CO4HUB

CO4HUB working paper – May 2026

A theory-driven typology of urban logistics hubs

Conceptualising the variation across European pilots through city logistics, sociotechnical transitions, ecosystem design, and the urban commons

Driving Urban Transitions

Co-funded by the European Union

About this working paper

This document is a working paper, not a finished output. It is a first draft of a typology that the project team will continue to test, refine, and revise across the remaining project period. The theoretical framing, the dimensions of the typology, the labels of the five types, and the empirical material used to populate them are all open to revision.

Two audiences might find this draft useful. The first is the project consortium and its extended stakeholder group, with whom the pilot evidence will be used to stress-test whether the typology distinguishes hub forms in a way that supports comparison and learning across sites. The second is the wider research and practitioner community working on urban freight, sociotechnical transitions, ecosystem design, and urban commons. Comments on the dimensions, on the boundaries between types, on missing or misclassified pilots, and on alternative theoretical anchors are particularly welcome.

A revised version will follow once the typology has been triangulated against the project's own pilots and against external feedback.

Lead authors

Esko Hakanen & Joel Wolff, Aalto University

Suggested citation: CO4HUB Project. (2026). A theory-driven typology of urban logistics hubs: Synthesising pilot evidence and conceptual foundations from city logistics, sociotechnical transitions, ecosystem strategy, and commons governance (CO4HUB Working Paper). Driving Urban Transitions Partnership.

Abstract

Urban logistics hubs (ULHs) are proliferating in policy discourse and pilot practice, yet research on them remains fragmented. This working paper is an attempt to consolidate the past theoretical accounts on ULHs across five largely separate theoretical traditions. First, literature on city logistics has had a long-standing focus on urban consolidation centres. Second, sociotechnical transitions, helps to position individual experiments within a wider regime and broader societal impact. Third, business model and ecosystem scholarship investigate how value is created and shared across interdependent but interlinked actors. Fourth, commons and co-production research provides a lens to evaluate the logistics infrastructure as a collective resource subject to polycentric governance. Last, literature on spatial planning combines co-production with node-place models to review the potential in extending existing infrastructure or facilities. Each tradition produces its own vocabulary and its own ideal types with implications relevant for the ULHs. Yet, none of the academic discourses alone captures the variation seen in contemporary pilots. To address this limitation, this working paper proposes a five-type typology organised by two dimensions: the coordination logic of the hub, and its functional-spatial integration in the city. Each type is anchored in a clear theoretical lineage and illustrated with documented European pilots. The paper closes with the limitations of the typology and the empirical work needed to refine it.

Keywords: urban logistics; urban consolidation centre; micro-hub; sociotechnical transitions; ecosystem; urban commons; co-production; typology; CO4HUB.

Contents

1. Introduction

The urban logistics hub (ULH) has become a recurring fixture in European policy strategies, research agendas, and pilot programmes. From peri-urban consolidation centres of several thousand square metres to cargo-bike depots tucked under railway arches, the term covers a striking range of arrangements. It has been equally used to refer to algorithmic platforms that orchestrate cross-carrier handovers or civic spaces where neighbours collect parcels alongside their library books. That breadth is useful for policy framing but unhelpful for a critical, theoretical analysis. When the same concept is used to refer to cases ranging a 5,000 square metre distribution centre on the urban edge and a 20-foot shipping container, the analytical work of comparison collapses into rhetorical equivalence.

Our project Cooperation for Hubs in Urban Logistics (CO4HUB) encounters this problem directly. We have planned for various pilots around ULHs, including battery swapping for electric delivery vehicles, joint consolidation of last-mile deliveries and waste, experimental micro-hubs, and customer-facing digital services. These are not minor variations of one underlying form. Instead, these pilots draw on different theoretical foundations, presuppose different governance arrangements, target different externalities, and depend on different conditions of success. Understanding these differences ensures that subsequent evaluations analyse comparable cases and policy recommendations help the city officials to understand which kind of an ULH would benefit their cause, on what terms, and with whom should they be pursued.

This working paper develops a typology of urban logistics hubs to support more careful comparison. It is generic, not project-specific. The five types proposed here are intended to apply to any documented urban logistics hub initiative, including but not limited to the planned CO4HUB's pilots. The aim is to give researchers, evaluators, and policy makers a shared vocabulary that respects the theoretical distinctions among hub families rather than flattening them.

Three commitments shape the construction of the typology. The first is that it should be theory-driven. Each type is anchored in a definable theoretical discourse from which its existence, internal logic, and likely contradictions can be derived. The five discourses recognised here are city logistics with its focus on urban consolidation centres (Allen, Browne, Woodburn, & Leonardi, 2012; Quak, 2008); sociotechnical transitions theory and its associated literature on strategic niche management (Geels, 2002, 2011; Schot & Geels, 2008); ecosystem and business model scholarship (Adner, 2017; Jacobides, Cennamo, & Gawer, 2018; Teece, 2010); commons, co-production, and polycentric governance research (Foster & Iaione, 2016; Hakanen, Eloranta, Shaw, & Töytäri, 2025; Ostrom, 2005); and co-production and node-place models in spatial planning (Allmendinger, 2009; Bertolini, 1999; Ostrom, 1996).

The second commitment is procedural. The construction follows the template laid out by Collier, LaPorte, and Seawright (2012). The typology has an explicit overarching concept, two analytical dimensions, a matrix, and cell types whose definitions follow consistently from their position on the dimensions. The intent is to avoid what Collier and colleagues call free-floating typologies whose categories cannot be derived from any explicit underlying property space.

The third commitment is epistemic. Sadre-Orafai (2020) warns that typologies in any field are always created from a particular perspective and with a specific purpose in mind, and that types, once named, tend to harden into apparent natural kinds. The categories proposed here are analytical conveniences. Many real hubs will straddle two or more types, and the dimensions themselves may need revision as evidence accumulates. The typology is a tool for thinking, not a final classification.

The remainder of the paper proceeds as follows. Section 2 explains what conceptual typologies are designed to do, draws the methodological scaffolding from Collier and from Sadre-Orafai, and states the criteria the typology is asked to meet. Section 3 reviews the five theoretical lenses that the typology is meant to honour, summarising what each contributes and what each occludes. Section 4 specifies the overarching concept, derives the two dimensions, and presents the matrix. Section 5 introduces the five types in detail, with each subsection naming the theoretical anchor, defining the type, describing its internal coordination logic, identifying its characteristic contradictions, and noting the sub-variants that current evidence supports. Section 6 places around twenty documented European pilots into the typology and discusses where the classification works cleanly and where it does not. Section 7 returns to the methodological questions: what the typology helps with, what it suppresses, and what further empirical work would refine it. Section 8 closes with implications for ongoing CO4HUB work and for adjacent pilot programmes.

A note on scope is in order. The paper concentrates on the operational and institutional architecture of hubs rather than on the choice of vehicle (cargo bike, electric van, fuel-cell truck), the choice of parcel format (B2C, B2B, returns), or the choice of governance instrument (zone, subsidy, procurement). These dimensions matter, and the typology can be intersected with them in subsequent work, but stacking them all into a single primary classification would produce a multidimensional cube that no reader can hold in mind.

The two dimensions chosen here, coordination logic and functional-spatial integration, are the ones that most consistently distinguish hub families across the five theoretical traditions reviewed in Section 3. Other dimensions, including temporality (permanent versus pop-up), funding structure, and digital intensity, are treated as descriptive secondary attributes within each type.

2. What typologies do, and what they do not do

A typology is an organised system of types (Collier et al., 2012). At its simplest form, a typology cross-tabulates two or more dimensions, treating the resulting cells as analytical categories that describe variation in a phenomenon. Ostrom's (2005) classification of goods based on their excludability and subtractability (i.e., private or public, club and common-pool resources) is a good example here.

2.1 Two distinctions that matter for what follows

The first distinction is between conceptual (descriptive) and explanatory typologies (Bennett & Elman, 2006; Elman, 2005). A conceptual typology maps out variation in a phenomenon; the cells describe what the cases are (Collier et al., 2012). An explanatory typology places independent variables on the dimensions and the explained outcome in the cells (Elman, 2005). The typology developed in this document is primarily conceptual. It describes variation in what urban logistics hubs are and does not, as such, attempt to predict which kind will succeed in which city.

The second distinction is between multidimensional and unidimensional typologies. A unidimensional typology arranges a phenomenon along a single ordered or unordered variable. A multidimensional typology cross-tabulates two or more. The typology proposed here is multidimensional and the five types are derived from the theoretical lenses rather than generated mechanically from the cells. The matrix therefore maps each type onto the two dimensions rather than producing the types by cross-tabulation.

2.2 Template used in this work

Collier and colleagues (2012) offer a template for rigorous typology construction that this paper follows. The typology developed in this document focuses on four aspects of these guidelines. First, name the overarching concept; it becomes the title of the typology. Second, identify the dimensions; they become the rows and columns. Third, specify the matrix; cross-tabulation pushes the analyst to think through the relations among the categories. Fourth, name the cell types and ensure that each one is, in Collier et al.'s (2012) terms, a kind of the overarching concept and that its meaning derives consistently from its position relative to the row and column variables.

The template is procedural, not substantive. It does not tell the analyst which dimensions to choose, only that they should be made explicit. The procedural discipline matters because most typologies in the urban logistics literature fail it. For instance, Meza-Peralta, Gonzalez-Feliu, Montoya-Torres, & Khodadad-Saryazdi (2020) reviewed more than two hundred publications on urban logistics spaces across three decades to find that the field still lacks shared definitions, that proposed classifications are mostly built from operational or spatial features without explicit dimensional grounding, and that the same term often picks out different categories across studies. Their work helps to anchor categories in supply-chain function, despite noting that, for instance, further work is needed to identify the context-specific managerial and behavioural characteristics, and their impact on decision making and the way economic, environmental and social criteria are measured and weighed against each other in each context (Meza-Peralta et al., 2020). In turn, the typology developed here is an attempt to include such dimensions.

2.3 Limitations to the developed typology

Typologies are abstract, closed classification systems that render complexities, nuances, and continuous features discrete and comparable for a theory-driven goal. Their analytical power comes from this reduction, but not without a cost (Sadre-Orafai, 2020). Once a typology circulates and becomes more commonly approved, its categories tend to be misrecognised as natural kinds rather than as constructions for a particular purpose. The boundary between a consolidation centre and a micro-hub can be misunderstood as a natural choice rather than an subjective, analytical decision. Pilots that do not fit the categorization can go unnoticed or be excluded rather than treated as evidence that the typology needs revision.

Two safeguards reduce that risk in this work. The first is to specify the purpose for which the typology is built, so that its claims are tied to the analytical task it was meant to perform. Our typology is intended to support comparison across hub pilots whose theoretical foundations differ. It is not built to allocate funding, regulate market entry, or score pilot success. The second safeguard is to keep the construction reversible. By openly publishing this first draft, we wish to attract discussion on the dimensions and their potential contradictions, point out the existence borderline cases, and treat the typology as a working hypothesis. Both safeguards are easier to write than to honour. The discussion in Section 7 returns to the limitations of our typology.

2.4 Evidence base

This typology draws on both peer-reviewed literature and grey literature on European pilots. Pilots are the primary empirical unit because they are where alternative hub forms are most legibly distinguished. Operational urban logistics in European cities mostly happens through carriers' established depots; novelty appears in pilot form, often funded under research and innovation programmes. The CITYLAB, ULaaDS, LEAD, and SENATOR consortia provide a substantial portion of the case material, supplemented by national and municipal pilots such as KoMoDo in Berlin, Binnenstadservice in Nijmegen, La Petite Reine in Paris, and HUB010 in Rotterdam. Where peer-reviewed evaluations exist, they are preferred. Where they do not, grey literature is used with caveats noted in Section 6.

3. Five theoretical lenses on urban logistics hubs

The five discourses surveyed here have largely independent intellectual histories. City logistics emerged from transport and operations research in the 1990s, in response to congestion and emissions caused by goods movement in dense urban centres. Sociotechnical transitions theory developed in science and technology studies and innovation research, originally in response to questions about how systems of provision (energy, mobility, food) change over decades. Ecosystem and business model scholarship grew out of strategic management, particularly the literature on platforms and on innovation in interdependent value chains. Commons and co-production scholarship draws on institutional economics and urban governance, with roots in Ostrom's (1990; 2005) work on common-pool resources and its more recent extension into urban infrastructure. Spatial planning literature combines co-production and node-place models to find solutions that fit to existing infrastructure and arrangements.

Each lens picks out a different facet of what urban logistics hubs are. Each frames the questions that researchers in that tradition find worth asking. Each gives rise, implicitly, to its own typology. The five are reviewed in turn.

3.1 City logistics and urban consolidation centres

City logistics is the longest-running tradition. Its central object of analysis has, for two decades, been the urban consolidation centre: a facility, typically on the urban edge, where incoming freight is broken down, consolidated by destination, and shipped onward in fewer, smaller, cleaner vehicles (Allen et al., 2012; Browne, Allen, & Leonardi, 2011). The expected gains are well-rehearsed in the literature: reduced vehicle kilometres travelled in the urban core, fewer emissions, less congestion, and smaller and quieter vehicles on residential streets.

Empirical evaluations have been less rehearsed than the theoretical case suggests. A long line of studies (e.g., Janjevic & Ndiaye, 2017; Marcucci and Danielis, 2008; Quak & De Koster, 2007; van Duin, van Dam, Wiegmans, & Tavasszy, 2016) point out that most European urban consolidation centres (UCCs) have failed financially once initial public subsidy ended. The reasons are remarkably consistent: the extra transshipment imposes a cost that neither shippers nor receivers have strong incentives to pay; the value created accrues to public goods (cleaner air, less congestion) for which there is no direct charging mechanism; and the carriers who would be the natural users see UCCs as competitors for the customer relationship rather than as cost-reducing infrastructure.

This pattern shapes the city logistics typology. Hubs in this tradition are sorted by spatial position (peri-urban, urban-fringe, in-city), by function (consolidation, cross-docking, last-mile fulfilment), and by sponsor (private carrier, public-private partnership, municipal). The empirical finding that financial sustainability is the persistent problem nudges the literature toward attention to business models, but the dimensions used to type hubs in this tradition remain largely operational. Governance, in the polycentric or commons sense, rarely features.

What the city logistics lens contributes to the present typology is its careful operational vocabulary and its accumulated evidence on what does not work. What it occludes is the variety of coordination arrangements that have emerged outside the classic UCC form, particularly micro-hubs run as niche experiments and platform-orchestrated hubs that displace much of the operational logic into software.

3.2 Sociotechnical transitions, the multi-level perspective, and niches

The sociotechnical transitions literature reads contemporary urban logistics as a system in flux. The multi-level perspective (Geels, 2002, 2011; Geels & Schot, 2007) frames change as the alignment of three levels: a landscape of background pressures (climate policy, e-commerce growth, public health concerns about air quality), a regime of established practices and infrastructures (carrier networks, diesel vans, retailer logistics), and niches in which alternative configurations are protected from full regime competition long enough to develop.

Strategic niche management (Kemp, Schot, & Hoogma, 1998; Schot & Geels, 2008) reads pilots and experiments as instances of niche development. Pilots are not, in this framing, demonstrations of mature technology. They are protected spaces in which actors build social networks, articulate shared expectations, and learn across technical, market, regulatory, and social dimensions. Whether a niche scales depends on internal dynamics (the quality of learning, the cohesion of expectations) and on the alignment of landscape and regime conditions.

A growing stream of research applies this frame to urban freight. Alternative delivery models and configurations provide differing results following a regulatory push for a desired societal impact (Quak & De Koster, 2007). Past research has applied the sociotechnical pathway thinking to, for instance, car-and-city co-evolution (Marletto, 2014) or scenarios on road-freight employing automated vehicles (Pernestål, Engholm, Bemler, & Gidofalvi, 2021). Such pilots provide a portfolio of niche experiments with varying results. Multiple niches develop in parallel, including cargo-bike micro-hubs, zero-emission delivery platforms, and joint procurement arrangements among municipalities. Within this variety one can find several characteristics that are consistent with what the MLP literature calls regime change or transformation (Geels & Schot, 2007).

For the typology, the MLP lens contributes two things. It identifies a specific kind of hub, the niche experimental micro-hub, that is structurally different from a consolidation centre because its purpose is not only operational. It also reframes other hub types as items in a wider portfolio of niche experiments competing for landscape alignment. What it occludes is the strategic-management interior of those experiments: how the actors involved actually design value flows, capture revenue, and structure the partnerships that hold the niche together. That is where the ecosystem lens picks up.

3.3 Business models, platforms, and ecosystem design

A third lens reads hubs as institutional configurations through which value is created and captured across interdependent actors. The business model literature (Teece, 2010; Zott, Amit, & Massa, 2011) provides the basic frame: a business model is the architecture of how an organisation creates, delivers, and captures value. The ecosystem and platform literature extends the frame to settings where the focal actor cannot create the value proposition alone (Hakanen, 2021). Adner (2017) defines an ecosystem as the alignment structure of partners that need to interact for a focal value proposition. Ecosystem literature highlights the relevance of complementarities and their connection on collective, context-specific investments as a key motivating factor driving a specific ecosystem (Jacobides, Cennamo, & Gawer, 2018). In turn, lack of proper alignment of investments often prevents ecosystem growth (Draschbacher, Rachinger, & Engwall, 2025). Hence, ecosystem literature focuses on a group of interdependent actors rather than the individual firm as the primary unit of analysis, when mapping the value creation and capture within the studied network of actors (Hakanen, 2021).

The ecosystem lens has a natural application to urban logistics hubs. A hub is not, except in the rare vertically-integrated case, an asset of a single firm. It connects shippers, carriers, receivers, building owners, the municipality, and increasingly software providers. Where a digital orchestrator coordinates handovers across firms, the hub is closer to a platform than to a depot. The platform literature on multi-sided markets (Rochet & Tirole, 2003; Parker, Van Alstyne, & Choudary, 2016) helps to clarify how cross-side network effects matter: shippers value the hub more when more receivers are reachable through it, and vice versa.

What this lens contributes to the typology is a way to differentiate hubs by who orchestrates value across actors and how. The platform-orchestrated hub is structurally distinct from a consolidation centre even when the physical asset looks similar, because the locus of coordination has moved from the operator of the building to the operator of the software. What this lens occludes is the political question of who has standing to participate in the orchestration, on what terms, and with what claims on outcomes. That is the commons and co-production agenda, still underrepresented in most of ecosystem research (Hakanen et al., 2025).

3.4 Commons, co-production, and polycentric urban governance

Ostrom (1990) showed that common-pool resources need not be governed either as private property or as state assets; communities of users can develop polycentric institutional arrangements that sustain shared resources over long periods. Her design principles (clear boundaries, congruence of rules with local conditions, collective-choice arrangements, monitoring, graduated sanctions, conflict-resolution mechanisms, and recognition of the right to organise) have been extended into urban settings by Foster and Iaione (2016), Iaione (2016), Bollier and Helfrich (2019), and others under the heading of the city as commons and co-city frameworks. The argument is that many urban resources, from public spaces to digital infrastructure to logistics capacity, share features with common-pool resources and can be governed by collective arrangements among the actors who depend on them.

Co-production literature (Brandsen, Steen, & Verschuere, 2018; Ostrom, 1996) overlaps with this framing. It treats the production of public services as a joint activity of professionals and citizens, with implications for how shared infrastructure can be designed, governed, and held accountable. Applied to logistics, the lens identifies hub forms in which carriers, municipalities, retailers, and residents share decision rights over a facility they collectively use, with rules developed iteratively rather than handed down.

In practice, fully commons-governed urban logistics hubs are rare. KoMoDo in Berlin approaches the form by combining a neutral facility operator (BEHALA, a publicly-owned port company), shared use by competing parcel carriers, and explicit governance protocols (Bundesministerium für Umwelt, 2019). The Co-City protocols developed by LabGov in Bologna, Reggio Emilia, and Turin offer institutional templates that, while developed for urban spaces and digital commons, can be adapted to logistics infrastructure. What this lens contributes to the typology is the recognition that governance form is itself a typological dimension. What it occludes is the operational and competitive logic that makes some governance arrangements feasible and others unstable.

3.5 Spatial planning: node-place models and co-production

The lenses reviewed so far each treat the hub as, at bottom, a logistics object: a consolidation facility, a protected niche, an orchestrated network, or a shared resource. A fifth lens starts from a different premise. It treats the hub first as a fragment of urban space, and asks how freight functions can be folded into infrastructure whose primary purpose is something else. It focuses on spatial planning that has become an umbrella term to encompass critical thinking about space and place, and how public policies or plans can improve its use through be actions or interventions (Allmendinger, 2009; Stead, 2021).

Two bodies of work refine our lens on spatial planning. Node-place theory in spatial planning explains why some urban locations can carry several functions at once (Bertolini, 1999; Weustenenk & Mingardo, 2023). Co-production theory explains how the resulting multifunctional sites get built and governed when no single actor owns the whole (Brandsen et al., 2018; Foster & Iaione, 2016; Ostrom, 1996).

Node-place models originate with Bertolini's (1999) analytical work on railway station areas. Bertolini reads each station as the meeting of two values. The node value measures the location's standing in the transport network, its connectivity and the intensity of movement it carries. The place value measures the intensity and diversity of the urban activities clustered around it, the people, jobs, and amenities that make it somewhere rather than merely a point of passage. A station sits in balance when its two values roughly match, and under strain when one outruns the other. The model's lasting contribution is the claim that node and place reinforce each other: local activity strengthens a transport node, and a strong node draws activity to its surroundings.

Recent work extends the same logic from stations to the broader category of the mobility hub. Weustenenk and Mingardo (2023) build a typology of six mobility-hub types from Dutch planning practice, distinguished by the quantity and complexity of their services, facilities, and transport modes, and read these hubs as sites where mobility functions concentrate to serve both network and neighbourhood.

Node-place theory says why such integration of multiple functionalities into one location is worth attempting, but not how a multi-purpose, multi-owner site gets produced and held together. In turn, co-production theory answers that question. Co-production refers to a process in which individuals from different organizations contribute to the production of goods and services, often through polycentric coordination (Ostrom, 1996). Brandsen, Steen, and Verschuere (2018) treat public services as the joint work of professionals and the citizens and users who depend on them, produced through continued collaboration rather than delivered top-down. Foster and Iaione (2016) carry the same idea into the governance of urban space, arguing that many city resources are best run through shared arrangements among the public bodies, civic actors, and users with a stake in them. Applied to a mobility-integrated hub, co-production identifies who holds standing at a site where a public or civic anchor (a transit operator, a municipality, a community organisation) hosts a freight function on terms set by its own public-interest mission. Carriers enter as one user among several, and the rules governing access answer to mobility, neighbourhood, and community objectives rather than to throughput alone.

What this fifth lens contributes to the typology is the recognition that functional-spatial integration and civic-public coordination together define a hub form the other four lenses cannot derive. The consolidation-centre tradition keeps freight in dedicated facilities; the ecosystem and commons lenses theorise coordination and governance among logistics actors but say little about co-location with non-freight infrastructure or about an anchor whose mission is not logistics at all. Node-place theory supplies the spatial rationale for multifunctionality, and co-production supplies the governance form that lets a civic or mobility actor host freight without surrendering its primary purpose. The tension between civic anchoring and operational scale becomes the characteristic contradiction of Type 5 in Section 5. This fifth lens illuminates why such hubs can be attractive and how they can be governed.

3.6 Summary

Each lens picks out a different facet of what hubs are. City logistics emphasises operational function and spatial position (Allen et al., 2012). The multi-level perspective emphasises niche-regime dynamics and the protected status of experimental sites (Geels & Schot, 2007). Ecosystem theory emphasises coordination architecture across interdependent actors (Jacobides et al., 2018). Commons literature emphasises governance form and the political question of who participates on what terms (Hakanen et al., 2025). Literature on co-production combined with node-place theory in spatial planning accounts for situations in which civic-public coordination brings together various perspectives in defining the hub (Allmendinger, 2009; Foster & Iaione, 2016). Next, Section 4 introduces the proposed typology and then, Section 5 elaborates how the five types proposed anchor in the previously presented theoretical lenses.

4. Constructing the typology

Following Collier and colleagues (2012), the construction proceeds in four moves: an overarching concept, two dimensions, a matrix, and named cell types whose meaning derives from their position in the matrix.

4.1 The overarching concept

The overarching concept of this typology is the urban logistics hub. The term needs definition before it can serve as the title of a typology. In the operational research literature, hub denotes a node in a many-to-many transportation network at which flows are sorted and consolidated (O'Kelly, 1987). Meza-Peralta and colleagues (2020) gather under urban logistics spaces any physical facility where freight transfers occur within or at the edge of an urban area. In this work, we define an urban logistics hub (ULH) as:

An urban logistics hub is a physical or co-located logistics facility within or at the edge of an urban area, through which freight is sorted, consolidated, transferred, or fulfilled, and which is organised under a specified coordination logic that orders the relations among the actors who use, operate, or govern it.

Three features of this definition deserve note. First, it is operationally agnostic: the hub may handle parcels, pallets, returns, waste, or all of these. Second, it is scale-agnostic: a single shipping container can be considered an ULH if it meets the functional criteria, similar to a 5,000 square metre building. Third, it is governance-explicit: a hub is not a hub by virtue of being a building; it is a hub by virtue of being organised under a coordination logic that orders the actors involved. Two physically identical facilities used by a single carrier and by a polycentrically-governed alliance are different hubs under this definition.

4.2 The two dimensions

Two dimensions structure the typology. The first carries the principal weight of differentiation. The second adds a secondary axis along which each type can take different positions.

4.2.1 Coordination logic (rows)

Coordination logic refers to the institutional arrangement that orders the relations among the actors who use, operate, or govern the hub. Four categories are recognised:

- *Hierarchical:* a single firm owns and operates the hub, and external relations take the form of bilateral contracts. The classic carrier-operated depot, or the carrier-operated UCC, sits here.

- *Platform-orchestrated:* multiple firms use the hub under coordination provided by a third-party orchestrator, typically supported by software and standardised data interfaces. The orchestrator may be neutral (a municipality, a non-profit) or commercial.
- *Collectively governed:* the users of the hub share decision rights over its operation through polycentric rules, with no single firm holding controlling authority. Design principles in the Ostrom tradition (Ostrom, 1990; 2005; Foster & Iaione, 2016) apply.
- *Civic-public:* the hub is embedded in public or civic infrastructure (a transport interchange, a community building) and is governed primarily by public-interest rules, with carriers and other users entering on civic-public terms.

4.2.2 Functional-spatial integration (columns)

Functional-spatial integration captures where the hub sits in the city logistics system and how tightly it is coupled with adjacent infrastructures. Three categories are recognised:

- *Edge consolidation:* the hub operates at the urban edge or in a peri-urban zone, consolidating inbound flows for onward delivery into the urban core.
- *Neighbourhood micro-distribution:* the hub operates inside the urban fabric, handling smaller flows at higher density, typically in support of cargo bikes, light electric freight vehicles, or pedestrian delivery.
- *Transit-integrated:* the hub is co-located with passenger mobility infrastructure (mobility hub, transport interchange, neighbourhood mobility node) and shares facilities, governance, or both with passenger transport.

The two dimensions yield a four-by-three matrix with twelve cells. The five types proposed below do not fill every cell. Some cells are unpopulated in the documented European record rather than empty by logical necessity; following Collier and colleagues (2012), they are read as currently empty, not precluded by design. Conversely, as indicated below, some cells may host more than one type. The hierarchical row in particular carries both Type 1 and Type 2, which share a coordination logic and are separated by purpose rather than by either mapped dimension. The matrix is presented in Table 1.

4.3 The matrix and how to read it

Table 1. Two-dimensional typology of urban logistics hubs.

Functional-spatial integration → **///** **Coordination logic ↓**	**Edge consolidation**	**Neighbourhood micro-distribution**	**Transit-integrated**
Hierarchical single operator; bilateral contracts	**Type 1: Urban consolidation hub** Purpose: consolidation & mature operations organised on the edge of urban area	Type assignment depends on purpose: **• Mature operations → Type 1** Purpose: single-firm consolidating last-mile deliveries in urban area **• Experimentation & learning → Type 2: Pilot micro-hub** Purpose: experimental micro-distribution, e.g., with alternative vehicles	(unpopulated) Purpose: enhanced and value-adding services aligned with passenger flows
Platform-orchestrated third-party coordination via software	Type 3a: Platform-coordinated edge hub *Purpose: cross-actor coordination*	Type 3b: Platform-coordinated city hub *Purpose: cross-actor coordination*	(emerging) Purpose: data-based & digital solutions that enhance existing offerings
Collectively governed commons; shared decision rights	(unpopulated) Purpose: consolidated deliveries informed by collective governance	**Type 4: Cooperative shared hub** Purpose: shared use of infrastructure and/or resources under collective governance	(emerging) Purpose: mobility hubs with collective freight access
Civic-public public- or civic-anchored	(unpopulated) Purpose: publicly-governed consolidation centres)	**Type 5a: Community-anchored freight hub** Purpose: multifunctionality (co-production) anchored to existing civic buildings (e.g., public libraries)	**Type 5b: Transit-integrated freight hub** Purpose: civic / mobility multifunctionality to optimise infrastructure use

How to read the matrix. Use coordination logic (rows) and functional-spatial position (columns) to locate a hub. Primary purpose is a third consideration that is stated within each box. The purpose can help to decide on borderline cases. The five types are derived from the theoretical lenses set out in Section 3, and each is placed at the coordinates it characteristically occupies. Coordination logic accounts for most of the variation between types, and a single type can span more than one column: Type 3 occupies both the *Edge consolidation* and the *Neighbourhood micro-distribution* columns (3a and 3b), and Type 5a spans the *Neighbourhood micro-distribution* and *Transit-integrated* columns with its two variants. Moreover, examples for Types 1 and 2 fit to the same box only to be separated by their primary purpose.

The choice to use coordination logic as the primary dimension and functional-spatial position as the secondary dimension reflects the analytical purpose of the typology. The user audience (researchers, evaluators, policy makers) most often needs to compare hubs whose operational form looks similar, but whose institutional architecture differs. The opposite weighting, taking operational form as primary, would reproduce the existing city logistics typologies and would obscure the governance-and-ecosystem questions that this work is intended to surface.

5. The five types of urban logistics hub

Each subsection below follows the same structure: theoretical anchor, definition, coordination logic, internal logic, empirical evidence, characteristic contradictions, and sub-variants. The structure is deliberately repetitive to make cross-type comparison easier.

5.1 Type 1: Urban consolidation hub

Theoretical anchor: city logistics; the urban consolidation centre tradition (Allen et al., 2012; Browne et al., 2011; Quak, 2008).

Definition: a logistics facility, typically peri-urban or at the urban edge, operated under hierarchical coordination by a single carrier, freight forwarder, or contracted operator, where inbound flows are consolidated for onward last-mile delivery into the urban core, often using lower-emission vehicles.

Coordination logic: hierarchical. One firm holds operational authority. External relations take the form of bilateral contracts between the operator and (a) shippers whose freight enters the facility, (b) receivers whose deliveries are consolidated through it, and (c) the municipality where it operates. A subsidy arrangement may add the public sector as a fourth contractual party.

Internal logic. The value proposition is environmental and operational efficiency through consolidation. Inbound trips by multiple carriers are replaced by a smaller number of outbound trips by the consolidating operator's fleet. The expected benefits accrue partly to the operator (route efficiency, asset utilisation) and partly to the public (fewer vehicle-kilometres, lower emissions, less congestion). The split between private and public benefit is structurally important: it determines whether the operator can capture enough of the value to make the consolidation economically self-sustaining.

Empirical evidence. Financial sustainability is the recurring failure mode. Among others, Quak (2008), van Duin and colleagues (2016), and Janjevic and Ndiaye (2017) document that most carrier-integrated UCCs in Europe have closed once initial public subsidy ended. The exceptions tend to be cases where the consolidation centre captures a niche shipper base (Allen et al., 2012, on the Bristol-Bath UCC) or where the operator combines consolidation with adjacent revenue streams (storage, value-added services). La Petite Reine in Paris illustrates a different exception: an in-city cargo-cycle delivery operator that has sustained operations since 2001 by combining commercial last-mile contracts (Nespresso, Star Service group clients) with a workforce-reintegration model that draws partial revenue from French social-enterprise funding. Its “Cargocycle” fleet aims to complete up to 200,000 deliveries a year (La Petite Reine, n.d.), with about 30% of staff hired through reintegration contracts.

Characteristic contradictions. The principal tension is that the operator must internalise the costs of consolidation while many of the benefits remain external. Public subsidy resolves the tension provisionally but does not address the underlying business-model fragility. Pilots in this type that have lasted past their initial subsidy period have typically done so by transitioning toward Type 3 (platform-orchestrated) or Type 4 (commons-governed) governance over time.

Sub-variants. Type 1 has at least three observable sub-variants distinguished by operator identity: carrier-led (a parcel carrier operating its own UCC), independent-operator-led (a logistics service provider operating a UCC under contract to multiple shippers), and public-led with private operations (a municipality owning the facility and contracting operations to a single provider). The sub-variants share the hierarchical coordination logic.

5.2 Type 2: Pilot micro-hub

Theoretical anchor: sociotechnical transitions and strategic niche management (Geels, 2002, 2011; Schot & Geels, 2008).

Definition: a small-footprint logistics facility, typically inside the urban area, operated under either hierarchical or proto-collective coordination, whose primary purpose focuses on a niche: for example, experimentation with alternative delivery configurations (cargo bikes, light electric vehicles, autonomous units) rather than mature operations. We use the term *proto-collective* to denote intermediate arrangements between hierarchical and collective coordination: multi-operator settings that share infrastructure under a neutral host but have not yet developed the full set of Ostrom (1990) design principles. A proto-collective hub typically satisfies the principles of clear boundaries, congruence of rules with local conditions, and recognition of the right to organise. However, it may lack codified collective-choice arrangements, formal monitoring, graduated sanctions, or explicit conflict-resolution mechanisms. Or of these exist, they are informal rather than rule-based. Movement from proto-collective to fully collective (Type 4) corresponds to the gradual formalisation of the missing principles.

Coordination logic: hierarchical at the start, more collective over time. Early-stage micro-hubs are typically operated by a single carrier or by a contracted operator running on time-limited research funding. As the niche matures, multi-operator and shared-governance arrangements often emerge, at which point the hub transitions toward Type 4.

Internal logic. The value proposition is learning, not throughput. A niche experimental micro-hub generates evidence about feasibility, costs, regulatory fit, user response, and operational protocols. Output metrics (parcels delivered, emissions avoided) matter, but the deeper purpose is to develop the social network, shared expectations, and operational vocabulary that would let the niche scale (Schot & Geels, 2008).

Empirical evidence. DPD's all-electric micro-depot in central London's Westminster exemplifies the type in its single-carrier form. Opened in October 2018 on a 5,000 sq ft refurbished site on Vandon Street, the depot was the UK's first all-electric parcel depot, with capacity for around 2,000 parcels per day. Inbound parcels are fed in by all-electric 7.5-tonne feeder trucks; final-mile deliveries were carried out at launch by ten Nissan eNV200 electric vans and a fleet of Paxster electric micro-vehicles, with EAV P1 e-cargo quadricycles added in late 2019 (DPD, 2018; Fleet News, 2018). DPD projected that running the operation on electric vehicles end to end would cut roughly 45 tonnes of CO_2 a year; the saving accrues to the electric fleet as a whole rather than to any single vehicle type. The depot has since become a permanent part of DPD's London network. Westminster fits Type 2 in its single-carrier phase. In turn, the Hochbahn micro-depot on Hamburg's Burchardstraße offers a useful contrast. Established in 2021 under the Reallabor Hamburg programme, it was a shared facility: four parcel carriers (REWE, Hermes, UPS, and Deutsche Post) ran cargo-bike deliveries from a common site coordinated by a neutral municipal operator. Over roughly two years of trials the carriers handled more than 300,000 cargo-bike shipments, and in late 2022 a private operator assumed the site for continued commercial use (Hamburg News, 2022). Because it pooled several competing carriers under a neutral host, the Hamburg facility sits closer to the shared-facility logic of Type 4 than to the single-carrier form, and we treat it as a borderline case rather than a clean Type 2 instance. Hochbahn micro-depot shows how readily a micro-hub shades into the shared configuration of Type 4 once multiple carriers and a neutral operator are involved.

Characteristic contradictions. The central tension in Type 2 is between protection and exposure. Niches need protection from full regime competition to develop, but they also need exposure to operational pressures to generate evidence relevant to scaling (Schot & Geels, 2008). Pilots that remain too protected become showcases that do not scale; pilots exposed too early collapse before generating learning. The most productive pilots calibrate exposure deliberately, often through staged graduation from research funding to operational revenue.

Sub-variants. Type 2 has at least two sub-variants distinguished by who carries the operational risk. Corporate-led pilots (DPD Westminster) are run by a single carrier to test technology, vehicle mix, or process design within its own network and graduate into business-as-usual operations if successful. Research-led pilots (most CITYLAB and ULaaDS sites) are funded by public research programmes, run by a consortium of carriers, researchers, and a host city, and produce learning artefacts rather than commercial continuity. Multi-carrier configurations under a neutral host (the Hochbahn micro-depot in Hamburg) sit at the Type 2/Type 4 borderline from the outset: they share proto-collective features (clear boundaries, recognition, congruence) without yet codifying the missing Ostrom's (1990) principles. Whether such hubs stabilise as Type 4 depends on whether collective-choice arrangements and monitoring become formalised over the pilot lifetime.

5.3 Type 3: Platform-coordinated hub

Theoretical anchor: ecosystem and platform business models (Adner, 2017; Hakanen, 2021; Jacobides et al., 2018; Parker et al., 2016; Teece, 2010).

Definition: a logistics facility, at any spatial position, in which the coordination among shippers, carriers, receivers, and operators is provided by a third-party orchestrator using software and standardised data interfaces, rather than by the physical operator alone.

Coordination logic: platform-orchestrated. The orchestrator may be commercial (a logistics technology provider), public (a municipality running a coordination platform), or hybrid. The orchestrator's value proposition is to reduce coordination costs across the actors who use the facility, capturing a share of the cost reduction as platform revenue.

Internal logic. The physical hub is necessary but no longer sufficient. Value increasingly comes from data infrastructure that allows shippers to allocate flows across carriers, receivers to choose delivery windows, and operators to balance capacity. The literature on multi-sided platforms (Rochet & Tirole, 2003) helps explain the network effects: more shippers attract more carriers, which attract more receivers, which feeds back. Adner's (2017) ecosystem-as-structure framing helps to identify where misalignment among partner activities breaks the value blueprint.

Empirical evidence. The LEAD project's digital twins of urban logistics networks in six European cities (Madrid, The Hague, Lyon, Budapest, Oslo, Porto) instantiate Type 3 at the coordination layer (LEAD Project, 2023). ULaaDS pilots in Bremen, Mechelen, and Groningen layer platform coordination over physical micro-hubs (ULaaDS, 2023). The EIT Urban Mobility Last Mile Digital Platform offers a commercial instantiation of the type (EIT

Urban Mobility, 2024). The World Economic Forum's 2024 report on transforming urban logistics treats platform orchestration as a defining feature of the next generation of urban freight (World Economic Forum, 2024).

Characteristic contradictions. The principal tension is between the orchestrator's interest in capturing data value and the carriers' interest in retaining customer relationships. Platforms that the orchestrator owns tend to drive carriers toward commoditisation, which carriers resist by withholding data and maintaining parallel coordination. Public or neutral orchestrators (a municipality, a non-profit) reduce the tension but face their own challenges around platform investment and sustained operation. The literature on horizontal collaboration in freight (Cruijssen, Cools, & Dullaert, 2007; Pomponi, Fratocchi, & Tafuri, 2015) documents the same tension under a different label.

Sub-variants. Type 3 has at least three sub-variants by orchestrator identity: commercial-platform, public-orchestrated, and consortium-orchestrated (multi-party platforms governed by their users, which border on Type 4). The boundary with Type 4 is fuzzy and depends on whether the platform governance is itself collective or whether the platform operator retains controlling authority over rule-setting.

5.4 Type 4: Collectively governed shared hub

Theoretical anchor: urban commons and polycentric governance (Foster & Iaione, 2016; Hakanen et al., 2025; Iaione, 2016; Ostrom, 1990; 2005).

Definition: a logistics facility used by multiple competing operators under collective governance arrangements that distribute decision rights across users, with explicit rules for access, use, conflict resolution, and revision developed iteratively rather than imposed.

Coordination logic: collectively governed. No single firm holds controlling authority. A neutral facility provider (often publicly owned) supplies the physical asset and basic operational support; the user collective develops the rules under which competing carriers share the facility. Ostrom's (1990) design principles for common-pool resources apply (see also Hakanen et al., 2025).

Internal logic. The value proposition is shared use of an infrastructure that no single operator would build alone, under governance that protects each user against opportunism by the others. The shared facility lowers capital and operational costs; the collective governance addresses the trust problem that otherwise prevents competing carriers from cooperating.

Empirical evidence. We chose KoMoDo Berlin as a potential European example, albeit it is not a full-fledged example of collective governance. Five competing parcel carriers (DHL, UPS, DPD, GLS, Hermes) shared a single micro-depot in Prenzlauer Berg under neutral facility provision by BEHALA, a publicly-owned port operator. Each carrier had access to a 14 square metre container; collective governance handled access scheduling, conflict resolution, and rule revision. Over twelve months, around 160,000 parcels were delivered by cargo bike, saving roughly 11 tonnes of CO_2 (BEHALA, 2019; Bundesministerium für Umwelt, 2019). The pilot has informed subsequent collectively governed designs in other German cities. Stadshub initiatives in the Netherlands (HUB010 Rotterdam, the City Hub network) borrow elements of the form, although their governance is typically more contractual than commons-style.

Characteristic contradictions. The central tension is between competitive carrier interests and collective governance demands. Carriers competing for the same end customers resist sharing data, capacity information, or operational details that they fear may erode their competitive position. The most successful collectively governed hubs minimise the data that must flow between competing users while maximising the operational benefit each derives from shared infrastructure. The neutral facility provider matters: a publicly-owned operator (as with BEHALA at KoMoDo) supplies a credible commitment that no single carrier could provide.

Sub-variants. Type 4 has at least two sub-variants distinguished by the role of the public sector: public-anchored commons (KoMoDo, with a publicly-owned facility provider) and self-organised commons (rare in logistics, more common in adjacent domains such as community-shared workshops). The second sub-variant is hypothetically possible but empirically scarce in current European urban logistics.

5.5 Type 5: Civic-public freight hub

Theoretical anchor: co-production and node-place theory in spatial planning (Bertolini, 1999; Brandsen et al., 2018; Foster & Iaione, 2016; Stead, 2021; Weustenenk & Mingardo, 2023).

Definition: a hub embedded in civic or mobility infrastructure (transit interchange, mobility hub, community building, post office) that combines freight handling with one or more other public-interest functions, governed primarily by public or civic rules with carriers entering on civic-public terms.

Coordination logic: civic-public. The facility is owned or anchored by a public, civic, or community actor whose primary mission is not freight logistics. Carriers and other commercial users access the facility under rules that prioritise public-interest objectives (mobility integration, community access, neighbourhood quality of life) over commercial throughput.

Internal logic. The value proposition combines logistics functionality with adjacent civic functions, using multifunctionality to spread fixed costs and to legitimise the facility's presence in the urban fabric. The hub may, for example, combine cargo-bike delivery with parcel collection by residents, micro-mobility services for travellers, and meeting space for community groups. Node-place theory (Bertolini, 1999) helps to anchor this combination: the hub is both a node in the freight network and a place in the urban fabric, and the integration of the two creates value that neither alone could deliver.

Empirical evidence. Bremen's mobil.punkt mobility hubs, extended under ULaaDS to include cargo handling and shared cargo bikes, instantiate the type at a small scale. PUDO networks operated through post offices and convenience stores share some features of Type 5 but typically lack the explicit civic governance, sitting closer to Type 3 (platform-orchestrated) with civic-aesthetic framing.

Characteristic contradictions. The central tension is between civic-public mission and commercial operational logic. Civic anchoring legitimises the facility but limits operational scaling; commercial logistics throughput finances the facility but threatens to crowd out the civic functions. The most stable Type 5 hubs limit commercial throughput by design, treating the facility as a small contribution to many objectives rather than as an attempt to replace conventional carrier infrastructure.

Sub-variants. Type 5 has two variants that correspond to the two sub-lenses making up the spatial-planning anchor. Type 5a, the community-anchored freight hub, derives from the co-production strand (Brandsen et al., 2018; Ostrom, 1996). It is a freight function hosted inside a civic space whose primary mission is something else: a library, community centre, post office, parish hall, or neighbourhood council building. The actors in that place co-produce how it runs, and the rules answer to local concerns. Type 5b, the transit-integrated freight hub, derives from the node-place strand (Bertolini, 1999; Weustenenk & Mingardo, 2023). It is a freight function co-located with passenger mobility infrastructure (a bus interchange, a metro station, a tram-stop mobility hub), where the location balances node value (network connectivity) and place value (urban activity), and freight enters as one of several functions sharing the site. Both variants share the civic-public coordination logic but split along the actor-centred versus network-centred dimensions of the spatial-planning lens.

6. Empirical illustration: pilots categorised

Table 2 categorises around twenty documented European pilots according to the typology. The table is illustrative rather than comprehensive; many more pilots exist, and the choice here reflects the availability of usable documentation, the diversity of types covered, and the geographic spread across national and municipal initiatives. Each pilot is placed in the type that best describes its coordination logic and functional-spatial position over most of its operational life. The Period column records the documented initiative or funding window; for the EU-consortium pilots (ULaaDS, LEAD, SENATOR) this is the project span and need not equal a hub's full operating life, and the LEAD entries describe network-level digital twins rather than single sited facilities, so their spatial-position coding should be read as the position of the modelled hub. Genuine intra-pilot type shifts are noted with a transition arrow; the clearest case is Binnenstadservice. KoMoDo and the Hamburg micro-depot, by contrast, were shared by several carriers under a neutral host from launch rather than evolving into that form.

Table 2. Selected European urban logistics hub pilots categorised by type.

Pilot	City / country	Period	Coordination	Functional-spatial integration	Type
Bristol-Bath UCC	Bristol-Bath, UK	2002–2016	Hierarchical (independent operator)	Edge consolidation	Type 1
La Petite Reine	Paris, FR	2001–present	Hierarchical (social enterprise)	Neighbourhood micro-distribution	Type 1 (single-firm consolidating last-mile deliveries in urban area)
Binnenstadservice	Nijmegen, NL	2008–present	Hierarchical → proto-collective	Edge consolidation	Type 1 evolving toward Type 4
DPD Westminster all-electric parcel depot	London, UK	2018–present	Hierarchical (single carrier)	Neighbourhood micro-distribution	Type 2 (various vehicles & processes)
Hochbahn micro-depot (REWE, Hermes, UPS, Deutsche Post)	Hamburg, DE	2021–2022	Multi-carrier under neutral host (from launch)	Neighbourhood micro-distribution	Type 2/Type 4 borderline (multi-carrier from launch)

Pilot	City / country	Period	Coordination	Functional-spatial integration	Type
KoMoDo cooperative micro-depot	Berlin, DE	2018–2019 pilot; 2020–continuation	Collectively governed (neutral facility provider)	Neighbourhood micro-distribution	Type 4
HUB010	Rotterdam, NL	2019–present	Platform-orchestrated → proto-collective	Neighbourhood micro-distribution	Type 3/Type 4 (Stadshub form)
ULaaDS Bremen mobil.punkt	Bremen, DE	2020–2023	Civic-public	Transit-integrated	Type 5 (mobility-anchored)
ULaaDS Mechelen	Mechelen, BE	2020–2023	Platform-orchestrated	Neighbourhood micro-distribution	Type 3b
ULaaDS Groningen	Groningen, NL	2020–2023	Platform-orchestrated	Edge consolidation	Type 3a
LEAD Madrid digital twin	Madrid, ES	2020–2023	Platform-orchestrated (digital twin)	Edge consolidation	Type 3a
LEAD The Hague digital twin	The Hague, NL	2020–2023	Platform-orchestrated	Edge consolidation	Type 3a
LEAD Lyon digital twin	Lyon, FR	2020–2023	Platform-orchestrated	Edge consolidation	Type 3a
LEAD Oslo digital twin	Oslo, NO	2020–2023	Platform-orchestrated	Neighbourhood micro-distribution	Type 3b
SENATOR Dublin	Dublin, IE	2020–2023	Platform-orchestrated	Edge consolidation	Type 3a
SENATOR Zaragoza	Zaragoza, ES	2020–2023	Platform-orchestrated	Neighbourhood micro-distribution	Type 3b
CITYLAB Rome	Rome, IT	2015–2018	Hierarchical (research-led)	Edge consolidation	Type 1/Type 2 hybrid
CITYLAB Brussels	Brussels, BE	2015–2018	Shipper-led horizontal collaboration	Neighbourhood micro-distribution	Type 3b
CITYLAB Oslo	Oslo, NO	2015–2018	Hierarchical (single carrier)	Neighbourhood micro-distribution	Type 2
CITYLAB Southampton	Southampton, UK	2015–2018	Research-led joint procurement	Edge consolidation	Type 1

6.1 Where the classification works cleanly

Several patterns emerge from placing pilots into the typology. The first is that Type 3 (platform-orchestrated coordination hub) is currently the most populated type. The LEAD and SENATOR projects, alongside the platform-oriented ULaaDS pilots, instantiate digital coordination across multiple shippers, carriers, and receivers; the physical hub functions as a node in a data-coordinated network, with the operational logic distributed across software and partner agreements. The convergence is striking. It also helps explain why current pilot evaluations sometimes report apparently incompatible performance figures: a Type 3 pilot evaluated as if it were a Type 1 UCC will look like a poor consolidation centre, when its purpose is the coordination layer rather than the physical throughput.

A second pattern is the clear separation between Type 2 niche experimental micro-hubs and Type 4 collectively governed shared hubs. The two types look operationally similar; both occupy small footprints inside the urban fabric, both often involve cargo bikes, and both are frequently funded by public programmes. The coordination logic distinguishes them. Type 2 is hierarchical, single-operator, and time-limited. Type 4 is collectively governed by competing operators with explicit rules and (usually) a neutral facility provider. Pilots that actually began under single-operator coordination and later stabilised as multi-carrier collectives, such as Binnenstadservice in Nijmegen, are the clearest evidence of the niche maturation pathway described by Schot and Geels (2008). KoMoDo Berlin, by contrast, was shared by five carriers under a neutral facility provider from its launch in 2018, so it exemplifies the Type 4 endpoint rather than the maturation path toward it. Either way, such transitions are consistent with recent work on how collective action shapes ecosystem emergence (Hakanen et al., 2025).

A third pattern is that Type 5 (civic-integrated mobility-freight hub) remains thinly populated. Bremen's mobil.punkt extension to freight under ULaaDS is one of the few European examples; the Dutch national mobility-hub programme has begun adding freight functions, but few of these qualify as full Type 5 hubs in the sense of governance-anchored civic integration. The thinness of evidence is itself informative: integration between passenger mobility and freight remains operationally and institutionally difficult, despite repeated calls for it in policy documents.

6.2 Where the classification strains

Several pilots resist clean classification. HUB010 in Rotterdam combines features of Type 3 (platform-orchestrated coordination via Vlot Logistics and city partners) with features of Type 4 (multi-carrier shared use with public anchoring through the municipality). It sits at the boundary between the two types and could be argued either way. CITYLAB Rome blended a carrier-integrated UCC structure (Type 1) with explicit research-led experimentation (Type 2). The pilot can be placed in either type with reasonable defence; the table records it as a hybrid.

Binnenstadservice in Nijmegen is the clearest case of intra-pilot evolution. It began in 2008 as a Type 1 carrier-integrated UCC with hierarchical coordination by a single independent operator (Konrad, 2021; van Rooijen & Quak, 2010). Over time, the relationships among the participating carriers, retailers, and the municipality have shifted toward more shared governance (Sluyter Logistics, 2023). Most recently, Nijmegen's zero-emission zone took effect in 2025. The pilot is recorded as Type 1 evolving toward Type 4, as single placement or category would not do justice to its progress.

The strain in these cases is not a defect of the typology so much as a sign of what the typology was designed to surface. Hubs that look operationally similar but coordinate differently can sit in different types. Hubs that look operationally different but coordinate similarly belong together. Pilots that evolve change type. None of this should be treated as a failure of classification; it is the kind of analytical signal that operational-only typologies tend to suppress.

6.3 What is missing from the pilot record

Three gaps in the empirical record warrant comment. First, southern and eastern European pilots are under-represented in the documentation accessible through English-language peer review and consortium grey literature. SENATOR's Zaragoza and Dublin sites help, as do CITYLAB Rome and the LEAD Budapest digital twin, but the dataset still tilts toward north-western Europe. Second, pilots that have closed without sustained operations are systematically under-documented. The literature on UCC failure (Quak, 2008; Marcucci & Danielis, 2008; van Duin and colleagues, 2016) makes clear that failure is the modal outcome for Type 1; case studies of closed pilots would be more informative for the typology than a longer list of currently-operating ones. Third, pilots in the global south, in non-OECD cities, and at the intersection of informal and formal logistics are almost entirely absent from the documentation underpinning the typology. The typology may not transfer cleanly outside European conditions; the next iteration should examine that question directly.

7. Discussion: what the typology does and what it does not do

7.1 What the typology helps with

The typology supports three analytical tasks better than the alternatives currently available. The first is comparison across pilots whose operational form looks similar but whose institutional architecture differs. A cargo-bike micro-hub operated by a single carrier under research funding is a different object of analysis from a cargo-bike micro-hub shared by five competing carriers under collective rules, even when the building, vehicles, and parcel volumes are nearly identical. Placing the two in different types (Type 2 versus Type 4) cues the evaluator to ask the right questions about each: how to graduate the niche in one case, how to sustain the governance arrangement in the other.

The second is the recognition of evolution. Several pilots in the evidence base have shifted type during their operational life. Binnenstadservice moved from Type 1 toward Type 4. The Hamburg Hochbahn micro-depot, by contrast, ran as a multi-carrier shared facility under a neutral host from its launch, so it sits at the Type 2/Type 4 borderline from the outset rather than evolving into it. The typology accommodates this movement explicitly. It also flags the analytical risk: comparing two snapshots of the same pilot at different times can mislead if the type has changed.

The third is the surfacing of governance as a dimension of analysis. Most operational typologies of urban logistics hubs treat governance as a background variable, mentioned in case descriptions but not used to differentiate categories. The typology proposed here takes coordination logic as the primary dimension, which means that two hubs differing only on governance fall into different types. The move is contestable; some readers will prefer a primarily operational typology. The justification is that governance is the dimension on which current policy debates about urban logistics (zero-emission zones, shared infrastructure, civic anchoring) most often turn.

7.2 What the typology suppresses

The typology suppresses several dimensions that matter empirically. Vehicle technology, parcel format, digital intensity, funding structure, and the regulatory environment are all treated as secondary attributes within types rather than as discriminating dimensions. The choice is defensible because the alternative produces a multidimensional cube that no reader can hold in mind, but it has costs. A reader interested in (for example) the role of zero-emission zones in shaping hub form will find the typology only partly useful; the regulatory dimension would need to be intersected with the typology as a separate axis.

The typology also suppresses the empirical question of which type performs best under which conditions. As a conceptual typology in Collier and colleagues' (2012) sense, it describes variation rather than explaining outcomes. A subsequent explanatory typology, built by re-using the same dimensions as predictors of an outcome of interest (cost per parcel, emissions per delivery, durability beyond initial subsidy), would do that work. The two should not be confused; an explanatory typology built on the same dimensions is a different analytical artefact and would be specified, tested, and reported differently.

7.3 This is a work in progress

This work should be understood as a working paper. In other words, the typology presented here should not be misunderstood as exhaustive or exclusive, but rather as a first step providing a comprehensive theoretical account to support ULH design. Our results offer a tool for thinking, not a final classification.

One should not treat categories as bounded objects in the world (cf. Sadre-Orafai, 2020). It is not a surprise to find real-life pilots or ULH implementations that fit two or more types simultaneously. We have accounted for this possibility in the present work in two main ways. The first is naming the borderline cases explicitly in Section 6 rather than forcing them into one type. The second is publishing the dimensions, the rationale for their selection, and the alternative dimensions that were considered, so that subsequent revisions can be argued openly rather than forced to a single category.

7.4 What further empirical work would refine

Three lines of subsequent work would refine the typology. The first is longitudinal case studies of pilot evolution. The cases noted in Section 6 as having changed type over time deserve closer analysis: what triggered the change, what made it durable, what failed when the same shift was tried elsewhere. The second is comparative governance analysis, focused on Type 3 and Type 4 in particular, where the boundary is currently fuzzy and where the consequential differences between platform-orchestrated and collectively governed arrangements are most visible. The third is regional extension. The typology was built primarily on European pilots; its transfer to other regions, particularly to cities with substantial informal logistics sectors, would test whether the dimensions and types hold up or require revision.

8. Conclusion and next steps

This working paper proposes a five-type typology of urban logistics hubs anchored in five theoretical traditions: city logistics with its focus on consolidation centres, sociotechnical transitions and strategic niche management, ecosystem and business model design, urban commons with their associated co-production literature, and spatial planning combining node-place and co-production models. The five types are the urban consolidation hub, the pilot micro-hub, the platform-coordinated hub, the cooperative shared hub, and the civic-public freight hub. Two dimensions structure the typology: the coordination logic of the hub and its functional-spatial integration in the city. The construction follows Collier and colleagues' (2012) template for conceptual typologies and is offered with the epistemic caution that Sadre-Orafai (2020) recommends for any classificatory work in a contested field.

The typology has three uses. For evaluators, it provides a vocabulary for distinguishing pilots whose operational form looks alike but whose institutional architecture differs, so that comparisons can be drawn on a shared basis. For policy makers, it makes the choice of hub form a deliberate one, conditioned on local coordination conditions rather than treated as a default operational category. For CO4HUB and adjacent projects, it offers a frame within which the project's own pilots can be positioned, understood in relation to each other, and learned from across sites. It is not a tool for funding allocation, market regulation, or pilot scoring.

This is a first draft. The dimensions, the labels, and the empirical placements are open to revision, and a subsequent version will incorporate the project consortium's pilot evidence and feedback from the wider research community. Comments are welcome and will be acknowledged in subsequent versions. The typology is offered as a working hypothesis, in the sense that Collier and colleagues (2012) recommend: conceptually creative, procedurally rigorous, and explicitly revisable.

Authorship and AI use

This working paper was prepared by the named author with substantial assistance from a large language model (Anthropic's Claude Opus 4.7 and Sonnet 4.6 models, accessed through the Cowork desktop application). The arrangement is reported here in detail, in line with emerging norms on transparent AI use in academic writing (Bockting, van Dis, van Rooij, Zuidema, & Bollen, 2023; COPE, 2023; Resnik & Hosseini, 2024).

The language model was used for four kinds of task. First, literature scoping: targeted web and database searches to surface candidate references on each of the five theoretical lenses and on documented European pilots, with the author selecting which sources were relevant and which were not. Second, structural drafting: producing initial prose for each section against an outline specified by the author, which the author then revised. Third, organising the empirical material into the tables and ensuring internal consistency across the type descriptions. Fourth, copy-editing for clarity and concision. The substantive intellectual decisions sit with the author.

Yet, notable caveats apply in this working practice. The cases and examples cited in this draft were identified by the language model. While they were subsequently verified by the author team, readers planning to quote or cite such sources are asked to cross-check the primary sources directly. Nevertheless, the authors take full responsibility for any remaining errors of attribution, paraphrase, or fact. A revised version, expected in Fall 2026, will review and strengthen our argumentation.

The decision to disclose AI use in a dedicated section, rather than in a brief acknowledgement, reflects the substantive role the tool played in producing the draft. Readers can judge for themselves the appropriate weight to attach to that role. We ask the readers to acknowledge that this document is intended to be a first draft of a working paper in the topic, so some mistakes or inaccuracies are to be expected.

References

Adner, R. (2017). Ecosystem as structure: An actionable construct for strategy. Journal of Management, 43(1), 39–58. https://doi.org/10.1177/0149206316678451

Allen, J., Browne, M., Woodburn, A., & Leonardi, J. (2012). The role of urban consolidation centres in sustainable freight transport. Transport Reviews, 32(4), 473–490. https://doi.org/10.1080/01441647.2012.688074

Allmendinger, P. (2009). Critical Reflections on Spatial Planning. Environment and Planning A: Economy and Space, 41(11), 2544–2549. https://doi.org/10.1068/a42227

BEHALA. (2019). KoMoDo – Kooperative Nutzung von Mikro-Depots durch die KEP-Branche für den nachhaltigen Einsatz von Lastenrädern in Berlin: Abschlussbericht. Berlin: Berliner Hafen- und Lagerhausgesellschaft mbH.

Bennett, A., & Elman, C. (2006). Qualitative research: Recent developments in case study methods. Annual Review of Political Science, 9, 455–476. https://doi.org/10.1146/annurev.polisci.8.082103.104918

Bertolini, L. (1999). Spatial development patterns and public transport: The application of an analytical model in the Netherlands. Planning Practice and Research, 14(2), 199–210. https://doi.org/10.1080/02697459915724

Bockting, C. L., van Dis, E. A. M., van Rooij, R., Zuidema, W. & Bollen, J. (2023). Living guidelines for generative AI: Why scientists must oversee its use. Nature, 622, 693–696. https://doi.org/10.1038/d41586-023-03266-1

Bollier, D., & Helfrich, S. (2019). Free, fair, and alive: The insurgent power of the commons. New Society Publishers.

Brandsen, T., Steen, T., & Verschuere, B. (Eds.). (2018). Co-production and co-creation: Engaging citizens in public services. Routledge.

Browne, M., Allen, J., & Leonardi, J. (2011). Evaluating the use of an urban consolidation centre and electric vehicles in central London. IATSS Research, 35(1), 1–6. https://doi.org/10.1016/j.iatssr.2011.06.002

Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (BMU). (2019). Modellprojekt KoMoDo: Ergebnisse und Erkenntnisse zur kooperativen Mikro-Depot-Nutzung in Berlin. Berlin: BMU.

Collier, D., LaPorte, J., & Seawright, J. (2012). Putting typologies to work: Concept formation, measurement, and analytic rigor. Political Research Quarterly, 65(1), 217–232. https://doi.org/10.1177/1065912912437162

Committee on Publication Ethics (COPE). (2023). Authorship and AI tools: COPE position statement. https://publicationethics.org/cope-position-statements/ai-author

Cruijssen, F., Cools, M., & Dullaert, W. (2007). Horizontal cooperation in logistics: Opportunities and impediments. Transportation Research Part E: Logistics and Transportation Review, 43(2), 129–142. https://doi.org/10.1016/j.tre.2005.09.007

DPD. (2018). DPD opens the UK's first all-electric parcel depot in central London. DPD UK. https://www.dpd.com/home/news/latest_news/dpd_opens_the_uk_s_first_all_electric_parcel_depot_in_central_london

DPD. (2020). DPD rolls out bespoke British-built cargo bikes for urban deliveries. DPD UK press release.

Draschbacher, T., Rachinger, M., & Engwall, M. (2025). To solve or to occupy: Addressing hybrid bottlenecks in innovation ecosystems. Technological Forecasting and Social Change, 212, 123982. https://doi.org/10.1016/j.techfore.2025.123982

Elman, C. (2005). Explanatory typologies in qualitative studies of international politics. International Organization, 59(2), 293–326. https://doi.org/10.1017/S0020818305050101

EIT Urban Mobility. (2024). Last Mile Digital Platform: Product fact sheet. Mobility Innovation Marketplace.

Fleet News. (2018). DPD opens all-electric parcel depot in London. https://www.fleetnews.co.uk/news/latest-news/2018/10/19/dpd-opens-all-electric-parcel-depot-in-london

Foster, S. R., & Iaione, C. (2016). The city as a commons. Yale Law & Policy Review, 34(2), 281–349.

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. Research Policy, 31(8–9), 1257–1274. https://doi.org/10.1016/S0048-7333(02)00062-8

Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. Environmental Innovation and Societal Transitions, 1(1), 24–40. https://doi.org/10.1016/j.eist.2011.02.002

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. Research Policy, 36(3), 399–417. https://doi.org/10.1016/j.respol.2007.01.003

Hakanen, E. (2021). What is a business model – for products, platforms, or ecosystems? Journal of Business Models, 9(4), 1–12.

Hakanen, E., Eloranta, V., Shaw, C., & Töytäri, P. (2025). Signaling collective action in ecosystems. Academy of Management Perspectives, 39(1), 22–43. https://doi.org/10.5465/amp.2023.0101

Hamburg Business. (2020). Micro depot for cargo bikes starts operating in Hamburg. Hamburg Business News.

Hamburg News. (2022). Micro depot for cargo bikes starts operating in Hamburg. https://www.hamburg-news.hamburg/en/companies/micro-depot-cargo-bikes-starts-operating-hamburg

Iaione, C. (2016). The CO-City: Sharing, collaborating, cooperating, and commoning in the city. American Journal of Economics and Sociology, 75(2), 415–455. https://doi.org/10.1111/ajes.12145

Jacobides, M. G., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. Strategic Management Journal, 39(8), 2255–2276. https://doi.org/10.1002/smj.2904

Janjevic, M., & Ndiaye, A. (2017). Investigating the financial viability of urban consolidation centre projects. Research in Transportation Business & Management, 24, 101–113. https://doi.org/10.1016/j.rtbm.2017.05.001

Katsela, K., Güneş, Ş., Fried, T., Goodchild, A., & Browne, M. (2022). Defining urban freight microhubs: A case study analysis. Sustainability, 14(1), 532. https://doi.org/10.3390/su14010532

Kemp, R., Schot, J., & Hoogma, R. (1998). Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management. Technology Analysis & Strategic Management, 10(2), 175–198. https://doi.org/10.1080/09537329808524310

Konrad, S. (2021). How to Consolidate for Last Mile—Learnings from a Small Dutch City. CityChangers.Org – Home Base for Urban Shapers. https://citychangers.org/how-to-consolidate-for-last-mile/

La Petite Reine. (n.d.). Un peu d'histoire: Quelques dates clés [Company history]. Retrieved May 29, 2026, from https://lapetitereine.com/lentreprise/un-peu-dhistoire/

LEAD Project. (2023). Low-emission adaptive last mile logistics supporting on-demand economy through digital twins: Final report. European Commission Horizon 2020 Grant Agreement No. 861598.

Marcucci, E., & Danielis, R. (2008). The potential demand for a urban freight consolidation centre. Transportation, 35(2), 269–284. https://doi.org/10.1007/s11116-007-9147-3

Marletto, G. (2014). Car and the city: Socio-technical pathways to 2030. Technological Forecasting and Social Change, 87, 164–178. https://doi.org/10.1016/j.techfore.2013.12.013

Meza-Peralta, K., Gonzalez-Feliu, J., Montoya-Torres, J. R., & Khodadad-Saryazdi, A. (2020). A unified typology of urban logistics spaces as interfaces for freight transport: A Systematic Literature Review. *Supply Chain Forum: An International Journal*, *21*(4), 274–289. https://doi.org/10.1080/16258312.2020.1801107

O'Kelly, M. E. (1987). A quadratic integer program for the location of interacting hub facilities. European Journal of Operational Research, 32(3), 393–404. https://doi.org/10.1016/S0377-2217(87)80007-3

Ostrom, E. (1990). Governing the Commons (J. E. Alt & D. C. North, Eds.). Cambridge University Press. https://doi.org/10.1017/CBO9780511807763

Ostrom, E. (1996). Crossing the great divide: Coproduction, synergy, and development. World Development, 24(6), 1073–1087. https://doi.org/10.1016/0305-750X(96)00023-X

Ostrom, E. (2005). Understanding Institutional Diversity. Princeton University Press. https://doi.org/10.1007/s11127-007-9157-x

Parker, G. G., Van Alstyne, M. W., & Choudary, S. P. (2016). Platform revolution: How networked markets are transforming the economy and how to make them work for you. W. W. Norton.

Pernestål, A., Engholm, A., Bemler, M., & Gidofalvi, G. (2021). How will digitalization change road freight transport? Scenarios tested in Sweden. Sustainability, 13(1), 304. https://doi.org/10.3390/su13010304

Pomponi, F., Fratocchi, L., & Tafuri, S. R. (2015). Trust development and horizontal collaboration in logistics: A theory based evolutionary framework. Supply Chain Management: An International Journal, 20(1), 83–97. https://doi.org/10.1108/SCM-02-2014-0078

Quak, H. J. (2008). Sustainability of urban freight transport: Retail distribution and local regulations in cities (ERIM Ph.D. Series Research in Management 124). Erasmus Research Institute of Management, Erasmus University Rotterdam.

Quak, H. J., & De Koster, M. B. M. (2007). Exploring retailers' sensitivity to local sustainability policies. Journal of Operations Management, 25(6), 1103–1122. https://doi.org/10.1016/j.jom.2007.01.020

Resnik, D. B., & Hosseini, M. (2024). The ethics of using artificial intelligence in scientific research: New guidance needed for a new tool. AI and Ethics. https://doi.org/10.1007/s43681-024-00493-8

Rochet, J.-C., & Tirole, J. (2003). Platform competition in two-sided markets. Journal of the European Economic Association, 1(4), 990–1029. https://doi.org/10.1162/154247603322493212

Sadre-Orafai, S. (2020). Typologies, typifications, and types. Annual Review of Anthropology, 49, 193–208. https://doi.org/10.1146/annurev-anthro-102218-011235

Schot, J., & Geels, F. W. (2008). Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda, and policy. Technology Analysis & Strategic Management, 20(5), 537–554. https://doi.org/10.1080/09537320802292651

Sluyter Logistics. (2023). Stadshubs: volledig duurzame logistiek is steeds dichterbij. Sluyter Logistics blog.

Stead, D. (2021). Conceptualizing the Policy Tools of Spatial Planning. Journal of Planning Literature, 36(3), 297–311. https://doi.org/10.1177/0885412221992283

Teece, D. J. (2010). Business models, business strategy and innovation. Long Range Planning, 43(2–3), 172–194. https://doi.org/10.1016/j.lrp.2009.07.003

ULaaDS. (2023). Urban Logistics as an on-Demand Service: Final synthesis report. European Commission Horizon 2020 Grant Agreement No. 861833.

van Duin, J. H. R., van Dam, T., Wiegmans, B., & Tavasszy, L. A. (2016). Understanding financial viability of urban consolidation centres: Regent Street (London), Bristol/Bath and Nijmegen. Transportation Research Procedia, 16, 61–80. https://doi.org/10.1016/j.trpro.2016.11.008

van Rooijen, T., & Quak, H. (2010). Local impacts of a new urban consolidation centre – the case of Binnenstadservice.nl. Procedia - Social and Behavioral Sciences, 2(3), 5967–5979. https://doi.org/10.1016/j.sbspro.2010.04.011

Weustenenk, A. G., & Mingardo, G. (2023). Towards a typology of mobility hubs. Journal of Transport Geography, 106, 103514. https://doi.org/10.1016/j.jtrangeo.2022.103514

World Economic Forum. (2024). Transforming urban logistics: Sustainable and efficient last-mile delivery (white paper). World Economic Forum, in collaboration with consortium partners.

Zott, C., Amit, R., & Massa, L. (2011). The business model: Recent developments and future research. Journal of Management, 37(4), 1019–1042. https://doi.org/10.1177/0149206311406265

Funding and acknowledgements

This project has been funded by the Agence Nationale de la Recherche (ANR), Business Finland (BF), Sveriges innovationsmyndighet (Vinnova), and the Österreichische Forschungsförderungsgesellschaft (FFG) under the Driving Urban Transitions Partnership, which has been co-funded by the European Commission.

Author disclaimer

Views and opinions expressed are those of the authors only and do not necessarily reflect those of the national funding agencies or the European Commission. Neither the funding agencies nor the European Commission can be held responsible for them.

CO HUB

Cooperation for Hubs in Urban Logistics

This project has been funded by the Agence Nationale de la Recherche (ANR), Business Finland (BF), Sveriges innovationsmyndighet (Vinnova), and the Österreichische Forschungsförderungsgesellschaft (FFG) under the Driving Urban Transitions Partnership, which has been co-funded by the European Commission.

DUT Driving Urban Transitions

Co-funded by the European Union