Scientific publication of the results of the three research pilots

Version 1.0

Deliverable 4.5

Project title:	**Fostering sustainable consumer behaviour with inclusive bicycle logistics infrastructure in urban outskirts**
Project acronym:	**SuCoLo**
Project duration:	01/2024 – 06/2026
Project number:	F-DUT-2022-0007
Work package/Task:	WP4 / T4.2
Project website:	https://sucolo.eu/
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This project has been funded by the Austrian Research Promotion Agency (FFG), Ministry of Enterprises and Made in Italy (MIMIT), the Federal Ministry of Research, Technology and Space in Germany (BMFTR) and the Swedish funding agency (Vinnova) under the Driving Urban Transitions Partnership, which has been co-funded by the European Union under grant agreement no. 905465.

Driving Urban Transitions

Co-funded by the European Union

VINNOVA Sveriges innovationsmyndighet

Bundesministerium Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie

FFG Forschung wirkt.

Finanziato dall'Unione europea NextGenerationEU

Ministero delle Imprese e del Made in Italy

Gefördert durch: Bundesministerium für Forschung, Technologie und Raumfahrt

Document versions

Version	Date	Changes	Authors
V0.1	16.04.2026	Establishment of the document	Michael Thelen (SRFG)
V0.2	20.05.2026	Review and formatting	Michael Thelen (SRFG)
V1.0	11.06.2026	Finalisation of the document	Michael Thelen (SRFG)

List of abbreviations

AI	Artificial Intelligence
COM-B	Capability, Opportunity, Motivation – Behaviour model
CO_2	Carbon Dioxide
DUT	Driving Urban Transitions
ETRR	European Transport Research Review
GIS	Geographic Information System
SDGs	Sustainable Development Goals
SME	Small and Medium-sized Enterprise
SUMP	Sustainable Urban Mobility Plan
SULP	Sustainable Urban Logistics Plan
T	Task
TRA	Transport Research Arena
WP	Work Package

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Administrative information

Basic information on the SuCoLo project and this deliverable:

Project title	SuCoLo: Fostering sustainable consumer behaviour with inclusive bicycle logistics infrastructure in urban outskirts
Project coordinator	Salzburg Research Forschungsgesellschaft mbH (SRFG), Salzburg, Austria; project coordinator: Michael Thelen
Project partners	Independent L. ONLUS (IND), Italy Sustainability InnoCenter (SIC), Sweden VIABIRDS Technologies GmbH (VIA), Austria Universität Leipzig (ULEI), Germany Südtiroler Transportstrukturen AG – Green Mobility Department (STA), Italy
Funding	DUT Call 2022 – European Commission under the Horizon Europe Partnership scheme Funding is being provided by the Austrian Research Promotion Agency (FFG), Ministry of Enterprises and Made in Italy (MIMIT), the Federal Ministry of Research, Technology and Space in Germany (BMFTR), and the Swedish funding agency (Vinnova)
Project nr.	F-DUT-2022-0007
Duration	01/2024 – 06/2026
Website	https://sucolo.eu/
Deliverable nr.	D4.5
Deliverable title	Scientific publication of the results of the three research pilots
Authors	Charalampos Harris Stamatopoulos (SIC), Viola Süß (ULEI), Michael Thelen (SRFG), André Ludwig, Benjamin Gaunitz (ULEI) and Valentina Mena (STA)
Version & status	Version 1.0
Date	11.06.2026

Purpose of the document

The purpose of this document is to present and contextualise the final scientific publication developed within the SuCoLo project and submitted to the Transport Research Arena (TRA) 2026 conference. Entitled *"Citizen-Centered Cargo Bike Solutions for Last-Mile Delivery and Personal Mobility in Urban Fringes"*, the manuscript was published in Springer Nature's European Transport Research Review (ETRR) Journal. The document summarises and explains the design, implementation, and preliminary results of the SuCoLo project's research pilots conducted in Leipzig (Germany), Merano (Italy), and Salzburg (Austria), which explore citizen-centred cargo bike solutions for sustainable last-mile delivery and personal mobility in urban fringe areas.

Building on the conference paper and accompanying presentation, this deliverable aims to document the methodological approach, key findings, and practical implications of the pilots in a structured and accessible format (T4.2 *Run and evaluate pilots in communities of local neighbourhoods*). It highlights how infrastructural innovations (e.g., micro-hubs, pick-up stations and shared cargo bikes), service design, and behavioural interventions (e.g., digital nudges) can be employed to foster more sustainable logistics and mobility practices.

Furthermore, the document contributes to the overall objectives of the SuCoLo project (in particular, Objective 5 *Ensure the take-up and exploitation of SuCoLo scientific products and results*) by demonstrating the feasibility, transferability, and scalability of the tested solutions, while supporting knowledge sharing among researchers, practitioners, and policymakers in the last project phase. As the TRA2026 conference's focus topics are *user-centred mobility*, *green mobility & decarbonisation*, *planning & operations*, and *transport and digitalisation*, SuCoLo's presence serves as both a scientific dissemination output and a foundation for knowledge transfer and capacity building beyond the project's duration to the SuCoLo project's target groups.

This document outlines the key facts of the publication, as well as a copy of the published manuscript.

Executive Summary

Purpose

The increasing demand for e-commerce and associated last-mile delivery services poses significant environmental, social, and economic challenges, particularly in urban fringe areas characterised by high car dependency and limited service accessibility. In response, the SuCoLo project investigates how infrastructural cargo bike solutions, combined with behavioural and digital measures, can contribute to more sustainable and inclusive logistics and mobility systems. Within this paper, the planning, running and preliminary assessment of three research pilots conducted in Leipzig, Merano, and Salzburg are delineated.

Methods

The research adopts a mixed-methods approach, combining participatory design, software-based planning approaches and pilot implementations. Across the three pilot cities, diverse yet complementary interventions were developed and tested:

- In Leipzig, a mobile micro-hub and cargo bike delivery service, complemented by a cargo bike sharing station;
- In Merano, the integration of cargo bikes into existing shared mobility systems alongside parcel lockers and local retailer-supported cargo bike delivery delivery and pick-up services;
- In Salzburg, the development and testing of digital behaviour change techniques (nudges) within an experimental e-commerce environment.

Data collection included surveys, workshops, usage data from pilot operations, and controlled experiments with online consumers, allowing for both qualitative and quantitative insights.

Findings

Preliminary results indicate that cargo bike-based solutions are technically feasible and socially accepted across different urban fringe contexts. The pilots demonstrate that:

- Cargo bike delivery services can reduce emissions, congestion, and noise while maintaining service quality;
- User preferences vary by context, with strong demand for doorstep delivery in some areas and high acceptance of parcel lockers and shared systems in others;
- Certain digital nudges demonstrate potential in influencing consumer choices toward more sustainable delivery options;
- The combination of infrastructure, service design, and behavioural measures should be harnessed in tandem to promote sustainable practices.

At the same time, uptake levels depend on local conditions, awareness, and user habits, highlighting the importance of tailored approaches.

Research Limitations and Implications

As exploratory pilots, the studies are limited in duration and scale, which constrains the assessment of long-term behavioural change, operational stability, and economic viability. Additionally, participation was voluntary, potentially introducing selection bias. Nevertheless,

the findings provide valuable insights into the implementation and scaling of sustainable logistics solutions in urban fringe areas and underline the importance of co-creation with local stakeholders and the tailoring of solutions to local contexts.

Practical Implications

The results offer guidance for municipalities, logistics providers, and e-commerce actors on how to design and implement integrated, citizen-centred logistics systems. In particular, they highlight the need to combine physical infrastructure with digital tools and behavioural strategies to achieve meaningful impact.

Originality and Value

This work contributes to the emerging field of sustainable last-mile logistics by demonstrating how the dual use of supply-side innovations and demand-side measures could be employed to further the 15-minute city ideal for urban fringe citizens. It provides empirically grounded insights into how cargo bike ecosystems can support the transition toward low-emission, accessible, and scalable logistics systems, while advancing the broader vision of sustainable urban mobility in line with concepts such as the 15-minute city. A key insight of the project is that interventions must be adapted to specific local contexts, while ensuring that the knowledge generated remains transferable through the use of shared methodological frameworks and open-access tools.

You can find the full published manuscript in the European Transport Research Review (ETRR) Journal's Lecture Notes in Mobility series here.

1. TRA Conference

1.1 Background

Co-organised by the European Commission together with major European technology platforms and research associations, the Transport Research Arena (TRA) is recognised as Europe's flagship conference on transport research and innovation. It was first launched in 2006 in Gothenburg and has since been organised on a biennial basis, rotating between different European host cities. Over the past two decades, TRA has developed into a platform for presenting cutting-edge research, technological developments, and policy initiatives in the transport and mobility sector.

In terms of scale, TRA is the largest European research and technology conference on transport and mobility, regularly attracting between 3,000 and 4,000 participants. The conference also features extensive exhibition areas, with often 100+ exhibitors and representation from dozens of countries; therefore, this conference was chosen due to its strong international reach and relevance.

Thematically, TRA covers the full spectrum of transport research and innovation. It is explicitly multimodal, addressing road, rail, air, and waterborne transport, as well as cross-cutting topics such as logistics, urban mobility, infrastructure, and digitalisation. Core themes typically include sustainable and low-emission mobility, transport digitalisation, infrastructure planning and operations, and user-centred mobility solutions. More broadly, the conference engages with broader societal challenges such as climate change, energy efficiency, safety, and socio-economic impacts of transport systems.

In terms of target groups, the conference brings together a diverse audience including researchers, academics, industry representatives, SMEs, transport operators, infrastructure managers, policymakers, public authorities, and civil society organisations. By promoting dialogue between these groups, TRA aims to serve as an interface between research, industry, and policy, supporting evidence-based decision-making and the uptake of innovative solutions.

1.2. Presentation

The content of the manuscript was presented in Technical Session 1 *Active Travel and User Behaviour (Active Travel Modes)*, which took place on 18 May 2026 from 08:45-10:15.

Figure 1 Presentation of scientific publication by Harris Stamatopoulos (SIC) on 18 May 2026

2. Introduction

Last-mile delivery is becoming increasingly challenging as e-commerce volumes grow and customers continue to prioritize convenience, especially home delivery and parcel lockers [1, 2]. Although the last mile represents only a small share of total supply-chain distance, it creates disproportionately high costs and negative impacts such as congestion, emissions, and noise [3]. Without changes to current practices, delivery vehicle numbers are expected to rise substantially by 2030, further intensifying these externalities [1, 4]. In response, many cities are introducing access regulations (e.g., low-emission zones) that restrict polluting vehicles and accelerate the need for cleaner delivery solutions. Cargo bikes, particularly e-cargo bikes, are increasingly discussed as a practical alternative for sustainable last-mile logistics [5, 6]. They are quiet, locally emission-free [7], and can access areas closed to cars, making them especially suitable when paired with micro-hubs that transfer goods from motorized vehicles to cargo bikes for the final trip [8]. This is particularly relevant in urban fringes, which are typically less well connected than inner cities and often shaped by car-oriented infrastructure and longer travel distances to services [9]. Shopping trips make up a substantial share of travel in such areas [10], now online shopping can partially substitute for these trips and improve access where local retail options are limited [9]. If delivery options are organized sustainably, they may support proximity-based planning goals such as the 15-minute city [11].

Beyond logistics, cargo bikes also show potential for personal mobility, including commuting and everyday errands [12]. Shared cargo bike systems can reduce barriers to adoption by avoiding purchase and maintenance costs [13] and may reduce car use, but uptake remains uneven and should be better embedded in mainstream mobility planning [12]. Despite growing interest overall, peri-urban contexts, and the combined roles of behaviour, infrastructure, and digital measures, remain underexplored. This paper therefore examines three exploratory studies in Leipzig, Merano, and Salzburg that test citizen-centred cargo bike solutions for last-mile delivery and personal mobility in urban fringes [14].

3. Methodology

The transition toward the 15-minute city calls for the integration of innovative technologies and digital tools to enable more sustainable and effective logistics systems [15]. The aim of this study is to bring urban fringe residents closer to the 15-minute city ideal by means of:

- ordering goods on e-commerce sites
- introducing cargo bike home delivery and parcel locker pick-up via a local courier
- integrating cargo bikes into bike sharing systems
- developing and piloting software, infrastructural and user-based innovations thereof in three research areas.

3.1 Research Areas

Leipzig, Germany

Lützschena-Stahmeln, an urban fringe district northwest of Leipzig, has limited services, high car dependence, and an aging population. Situated close to large logistics centres, it is a suitable test location for sustainable last-mile deliveries. The pilot tests a mobile micro-hub for home delivery and route planning with cargo bikes. Hub and cargo bike sharing station sites were chosen via a GIS suitability analysis implementing a simulation layer as heatmap of suitable vs. unsuitable locations [16]. Operated from a peripheral site, parcels were transferred to the micro-hub for local cargo bike distribution. Given that doorstep delivery remains the preferred option [17], a local bike courier delivers letters and small parcels for a major logistics provider, as well as fruit/vegetable boxes and regional products. A cargo bike sharing station was also installed, allowing residents to rent cargo bikes for free via an existing bike-sharing app [13, 18] (Figure 2).

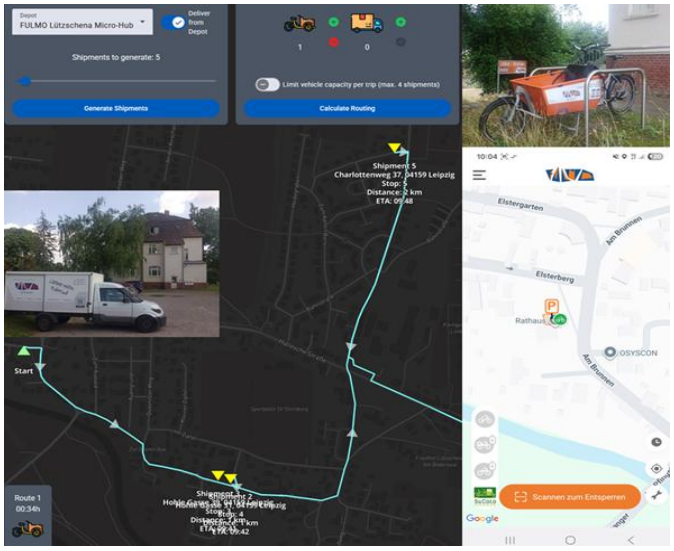

Figure 2 Leipzig micro-hub, routing optimization app, cargo bike rental station & app [18, 19]

Merano, Italy

Previous research indicates that urban fringe residents are more likely than inner-city residents to use parcel lockers, especially when lockers are located near workplaces [20]. Commuters are a key target group because lockers allow convenient pick-up during the trip home, reducing detours and aligning deliveries with daily mobility routines, as shown in earlier initiatives [21]. Accordingly, the local transport agency plans to introduce commuter-oriented pick-up options. In parallel, many Merano retailers seek additional sales channels beyond in-store shopping, including sustainable home delivery and parcel-locker pick-up supported by a local cargo bike courier. To reduce congestion, public authorities also aim to expand shared mobility by adding cargo bike sharing for transporting goods and children.

Merano implemented its first commuter-focused parcel locker near a regional train station, coworking space, and bus terminal, with deliveries from participating shops handled by a local

cargo bike courier. The courier also provides cargo bike home delivery in cooperation with 10 local shops. In addition, five shared cargo bikes, including an accessible e-scooter, were integrated into the city's shared mobility system at six partner companies and can be booked via a Mobility-as-a-Service app (Figure 3).

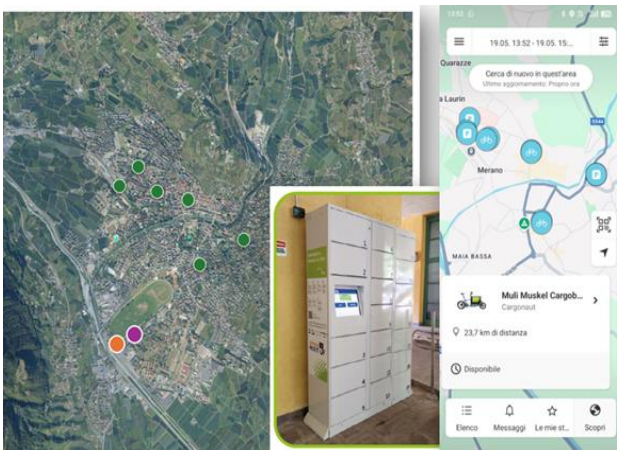

Figure 3 Merano pilot area showing key infrastructure: commuter train station (orange), parcel locker (purple), and cargo bike sharing locations (green) [22]

Salzburg, Austria

Alongside the uptake of clean delivery vehicles, demand-side strategies are needed to motivate consumers to choose sustainable delivery options when available [23]. In e-commerce, consumers' role in delivery decisions has often been underestimated [24], creating a need for retailer-friendly ways to communicate greener choices. This is particularly relevant because more than half of European SMEs sell online [25], yet many small businesses lack the resources to implement technically complex features (e.g., CO_2 calculators). Effective messaging therefore needs to be simple and low threshold.

The Salzburg pilot complements SuCoLo's infrastructure measures by targeting online purchasing decisions. Six digital nudges, i.e., user-interface elements that steer behaviour in digital choice environments [26], were designed to encourage selection of local cargo bike courier delivery. The nudges were developed using the COM-B model and systematic intervention design [27], then documented via a behaviour change technique taxonomy [28]. The final nudge types were green leaf, voucher, loyalty points, urgency, default, and priming. These nudges and a control condition were tested in an experimental e-commerce simulator with Austrian online shoppers (n = 1,101), and effects were analysed in relation to socio-demographic factors (Figure 4).

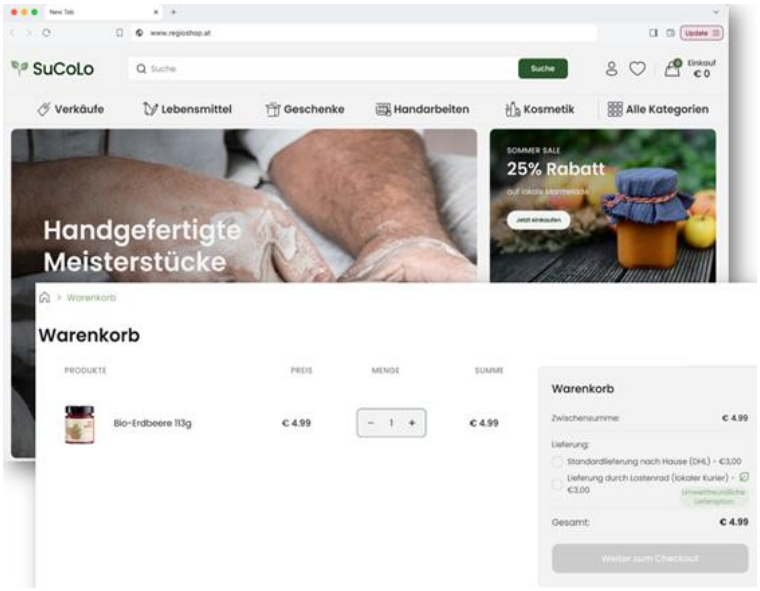

Figure 4 Experimental e-commerce simulator with the depicted digital nudge on the checkout page [29]

4. Preliminary Results

Leipzig, Germany. Customer preferences were assessed using participatory design (workshops and surveys). Survey results indicate an older population and a strong preference for doorstep delivery. Still, 42% of respondents could imagine using a click-and-collect option at a neighbourhood centre, partly due to the opportunity for social interaction. The pilot was active for 28 weeks and completed about 365 deliveries. The rental cargo bike, promoted via a dedicated campaign, was rented 11 times. These early outcomes align with survey findings, including low uptake of digital rental tools and seasonal effects, as the service was introduced during the summer holiday period. Upcoming peak ordering periods (e.g., Black Week and pre-Christmas) are included in the continued pilot.

Merano, Italy. The 13-month pilot aimed to promote cargo bikes for shopping, daily travel, and deliveries through a sharing system and a bicycle courier service to reduce urban traffic. In the first five months, the project delivered outreach through four promotional events, five pop-up events, and three workshops, supported by weekly campaigns and active involvement of shopkeepers, stakeholders, and political representatives. To date, 77 users have registered and the courier service has completed 266 cargo-bike deliveries, indicating increasing participation and local visibility.

Salzburg, Austria. The Salzburg study is ongoing. Initial testing suggested that the online shop simulator and the newly developed digital nudges are feasible and well accepted. Pre-test feedback indicated that the simulator closely mirrors typical online shopping and that the nudges are understandable and usable from a consumer perspective. These results support progression to a larger field experiment; outcomes will be reported in future work.

5. Concluding Remarks, Limitations and Future Work

Building on past initiatives, the SuCoLo project [14] aimed to demonstrate the potential of cargo bikes and inclusive logistics solutions to address the growing challenges of sustainable last-mile delivery in urban fringes. Through three complementary pilots in Leipzig, Merano and Salzburg, the project has shown how both supply-side innovations and demand-side measures could be employed to further the 15-minute city ideal for urban fringe citizens. Importantly, the project highlights the necessity of tailoring interventions to local contexts, while maintaining transferability of insights through common methodological frameworks and open-access tools.

Key limitations, typical of exploratory pilot studies, include the pilots' limited duration, which restricts conclusions about long-term behaviour change, operational robustness, and economic viability. The implementations also remain small-scale and rely on voluntary participation, which may introduce selection bias and limit generalizability to denser or more diverse contexts. Finally, predefined project objectives and timelines constrained the exploration of alternative approaches.

Despite these constraints, the pilots were co-created with municipalities, logistics providers, e-commerce actors, citizens, and civil society, supporting both technical feasibility and social acceptance. This participatory approach proved essential for implementation quality and for strengthening scalability to follower cities. Overall, SuCoLo addresses environmental, social, and economic sustainability by combining infrastructural, behavioural, and digital measures to reduce congestion and emissions, improve accessibility, and enable replicable service models.

In short, the activities and outputs of SuCoLo sought to address all three pillars of sustainability, highlighting their environmental, social and economic contributions.

Table 1 SuCoLo activities & outputs according to the pillars of sustainability

Sustainability pillar	***SuCoLo activities***	***Impact***
Environmental (SDGs 9, 11 & 13)	Cargo bike pilots (Leipzig, Merano, Salzburg); mobile micro-hubs; integration into shared mobility; digital nudges for greener delivery choices	Lower CO_2, noise, and congestion; supports low-emission zones in urban fringes
Social (SDGs 3, 9, 10 & 11)	Citizen engagement (surveys, workshops, pop-ups, e-commerce simulator); collaboration with local shops/SMEs; shared cargo bikes and inclusive mobility options	Improved access to goods and services (elderly residents, commuters, limited mobility); stronger local networks; higher acceptance and uptake
Economic	Partnerships with couriers, software providers, and	Potential cost savings; new service models/revenue streams; improved

(SDGs 8, 9, 11 & 17)	shops; parcel lockers linked to cargo bike delivery; cost-efficient micro-hub operations; open-access replication toolkit	transferability and scalability for follower cities

Next project steps include: (1) developing adoption plans for follower cities, (2) publishing an open-access toolkit for bicycle hubs and sustainable logistics and a behaviour-change guidebook, (3) producing policy recommendations for integrating cargo-bike logistics and mobility into Sustainable Urban Mobility Plans (SUMPs) and Sustainable Urban Logistics Plans (SULPs), and (4) extending research on micro-hub placement, software integration for cargo bikes, longer observation periods and broader participant profiles, long-term user effects, and the real-world implementation of delivery nudges in e-commerce environments.

Acknowledgements

This research, as part of the project Fostering Sustainable Consumer Behaviour with Inclusive Bicycle Logistics Infrastructure in Urban Outskirts (SuCoLo), has been funded by the FFG, MIMIT, BMFTR and Vinnova under the Driving Urban Transitions Partnership, which has been co-funded by the European Union under grant agreement No. 905465.

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