Low impact in lastmile logistics

Zero emission zones: are we ready?

Assessing the development in the zero-emission readiness of local SME's in city centers

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Abstract

29 Dutch municipalities aim to implement zero emission zones in the transition period between 2025 and 2030, phasing out commercial vehicles which make use of combustion engines. Much discussion has been had regarding the impacts of these zones, however, small to medium enterprises (SMEs) operating from city centres are often overlooked in discussions about zero emission zones despite their significant role in the urban logistics ecosystem. This research focuses on this fringe group, predominantly composed of retailers, many of whom do not identify as logistics actors. This article presents the findings from the zero emission city logistics quickscan conducted in 2025, comparing them with results from 2022 and 2024. The goal being to gauge the development in awareness and the subsequent adoption of zero emission operations among SMEs. The analysis reveals trends in the readiness and adaptation of these enterprises to the impending regulatory changes, highlighting the challenges and opportunities they face in the transition to sustainable urban logistics. The article also touches on the quickscan methodology of data collection which was executed by students and it's perceived impact on these students.

The zero emission zones are coming

The 1st January 2025 marked the beginning of a 5 year transition period towards zero emission city logistics for 14 municipalities (16 at the moment of writing, June 2025) in the Netherlands (Opwegnaarzes, 2024), these municipalities are the front runners in a total of 29 municipalities who have signed an accord mandating them to implement zero emission zones in a targeted 30-40 Dutch municipalities by 2030 (Rijksoverheid, 2021).

This accord details a scaled phasing out process of commercial vehicles, beginning with Euro 4 vehicles in 2025 and ending with a ban of all commercial vehicles that do not meet the zero emission requirements in 2030 (Rijksoverheid, 2021). The municipalities that are signatories to this agreement have 4 years in which to implement the zero emission zone after signing and in their period they engage in various efforts to inform the public of the upcoming change. These efforts include

traditional print media, radio, logistics brokers; which are agents hired by the municipality to guide businesses through their transition journey and letters to the potentially affected business owners which are sent by the Dutch vehicle licencing authority the RDW.

The Dutch government has offered business owners exemptions to use their phased out vehicles in the city centres under special conditions such as customised vehicles or vehicles that are dually used for personal transport (RDW, 2025) and there have been four different subsidies available from the Dutch government for the purchase of zero emission vehicles, one of which is the SEBA, subsidy scheme for zero emission commercial vehicles (vans) which offered up to € 5 000.00 per vehicle and AanZET for trucks (Netherlands Enterprise Agency, 2024).

With all the activity around preparing for the zero emission zones, there still lies a question of small to medium city centre businesses and their awareness and readiness for the zero emission zones rollout.

Although there have been numerous pilots involving zero emission vehicles, the concept of extensive zero emission zones (ZEZs) is relatively new. The implications of ZEZs for both authorities and companies are not entirely covered in the literature. Some Dutch studies, such as those by De Bok et al. (2021) estimate the impacts, while other reports, including those by Cui et al. (2021) and TDA (2023) discuss the establishment of ZEZs.

This paper delves into the results of the zero emission zone maturity scan developed by Motloung and Quak (Towards a Zero Emission Maturity Model, 2021) to understand the preparedness of small to medium businesses for operating in zero emission zones, comparing the changes over time of inner city businesses in the Noord Brabant municipalities of Tilburg, Breda, Eindhoven and ‘s- Hertogenbosch, who are all signatories to the accord. The choice for SME’s is made as many of these small enterprises do not consider themselves as logistics companies and are therefore difficult to reach in the communication on ZE zones, although they often operate a (small) fleet of commercial vehicles to support their business activities. The paper also covers the methodology, which includes the quick scans conducted by first year students and their first hand experiences when engaging with these businesses.

Development and deployment of the ZE maturity scan by students

The ZE maturity scan

The Zero-Emission Maturity model was developed in 2021 following efforts to understand whether small to medium businesses in the pre-announced zero emission zones have insight into zero emission policy as well as the extent to which they have evolved in terms of readiness for sustainable last mile operations. This model was created with a background on the Capability Maturity Model Integration (CMMI) (Paulk, Curtis, Chrissis, & Charles, 1993), The Project Management Maturity Model (PMMM) (Kerzner, 2001), The Business Process Maturity Model (BPMM) (Fischer, 2004) as well as the Synchromodal Transport Maturity Model (Alons-Hoen & Somers, 2017). These texts provide a background into how maturity models can be used to benchmark as well as provide insights on the current status of processes as systems, which is the case for the Zero Emission City Logistics Maturity model.

This model categorises small to medium enterprises into 6 levels characterising their zero emission operations readiness. These levels are described in the (Towards a Zero Emission Maturity Model, 2021) paper as:

Level 1	**Oblivious** - Businesses are unaware of their macro environment and the sustainability issues affecting it
Level 1	**Awareness** - Businesses are aware of zero-emission policies but are not making efforts aligned with these policies
Level 2	**Interest** - Businesses show interest in zero-emission initiatives and start exploring options
Level 3	**Managed** - Businesses begin to manage and implement initial zero-emission practices
Level 4	**Established** - Businesses have established zero-emission practices and integrate them into their operations
Level 5	**Optimized** - Businesses have optimized their operations to fully align with zero-emission goals, continuously improving and innovating

In order for businesses to be categorised, they are required to fill in a zero emission maturity quick scan, which is a questionnaire comprising of 7 sections which includes questions on business strategy, infrastructure, finance, operations, fleet management, and partnerships. These questions cover the bases for assessing the Zero Emission maturity, in light of the upcoming zero emission zones as well as general sustainable practices.

Thus far the ZECL MM has focussed on North Brabant Big 4 municipalities (Breda, Tilburg, Eindhoven and 's-Hertogenbosch), including some scans which were conducted in Rotterdam.

Questionnaire deployment generally has a number of issues stemming from the lack of motivation for the businesses to fill out the questionnaire, human error due to misunderstanding the questions and with longer questionnaires, incomplete responses leading to lower response rates. To combat this QuickScan method has been used to interview employees in these businesses.

A convenience sampling methodology was employed to this data collection process via Quickscans that are done by students. Each participating student was tasked with surveying 15 businesses, with the selection process left to their discretion. Students chose businesses "at will," primarily selecting those that were easily accessible within the city center and, crucially, open to engaging in an interview regarding their operational practices.

The primary rationale for adopting convenience sampling in these quickscans was its practical feasibility and efficiency. Given the scope of the study and the limited resources, this method allowed for rapid data collection from a number of businesses. However, it is important to acknowledge the inherent limitations of this methodology. The voluntary participation of businesses introduces a potential for bias, as those willing to engage may differ systematically from those who were not approached or declined to participate. Consequently, the findings of this quickscan may not be fully representative of the entire population of small businesses within the city centers concerning their zero-emission last-mile operations.

Assigning students

The Breda University of Applied Sciences has room in the logistics engineering and logistics management undergraduate degree curriculums for students to have access to and experience logistics within real companies. This is done through the Connection to Industry and Research modules which comprises of 2-3 ECTS study credits for each semester in their first and second year of study excluding their first semester. CIR allows students 4-8 hours weekly for them to complete an assignment of their choice and it is within this flexible study room that the Zero Emission City Logistics Quickscans are completed in the form of an internship.

The enrolment of these students begins with a recruitment presentation which covers the basics of the zero emission policy and a description of what is required of them, the target for the number students is set to 15 students maximum with the assignment for each student to complete 10-15 Quickscans.

The benefits of this approach are manifold, including;

- For students, this assignment helps them familiarise themselves with the state of city logistics, for some, particularly those in their first year of study, it has been a first encounter with the topic of city logistics and zero emission zones.
- In terms of the data collection aspect, which may be time consuming and cumbersome, the effort of collecting data is spread among a few people who have a single guideline to ensure consistency. This increases the reach considerably.
- Business owners and employees are also engaged face to face which not only improves response rates as compared to email questionnaires but also develops a level of rapport that allows them to ask questions. The business owners that were oblivious to these zero emission zones are then informed and they are left with an impression that may encourage them to seek out more information on zero emission zones or zero emission logistics operations.

In order to equip the students for the QuickScan, the first 3 weeks of their CIR internships are spent on recommended reading including publications about the zero emission policy, websites informing small businesses about the zero emission zones as well as last mile logistics solutions. In addition to this, the students attend a workshop where they interact with each other, have a debate about various zero emission topics to build confidence in their responses and they learn how to fill the QuickScan questionnaire, the last part of the workshop is a Breda City Walk where they explore the city centre as a group along with the workshop coordinator using their 'last mile logistics eyes' and answer questions based on what types of vehicles they see, who these vehicles belong to and the kind of signage they can spot alluding to delivery windows and regulation enforcement. Lastly, in the third week, they begin drawing up a list of targeted small businesses using Google maps and their city walks and start cold calling to set up interviews. After these 3 weeks, the students are then allowed to conduct these Quickscans independently.

To date, three groups of students have done their internships under the ZECL MM assignment , with 12 students in 2022, 11 in 2024 and 6 in 2025, filling in excess of 400 Quickscans over the years. The objective of these scans being to establish the maturity of small businesses in city centres over time.

Zero emission readiness over the years

At the start of 2025, zero emission zones were introduced in 16 cities, including three of the B4 municipalities. Tilburg and Eindhoven implemented these zones on January 1, 2025, followed by Den Bosch on March 1, 2025. While these zones did

not completely ban diesel-fueled commercial vehicles, they marked the beginning of a transition towards carbon reduction, with increased awareness preceding this change. The following chapter examines the results of the 2025 zero emission city logistics maturity quickscans, comparing them with previous years to determine the progress in the Zero Emission maturity of small to medium businesses over time, using the classification levels of the Zero Emission Maturity Model. The first section of this chapter delves into the treatment of the 2024 and 2025 as was done for the 2022 scans as per the Zero Emission Logistics Maturity Model paper: What do Inner City SME's know about the planned zero emission zones. And the second section takes a look at the development of zero emission city logistics maturity.

B4 2024-2025 Results

The 2024/2025 QuickScans were conducted as part of the CIR I course module, with 17 first year students collecting scans over 2 years, 11 students in 2024 and 6 in 2025. The total number of scanned businesses amounted to 210, however, after data cleaning, 179 were declared valid (n=179) as there were some false starts and duplication which occurred due to the pairing up of students. The number of scans per city is recorded as shown in the below table.

Table 1 Scanned Locations

Location	Count
Breda	88
Den Bosch (s'Hertogenbosch)	11
Eindhoven	6
Tilburg	59
Rotterdam	13

The supply chain position (see figure 1) of these valid scans comprised mostly of recievers at 61%, shippers at 25% and 13% were last mile transporters. It is important to note at this juncture that the categories were not mutually exclusive as some surveyed businesses served as both shippers and receivers. When looking at the city logistics segment, retailers dominate expectedly with 82% of the scans attributable to retailers, followed by post and parcel service providers at 7% with the remainder being cold chain logistics at 5% then Facility logistics, construction logistics and waste logistics at 3,2 and 1% respectively.

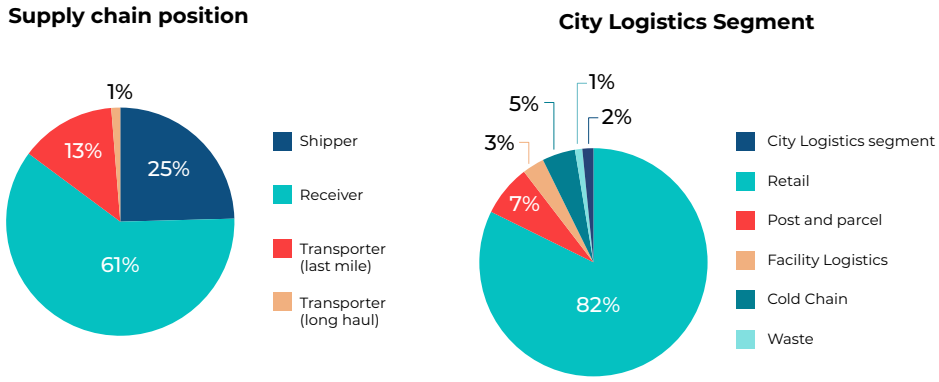

Figure 1 Supply Chain Position and City Logistics Segments

Looking at the aspect of how the goods are distributed to and from the shops, the respondents were questioned about the types of vehicles they used (figure 2)and 105 businesses indicated their use of vans, 47 noted box trucks and 18 noted truck and trailer combinations. Of the 18 businesses indicating that they make use of truck and trailer combinations, 4 were receivers of cold chain products and the rest were retailers. These 3 categories are the most prominent and all three will be undergoing transition to zero emission within the next 5 years, point out the importance of awareness as these businesses will be impacted by the zero emission policy. At this juncture it is interesting to note that there are some businesses which make use of personal passenger vehicles for their logistics and these will not be banned in this transition, they are however, subject to other regulations and permitting requirements. 10 businesses indicated their use of cargo bikes and these businesses are all restaurants that utilise the bikes for food delivery via delivery partners such as UberEATS or Thuisbezorgd.

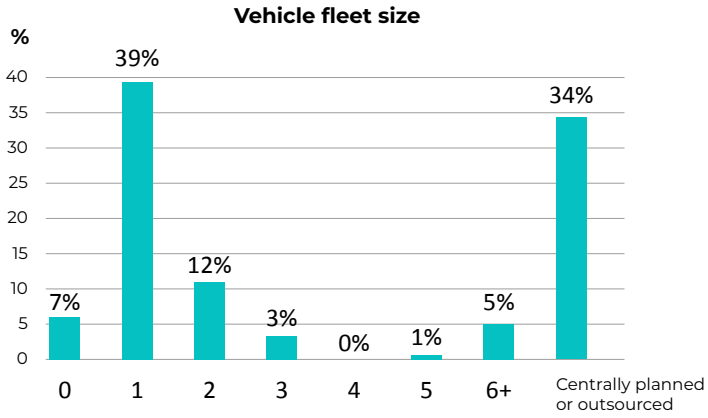

Figure 2 Vehicle Fleet Size

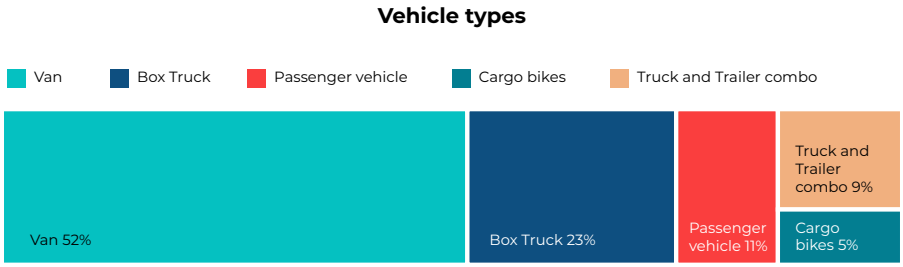

Figure 3 Vehicle Types

39% (n=69) of the businesses responded that they had 1 vehicle of those with a single vehicle, 10 were passenger vehicles and 2 were cargo bikes, both of which the zero emission zone is not applicable to. 37 of the vehicles are vans and 13 are box trucks, both of which will be impacted by the zero emission zones, however, numerous options are available.

Comparison of Attitudes Over Time

The zero emission zone maturity quickscans have been running for 4 years, from 2022 to 2025 and as such, it is now possible to view the progression of the zero emission maturity over time when comparing results from the 2022 scans to the 2024 and 2025 scans, which will in this subchapter be addressed separately. The scans will in this section be explored in accordance to the maturity levels introduced in section 2.1.

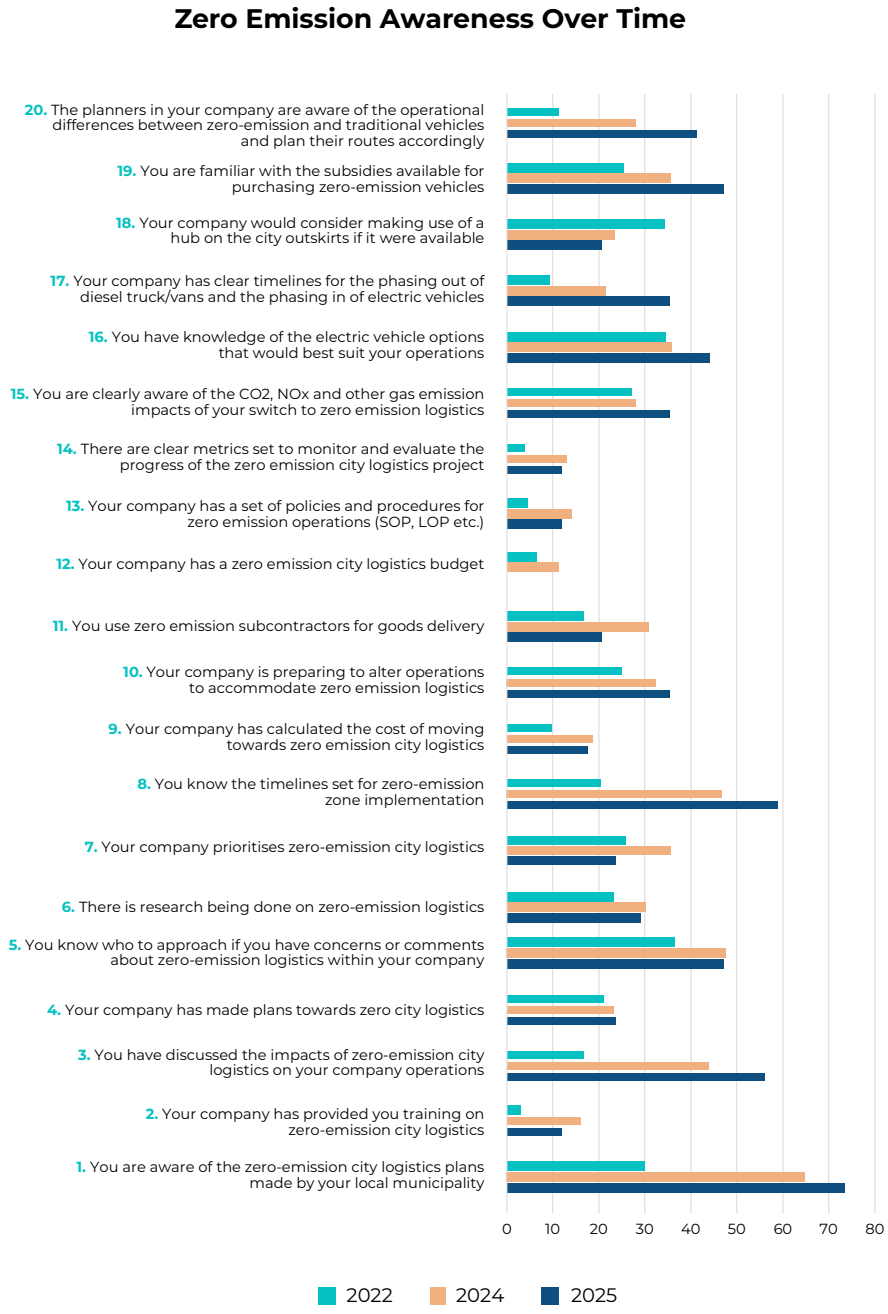

Figure 4 Zero emission awareness over time

A positive trend is visible in the zero emission zone awareness of businesses over time, as in 2022 70% of scanned businesses were unaware of the zero emission zones, this follows from the Implementation Accord signing at the end of 2021. In 2024, the number of oblivious businesses drops by half as only 35% were unaware of the changes that were to occur in 2025. In the 2025 scans this number drops to 26,5% of which most of these businesses are in Breda, which, even though having announced that they would rollout an zero emission zone, had still not adopted the regulations. Furthermore, 58% are aware of the zero emission zone rollout, jumping 40% from 2022's figure of 18%. Considering that Breda has not yet rolled out the zero emission zone, this figure is in line with the proportion of the scans carried out in Breda.

Businesses that show interest in sustainable options for their city logistics operations, whether in light of zero emission zones or not indicate a marked interest in discussing zero emission zones with their employees. According to the questionnaire, in 47% of scanned businesses, the employees knew who to approach to address concerns or have a discussion pertaining to zero emission logistics, this is compared to 36% in 2022. In addition to this, 47% of businesses are aware of the subsidies available for zero emission vehicle purchase and 44% are confident in the types of e-vehicles which would be suitable for their operations (34% in 2022). 29% of businesses are actively doing research on how to implement zero emission operations, compared to 23% in 2022. When businesses were asked if they had budgeted for zero emission logistics operations only 6% responded positively in 2022 and 11% in 2024, which is low considering the large upfront cost of purchasing zero emission vehicles, particularly for businesses that are making use of vans and larger vehicles However, it must be mentioned at this juncture that although interested, some respondents mentioned that they have a distrust in government and traditional media so they would prefer to wait it out even when they are doing the research in case there are more changes in the zero emission policy. Overall, in 2025 38% of scanned companies fell into level 2 and are showing a interest in transitioning to zero emission logistics.

In the 'Managed' stage, businesses have implemented pilots or have a partially zero emission fleet, this includes businesses that are using cargo bikes for last mile logistics services. In 2025, 35% of businesses have a clear timeline for phasing out traditional vehicles which when compare to 9% in 2022 is impressive, furthermore, 41% of businesses indicated that their planners are aware of route planning practices that decrease emissions and plan according. This is particularly important as zero emission deliveries are not just about having a new fleet, but more so about embodying sustainable thinking resource use. 35% in 2025 has prepared to alter operations to accommodate zero emission logistics, a 10% rise from their 2022 figure. Even within this stage, there is a low level of zero emission city logistics training sitting

at 11,8% (which is a rise from 3% in 2022), however, this may be attributable to the fact that retailers see it as being a change that applies to logistics and not their core business of selling products.

Only 17% of businesses overall fell into the Established level, this is characterized by businesses who are using logistics service providers that prioritise zero emission delivery, this includes companies such as PostNL and DHL post and parcel deliveries which have in the past few years become more sustainable. In 2025 only 23% businesses indicated that they prioritise zero emission logistics, which is concerning as these businesses will all be impacted by 2030 and need to have established zero emission operations, however, there are still 4 years left for the businesses to transition.

Overall, none of the businesses which have responded have reached the optimized stage as even the companies that are using e-vehicles, zero emission logistics subcontractors or cargo bikes still have a portion of their deliveries done in the traditional way and have not thought further.

An interesting change in the scans is 15% drop in businesses that would make use of shared hubs, it seems that as businesses become more aware of the electric vehicle option and subsidies available, their willingness to explore a change in operations wanes as electric vehicles allow them to run their operations in a similar way to traditionally fuelled vehicles with the exception of considerations regarding the charging, which for small to medium businesses is not a great change as the vehicles remain parked for hours at a time.

What can we learn from these scans

Practical results

Continuing to conduct maturity scans is essential for tracking progress, identifying gaps, and informing local policy development on zero emission logistics perception. These scans encourage continuous improvement, help to benchmark the progress of SME's. They also build trust among businesses by demonstrating an interest and commitment to allowing businesses to voice their concerns about policy changes. Overall, maturity scans are a valuable tool for communicating a structured and effective transition to zero emission logistics, benefiting businesses, policymakers, and the environment. From the results of the Zero Emission Maturity Model scans, we can learn several key insights about SMEs:

- There is a positive trend in awareness of zero emission zones (ZEZs) among businesses. This indicates growing awareness and understanding of ZEZs over

time.

- Businesses are showing increased interest in sustainable logistics options.
- There is a marked improvement in employee engagement regarding zero emission logistics.
- More businesses are actively researching and planning for zero emission logistics
- Despite the interest, budgeting for zero emission logistics remains low. This highlights the financial challenges SMEs face in transitioning to zero emission logistics.
- Some businesses expressed distrust in government and traditional media, preferring to wait for more stable policies before fully committing to zero emission logistics.
- Only 17% of businesses overall fell into the 'Established' level, characterized by using logistics service providers that prioritize zero emission delivery. This indicates that while progress is being made, many businesses still have a way to go before fully optimizing their logistics operations.
- The drop in businesses willingness to use shared hubs due to the convenience of electric vehicles with minimal changes also indicates the traditional mindset of these businesses.
- Small to medium businesses in retail mostly do not see themselves as decision makers or influencers in city logistics activity as it does not align with their core business and therefore do not actively seek out information on city logistics policy, it is therefore of paramount importance to engage the businesses directly which the quickscan did.
- The results are not generalisable as the willingness of the businesses was a factor and most small businesses are run by an older demographic that was uneasy about engaging in English

These results show a positive trend towards awareness and interest in zero emission logistics among SMEs, but also highlight the challenges and areas where further support and incentives may be needed to facilitate the transition.

Practical results process wise

Using students for data collection in maturity scans offers several benefits. It provides a cost-effective and scalable workforce, allowing for extensive data collection without significant costs. Students gain practical experience and skills in city logistics, data collection and analysis, enhancing their education. Their involvement also bring fresh perspectives and innovative approaches to the process. Additionally, engaging students fosters a collaborative relationship between the educational institution and businesses, promoting knowledge exchange and community involvement. Using students for quickscans has proven to be a mutually beneficial approach that supports both educational and research objectives.

The CIR students are tasked with writing a reflection report after they complete the QuickScan, this report relates to their personal professional development as well as the interaction and reception by the business owners and employees. One of the comments that stood out was the unwillingness of most businesses to engage, there is consensus on this from all the students over the years.

One of the difficulties the students face is the language barrier for international students who have had limited interaction with Dutch, this language barrier also contributes to the unwillingness to interact in some cases. When asked about the general feeling of business owners who were willing to be interviewed, one student stated that an uneasiness pervaded the interaction initially and when they clarified that it is a casual conversation for the students own development and not an official inspection, the respondents became more forthcoming.

As the students progressed they reached the realisation that if targeted at a convenient time when business was slow, and they used a 'short, confident and polite introduction' the response rate improved, however, they did not quantify this improvement. A pattern arose that when interviewing small 'Mama and Papa' shops, they were most likely unaware of the ZE policies, whereas the larger establishments had some awareness and some had already begun operating in more sustainable ways.

In terms of their own development, as some students realised that the assignment is not a great personality fit and gravitated towards less confrontational aspects of the assignment, a trend of partnering up has become more notable as the years progress with 2 pairs forming in the 2022 scans which made up 27% of the students, and this pairing only being for the first few scans and breaking up for the latter scans. 2 pairs formed in the 2025 group and they both stayed the course, doubling up on the scans to total 30 scans for each pair, as each individual was tasked with 15 scans. Of the remaining 2 students in the 2025 scans that were not paired up, one opted out of the quickscans and the other chose a novel approach, sending the quickscan to their peers that are interning in SME's and some in companies that conduct inner city transport.

Overall, the 2025 cohort reported that they have become more confident with speaking to strangers and have discovered attributes such as organizational skills as well as communication skills that they were unaware of. Their willingness to partner up also helped them understand how to leverage each others strengths and engage their cross cultural competencies.

Implications and conclusions

The Zero Emission Maturity Model scans have several implications for city logistics: These scans help assess the readiness of businesses for zero emission zones (ZEZs). By evaluating various levels of maturity, the businesses current position can be established and areas for improvement can be identified. The tool can also be used to identify best practices in businesses that have advanced maturity. The action of approaching the businesses in person could also trigger the respondent to do further research and thus spark a conversation.

The ZE city logistics maturity model also provides a structured framework to transitioning towards zero emission logistics. It outlines steps for businesses to progress through different maturity levels, from initial awareness to optimized operations. Small and medium-sized enterprises (SMEs) can benefit from tailored advice based on their maturity level. This helps them adopt best practices and technologies to meet ZEZ requirements. The model furthermore emphasizes continuous improvement, encouraging businesses to assess and enhance their logistics practices to achieve zero emissions.

The attitudes of business owners have improved over time with regards to their knowledge about zero emission zones, zero emission logistics and the changes that these pose towards the running of their businesses. There is also a great number of businesses that have expressed that they are leaning towards electric vehicle use and those who lean towards opting to get deliveries from their suppliers using logistics service providers to avoid the high costs of transitioning towards zero emission. In terms of readiness, the outcome does not look bleak as there are options for delivery even within zero emission zones, however, there is still a long way to go for establishing widescale zero emission operations even within ZE zones.

Insights from these scans can inform policymakers about the challenges and progress of businesses in adopting zero emission logistics, the results also offer an assessment of how communication efforts reflect in the increase in zero emission zones, particularly for businesses whose core operations are not focussed on logistics. This can lead to more effective policies and support mechanisms.

Acknowledgements
This research was partly done in cooperation with RWS in the ‘Onderzoek Zero Emissie zones goederenvervoer’ project funded from RWS (zaaknr 31183501) and implemented by the Smart Cities & Logistics (BUas) professorship.

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