1

Where Are We After 20 Years of Urban Logistics?

1.1. Introduction

The issues regarding the organization of logistics and freight transport in urban areas are not new: the first written document that deals with the regulation for the transport of goods within a city is attributed to Julius Caesar in the 1st Century BC [QUA 08]. In fact, the *Lex Iuliana Municipalis* (municipal edict) that regulated urban deliveries by establishing night-time delivery schedules in the city of Rome is the oldest example of a law written in the interest of urban stakeholders to solve the nuisances that goods deliveries commonly cause, even in antiquity.

Even though other older civilizations were also interested in the supply of cities (the Greeks, the Phoenicians and the Persians were known to have major commercial activities and cities closely linked to the trade of goods, [GAR 89, TEP 11]), it is ancient Rome, and in particular the Roman Empire, which has provided the oldest and most significant written examples of urban logistics[1]. So much so that the *Lex Iuliana Municipalis* remains as the exclusive record for night-time deliveries in ancient times. The Roman Empire subsequently developed real skills in the organization of supplies for the imperial capital. Indeed, under the rule of Augustus, in the 1st Century AD, an exemplary position was created: the prefect of Annone (*Praefectus*

1 Archeological analyses and discoveries of objects and buildings for the pursuit of logistics show the importance of logistics in Phoenician, Egyptian and Greek cities before the Roman Empire, however, the first written legal texts date from the time of Julius Caesar, with the next one at the time of Augustus [PAV 76, GON 16].

Annonae). Although a similar role had existed centuries before, its function was of limited duration and only in cases of extreme drought or famine (*Tite-Live*, Jacques Heugron edition [HEU 70]). This prefect had the vital mission of supplying the city of Rome and managing food stocks, first to alleviate problems pertaining to famine and malnutrition, and second to oversee the proper functioning of the city. In the 1st Century BC, Julius Caesar created the station of *ediles cerealis*, an office responsible for the supply and management of the grain and cereal stocks of Rome. Augustus, between 8 and 14 AD, reformed this function by bestowing it to an equestrian knight and permanently establishing the Annone prefecture [PET 74], whose primary charge was over grain and cereal supply, which was then extended to include wine and gradually expanded to oversee other foodstuffs. This prefect had both a logistics and spatial planning role [PAV 76], when he decided on, or at least suggested, the construction of the *Horrea* grain warehouses, grouped in zones according to activity (such as those found in current urban logistics zones), where the planning and management for the supply for grain distribution areas coexisted with the purely operational functions of buying and managing arrivals, stocks, and their distribution to markets and key families [VIR 11, MIM 14]. These *Horreas* have also been the subject of numerous studies [VIR 87, ARC 11, MIM 14], as well as those affairs between the port of Ostia and the city of Rome, and the transport of food items from the seaport to the distribution warehouses [VIR 15]. This function was also extended to other important cities such as Alexandria [BOW 05], but not to Constantinople, where the municipal organization did not provide for a specialized prefecture to govern over the city's supply network [PAV 76]. This example is the first documented case of the public management of urban logistics [CHA 60, PAV 76, RIC 80, VIR 95, VIR 00, VIR 07, VIR 11, MIM 14], and yet it still remains relatively unknown to both experts and practitioners[2].

With the decline of the Roman Empire and the changing of the capital (from Rome to Constantinople), the public functions associated with the cities in the western part of the Empire gradually lost more and more power[3].

2 Retrospectives on urban logistics do not generally go beyond the second half of the 20th Century. Libeskind [LIB 15] is, in our opinion, one of the first to have attempted the difficult task of retracing the history of urban logistics; although this book was developed in a French context, antiquity is included all the same. Nevertheless, it relates interesting and little known facts of logistics in the cities throughout the course of history.

3 The most thorough study on the subject presents the Annone prefectures as having significant functions until the end of the 4th Century [PAV 76].

In the Middle Ages, a completely different organization took over. Nevertheless, the supply of cities remained structured [BRI 95]: instead of centralized management, an oligarchic structure, sustained by the guilds of traders and craftsmen of large cities and by the feudal lords in smaller ones, made it possible to ensure the supply and nutrition of populated centers [DES 09]. We also begin to observe the rise of inter-urban logistical organization within Muslim kingdoms (North Africa and the Iberian Peninsula), which allowed cities to both supply and develop the production and trade of goods between those kingdoms [BOO 90, KID 05], and which followed the logic of a "system" or logistical cluster (a concept taken up centuries later, [CED 06, CAP 15]). Nevertheless, actions in the interest of the public, primarily for the development of wharves, the construction or restoration of canals and roads, were necessary for the growth and development of commerce within the city, and as a result, the need for logistics. One of the most illustrative examples is that of the supply of goods for Paris, which were mainly conveyed by river, and whose facilities required supervised enhancement in order to increase both their capacities and efficiencies [NOI 11].

From the Middle Ages up until the 20th Century, the supply of cities was predominantly driven by private stakeholders, first by the guilds and later on by other forms of associations and groups. Procurements made by commercial stakeholders and the associated infrastructure were limited (before the beginning of the 20th Century, the main access routes to cities were via river channels, after which came the railway, Libeskind, [LIB 15]. Major innovations (linked to the increase in the range of products that will not be dealt with here) were achieved through technical advancements (mainly in terms of the vehicles and means of transport) or in terms of infrastructure: improvement of the river courses, the return of urban warehouses during the Renaissance and the Restoration or the invention of the steam engine which stimulated, among other things, rail transport.

The logistics underpinning the supply of Paris oversaw various phases for the development of its waterways [LIB 16]: canals were built in the 17th Century to connect the Loire and the Seine, thereby improving communications between the Atlantic ports and the French capital. In addition, food warehouses were created and developed so as to facilitate long distance (river) and urban (road) transport. The 19th Century saw the rise of rail transportation and the progressive development of urban trams (the first were horse drawn, later upgraded to coal locomotors, and over the

course of the 20th Century, replaced with electric locomotors). Although these trams were mainly dedicated to the transport of people, we find many examples where goods were transported by rail (and in some cases tramway) in several European cities [LIB 14].

With urban expansion in the 1950s and the large-scale construction of roads, coupled with a boom in the automotive sector (and subsequently in commercial road vehicles), a new era of urban logistics arrived on the scene: driven by quasi-exclusive private stakeholders who were responding to the market. Indeed, two related phenomena promoted the development of transport and logistics stakeholders: the first is the strong priority given to the transportation of people in the construction and planning of cities, which did not account for the transportation of goods since at that time city planners were not well aware of this sector; the second was access to commercial vehicles, a result of the industrialization of their production, which allowed companies of all sizes to specialize in freight and transport logistics. For those reasons, logistics in cities were left to private stakeholders [CRA 08] and held little interest for public stakeholders [CER 98] who introduced few tangible initiatives, the urban section being considered as the last kilometer of a longer, more organized transport system as a whole [AMB 85]. An emblematic example is the Sogaris-Garonor road freight terminal [DAB 96], which operated in the Paris region between 1967 and 1969 as a true urban consolidation center (the scope of this freight terminal was the Paris and Ile-de-France region, and the services offered were of the same nature as those offered by urban consolidation centers that were to be developed later in the 1990s and 2000s). This consolidation platform evolved into a multi-purpose logistics platform (and later on, the domain of urban logistics) responding to the ever-changing needs of a purely liberal and competitive market.

The 1970s were characterized by the beginnings of scientific works on urban freight transport and the introduction of goods transport in retailing and industrial zones [WAT 75]. Although cities are still developed and organized with the priority of personal mobility, economic activities remain of vital importance to the success of urban areas. An increase in the urban population indirectly leads to an increase in the flows of goods for the supply of cities. This is reflected in the United States and Japan where roads and parking facilities in the retail and industrial areas of some cities are extremely overcrowded, accounting for the rise in scientists and practitioners who began to address the quantification and qualification of goods transport within urban areas [DEM 74, WAT 75, MAE 79], predominantly in the

context of North America. Those works correspond more to the needs of private stakeholders (industrialists, traders, transport companies, etc.) than to those of public stakeholders. Those works being pioneered by the United States [OGD 92, HOL 12] remained largely unknown in France. This is partly due to the fact that in France at that time, priority was given to the urban transport of people. It was only later in the 1990s that public authorities began to really take an interest in the transportation of goods [AMB 99a].

In Europe, the first actions in terms of the promotion of urban logistics instigated by public authorities were to combat the rise in congestion that worsened throughout the 1980s. However, public awareness for the need to act in a coordinated way so as to alleviate inconveniences and mitigate problems originating from urban freight transport and urban logistics shortfalls only became widespread in the 1990s. Indeed, the first actions by public authorities in the 1980s were regulatory and temporary in nature, mainly in the form of access regulations or parking restrictions that were implemented locally by the municipality and without much coordination or a desire for unification at the regional or national level [DAB 98, GON 08, MAG 07, SPI 08].

It was only in the 1990s that major concepts supporting urban logistics were developed and the notion of urban freight transport was approached by various countries somewhat differently, but which nevertheless had many parallels [COS 98, ECM 99] with Germany, France, the Netherlands, the United Kingdom and Switzerland being the more active of the European countries. Several authors state that the concept of urban logistics used today on an international scale can be derived from its German namesake *city-logistik*, according to Thoma [THO 94], often further citing the works of Ruske [RUS 94] and Kohler [KOH 97] as pioneers in the field. Nevertheless, in addition to the report by Thoma [THO 94], there is a previous record for the use of the term “city logistics”: that of McKinnon [MCK 91], who used it during a seminar dedicated to urban logistics. However, it was only at the International City Logistics Conference, through Eiichi Taniguchi, that this term became popular, and where at the same time, one of the three predominant definitions was presented as well [TAN 01].

Furthermore, coordinated actions (initiated by public and/or private stakeholders) were being amplified in Europe, mainly in Germany, France, Italy, the Netherlands, the United Kingdom and Switzerland [ROS 05]. However, the involvement of public stakeholders was not homogeneous throughout Europe. Indeed, while in France, the national awareness allowed for the development of the national program "Marchandises en Ville" (Goods in the City), which started in 1993 [DUF 99, GON 12g], Germany and the United Kingdom adopted a completely different path: one where urban logistic actions in those countries were primarily carried out by private stakeholders, with little or no financial support from public stakeholders, and where regulations regarding urban freight transport remain neutral [GON 08]. The Netherlands, on the other hand, adopted a hybrid path, where a strong initiative from private stakeholders is being regulated and administered by local and regional public stakeholders to reward and encourage good practices [COS 98]. Other countries, such as Spain and Italy only became aware of the necessity and challenges regarding urban logistics in the early 2000s. Northern countries adopted a similar logic to that of Germany and the United Kingdom at the end of the 2000s. Central and eastern European countries began to focus on urban logistics issues in the mid-2000s, although some experiments took place in the past [BES 09]. Outside Europe, the rationale remains similar to that of the 1970s, however, new problems of optimization, relating mainly to the localization and organization of routes, are beginning to appear, in addition to a growing demand for the estimation of urban logistics, as previously mentioned.

The 2000s was the most active era for urban logistics, both in terms of research and practice into communities (we will examine this in greater detail later on). Nevertheless, it was not until very recently (the first observations of unification by the scientific community are presumed to have taken place in 2016) that we began to observe heterogeneity in the research and practice of urban logistics, which have for a long time made it difficult to produce methods, as well as approaches. That has made it possible to tackle the questions of urban logistics in a unified and homogeneous way, thereby opening them up for comparison.

We will next present a summary of those research and practical actions, by no means an exhaustive list, but nevertheless useful for a general overview of urban logistics, not only in France but also internationally. We thus first present an overview of the main research topics worldwide, making particular mention of those being extended by French research. Then, we

propose an overview of significant urban logistic actions and practices according to the classification proposed by Ville *et al*. [VIL 13]. Finally, at the end of the chapter, a discussion will take place on the difficulties, concerning the apprehension and categorization of urban logistics.

1.2. The valorization of research in urban logistics: French and international approaches

Urban logistics has been a subject of interest for researchers for several decades. In France, the need for a better knowledge and understanding of urban logistics together with a strong scientific and political resolve culminated in the emergence of the "Marchandises en Ville" national program in 1993 [DUF 99]. At the same time, the topic was also being embraced by other scientific communities in different European countries, mainly Germany [RUS 94, THO 94, KOH 97], the Netherlands [COS 99] and the United Kingdom [MCK 91]. Nevertheless, the challenges facing the supply of goods for economic activities within the context of the city were already a popular topic in the United States as far back as the 1970s [WAT 75].

Internationally, urban logistics (or urban freight transport) up until the mid-1990s was considered to be a specific subject in the domain of transport engineering and continued to develop within a small community. It is important to note, however, that works charged with estimating the urban flows for the transportation of goods have existed since the 1970s [DEM 74, MAE 79, SON 85, ERI 97]. Following on from a series of communications insisting specifically on a growing need for freight transport planning, the specialized urban logistics research community finally saw the day in 1999 of the first international conference on City Logistics, organized and held in Cairns, Australia.

Indeed, during its first year, the conference hosted less than 20 presentations[4]. Since then, however, most notably in 2003 (the third conference which was held in Madeira, Portugal), City Logistics has grown to include more than 100 participants from many different countries and

4 These statements were given at the ILS 2016 conference in Bordeaux by Jesus Muñuzuri, Professor at the University of Seville, and Ron van Duin, Professor at the Delft Technical University, both of them having participated in the First International conference on City Logistics.

across many disciplines. Other conferences followed, such as the I-NUF (organized in 2005 by the Metrans Center in Long Beach, California, with a predominantly national scope that has since, as of 2013, become international), although it remains firmly anchored around a vision of urban logistics for cities in the United States. A series of conferences and seminars by the European NECTAR research network were also organized in the late 2000s and early 2010s [MAC 11], but have now transitioned towards a broader conception of the topic: sustainable logistics [MAC 14]. In 2013, the Volvo Research and Education Foundation (VREF) launched two centers of excellence in the field, in addition to organizing their first conference in 2012, followed by a second in 2014, with the latest one having taken place in 2016 (the first conference was by invitation only, while the second and third conferences were open to both academics and practitioners and always held in Gothenburg, Sweden).

Other conferences (CTUA – Commercial Transport in Urban Areas held in Berlin in 2012; the International Workshop on Urban Freight Modeling held in Rome in 2012; URBE – Urban Freight Behavior held in Rome in 2016), as well as group sessions on various urban logistics themes held at prestigious international conferences (TRB Annual Meeting, WCTR, ILS, etc.) have also contributed to the international exchange between researchers.

In France, a conference on urban logistics has been organized in Nantes annually since 2011, becoming an international event in 2015. It remains one of the more representative reference events for Francophone research in this field. The pioneering conference led by the French community in urban logistics, however, remains the Jacques Cartier symposium on urban goods transport, first held in Montreal in 2000 [PAT 01], which, while presenting a broad overview and international speakers, was primarily addressed to a Franco–Quebec audience. To that can be added the many one-day workshops of recent research, under the auspices of the national "Marchandises en Ville" program or PREDIT (the French "program for research and innovation on land transport"), the FRELON chair ("freight and urban logistics") at the Ecole des Mines de Paris, as well as the extensive research being done at the various academic institutions and universities. These reflection days are aimed at a diverse public made up of both researchers and practitioners. Urban logistics also plays a major role in French-language conferences such as the CIGI ("international industrial engineering conference"), the RIRL ("international logistics research meeting") and the MTL ("mobility, transport and logistics"), events that are typically academic in character.

In addition, of course, there are the many scientific publications on the subject, a testimony to both the popularity of the subject and its growing need as perceived by the scientific communities. On the contrary, this has resulted in greater heterogeneity and a general lack of unification among the works being put forward. Moreover, significant differences between the publication and diffusion channels for urban logistics research in France and the rest of world are obvious: in France, the research tool for urban logistics research has traditionally been the research report, and to a lesser extent technical notes, mainly related to the role of the PREDIT program and its modes of research justification; overseas, however, although reports are often used (at the European or North American level) to give an account of the results of collaborative projects, they are more often than not accompanied by numerous academic publications, preferably in peer-reviewed scientific journals. While in some countries and disciplines, publications in the national language are prioritized[5], the global trend is to publish in English.

More specifically, the results of an online search using the Google Scholar engine give out 668 French urban logistics documents, made up of 80 peer-reviewed journal articles, 9 monograph books and 2 collaborative books as well as 15 doctoral theses. The rest of the documents include book chapters (the identification of which is difficult and time-consuming given the small number of books on urban logistics), articles in specialized non peer-reviewed journals (mainly "*Transports*", "*TEC*" and "*Transports Urbains*"), as well as reports, notes and research papers. On the contrary, it would take far too long to analyze in detail the equivalent English Google Scholar results (3,900 documents contain the expression "urban logistics" with a further 7,550 for "city logistics"). Nevertheless, a search in the Thompson and Reuters Web of Science database (an international reference site for academic research on peer-reviewed journals) links 735 articles[6], about half of which are in the engineering sciences, and a quarter are associated with economics and management sciences, with the other quarter made up by social sciences, such as planning or regional and urban sciences.

5 This is the case for France and Italy, notably in humanities and social sciences, as well as in Germany, China and Latin America, not only in the humanities and social sciences but also in engineering sciences, among others.

6 Articles containing the terms "city logistics", "urban logistics", "urban goods" or "urban freight".

To this bibliographic research, we can add the main collaborative works in urban logistics [MAC 11, GON 14, TAN 15], and the proceedings of the nine international "City Logistics" conferences, the five I-NUF conferences and the last two VREF conferences. With the view of establishing a foundation upon which to examine the dominant research topics taking place in urban logistics, the main recurring themes at international conferences and English-speaking, peer-reviewed journals can be grouped into seven broad categories:

– demand estimation: international demand-based works are centered either on identifying determinants in the interest of systematizing freight transport demand generation [HOL 11, SAN 16b] or on the theoretical aspects of modeling, which give very few operational models. However, some of them [SON 85, DEL 89, ERI 96, JAN 05, MUÑ 09, COM 13] are used in spite of being rather unknown in France;

– supply estimation and transport optimization: those approaches are mainly derived from operational research and the optimization of vehicle routes [TAN 99, TAN 12, CRA 08, CRA 09, CAT 17];

– regulation, public policy and key stakeholders: the main works concern the regulation of access to cities [DAB 08, VIL 13] and the possibility of action by public authorities [HES 04, LIN 10, LIN 13];

– logistics planning, spatial planning and the spatial dynamics of urban logistics [AND 05, DAB 10, DAB 12, DAB 15];

– experiments and pilots, case studies and best practices [ROS 05, SPI 08, BES 09, DAB 11b, ALL 12a, ALL 14b];

– data collection issues [HUN 06, ALL 12b, ALH 15];

– evaluation of sustainable urban logistics [TAN 00, VAN 08, VAN 10, PAT 10, MEL 11, VAG 11, MAC 14].

On the other hand, the French perspective focuses predominantly on the following themes:

– quantitative surveys and demand modeling, with a strong research orientation based on the FRETURB model [PAT 99, AUB 99, AMB 10, ROU 10];

– characterization of urban logistic spaces [BOU 13, BOU 15, GUY 15];

– qualification of e-commerce practices, home deliveries and other forms of urban commerce and distribution [ALL 07, BAR 13, DUC 13, BEL 13];

– operational research and decision-making support [HUA 11, GIA 15, GON 15, GUY 15];

– regulation and public policies [DAB 98, DAB 10];

– aspects of organization and stakeholders [CHA 12, CAP 15];

– spatial aspects and planning logistics [DAB 10, DAB 11b, HEI 17];

– monitoring and evaluation of the urban logistics experiences [GÉR 07, HEN 08].

From those non-exhaustive overviews, we can deduce that, although most French research topics find their place in international communities, we nevertheless observe several differences between the French visions and approaches and those of international communities. The first is the approach of "pairs", i.e. the positioning of research and studies in relation to that of other members of the community. Most French works have historically been positioned in relation to the French context and research taking place in France. In fact, most of the work carried out by the national "Marchandises en Ville" program is derived from projects financed by PREDIT (French national research program on inland transport), ANR (French national agency of research) or ADEME (French agency of energy and environment), and naturally their results have taken the form of research reports and books largely written in French. The notes and articles on the research and its popularization have also always been written in French. Those articles mainly cite Francophone sources and compare French experiments with one another or, in some studies, with close neighbors, such as Belgium or Switzerland. This is the case of the Urban Logistics Spaces (ULS) studies for example, which present a typology and a comparison that is only based on France (excluding overseas territories) [BOU 06]. In Italy, similar studies are made using comparisons, but from an international standpoint [ROS 05, SPI 08, MAG 07]. In addition, scientific articles in English offer international comparisons [WHI 99, BRO 05, ALL 12b]. The same observations can be made for the works on e-commerce [DUR 09, DUR 10, BEL 13], works on regulation and stakeholders [CAP 11, DAB 11a, GÉR 07], and those regarding practical experiments and their evaluation [GÉR 07, HEN 08, GÉR 15]. Still, we observe some French works that can

be seen to have been generated from an international perspective [DAB 96, AUG 08, AUG 09]. Only the community working on decision-making support (Decision Sciences) has a distinctly international positioning, with publications systematically released in English [HUA 10, GUY 12, GON 12c], and whose works are seen by the rest of the French urban logistics community as more theoretical than applied [GON 12b]. In summary, the dominant vision of urban logistics research in France is often limited in terms of scope and activities taking place in the French context, with several actions sometimes going in a different direction to that of the international context.

Let us take, for example, the case of the works based on demand modeling[7], which in France, follow a logic wherein the model must be closely linked to the data source used to generate it. Furthermore, this source, if possible, should be constructed with the clear goal of a determined model [AMB 10]. By this logic, the model first determines the data requirements and then determines the resources that must be used to collect this data, with a set margin through which adjustments are made possible. We find four main modelling approaches: the IRT ("Institut de Recherches sur les Transports", 1977[8] [INS 77], "transportation research institute") who model the flows of goods entering cities, the FRETURB model [AUB 99] and the CERTU method for the sizing of delivery spaces (that includes a simplified estimate of demand in terms of the number of vehicles), CERTU, [CER 13], taken from both city freight surveys [AMB 10] and descriptive models built from shipping surveys [GUI 09, GUE 14]. These static and systematic approaches have an immediate operational focus, while in international communities, the aspects put forward are more theoretical and conceptual in nature. Moreover, the two main visions for urban freight transport modeling in international communities are to make the best of the data available, often with small quantities and/or granularity [MUÑ 09, SAN 14], or to collect data based on available resources and then apply the best available model [HOL 14]. According to those two rationales, the model

7 One of the main research topics of the author, as we will see in Chapter 5, is demand modeling. In this field of research, contributions to FRETURB modeling [GON 14f] have highlighted the gap between the French vision and what has subsequently been, if not the international standard, the dominant vision [HOL 11, GON 17]. For that reason, it seems pertinent to illustrate the general vision of this book through this example of the divergence between the French vision and international standards.

8 That work remains not often quoted; however, in our opinion, it is the first real attempt to model urban logistics in France, and as such deserves to be taken into consideration.

is adapted to the available resources and the needs defined after, implying a path that is inherently opposite to classical French modeling.

Moreover, research objectives are not always similar, even when subjects coincide. In addition to the modeling work presented in the preceding section, French work on e-commerce is mainly aimed at qualifying practices [PAT 04, AUG 08, DUR 09, DUR 10, DUR 10, BEL 13, AYA 14] while at the international level, the main objectives are optimization [NEM 04], categorization (quantitative and/or qualitative) of e-commerce customers [ROH 04] or quantitative characterization of practices [GEV 11].

Qualitative work on experiments and pilots, even those with different perspectives and scopes of vision, offer comparisons between methods and analyses that are easier to compare. Furthermore, work on public policy and regulation – which in general remains closely linked to each country, even to each city, through the context and specificities of the regulations in question – also seem comparable by nature. Finally, work on decision-making support, which as previously stated follows the standards set by international journals, appears to already be well-positioned in relation to other countries, and yet generally remains theoretical or computational, with little application (already the case as early as the 1970s, as pointed out by [ACK 79]).

Even within each category, where we may come across a like-minded community with the same objectives and discourses, the work is still extremely varied and we observe little unification. Qualitative studies do not always provide enough detail on their methodologies and information sources in a homogeneous way, which in turn makes comparison difficult. Assessments are made for specific cases, and despite attempts at unification, there is currently no methodological reference by which to evaluate sustainable urban logistics, as is the case for other fields (e.g. global supply chain and logistics management). In other words, we observe a large body of work with very little unification. Operations research works remains poorly applied and varied, with the standard based on the types of models used, on the way results are produced, presented and discussed, and on the highly computational and conceptual aspects of the approaches under which they fall. The different types of modeling frameworks also illustrate the difficulty of converging towards a standardized model, as the standards for urban transport of people or long-distance freight transport cannot be transposed into the context of urban logistics, or in any case do not give satisfactory results [GEN 13].

It is only in the field of regulation and public policy that comparable and international works have been proposed [DAB 08, LIN 13], since these are inspired by comparable works, even if they are made over different kinds of applications. The unification of methodologies and analytical frameworks thus appears to have been made as a sub-theme of law and/or political sciences, with derivatives into urban logistics being seen more as an applied field.

However, if in France the research on urban logistics seems to have taken a different position that is from the outset somewhat France-orientated, what is it in practice? Hence we propose to look, in a synthetic and non-exhaustive but nonetheless general way (taking into account the main activities and key projects), at how research has influenced practice, not only in France, but also throughout the world.

1.3. From research to practice: a plethora of projects, initiatives and their practical application

As just described, the valorizations of scientific research activities being undertaken in urban logistics are different in nature, and can be grouped coherently through a set of subjects. To this must be added the various research activities which result from collaborations between the scientific and practical communities, notably those taking place around collaborative projects. Without listing all the projects and actions (this list would be extremely long and, to the best of our knowledge, without a more or less exhaustive and objective systematic syntheses of research projects in France or Europe, it would be difficult to get a complete overview that appreciated the detailed analyses of the works resulting from these projects, and besides this it is not the purpose of this book), we will nevertheless attempt a non-exhaustive overview, which shall take into account the most significant or most-quoted achievements in the literature, not only in terms of science but also those that are more technical and practical in nature.

Actions connected to research projects are rare before the 1990s, or even the 2000s. In the United States, a series of works, promoted by the TRB (Transportation Research Board) in the 1970s and 1980s ([DEM 74, WAT 75], among others) was particularly interested in the knowledge and modeling of city freight and heavy goods traffic flows [HOL 12], mainly motivated by the congestion that goods transport induced in terms of city

access and the car parks of large commercial areas. Parallel needs, pertaining though to issues of congestion and parking in historic city centers, can be identified in several European cities, which resulted in instructions to research institutes for the development of models for forecasting freight transport flows, mainly in France [INS 77], Germany [SON 85], Italy [CRO 06], Sweden [ERI 97] and Norway [MIN 96], among others.

However, the first major transnational achievements for urban logistics were the European Cooperation in Science and Technology (COST) project number 321, which was developed between 1994 and 1998 and included 12 participatory countries (Denmark, Finland, Germany, France, Greece, Italy, the Netherlands, Slovenia, Spain, Sweden, Switzerland and the United Kingdom). The purpose of that operation was to synthesize and unify the various actions being undertaken on a viewpoint of urban logistics, first to identify the national logical frameworks, and then to give a European reference framework [COS 98]. That collaborative action produced a large number of documents (more than 50 documents, comprised of reports, technical documents and summaries of meetings, the vast majority of which had an English version in addition to the original version that was recorded in the respective national language[9]). Yet, those documents are not available online, although the final report [COS 98], published by the European Commission, has recently been uploaded free of charge. That document, which is perhaps the first real effort to unify urban logistics, is unfortunately hardly known and cited (an in-depth search of Google Scholar reveals less than 10 citations of the document; disappointingly, the document is referenced in different ways, which in turn raises the difficulty of finding all the works that make reference to it). Nevertheless, it constitutes a fundamental basis for understanding the beginnings of urban logistics in Europe [GON 08] and merits a thorough reading by those wishing to have a solid comprehension of the topic.

Another pioneering project is that of ELCIDIS (Electric Vehicle City Distribution Systems), which, within the framework of the European Commission's Energy program, grouped six cities (Erlangen, La Rochelle, Milan, Rotterdam, Stavanger and Stockholm), according to the growth of their

9 According to the list of documents provided by COST 321 [COS 99], only four reports have no English version: two are for a technical work on flow modeling in Düsseldorf, but the main results and conclusions are reported in the summary which has an English version; the other two are French works, which are the only national works not to have been translated into English.

electric and hybrid vehicle industry. The aim of that project was to experiment with electric vehicle urban delivery solutions, in particular those that enabled the development of the La Rochelle Urban Consolidation Centre[10] (UCC), one of the oldest and most cited examples of urban logistics in France [GON 13d]. In addition to the UCC, the use of light electric commercial vehicles was tested in both Rotterdam and Stockholm, while electric and hybrid vehicles were used for mail distribution in the remaining three cities. Although somewhat more quoted than the COST 321, that work is also poorly cited in the scientific literature (less than 20 quotes, according to a Google Scholar search, openly refer to documents in the ELCIDIS project).

From the year 2000 onwards, and following the COST action, the European Union has really become aware of the urban dimension of freight logistics and the need for action. That is reflected in the rise in calls for projects specific to the urban distribution of goods. According to Russo and Comi [RUS 04b], it is through the Fifth Framework Program (1998–2002) that the European Union outlined its priorities for European Union research in the field of urban freight transport. The Competitive and Sustainable Growth subprogram has brought many projects into being, including[11]: BESTUFS[12] (Best Urban Freight Solutions), CUPID[13] (Coordinating Urban Pricing Integrated Demonstrations), EUTPII[14] (Thematic Network on Freight Transfer Points and Terminals), MOST (Mobility management strategies for the next decades), PROGRESS (Pricing regimes for integrated sustainable mobility), OSSA (Open framework for Simulation of transport Strategies and Assessment, 2000–2003) and REVEAL (Remote Measurement of Vehicle Emissions At Low cost). Those projects were the first to propose assessments, pilots and evaluations on the concrete actions being taken on urban logistics, even if these were only under projects

10 This multi-term is referred to as an Urban Consolidation Center (UCC), an Urban Distribution Center (UDC) or a City Distribution Center (CDC). We use here the first declination of the term (i.e. UCC).

11 That synthesis is not exhaustive; the projects proposed here are examples. An exhaustive synthesis would require a specific study and a detailed bibliographic analysis for which resources should be mobilized and remains complementary, but outside the objectives of this book.

12 See: www.bestufs.net. A summary of the project and its main challenges was put forward by Zunder and Ibáñez [ZUN 04].

13 See: www.ttr-ltd.com/Project-Archive/Transport-Pricing-CUPID/.

14 See: www.uirr.com/fr/projects/completed/item/9.html.

with broader themes such as urban mobility or electric vehicles. Only BESTUFS, a project specific to urban logistics, focused on the identification of good practices and was the first to launch momentum on that subject (we could also think of it as the basis for the growth of trend projects based on good practices, as we will see in the following section).

The Sixth and Seventh Framework Programs continued along this logic with two priorities: the identification of good practices in terms of urban logistics and the continuation of experiments and evaluations. Of the CORDIS[15] information system's database, 35 projects from those framework programs (i.e. FP6 and FP7) deal directly with urban freight transport, 10 of which are exclusive to urban logistics (other projects, urban logistics as a sub-part of freight transport in the broadest sense, rail and freight transport, urban mobility or spatial planning). Of those projects exclusive to urban logistics, two were from FP6 with the other eight coming under FP7. The prime examples of projects under these two framework programs are: BESTUFS II (the BESTUFS sequel, which took place between 2004 and 2009, for which a summary of both projects was produced in 2009[16]) and FIDEUS (Freight Innovative Delivery in European Urban Space) for FP6, and BESTFACT (Best Practice Factory for Freight Transport[17]), CITY MOVE (City Multi-role Optimized Vehicle), CITYLOG (Sustainability and Efficiency of City Logistics), DELIVER (Design of Electric Light Vans for Environment-impact Reduction), FREVUE (Validating freight electric vehicles in urban Europe), FURBOT (Freight Urban Robotic Vehicle), MODUM[18] (Models for Optimizing Dynamic Urban Mobility), OPTICITIES (Optimise Citizen Mobility and Freight Management in Urban Environments), SMARTFREIGHT (Smart freight transport in urban areas), SMARTFUSION (Smart Urban Freight Solutions), SPIDER PLUS (Sustainable Plan for Integrated Development through the European Rail Network – Projecting Logistics & Mobility for Urban Spatial Design Evolution), STRAIGHTSOL (Strategies and measures for smarter urban freight solutions) and TURBLOG_WW

15 See: cordis.europa.eu/.This is a web page listing all the European projects and their various updates. The site does not have all the deliverables, but presents an overview of the research funded by the European Union.
16 All BESTUFS I and II project documentation is available at: www.bestufs.net.
17 See: www.bestfact.net.
18 Not to be confused with the ANR MODUM French project, which we will also discuss in this chapter. For MODUM (FP7) project: modum-project.eu/.

(Transferability of urban logistic concepts and practices from a world-wide perspective) for FP7.

The last framework program, Horizon 2020, was built around expert groups that define the priorities of the calls for projects and saw a move towards more technical projects. The six exclusively dedicated projects below can be identified:

– GALENA (Galileo-based solutions for urban freight transport), aims to offer technical solutions to assist urban deliveries by using Galileo satellites (the European equivalent of GPS);

– NOVELOG (New cooperative business models and guidance for sustainable city logistics), based on the proposal of cooperative services for urban logistics;

– PORTIS (Port-cities: Integrating Sustainability), which studies the role of ports and their logistics in terms of the development and sustainability of cities;

– SUCCESS (Sustainable Urban Consolidation Centers for Construction), which aims to unify the concept of the UCC in terms of the construction sector;

– CITYLAB (City Logistics in Living Laboratories);

– PROSFET (Promoting Sustainable Freight Transport in Urban Contexts: Policy and Decision-making Approaches).

The last two projects reflect the objectives for experimentation and the identification of good practices. We also note that there are more proposals for services and land use planning, and fewer for good practice or more traditional projects.

In the year 2000, the European Commission launched the CIVITAS (City-Vitality-Sustainability) initiative, which supports cities through bold and innovative measures to radically improve urban transport. The program took place in four stages:

– CIVITAS I (2002–2006) involved 19 European cities that cooperated under four projects: VIVALDI, TELLUS, TREND SETTER and DES MIRACLES;

– CIVITAS II (2005–2009) involved 17 European cities that cooperated under four projects: SUCCESS[19], CARAVEL, MOBILIS and SMILE;

– CIVITAS PLUS (2008–2012) involved 25 cities that cooperated under five projects: MIMOSA, ELAN, ARCHIMEDES, RENAISSANCE and MODERN;

– the fourth component, CIVITAS[20], in collaboration with Horizon 2020, consists of two projects that include urban logistics: CIVITAS ECCENTRIC (Innovative solutions for sustainable mobility of people in suburban city districts and emission free freight logistics in urban centers) and CIVITAS SATELLITE (Support Action Towards Evaluation, Learning, Local Innovation, Transfer and Excellence).

In all cases, the CIVITAS projects are the result of urban networks on subjects broader than just urban logistics, but nevertheless have enabled the comparison of practices and experimentation of several urban logistic actions.

Urban logistics has also held an important position ever since the third year of the INTERREG program [FRO 04]. The INTERREG III program was a community initiative of the European Regional Development Fund (ERDF) created to facilitate cooperation between regions of the European Union over the 2000 to 2006 period. It encouraged transnational cooperation, building on the interaction between national, regional and local authorities and a wide range of non-governmental organizations. The objective was to achieve a sustainable, harmonious and balanced development of the community with better territorial integration. Important urban transport projects were launched, including: CITYPORTS and MEROPE. The SUGAR project, for its part, was launched under the framework of the INTERREG IV program, in 2007, for a period of four years. The objective of that project was to study good practices in urban logistics as promoted by local and regional authorities. A guide to helping public decision-making has been produced [DAB 11], however, issues of transferability plagued the project at an early stage; in any case, that contribution remains one of the first to address the issues of transposition and transferability of urban logistics practices.

19 Not to be confused with the H2020 SUCCESS project on urban distribution centers for the construction industry. The CIVITAS SUCCESS (Smaller Urban Communities in CIVITAS for Environmentally Sustainable Solutions) project grouped three cities (La Rochelle, Preston and Ploiesti) around the challenges of urban mobility (people and goods) for medium-sized cities. See: www.civitas.eu/content/success.

20 See: www.civitas.eu.

In France, research on urban logistics has been structured around the national "Marchandises en Ville" program (a summary of which can be found in [GON 16d], and about which we will not go into detail here, but instead limit ourselves to stating its main objectives and organization). The program was created in 1993 and was managed up until 2013 by the DRI (*Direction de la Recherche et de l'Innovation*), the DGITM (ministry departments in charge of infrastructure and/or sustainable development according to its denominations over the years, *Direction Générale des Infrastructures Terrestres et de la Mer*) and the ADEME (*Agence De l'Environnement et de la Maitrise de l'Energie*). The objectives of the program were originally to organize, support and finance the research of freight transport in cities in order to create a knowledge base and to support public authorities in their decision-making. The first wave of quantitative surveys took place in the cities of Bordeaux, Dijon and Marseille [AMB 96, AMB 99a, AMB 99b, AMB 10], and supported by a set of books on the diagnosis and the support of public decision-makers as well as the logistics of urban spaces [CER 98, DAB 98, BOU 02, PAT 02, BOU 06], among others). In fact, given that the program is created around local authorities and the challenges they face [DUF 99, FRI 98], the work is mainly oriented towards the public and institutional decision-making sphere.

Urban logistics was then one of the main fields of application for the French "research and innovation program for land transport" (PREDIT). Urban logistics falls into two fields of study, which are often considered separately [ROU 13]: on the one hand is urban personal transport that has historically been linked to the mobility of people, and on the other is freight transport logistics, often considered at the intercity, international and/or intercontinental scale. In addition, the French vision for urban logistics developed in a context of strong support (but in a way, also biased) for public administrations [GON 16d]. For that reason, urban logistics has no specific section in the PREDIT program, but nonetheless appears explicitly in three of the steering groups: urban mobility, freight and transport logistics (GO4 of PREDIT 4), and decision-making support for public authorities. A summary of PREDIT's work on urban logistics can be found in [ROU 13], not on an administrative (i.e. program-related) or chronological basis, but on the basis of the following three criteria:

– their sphere of operation, according to the three leverage actions to achieve sustainability, as identified in [GON 12d], i.e. the technological, organizational and regulatory aspects of urban logistics;

– the scale of their implementation, i.e. their scope, which may be global (the size of the urban area or an agglomeration thereof, are the minimum scales considered to be representative of an urban system), local (neighborhoods, downtown or a dedicated site such as a shopping mall or activity area) or specific (linked to a particular niche or link in the chain);

– their level of utility, i.e. the position within a general situation for the development of an operational solution, starting with the estimate, through to the operational implementation of a technical, technological or organizational solution.

In addition, other sources of funding, such as the national research agency (up until 2013 under its Sustainable Cities and Buildings program, and its generic call for projects ever since), ADEME and PUCA (*Plan Urbanisme Construction Architecture*), among others, were interested in urban logistics.

Several projects labeled by PREDIT (whether financed by this program or by others) are mostly involved in the overall supply chain, with a section dedicated to urban logistics. The FIDES (*Flexibilité et Impacts de la Demande de transport des différents secteurs Economiques, et simulation de Scénarios d'Evolution*) project is studying levers with which to control the flexibility of transport demand, with its third component, from a prospective standpoint, highlighting the importance of sustainable e-commerce (with the development of logistical organizations that reduce the number of home deliveries near the place of consumption) and logistical pooling. On this subject, two neighboring projects have been developed: LMD (*Logistique Mutualisée Durable*), which is oriented towards collaborative distribution strategies, notably the shared VMI (vendor's management inventory), between producers and retailers, and LUMD (*Logistique Urbaine Mutualisée Durable*), linked to the control of the urban delivery of non-food products. In both cases, specific freight exchanges are recommended and analyzed. The ECLUSE (*Etude des Changements en Logistique Urbaine dans la région de Saint-Etienne*), PLUME (*Plates-formes en centre-ville pour la Logistique Urbaine*: study on Marseille), MODUM, SILOGUES and ANNONA

(decision-making tool for the development of sustainable urban logistic schemes) projects are concerned with the development of decision support tools in terms of the evaluation of urban logistics scenarios, and also an attempt at unification has been envisaged, although that unification is still in the preliminary stages. The MILODIE project made it possible to study the impact of information sharing in and on e-commerce organizations, the behavior of online buyers and the reception of ordered goods. Other projects deal with logistics organizations (Signature, FUSION CO2, VLD, Epilog, Open Freight), but do not take a direct look at the problems specific to urban logistics. Regulatory aspects and policies on land use, planning, public space management and transport (people and goods) communities. A study on regulation in terms of access to cities was carried out by the firm Interface Transports. In addition, these issues are addressed in several projects funded or supported by PREDIT, such as EVAL (methodology for the evaluation of innovations in urban logistics), FIDES, ALF (*Aires de Livraison du Futur*) or MODUM (for more details on French projects and the unifying role of PREDIT, see [ROU 13]). Although this overview nevertheless remains non-exhaustive, it shows the difficulty of unifying and completing an exhaustive inventory of the applied research that has taken place in urban logistics in France.

To that is added a plethora of experiments and activities, not always financed by collaborative research projects, not only in France but also in Europe and throughout the world. A preliminary non-exhaustive overview was made by Gonzalez-Feliu [GON 08]. We propose to extend this to include an overview of worldwide urban logistical practices (again, non-exhaustive, but which includes the main works and key actions happening in this field). The examples shown in the following section far from constitute an exhaustive inventory (in terms of limited space, but also because of the difficulty and resources required to carry out an exhaustive inventory, the examples presented here are certainly representative of the different countries listed, but nonetheless are only a sample of the vast plethora of urban logistic operations in the world). They nevertheless show the diversity and complexity of urban logistics activities in the world and the difficulty of understanding the different needs and phenomena of urban logistics in an organized and unified way.

1.3.1. *France*

The activities taking place in urban logistics in France have classically been closely linked to the national "Marchandises en Ville" program, at least up until 2013[21]. According to Dufour and Patier [DUF 99], this program was initially implemented in two phases. The first phase was devoted mainly to the acquisition of knowledge (both quantitative and qualitative) on urban freight transport and had specific funding, with the program being strongly integrated into PREDIT 2 at its launch in 1996 [ROU 13]. The second phase began effectively in the 2000s [BOU 02] with the objective of developing and analyzing the various French experiments taking place in the field, while continuing the development of knowledge and methods. It received support from the ministry of transport through PREDIT 3 and 4 [ROU 13]. In addition to these actions, bi-monthly meetings in the form of a technical committee, tasked with an important mission of monitoring, were held up until spring 2012, when the last meeting took place[22]. A final meeting of a subgroup of the technical committee for the national "Marchandises en Ville" program (aimed at establishing a scientific committee) was held in 2013[23] with the objective of re-launching the program, and a further meeting was held in late November 2016, by a new scientific committee. Nevertheless, little information has been released and no official announcement has been made.

In the meantime, the main French cities (Bordeaux, Lille, Lyon, Marseille and Paris, among others) have managed to continue without the need for or support of the program and seem to be autonomous in their approaches and developments. Moreover, during the reorganization of the program, many urban logistic skills began to appear within public authorities, particularly

21 The program was active from 1993 to 2013 [GON 16], with the last meetings taking place in 2012. Although a DRI boost was launched towards the end of 2016, communication about this new program, which appears under construction, is poor. Moreover, due to the multiplicity of stakeholders currently working in urban logistics, both in research and practice, in both the public and private sector, it seems difficult to re-center everything around the program without creating biases or imbalances, particularly after almost 4 years of absence, and uncertainty about its real continuity and international positioning, all the while its ability to mobilize funding in the current period of severe budgetary constraints persists. This view is, of course, personal and is not presented as a truth, but as an anxiety, that eagerly awaits more information on the future of this program.

22 The author participated in meetings as part of the Technical Committee for the national "Marchandises en Ville" program from 2009 to 2012.

23 The author participated in the meeting, which had fewer than 10 participants.

those located in large and medium-sized cities (with a network of city planning freight referrals (or commodity advisers), launched by Diana Diziain in 2014, who was at the time a commodity adviser in the Greater Lyon area, which currently includes some 20 referents, including those from the above-mentioned cities and also including those coming from smaller cities such as Grenoble and Saint-Etienne). CEREMA (an entity created in 2014 to bring together several departments of the Ministry of Sustainable Development around mobility and spatial planning) also has several functions related to urban logistics, both in terms of their territorial technical centers (former CETE) and as part of their central services (former CERTU and SETRA), which have proposed several technical documents on the issue. The DGITM and the DRI also have, among other things, functions related to freight transport that deal with urban logistics. For example, the unification criteria for the establishment of charters or the collection of data. Nevertheless, the various attempts at unification are only concerned with those within the French territory and take little account of international actions and standards. Nevertheless, that institutional importance has given rise to an obligation to include freight flows in urban transport plans [CER 98], a definition of the various urban logistics spaces[24] [BOU 14], the FRETURB software (a detailed description of the model in its global vision can be read in [GON 14f]) and to numerous methodological documents and technical guides on the topic (generally published by CERTU and then CEREMA[25]).

To this can be added the numerous pilots, trials and actions, notably the Paris Charter for Sustainable Urban Logistics, which as of 2013 has served as a guide for the coordination of the various urban logistics actions occurring in the capital city; the concerted actions being made in Greater Lyon, various pilots like the *Vert Chez Vous*, *Distripolis* and *Tram Fret* projects; as well as urban freight train operational systems such as that of Samada-Monoprix [DEL 12], the inland *Franprix* waterway delivery [LEN 14, GON 14g]; or the UCCs of La Rochelle or

24 Nevertheless, attempts at alternative definitions and misuse of the ULS (Urban Logistics Space), which is often confused with LDP (Local Delivery Point), have recently been observed.

25 See: www.territoires-ville.cerema.fr/transports-de-marchandises-en-ville-r207.html.

Lyon [TRE 12, GON 13f], the latter having been stopped at the end of 2016[26] due to incidents and difficulties in achieving economic profitability despite having a good initial capacity to capture part of the demand [GON 13f].

1.3.2. *Italy*

Unlike France, Italy did not have a ministry-linked national body to promote urban logistics. Nevertheless, it is one of the countries with the most active urban consolidation centers, along with the United Kingdom [GON 13d, GON 14b]. This can be linked to the role played by the City Logistics Italia association which operated between 2004 and 2009 and promoted urban logistics practices, especially among private stakeholders[27] [GON 08]. Moreover, the strong autonomy of the Italian regions meant that it was never the state which regulated and stimulated urban logistics [MAG 07, SPI 08]. Nevertheless, urban logistic actions were spread unevenly across the regions. Two regions were the first to promote and regulate good practices in urban logistics: Emilia-Romagna (notably in collaboration with the municipal urban logistics plan of Bologna, and the UCCs of Modena and Parma, a van-sharing system in Reggio Emilia, as well as regional regulations, the setting up of a system for financing municipalities to carry out urban logistic actions[28], and the development of urban logistics as a priority theme for the regional Institute of Transport and Logistics) and Veneto (notably the UCCs of Padua, Vicenza and Venice, in addition to regional regulations). Three other regions followed: Piedmont (with the rise of Turin, mainly in recent years), Lombardy (with the UCCs of Como and Milan and several regulatory actions and delivery support in Bergamo and Milan) and Tuscany (notably with the UCC of Lucca). Other experiments, such as the Genoa UCC and ticket system that

26 Remarks made by several people from the company's direction in various technical meetings conducted in December 2016 and January 2017.

27 The author participated in several meetings and exchanges with key players of the association between 2005 and 2007, during the realization of his doctoral thesis. The association, created in 2004, played an active role in promoting good urban logistics practices in Italy until 2009, the last time it carried out official activities.

28 That region has proposed its first "air quality program agreement" for different zones, and for each of them, specific funds have been set up to finance urban logistics projects on cities of more than 50,000 inhabitants.

aimed to limit the movement of heavy goods vehicles (both terminated), the Naples freight train (also terminated) or the Frosinone UCC, also took place. Furthermore, Italy has also relied heavily on European projects, Turin, Rome and Emilia-Romagna being the most active territories in that regard.

City logistics Italia, at its second congress held in Rome in 2006, also determined that separate measures do not constitute a sustainable and competitive urban logistics system, stressing that certain measures already adopted by Italian cities are only provisional and will not lead to long-term planning without the integration of other measures. Those measures can be organized into four groups [GON 08]:

– regulatory policies, which can be restrictive or incentivized;

– information and communication tools;

– contributions in infrastructure, technology or civil engineering;

– partnerships between public and private enterprises.

The association also organized, twice, a trade show dedicated to urban logistics. Unfortunately, this was discontinued due to a lack of funding. Following on this, the institute of transport and logistics (Emilia-Romagna region) carried out numerous actions for the unification and valorization of urban logistics planning. These included a wave of surveys on freight transport into the city [ROS 05], as well as a model for the diagnosis of this transport, called City Goods [GEN 13], in the image of the French surveys and inspired by the FRETURB software; City Goods proved to be both popular and useful in Italy. In 2012, collaboration between PTV and the creators of City Goods was initiated to investigate the possibilities for internationalizing the model and integrating it into the VISUM[29] software. The Piedmont region, the municipality of Turin and the agency for the mobility of the Turin metropolitan, also played an important role in Italian urban logistics. Surveys were carried out in Turin (in 1995) and Cuneo (in 1997) to quantify the movement of goods and parking practices in urban businesses[30], mainly in the city center, and a large local project

29 Remarks by Guido Gentile in a telephone conversation conducted in May 2013.

30 The author had access to the 1995 Cuneo surveys, as well as two Politecnico Turin studies on the Cuneo and Turin surveys, which were not referenced at the request of the university, during his doctorate; however, later on, when he wished to use this data in his thesis, no official documents could be found online.

(URBELOG[31]) took place between 2013 and 2016 to identify the main technologies needed to assist logistical operations in areas with limited traffic (Areas Limited to Traffic or ALT).

Moreover, those ALTs, areas wherein access is regulated by different permits depending on the type of transport (people and/or goods) and the characteristics of the vehicle or trade with which it was concerned, constitute one of the main contributions by Italy to the field of urban logistics. The ALT's concern stems from the nature of Italian legislation as well as its culture. As exceptions to the rule are common and widespread, real life application resulted in waivers of access restrictions being commonplace with freight operators often more inclined to pay fines than to comply with restrictions. Nevertheless, electronic access control (badges and cameras) and a hardened policy of these controls and fines (for example, in Turin, which implemented an incremental fine system to penalize repeat offenders, such as the case of Vicenza and Florence, which were the subject of a lawsuit brought about by the association of key stakeholders in express transport in Italy as a result of a desire by public stakeholders to adopt derogations and the principle of the polluter pays system) show that the issue of urban logistics is being taken more and more seriously. The other important contribution (as already stated) is that of urban consolidation centers, with about 20 experiments and projects having taken place since 2003 with about two-thirds of those systems still in operation [GON 14b].

At the national level, the Italian Ministry of Transport has included urban logistics in their 2011–2020 national logistics plan [MIN 10] and proposed an agreement between the Ministry of Transport and the urban communities of Turin, Milan and Naples on the planning and management of urban logistics [MIN 12]. Urban logistics is also present as a joint decree of the ministry with the university system, and research on the dissemination of Intelligent Transportation Systems (ITS) and their application to the transport of people and goods [MIN 13].

1.3.3. *Southern Europe (Spain, Greece, Portugal and other countries of Mediterranean Europe)*

Cities in Southern Europe (excluding France and Italy) are often viewed as "imitating" cities or users; in other words, cities which have applied and

31 Electric Urban Logistics: icelab.polito.it/ricerca/progetti/nazionali/urbelog.

adapted urban logistics solutions that have already been experienced by other cities. Indeed, the body of work dedicated to good practices pays little attention to Portuguese, Greek, Spanish and Mediterranean cities outside of France and Italy: for example, in the set of good practices identified in the SUGAR project [DAB 11b], only three out of 44 actions are taken from cities in these countries, all three of which were Spanish (night deliveries and vehicle reception points are practices which are already recommended in the Netherlands and in France). Nevertheless, these countries have made significant contributions to the existing *status quo* of urban logistics in practice. These contributions can be grouped into two categories.

The first is the fact that practices already in existence in other countries have been adapted to the local context and have therefore actively contributed to their perpetuation and transfer (the transferability of urban logistics actions is a sensitive topic, and the applicability of these actions onto other contexts seems to us an important contribution). Here, we find the UCC of Malaga, inspired by those of La Rochelle, and which were profitable for several years, until the Spanish economic crisis (which precipitated their closure). We can also mention the case of San Sebastian (started in 2013), night deliveries in Barcelona, the deployment of urban logistics spaces of different natures (taken from the French model, Boudouin, [BOU 06]) and transposed onto the main Spanish cities such as Barcelona and Seville, in addition to the increase in electric scooters, also in Spain, as well as the proposed Greek transport plans that included goods and which were inspired by the French UCCs [ROS 05].

The second are the innovations originating in these countries. Three systems seem particularly interesting to us: the variable use of taxiways in Barcelona, the intelligent area delivery systems in Bilbao and the logistics pooling system in Evora (Portugal). In 1997, the city of Barcelona carried out one of the first urban freight transport surveys in Europe [PRO 97]. In the early 2000s, the city set up two ring roads within the city (Balmes and Muntaner streets), installed signs with interchangeable messages to indicate a differentiated use of lanes of these roads according to the time of day: in the evening, the lanes on the right are dedicated to residential parking; in peak hours, they are used as bus corridors; for a given period in the morning, they are used as loading and unloading areas; and for the rest of the time, they operate as a taxiway. This system, well established and functional as of 2001 (several new streets and intersections were adopted this year, according to

[GAR 01]), was only publicized in Europe after being included in the best practices guide that was compiled by the SUGAR project [DAB 11]. Lyon, for example, began adopting this system in 2015 [CHI 16].

Intelligent systems for the reservation of delivery areas have been experimented with by the FREILOT project [BLA 10] in two cities (Lyon and Bilbao), while in Lyon (which was developing at the same time a delivery area reservation system under the ALF project, [DAV 14]), the experimentation was not conclusive, and in Bilbao, it aroused a strong interest among private stakeholders, despite the skepticism of public stakeholders[32]. In the end, following an evaluation that showed an interest in the deployment of systems that freed up space for the loading and unloading of goods [PLU 12], public authorities used the Euskadi ML Cluster to initiate a consultation phase to evolve the system, by replacing the reservation system with a sensor-based information system that covered a wider range of delivery areas and indicated their immediate availability. This delivery area communication system was still communicated with the municipal police in order to ease and improve illegal parking controls [LEK 14]. Finally, the city of Evora in Portugal hosted the ECOLOGUS project, which was developed on the initiative of an association of transporters (ANTRAM) in response to a change in the regulation of access to the city center. The objective was to develop a collaborative UCC (i.e. on the basis of cooperation, not the imposition or promotion by public stakeholders) with biodiesel powered vehicles. The organization of the transport and delivery system in the city center was organized by ANTRAM with the support and endorsement of the transporters [GON 13f]. The experience, which started in the 2000s, seems to be inactive today (little information is available), but it has nonetheless inspired, directly or indirectly, other initiatives. For example, the City Logistics system in Lyon started out from a similar organization, although it is important to note that the two business models are completely different (Evora was associative, while City Logistics was founded as a company).

32 The author was in charge of the evaluation of these systems for the FREILOT project and had discussions with the public authorities of Bilbao which asked for a rapid evaluation in order to close the experiment, while the transport carriers wished for it to continue. The final evaluation showed that there was an interest in deploying it, not in terms of direct pollution it averted, but in terms of the time it saved for companies [GON 13c, GON 14j], leading the different stakeholders to have a dialogue in order to find a solution that was relevant and acceptable to all.

1.3.4. *Germany*

Germany was one of the first countries to develop urban logistical solutions. In many cases, these came about in the early 1990s [COS 99]. The notion of urban logistics, as popularized by Taniguchi *et al*. [TAN 01], has its origins, among others, in the German *citylogistiek* [KOH 97]. Most of the cities concerned were small or medium-sized (less than 1,000,000 inhabitants), although we can find an operational urban logistics infrastructure in Berlin (the Potsdamer Platz). What characterized the German urban logistics of the 1990s was the weak (sometimes non-existent) intervention of public authorities [COS 98, GON 08]. Most of the German experiments in the 1990s proposed UCCs, promoted and piloted by private stakeholders, as examples (little known in France) of logistic pooling (in the strictest sense of the term, i.e. the sharing and pooling of logistical resources; Gonzalez-Feliu and Morana, [GON 10c]). More than 15 UCCs were created during that period [BRO 05, GON 13f], but all have since been stopped apart from the Potsdamer Platz, which has evolved and become a shared infrastructure, although no longer a UCC, and the Dresden CarGo Tram, which originated from a private initiative (to connect a Volkswagen factory in the heart of the city with the periphery). According to Gonzalez-Feliu [GON 08], the commonalities for these German projects are:

– the need to coordinate and optimize the vehicle load. The average load of vehicles used in these UCCs was approximately 70 to 80%;

– a high degree of privatization and voluntary collaboration between private enterprises;

– the use of light vehicles in urban areas, the reduction in the total number of vehicles (on average 55%) and transport costs (20–30%).

However, as these initiatives are linked to economic performance, most of the German UCCs have been stopped. Only the underground infrastructure of the Potsdamer Platz in Berlin still seems to be active today. Public stakeholders focused on other aspects, such as urban transport plans, including trade flows and the support of Chamber of Commerce on transport development. The German experience cannot, however, be considered a failure, given that those private UCCs worked and were economically viable (at least for the greater part) for several years. As they were mainly private operations with little intervention by public authorities, and they were the result of real collaboration and consultation between transport and logistics

stakeholders as well as traders, the decision to terminate each UCC was motivated by the identification and adoption of more relevant or efficient urban distribution strategies for these stakeholders.

Other innovative urban logistics solutions originated in Germany. The most emblematic are the delivery instructions to the final consumer; in particular, those promoted by DHL, which allowed recipients to withdraw their orders without a time constraint and at the same time facilitate the last kilometer transport. Another emblematic example is the Dresden CarGo Tram, which was created in 2000 to meet a need for a Volkswagen plant in the heart of the city [ARV 13]. This system was initially planned for the internal needs of the car manufacturer but was opened up to other flows in the late 2000s. Recently, it was tested, using the same equipment, to serve a shopping center with more than 100 shops [ARV 13, ARV 16].

Although there has been little intervention at the national level, Germany is the only country with systematic standard surveys (i.e. conducted in several cities at regular intervals): the KiD (Kraftfahrzeugverkehr in Deutschland) surveys or transport vehicles in Germany; possibly, the databases of the federal motor transport agency (Kraftfahrbundesamt or KBA) can be used to supplement them [LEN 13]. Nevertheless, these surveys and databases are linked to commercial transport, i.e. to transport carried out in the context of professional activities. Those data sources include freight carried by professionals (whether on their own account or by others), but not the movements of individuals mobilizing goods. They remain one of the most comprehensive and up-to-date knowledge bases in the world.

At the level of public action, the Berlin Senate was one of the most active players. Their first action in the 1980s, to quantify and model commercial transport flows, gave rise to the Wiver model [SON 85]. This model is now part of the VISUM software (for modeling urban transport) of the company PTV, making it the first module for commercial transport. Another model, combining both personal and commercial transport, is VENUS [JAN 05], which is today still widely used in Germany [GON 12b]. The Berlin Senate has also contributed to the development and regulation of air protection zones (the German equivalent of the Italian ZTLs) as well as regulations seeking to organize and regulate freight transport in the German capital [HES 04, MEN 13].

1.3.5. *Belgium and the Netherlands*

Belgium is a country that does not feature prominently in the "good practices" of European urban logistics; however, that does not mean that it was last to come to the table. On the contrary, the country was one of the first in Europe to define short-haul goods transport (generally speaking, transport whose range of action does not exceed 10 kilometers of the urban center, Ambrosini, [AMB 89]), governed by specific regulation that required drivers to carry a legally recognized category permit. Although these categories were mainly linked to ports (such as Antwerp), in practice they also included a group of carriers operating in urban areas [AMB 89]. In addition, Belgium is one of the first countries to launch surveys and quantitative works on e-commerce flows [GEV 11, BEC 16, CAR 16].

The Netherlands has always been regarded in urban logistics as an intermediate country in terms of public intervention by authorities. Indeed, while Germany (and to some extent the United Kingdom and Northern Europe) are often in urban logistics seen as less interventionist countries, and France (and Italy to some extent) as countries where the regulatory role and power to ban communities is seen as strong, the Netherlands is often seen as a country where private action is strong and public intervention remains moderate, but not negligible. Although there have traditionally been no national regulations in this domain [QUA 08, VAN 12], several Dutch cities have been heavily involved with the application of urban logistics. We find examples of UCCs in Amsterdam, Utrecht, Leyde and Nijmegen, among others [SCH 02, ROS 05, GON 08, QUA 11]. The first three have since been terminated, while the latter is still currently operational [VAN 10]. The Netherlands was the first to promote and disseminate to several cities the permit (sticker) systems linked to regulations controlling access to the city center according to the pollution level of the vehicle in question [GON 08]. It was also in the Netherlands that the PIEK program (noise emission standard for night deliveries) was tested and disseminated [SCH 05].

Another field in which the Netherlands is a leader is that of intermodality. In addition to the experience of the Amsterdam cargo tram (started in March 2007 and stopped in November 2008, [ARV 13]) and the delivery of beverages via barges [VAN 14, VAN 13], we can observe the electric road train, electrically assisted bicycles and/or bicycle delivery systems [SCH 15].

1.3.6. *The United Kingdom*

The United Kingdom has two distinct characteristics: given that the country is an archipelago (hence the important role of ports for freight transport; Ducruet, [DUC 09]), the transport sector was one of the first to undergo a strong liberalization [WEB 98]. The second characteristic influences the fact that the United Kingdom is one of the countries where there is the least public intervention (specifically, restrictive regulations). The flagship example is London, with its urban toll system, which operates on the "polluter pays" principle, and applies to both the transport of people and goods [PRU 05].

The United Kingdom is also one of the countries with the most UCCs in operation [GON 13f, ALL 14b], most of which are linked to airports and/or factories [BRO 05], or to shopping centers, which assume, through their commercial tenants, any additional costs of the system. Bristol [GRA 16] is one of the better known examples of this.

1.3.7. *Northern Europe (Sweden, Norway, Finland and Denmark)*

Northern European countries have been investing in urban logistics since the end of the 1990s [ROS 05], particularly in incentivized and regulatory actions without a strong interventionism by public stakeholders [GON 08]. In other words, few UCCs or "public service" systems have been developed in these countries, but have taken actions aimed at improving the operations of transport and logistics companies [COS 98, ROS 05]. Indeed, most of the urban logistic actions in northern-European countries follow the logic of improving the performance of private stakeholders, rather than the logic advocating taxation under a goal of collective utility. In these countries, we come across studies to improve the logistics of the catering sector [BOS 13], logistics pooling projects in terms of an economically driven collaboration among private stakeholders [COS 98], and surveys [SÁN 16] on the basis of those used in the main studies on unified demand generation models in the United States [HOL 11].

1.3.8. *North America*

In the United States of America, urban logistics is a promising subject: the early work in this field dates from the 1970s [DEM 74, WAT 75] and the flagship institution in transport research and studies, the Transportation Research Board of National Academies (or TRB), has established a committee dedicated to urban freight transport. Nevertheless, the challenges and objectives of urban logistics within cities of the United States (and Canada) vary significantly[33]: the common challenges related to freight transport within inner cities and the shortage of parking bays for deliveries, have not been a priority for most cities (San Francisco and New York being the exception, due to their high population densities and similarities to European cities); however, the main problems and nuisances are linked to congestion in the major arteries that provide access to cities and their impact on delivery performance [WAN 16]. In this regard, a large part of the actions concern road infrastructures and their improvement, in order to smooth traffic congestion as well as to understand and control the slackening of logistics [DAB 12, DAB 14, ROD 17]. The research and applied practices of the United States can be credited with the generalization and standardization of night delivery experiments [HOL 14][34] for non-assisted reception systems, as well as two methodologies of data collection and modeling, which are complementary: the categorical generation methodology of Holguin-Veras *et al*. [HOL 11, HOL 13] and the MIT km² methodology[35] [MER 15].

In Canada, a number of urban freight surveys have been conducted, mostly in Toronto: a first wave focused on establishments to model freight generation and urban route estimates [HUN 06, HUN 07]; a second study focused on the use of GPS devices to collect transport data by comparing them to conventional transport surveys [MCC 08, SHA 11]. In addition, the province of Quebec has carried out studies on truck traffic [PAT 01]. Recently, the city of Montreal carried out a study on urban deliveries by adapting the STAN and EMME3 models to the Montréal metropolis [SIM 17]. Another important contribution is the depository system for glass

33 These differences were presented at the fifth conference on urban freight transport, I-NUF, held in Long Beach, California, in 2013.

34 Although already experienced by the Netherlands, night deliveries struggled to spread around the world. The New York experience, wherein they introduced unattended delivery systems to bypass the need to deploy night staff, has been successful not only locally but globally. Indeed, the New York Protocol has been tested successfully in several cities across the United States, as well as in South America, and more recently in Europe.

35 See: http://lastmile.mit.edu/km2.

and aluminum can collection in the province of Quebec and the reverse logistics system for recycling and reuse which results.

Mexico, a country that began to take an interest in urban logistics (late 1990s) a little later than their northern neighbors, however remains very active in this field. In 2006, the city of Mexico carried out a comprehensive study on freight transport in the metropolitan area, which included an analysis of carriers, origin–destination matrices and a supply-and-demand analysis, among others [LOZ 06]. Mexico has also given attention to urban logistics zoning [LOZ 08], with examples of practical application throughout the country, as well as informal transport [CED 16].

1.3.9. *Asia-Pacific Region*

Since the 1990s, the countries of Eastern Asia and the Pacific Islands have distinguished themselves through their involvement with urban logistics. In fact, the first two international logistics conferences were held in Australia and Japan [TAN 99, TAN 01]. In 2005, the Eastern Asia Society for Transportation Studies (which includes Chinese, Japanese, Korean, Australian and New Zealand researchers and practitioners) set up a research and exchange group on regional and urban logistics[36]. China, in its period of full development, was very concerned with the development of urban logistics zones within major metropolises, while issues of congestion and pollution began to emerge in the late 2000s [MA 14]. Regulations and legislation, mainly related to vehicle access, have since been developed and are now active. In addition, nine pilot cities have played host to several urban logistics experiments (China Ministry of Commerce, 2012), and three of them now have a logistical authority, an authoritative body that is also present in four other Chinese cities (Ma, 2014).

Japan is irrefutably one of the pioneers in urban logistics [TAN 01, SPI 08]. In addition to the research contributions it has already made (notably the work of Professor Eiichi Taniguchi and his team, among others), we observe many practices specific to the Japanese territory. We will highlight here the beginnings of urban logistics systems in Tenjin in 1978 [TAN 14], the logistics of multi-function proximity supermarkets [DAB 09, CAP 12], urban logistics hotels [BOS 09] or the two emblematic

36 See: www.easts.info/activities/irg/list.html.

UCCs: Motomachi, Yokohama and Soramachi, all taking place within the metropolis of Tokyo [TAN 14].

Australia is one of the other countries in the region that has been heavily involved with urban logistics. However, the congestion and pollution problem characteristic of Chinese metropolises or Japanese cities are not relevant in this country, which has smaller, less densely populated cities that span large tracts of land. Nevertheless, challenges with road infrastructure and compliance with delivery schedules are apparent, similar to cities within the United States. We can highlight a set of data collection studies, mainly done through GPS, to identify and characterize delivery routes [GRE 08].

1.3.10. *South America*

South America is often seen as a "transfer" region for actions and solutions already developed in other regions. We observe here the deployment of night delivery systems and data collection protocols in Brazil, Colombia and Ecuador [DEO 14, HOL 16], urban distribution systems in Chile [TUR 11] as well as considerations for decision support systems [PAR 17], among others. Nevertheless, those countries also have sound and interesting practices. Despite the high rate of informal transport observed, these countries have developed services via the non-motorized delivery to the last meter (although this work remains precarious), with relay systems and chains of carriage delivery with a high degree of organization and coordination[37]. We also observe highly specialized urban logistics zones, linked to a strong presence of industries (mainly textiles and food) in dense areas of South American metropolises, which have resulted in advanced systems of logistical collaboration and logistic urban zones not on the outskirts, but in the heart of the city. That context (high informality, urban industry, etc.) allows for the development of trades or actions specific to Latin America, such as the delivery system to the last meter in the streets of Lima, which are closed to motorized traffic [TUR 11], and the shared use of public transport by people and goods simultaneously [AMA 12], the dispersal of small, non-franchised and independent multi-functional businesses [CED 16] or multi-stage systems for wholesale markets [PAL 17], among others.

37 These systems were observed in the cities of Bogotá (Colombia) and Lima (Peru), during two visits in March and May 2016, respectively.

1.3.11. *Other regions of the world*

– Central and Eastern Europe. Central and Eastern Europe is still in the very early stage of deployment. It appropriates and adapts existing actions which have already proved their worth in other European countries [DAB 11].

– Africa and the Middle East. For the time being, African and Middle Eastern countries have had little presence in the scientific and technical literature concerning urban logistics. Nevertheless, urban logistic practices do exist, although these are difficult to identify in the international community. For example, two-wheeled motorized transport is characteristic of logistics in sub-Saharan countries [AKI 16], while countries along the Mediterranean basin are beginning to draw heavily on European experiences (Moroccan Logistics Development Agency, 2014).

– Southeast Asia. The cities of Southeast Asia also remain little studied, but the various challenges regarding the freight transport within cities seem important given the large size of the principle cities in the region. A good example is that of the Indian "*dabbawala*" [PAT 06, BAI 13], C2C (consumer to consumer) food deliverers, who, for more than a century, have constituted a sustainable delivery system (it supports the economy of many families, is non-motorized and at the same time contributes to the social integration of the populations concerned). Several authors have taken an interest in this system, and a Harvard case study has been developed and used when teaching to demonstrate the different contexts worldwide [THO 10].

This non-exhaustive overview shows the heterogeneity and diversity of both research and studies of the institutional, commercial, logistical and practical actions occurring worldwide, and also indicates the dominant set of actions and the quest for unification which has been difficult to realize in theory, but which is nonetheless realized in practice. For example, despite efforts to formalize actions related to overnight deliveries in France (i.e. in a white paper), US experiments have given rise to a methodology that is followed by several countries in South America and Europe. The actions on parking are recurrent, as are those regulating access to cities and urban logistics spaces, and although the unification of regulations and implementation procedures is not yet a reality, we can observe that practices

remain very similar. Finally, the UCC, the main battleground of urban logistics, has an unequal fate in the world: while in France, that type of structure has difficulty in being perpetuated, in Italy, similar structures remain operational, while in Japan, the United Kingdom, the Netherlands and Chile, those structures have adopted a different organizational model and are now a reality.

1.4. Key questions in the quantitative and qualitative identification of urban logistics

As mentioned earlier, one of the main challenges in urban logistics (possibly the most complex one) is to create knowledge of the current practices so as to be able to define benchmarks for measuring the impact of new actions or proposals. In this regard, a multitude of scientific works have been developed over a period of more than 40 years. Nevertheless, these approaches are not unified, although in the case of data production, several efforts have been made to impose order. Knowledge of how that happens is important for the quantification of freight transport within cities; however, it is equally important that we use the extensive qualitative data to understand why.

In urban logistics, to identify and characterize sustainable practices and solutions, four categories of methods can be deployed:

– measures or observations;

– surveys and interviews;

– analyses of the sources and existing databases;

– reproducibility by substituting the data, model and/or simulation.

Observations and measurements result from the transcription of reality, either through human observation or through the capture and measurement by devices (usually automated procedures). Although these are met using different objectives, resources, procedures and treatments, they nonetheless respond to the same principle: under a given, predefined framework, the phenomena is measured or captured, then reported and recorded for further processing. In statistical terms, two main sources of error need to be

considered. The first is the measurement error of the device or operator (for example, a reading error on the part of a person; an oversight or a miscount; or errors relating to the sensitivity of sensors or the malfunction of measuring mechanisms). The second is related to possible errors when transcribing or manipulating the results (whether by manual transcription or during the computerized transmission of the data, for example GPS data).

The main methods and techniques for collecting data in this category are:

– manual vehicle counts;

– automated vehicle counts;

– field observations (actual parking practices, mainly for delivery);

– observations of actual practices of conduct and delivery docks (that in general take place without any interaction with the driver);

– collection of the GPS data of truck routes and truck stops.

Surveys, on the contrary, are administered on the basis of a questionnaire and generally collect quantitative, categorical and/or qualitative information. According to Allen *et al*. [ALL 12a, ALL 14a] and Gonzalez-Feliu *et al*. [GON 13b], several types of surveys can be deployed to describe urban logistics. These surveys can be general (i.e. aimed at different types of stakeholders and activities, including the practices taking place in different phases of urban logistics) or specific (i.e. targeting a single group of stakeholders, spaces or phases). On the whole, general surveys combine several specific surveys, which are deployed in parallel, which have been coordinated upstream and which are integrated later on downstream.

The main specific surveys are:

– establishment surveys, which identify the different delivery practices, but from the point of view of the institutions;

– transport carrier surveys, which examine practices from the point of view of the transport carrier(s);

– driver surveys, which track delivery drivers, either through a logbook, filled in by another entity or self-administered, or else in the form a survey at the end of the excursion, either by an on-board survey or a situation where the investigator interacts with the driver;

– foot-to-highway surveys, which combine first-hand observations with a survey of the stakeholders encountered during these observations;

– individual surveys (consumers, households) and surveys of logistical service providers;

– surveys on technical functions, support and operational profiles of the communities.

With regard to general surveys, we find:

– surveys on goods transport within cities, based on a survey established and compared with surveys by carriers and shippers [AMB 10];

– surveys on the flows of goods, also called shipping surveys [GUI 09, HOL 09];

– surveys on German or Canadian commercial transport [HUN 06].

Other methods and techniques relate to the analysis of sources and data, mostly documents containing information such as transport plans and also (in some cases) fuel or electric consumption. In general, this type of data requires prior processing and interpretation if it is to be used in the description of urban logistics. They are often combined with other methods to supplement data gaps, to provide details on issues that have received little attention, or in the event where surveys have been poorly answered.

When facing data gaps (whether due to the non-response or simply the absence of relevant databases), data reconstruction can be a viable alternative. It can be done either through statistical procedures (based on averages or probabilities) or by using methods for data estimation through modeling or simulation.

As far as qualitative studies are concerned, we can observe a multitude of works in urban logistics that attempt to qualify different actions and experiences. Three main approaches are proposed:

– case studies;

– comparative analyses;

– guides for good practices.

Research case studies are very popular in urban logistics. They can be of two types: inductive or descriptive. Through the description of a concrete example, inductive case studies [EIS 89] aim to induce theories, mostly with management or urban planning as the end goal. Descriptive case studies (of the Harvard School variety) are synthetic examples of how to illustrate existing theories, and provide a field-based source to input knowledge on a variety of topics, mainly management sciences, based on a standardized method that allows for a certain degree of comparability.

Comparative analyses aim to create knowledge through the comparison of two or more case studies, mostly on a purely qualitative and descriptive basis. However, some works support a comparison of quantified facts that help to emphasize the qualitative aspect [BRO 05, ALL 12b, ALL 14b, LEO 12, GON 13c, GON 14b].

The "good practices" guides (unlike comparative analyses), do not make comparisons, but are intended to show descriptive examples of actions or experiments that are considered exemplary with a view to promoting and reproducing them elsewhere. Nevertheless, most of these guides remain very descriptive (sometimes bordering on advertising) and cite few examples of analyses as to the transferability and applicability of these practices onto other contexts [DAB 11, TUR 11].

From this brief and non-exhaustive overview of the academic literature, we can conclude that the quantification and qualification of sustainable urban logistics does not follow a standard or unified logic, and more often than not, the marked absence of unification makes it difficult to compare the case studies presented by different authors. Moreover, most of the work is limited to presenting good practices in urban logistics, without necessarily proposing an evaluation that allows for them to be compared with others, or even to serve as a basis for consequent experiments. Furthermore, comparative studies and those focused on the transferability and applicability of these practices remain few in number.

It is therefore imperative to tidy up this vast body of work and, from this position of improved organization, propose a case study structure that is more systematized and unified. A common knowledge base can then be created that is able to relate and compare a new experiences with those that have already been applied in practice. To this end, it is important to define both unified and transferable frameworks for the understanding, analysis and

planning of urban logistics. The main aim of this book is thus: to propose an approach for sustainable urban logistics, albeit non-exhaustive, but as open and as objective as possible, outlining the various methods that can be used for its planning, estimation and analysis. As we will see throughout this book, despite the fact that few standards in urban logistics are officially recognized, the dominant practices and actions suggest a *de facto* unification and standardization of several methods and techniques. Over the course of the following chapters, it is to these approaches in particular that attention will be given.