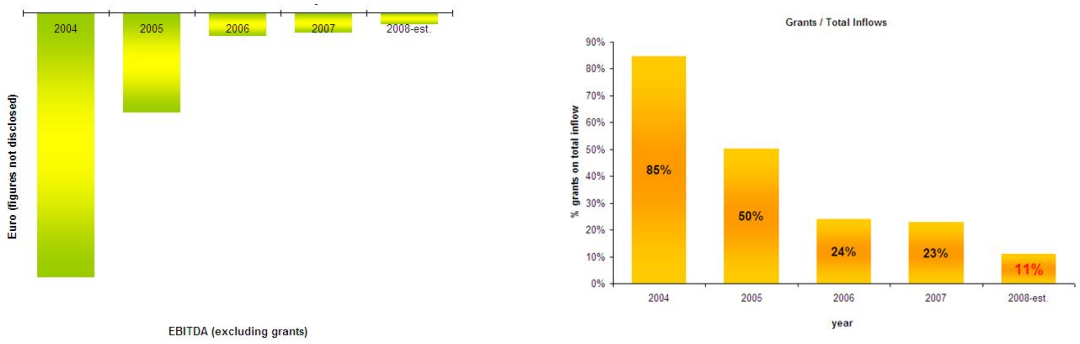
The Framework Agreement is the result of a lengthy and effective concertation process among Public Authorities and private stakeholders. During the concertation, specific aspects were investigated thoroughly, including the setting of tariffs. Finally, the public ownership of vans allowed the application of very effective "fostering policies": Cityporto vans are exempted from time windows for entering the LTZ and can access the reserved lanes in the city.

**Figure 6.8 – "Cityporto Padova" – trend of deliveries per month 2006-2009**




*Source: Cityporto 2009*

**Figure 6.9 – "Cityporto Padova" - EBITDA (index) and grants/inflows ratio 2004-2008**




*Source: CERTeT Bocconi on Cityporto data*

### 6.2 The evaluation of environmental performance: methodological aspects

The analysis, made through a CBA approach, aimed at assessing the externalities saved by the implementation of Cityporto service, in a definite period between September 2004 and December 2005. When the CBA was performed, that was the time horizon for which a complete tracing of deliveries and routes was available at the manager's premises. A database of more than 52000 records (one record per delivery) was built, covering 313 days and 1892 delivery trips, made by the 4 vans operating at Cityporto at that time.

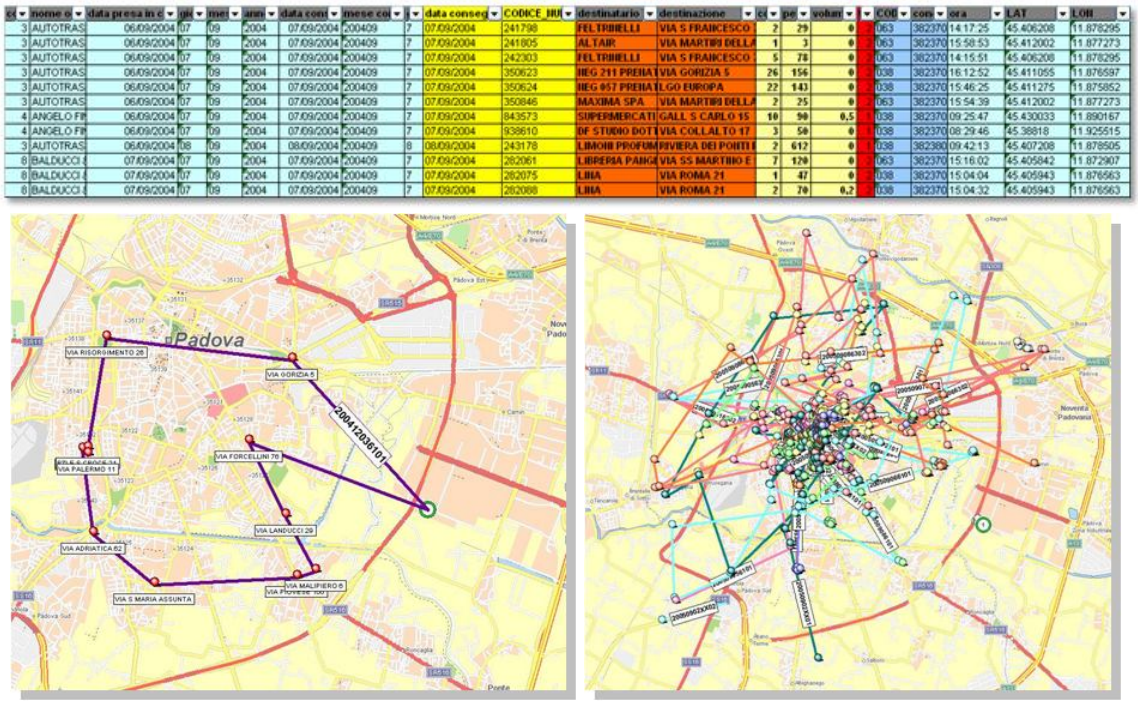
The aim was the calculation of the differential of externalities based on (i) trip length, (ii) vehicle emission factors, in ex-ante and ex-post scenarios. External costs for main air pollutants (PM10, CO, NOx, SOx, VOC), global warming (CO2), noise pollution and accidents were applied in order to assess the social NPV[18] of the implementation of Cityporto in the defined time horizon. Value of Time for goods was not calculated, and time cost benefits not included, following a cautionary approach[19]. The monetary impact of reduced congestion was not included in the CBA as well, although the Municipality estimates a potential reduction of 5% on the total number of vehicles accessing the entire Municipal territory. However, in 2004-2005 the impact on congestion was lower, if not negligible, due to the limited number of operating vehicles.

The two scenarios were built as follows:

- "Ex post" scenario: two databases provided by Cityporto were integrated (Figure 6-10-a). A GIS software[20] was employed for tracing intermediate and end points of the deliveries and calculating each trip distance. The final outcome was the visual tracing of each of the 1892 delivery routes (Figure 6-10-b) and the assessment of the average distance per trip (km) performed by Cityporto vans, by month.

[18] Net Present Value.
[19] Assessment is still in progress, in a forthcoming monitoring phase.
[20] PTV-Intertour®, run by TPS s.r.l.

**Figure 6-10 – (a) sample of Cityporto database of deliveries – (b) sample of visual tracing of a delivery trip**



| ci | nome ci | data presa in c | gi | mes | anni | data cons | mese co | i | data consegn | CODICE_IRI | destinatario | destinazione | co | pe | volum | i | CON | cons | ora | LAT | LON |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | AUTOTRAS | 06/09/2004 | 07 | 09 | 2004 | 07/09/2004 | 200409 | 7 | 07/09/2004 | 241798 | FELTRINELLI | VIA S FRANCESCO | 2 | 29 | 0 | | 063 | 382370 | 14:17:25 | 45.406208 | 11.878295 |
| 3 | AUTOTRAS | 06/09/2004 | 07 | 09 | 2004 | 07/09/2004 | 200409 | 7 | 07/09/2004 | 241805 | ALTAIR | VIA MARTIRI DELLA | 1 | 3 | 0 | | 063 | 382370 | 15:58:53 | 45.412002 | 11.877273 |
| 3 | AUTOTRAS | 06/09/2004 | 07 | 09 | 2004 | 07/09/2004 | 200409 | 7 | 07/09/2004 | 242303 | FELTRINELLI | VIA S FRANCESCO | 5 | 78 | 0 | | 063 | 382370 | 14:15:51 | 45.406208 | 11.878295 |
| 3 | AUTOTRAS | 06/09/2004 | 07 | 09 | 2004 | 07/09/2004 | 200409 | 7 | 07/09/2004 | 350623 | IIEG 211 PREMA | VIA GORIZIA 5 | 26 | 156 | 0 | | 038 | 382370 | 16:12:52 | 45.411055 | 11.876597 |
| 3 | AUTOTRAS | 06/09/2004 | 07 | 09 | 2004 | 07/09/2004 | 200409 | 7 | 07/09/2004 | 350624 | IIEG 957 PREMA | LGO EUROPA | 22 | 143 | 0 | | 038 | 382370 | 15:46:25 | 45.411275 | 11.875852 |
| 3 | AUTOTRAS | 06/09/2004 | 07 | 09 | 2004 | 07/09/2004 | 200409 | 7 | 07/09/2004 | 350846 | MAXIMA SPA | VIA MARTIRI DELLA | 2 | 25 | 0 | | 063 | 382370 | 15:54:39 | 45.412002 | 11.877273 |
| 4 | ANGELO FI | 06/09/2004 | 07 | 09 | 2004 | 07/09/2004 | 200409 | 7 | 07/09/2004 | 843573 | SUPERMERCATI | GALL S CARLO 15 | 10 | 90 | 0,5 | | 038 | 382370 | 09:25:47 | 45.430033 | 11.890167 |
| 4 | ANGELO FI | 06/09/2004 | 07 | 09 | 2004 | 07/09/2004 | 200409 | 7 | 07/09/2004 | 938610 | DF STUDIO DOTT | VIA COLLALTO 17 | 3 | 50 | 0 | | 038 | 382370 | 08:29:46 | 45.38818 | 11.925515 |
| 3 | AUTOTRAS | 06/09/2004 | 08 | 09 | 2004 | 08/09/2004 | 200409 | 8 | 08/09/2004 | 243178 | LIMONI PROFUM | RIVIERA DEI PONTI E | 2 | 612 | 0 | | 038 | 382380 | 09:42:13 | 45.407208 | 11.878505 |
| 8 | BALDUCCI E | 07/09/2004 | 07 | 09 | 2004 | 07/09/2004 | 200409 | 7 | 07/09/2004 | 282061 | LIBRERIA PANG | VIA SS MARTIRI E | 7 | 120 | 0 | | 063 | 382370 | 15:16:02 | 45.405842 | 11.872907 |
| 8 | BALDUCCI E | 07/09/2004 | 07 | 09 | 2004 | 07/09/2004 | 200409 | 7 | 07/09/2004 | 282075 | LIBIA | VIA ROMA 21 | 1 | 47 | 0 | | 038 | 382370 | 15:04:04 | 45.405943 | 11.876563 |
| 8 | BALDUCCI E | 07/09/2004 | 07 | 09 | 2004 | 07/09/2004 | 200409 | 7 | 07/09/2004 | 282088 | LIBIA | VIA ROMA 21 | 2 | 70 | 0,2 | | 038 | 382370 | 15:04:32 | 45.405943 | 11.876563 |



*Source: Cityporto and TPS s.r.l.*

- "Ex-ante" scenario: a questionnaire survey was performed. The panel of interviewed operators was representing 88% of Cityporto deliveries in the selected time horizon. The aim of the survey was the assessment of:

1. How many deliveries per trip operators performed in the city centre *before* Cityporto
2. How many vehicles (of which Euro-category) involved
3. How long were the delivery trips.

The comparison between "Ex-ante" and "Ex-post" scenarios allowed the assessment of the global reduction of mileage performed by freight vehicles in Padua after the implementation of Cityporto, and of the externalities saved both by the reduction of trip length and by the adoption of LNG-powered vehicles by Cityporto.

The CBA approach presented other methodological peculiarities:

- No investment costs were accounted: since no investment for infrastructure was needed, public grants - given by the public for the start-up and for the purchasing of LEV – were assumed as the “cost side” of the CBA;
- No differential between operational costs "ex-ante" and "ex-post" were assumed. The assessment of operational costs "ex-ante" in the questionnaire survey gave scarce results, not significant for assessing the differential with the "ex-post" scenario. On the other side, the tariff paid by the operators for the cross-docking could be assumed as a proxy of the "road user's producer surplus" in our CBA[21]. Following a cautionary approach, this category of possible "internal benefit" was not considered.

### 6.3 The evaluation of environmental performance: results

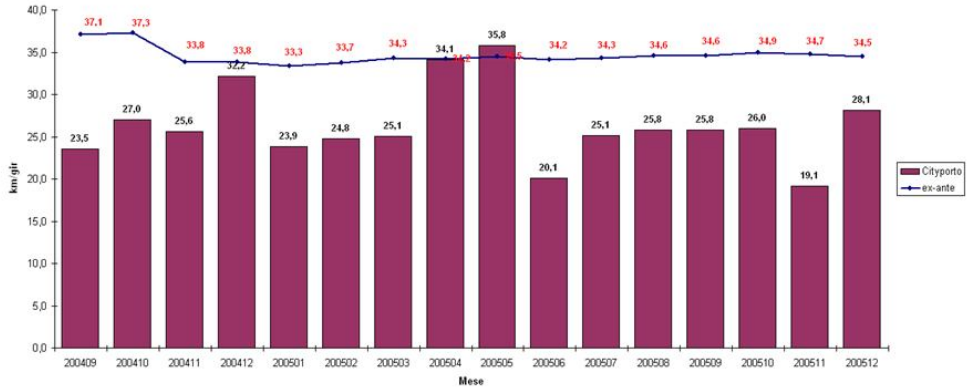
The benchmark between scenarios evidenced a net decrease of the distance covered by freight vehicles in Padua: 11000 km less per month, about 127000 in the entire 15-month period. The average trip length decreased by 37%, from 34 to 25 km (Figure 6.11). Impacts are positive also for the fleet management: 12 trips per day are saved, and the corresponding vans used "ex-ante" by the operators can be deployed on delivery areas other than the city centre. As a first conclusion, the presence of Cityporto transit point allows a net reduction of the route length for deliveries in the inner city. Even without considering that Cityporto vehicles have mount less pollutant engines, the service results in a significant reduction of emissions and congestion.

As concerns the Euro emission category of vehicles used by the operators in "ex-ante" scenario, the survey reported a common use of the pollutant Euro 0 vans:

- 19 operators used Euro 0 vans for delivery trips in Padua inner city;
- 2 operators used Euro 1 vans, one Euro 2 and one Euro 3.

[21] A definition of road user's producer surplus is given in European Commission – DG REGIO (2008), pg.134.

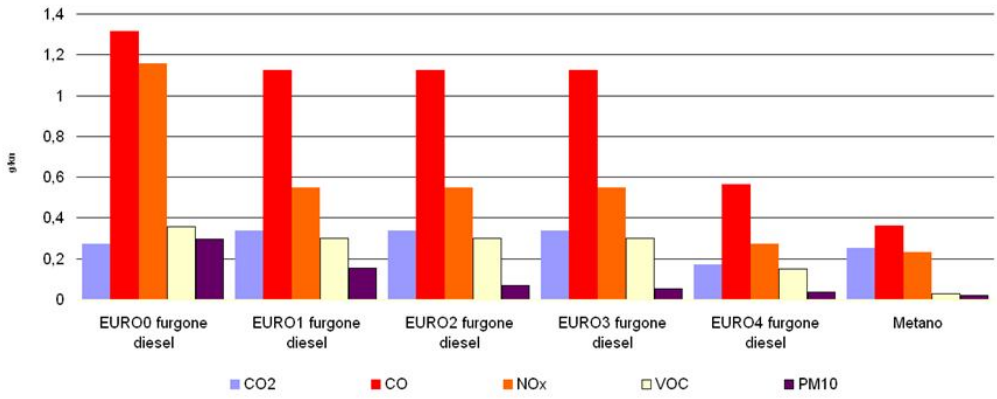
**Figure 6.11 – Average length of trips for deliveries (Km/trip) – Ex-ante vs. Ex-post**




*Source: Vaghi, Pastanella, 2006*

The calculation of the differential of polluting emission was then based on COPERT2 emission coefficients, comparing reference [g/km] values of Euro 0-4 diesel vans[22] and LNG vehicles (Figure 6.12).

**Figure 6.12 - Emissions per engine emission class (g/km, mg/km for CO2) – diesel van < 3.5 tonnes payload**




*Source: COPERT2 data*

Taking into account the specific emissions of the vehicles employed, and the average trip length in "ex-ante" and "ex-post" scenario, the implementation of Cityporto led to a net saving of the following quantities of polluting emissions, in the 15-month period considered.

[22] Less than 3.5 tonnes of payload.

**Table 6.7 – Quantities of polluting emissions saved in Cityporto 15-months observed period**

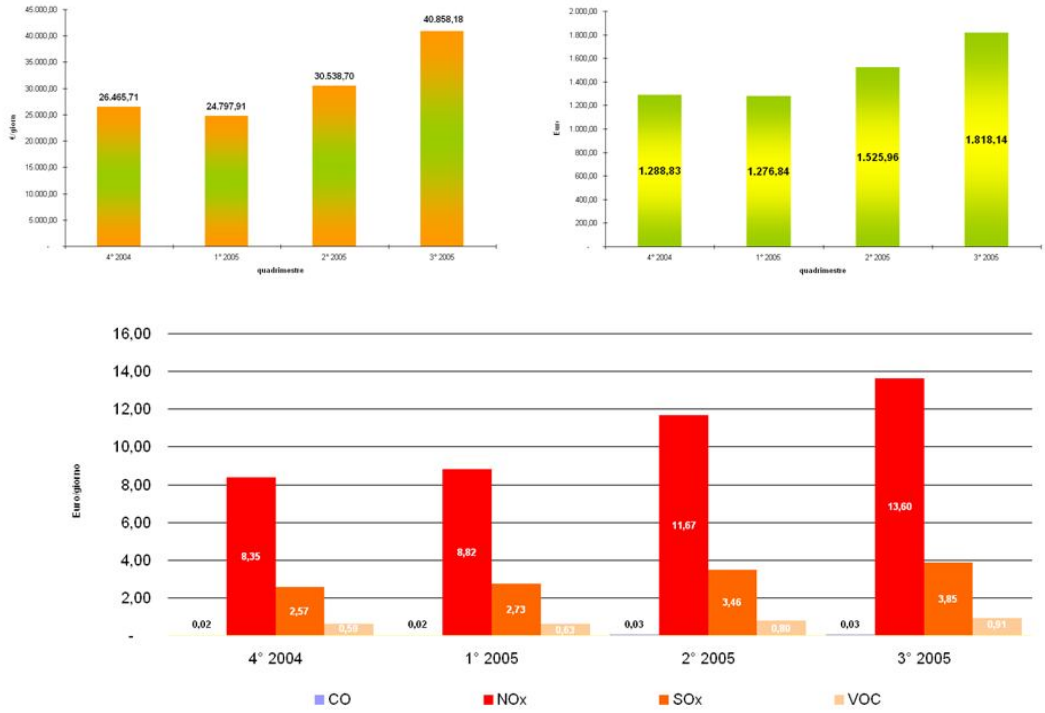
| Pollutant | Emissions saved (CO2: Tonnes; other pollutants: Kg) |
|---|---|
| CO2 | 38,4 |
| CO | 202 |
| NOx | 163 |
| SOx | 16,3 |
| VOC | 58,1 |
| PM10 | 41,4 |

*Source: Vaghi, Pastanella, 2006*

The application of specific external costs [Euro/g] to these figures[23] led to the final outcome in terms of external costs saved, as showed in Figure 6.13 and Figure 6.14. It can be noticed that the average benefit per day sums up to 550 Euros in the 3rd quadrimester 2005, the period when the traffic managed by Cityporto is higher, i.e. almost comparable to the traffic recorded in 2008 and 2009. The bigger contribution in terms of external benefits is given by the reduction of PM10 emissions that accounts for 508 Euro/day, i.e. about 122000 Euro in the entire period.

[23] Unit external costs suggested by Federtrasporto (2002) for polluting and CO2 emissions, for Northern Italy urban and metropolitan areas, were applied. Unit cost figures were appreciated to 2005 values.

**Figure 6.13 – External costs saved for (a) PM10 emission decrease; (b) CO2 emission decrease; (c) other pollutants emission decrease**




*Source: Vaghi, Pastanella, 2006*

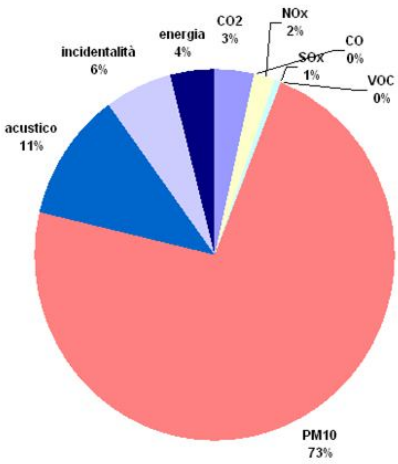
Adding the external benefits in terms of noise pollution, congestion and accidents avoided[24], the final results of the CBA speak about a total benefit for the society of about 169000 Euro in 15 months. The contribution of each benefit category is shown in Figure 6.14.

As remarked above, Cityporto traffic of the 3rd quadrimester 2005 can be used as a proxy of the more recent years. Hence, the value of benefits of 3rd quadrimester 2005 has been spread over a 5-year time horizon, in order to assess and actualise the total amount of benefits gained even in the "maturity" period of the service.

Made this assumption, the NPV of total benefits sums up to 728500 Euro. The NPV of total public grants (assumed as the "cost-side" of the CBA, as stated in 6.2), is 438000 Euro, leading to a positive Benefit-Cost Ratio (B/C R), equal to 1.66.

[24] The calculation was made taking into account unit external cost suggested for Italy by FS-Amici della Terra (2002).

**Figure 6.14 – External costs saved by category**




*Source: Vaghi, Pastanella, 2006*

## 7. Conclusions

Starting from the definition of the scope and purpose of city logistics, the present chapter has presented an overview of the most advanced measures for rationalising urban distribution in Italian cities. The survey shows that Italy, although coming as a "second mover" in the city logistics European experience (started in the Nineties) has implemented very actively the concept of "city logistics system", defined as the implementation of multiple and cooperative measures of urban logistics. The high number of cities (although all of them are almost medium-sized) developing city logistics projects and the promising number of systems activated demonstrate the assumption.

The analysis of Cityporto-Padova case study gives a promising outcome as concerns the environmental effectiveness of city logistics. The positive B/C R showed in Padua has indeed encouraged other Italian cities in the development of city logistics systems with the same features as Cityporto, leading to the activation of at least two other "cityporto-s" in Centre-Northern Italy.

However, the case study demonstrates how UDC-based city logistics systems are economically viable and environmentally effective only if some "success factors" are present. Among others,

the availability of a peri-urban platform, a thorough concertation process, and a "fostering" regulatory policy for access and loading/unloading, issued by the Municipality.

The case study gives a controversial outcome as concerns congestion, suggesting that UDC-based city logistics system could lead significant results in terms of congestion decrease if they reach the aim of "capturing" a big part of the urban freight traffic on third-party account. The Italian and European experience (e.g. Velocelogistic in Vicenza) suggests that it can be achieved only with the enforcement of major restrictions to access to Limited Traffic Zones.

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