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Zero-Emission Zone (ZEZ) Maturity Model: First Results

A look into how far SMEs are in preparing for the rollout of zero-emission zones in earmarked cities

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Abstract

With the approach of the zero-emission zone implementation in 30-40 cities mandated by the Dutch climate agreement in 2025, comes the need to determine whether the SMEs located within these zones are aware of the coming changes. The zero emission zones are set to change how city logistics is currently being executed with the aim of decreasing emissions in the city centre by transitioning to zero emission vehicles and optimizing deliveries to create less flows. However, it is currently unclear whether small to medium businesses located within these zones know about the new regulations within their local municipalities. This article delves into the initial results of The Zero-Emission City Logistics Maturity QuickScans which are used to facilitate the determination of the maturity of small to medium enterprises in light of zero-emission city logistics operations.

The zero-emission city logistics maturity is stratified into 6 levels, starting at level 0 (oblivious, where companies are unaware of their macro environment and the sustainability issues affecting it), level 1 (awareness, in which companies are aware, but they are not making efforts that are aligned to the zero-emission policies), level 2 (interest), level 3 (managed), level 4 (established), to level 5 (optimized). The maturity model allows determining the level of the different companies in 5 so-called 'areas of transformation', i.e.: personnel, fleet management, operations, finance and purchasing.

The research makes use of the QuickScan method to facilitate data collection by students who then approach businesses to compare their progress against other businesses. The QuickScan is used to determine the current ZECL level by conducting on-site viewings, taking photographic evidence, and hosting interviews with the QuickScan questionnaire, the answers to the questionnaire will determine the levels of each area of transformation which will be indicated on the matrix.

This paper concludes with the preliminary results from the QuickScans performed by students; the first results show that many SMEs are in the lower maturity levels at this moment, and more effort needs to be invested to make sure sufficient preparation is made to be able to comply with the zero-emission regulations in the future. Additionally, local authorities and the cooperating interest groups and the Dutch Ministry of Transport need to increase efforts in communicating the planned zero-emission city logistics policies.

Background

The climate crisis has been a matter of great concern since the United Nations Conference on the Human Environment (McNamara, 1972) drew attention to the dangers of climate destruction. Since then, various reports and conferences have been held around the theme of reversing or limiting climate change. The 2015 Paris Conference was one such initiative geared towards institutionalizing sustainability efforts in various industries including logistics and the supply chain. The Paris conference's aim was to bring light to the climate crisis and as a result a treaty was created to bind signatory countries to the aim of limiting the rate of global warming to no more than 2°C as compared to pre-industrial levels. (United Nations, 2015)

The Netherlands is a signatory country that has created sustainability agreements for different industries, called the Green Deals. Stemming from the Green Deals as well as the Paris climate agreement is the Dutch climate agreement (Rijksoverheid, 2019), which states that by 2030, 30 to 40 municipalities in the Netherlands are required to roll out zero-emission zones. This agreement has led to the development of the Implementation Agenda (Rijksoverheid, 2020), which states the types of commercial vehicles that will be allowed to enter city centres after the 1st of January 2025. There are a few of exceptions to these so called 'zero-emission zones (ZEZ)', which include the use of certain Euro 6 and Euro 5 vans and trucks which will still be able to enter the cities in the interim before 2030, these exceptions can be viewed in Table 1: Phasing Out Dates ZEZ

Table 1 Phasing Out Dates ZEZ

Vehicle Type	Phasing out date
All commercial vehicles	1 January 2025
Euro 6 truck and trailer combi purchased after 2017	1 January 2030
Euro 6 Box Trucks purchased after 2020	1 January 2030
Euro 5 Vans	31 December 2026
euro 6 vans	31 December 2027
Plug-in hybrid electrical trucks	1 January 2030

Motivation

Logistics accounts for 10.6 megatonnes of CO_2 emissions in the Netherlands annually (TNO, 2020), of this 10Mtonnes, city logistics contributes 3.6 MT which is quite consequential, this is because commercial vehicles are still largely using fossil fuels which have a high impact on localised pollution and a detrimental effect on liveability.

Figure 1 Proportion of CO_2 emissions from logistics activities (TNO, 2020) below indicates the proportion of logistics pollution attributable to each segment. As you can see from the chart, the light grey outer section includes the city logistics segments: general cargo, construction logistics, facility, waste, temperature-controlled as well as post and express, ranked from the most polluting to the least. The post and express segment is the least concerning at an annual contribution of 0.03 Mtonne, however, with the growth of e-commerce, this segment still needs great observation over the coming years.

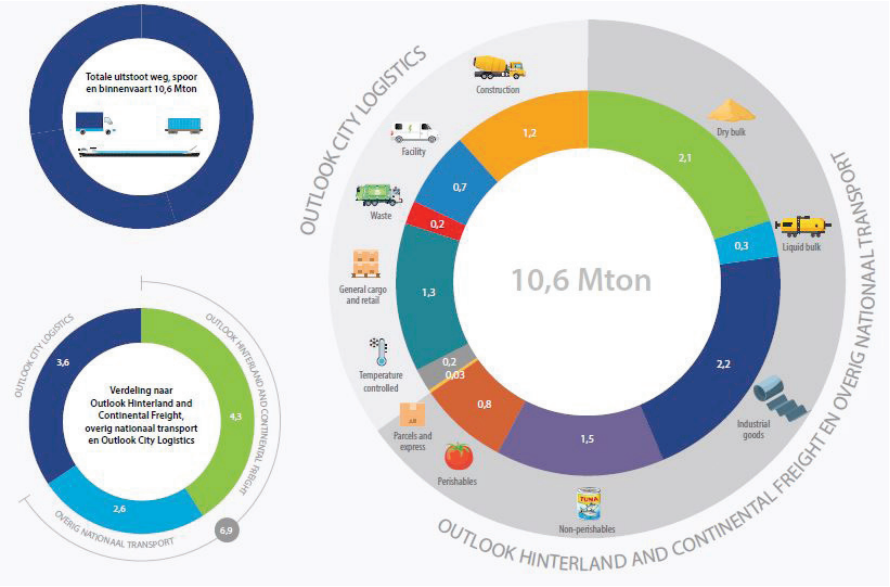

Figure 1 Proportion of CO_2 emissions from logistics activities (TNO, 2020)

The emissions are particularly concerning as ¾ of the Dutch population live in urban areas (Nabielek et al., 2016) and are exposed to the daily issues surrounding logistics such as air pollution, noise pollution, traffic and delays. Why is city logistics such a large contributor? Unlike the long-haul road transport and marine transport, city logistics makes use of trucks which travel down narrow roads in traffic with multiple stops in the city thus exacerbating what is already a large polluter.

It is thus important to limit the emissions stemming from city logistics in order to promote the health and wellbeing of city dwellers as well as creating a more organized city logistics system. This is done by zoning into the parties responsible for the commercial traffic flows in the city: businesses. The focus of this research is therefore on small to medium businesses located in the city centres of the predetermined zero emission zones. This is because larger

companies have logistics departments that coordinate the delivery of goods to their retail stores and as such are more exposed to the logistics regulations and upcoming changes through different logistics organizations they may be part of. It is however, still unclear whether small to medium businesses are privy to this information and what they are doing to make their city logistics operations more climate neutral.

Research

Problem

27 municipalities in the Netherlands have declared the implementation of zero-emission zones from January 1st 2025, however, in as much as this news has been disseminated to the logistics fraternity, some logistics players are not as privy to this information. This research, therefore, endeavours to determine the progress of companies, specifically small to medium enterprises as well as franchises which are located in the city centres, towards zero-emission city logistics operations.

Maturity Model

The Zero-emission City Logistics Maturity model was developed to standardize and stratify the progress of zero emission city logistics initiatives into 6 different levels that companies may fall into en route to optimized zero-emission city logistics (Quak et al, 2021).

This model is drawn from various others that have been used over the years such as the Project Management Maturity Model (Harold Kerzner, 2001), The Capability Maturity Model (Paulk et al., 1991) as well as the Business Process Maturity Models (Rosemann & De Bruin, 2005)2005, in addition to this, inspiration was drawn from the Synchromodality Maturity Model (Alons et al., 2019) which is currently in use to measure the modal shift maturity.

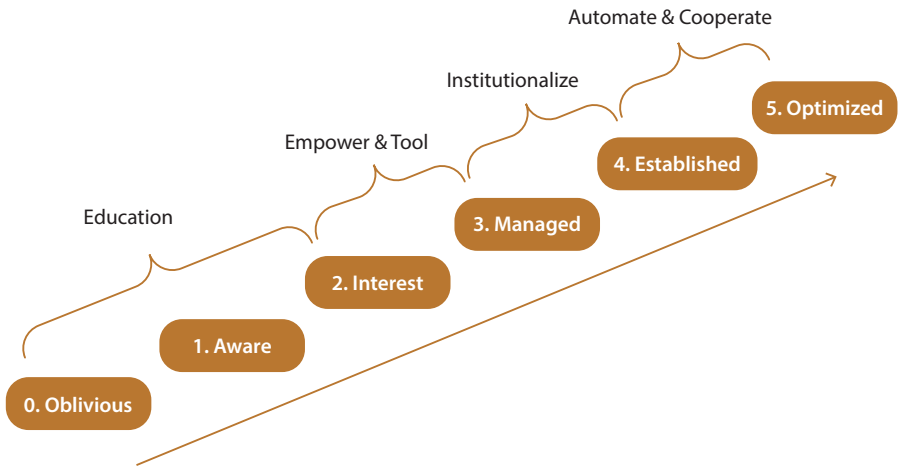

Figure 2 Maturity Levels (by author)

The model employs a stepwise approach to progressing towards maturity, which in this case is taken to mean that the company is fully prepared for the zone rollouts and has embraced zero-emission city logistics operations at the time the survey is conducted. The first three steps are geared towards education and research, before a company can implement any new initiatives, the employees need to get oriented with the concept, taking them from level 0-to 1, once aware it is vital to determine whether it is in the company's best interests to shift to more sustainable distribution methods by conducting research, this leaves them in level 2, the interest stage.

The second phase is the empower and tool phase where the resources required to transform operations are identified and plans are implemented. The phase where the company is running trials falls into level 2 and where companies have found what works for them after trials and start rolling the new changes out into daily operations falls into level 3.

After the official rollout, comes the phase where the necessary documents and training need to be developed, this phase comes as operations start to smooth out and sustainable last-mile delivery becomes part and parcel of the company's ethos, this phase straddles both levels 3 and 4.

Once the details are ironed out it then becomes simpler to automate certain processes and foster collaboration. Since zero-emission logistics is not restricted to just electrical vehicles, collaboration opens opportunities such as shared routes among entrepreneurs, use of city

hubs as well as perhaps co-investment into more efficient initiatives and infrastructure, once optimizing zero-emission city logistics processes becomes a priority this falls into level 4 and the optimized operations fostering innovation fall into phase 5.

Table 2 Explanation of maturity levels

Area of Transformation	Characteristics (High Level)
Level	
0. Awareness	No knowledge or awareness of ZES
1. Initial	Conversations are had around ZES, however, these are informal and unstructured. The knowledge of ZES is not institutionalised.
2. Executed (Researched)	The company starts to make solid moves toward ZES by allocating resources to the formation of ZES oriented projects including setting up teams and budgets
3. Managed	The impacts of ZES are known and the teams are at work with implementing ZES operations, up to 25% of operations are ZES oriented. Employees throughout the company are trained on what ZES is and how to become more sustainable
4. Established	The initial stages of ZES implementation have been successfully implemented including pilots and the operations are being ramped up significantly as there is a track record of success (25-75% ZES)
5. Optimized	100% ZES operations, clear metrics which are measured and assessed by both the company and their partners/subcontractors, there is good collaboration and the company is focused on continuous improvement and employing innovative solutions

The model also focusses on different decision-making functions in a business that are involved in making the decision to go zero-emission or any major changes, these functions were determined according to the areas which need to be paid attention to in order to facilitate the research, purchase and operation of zero-emission city logistics, these are:

- **Personnel**
  Staffing relates to making sure that there is sufficient labour to conduct the job and that the staff is well trained. It is usually the forte of the HR department to take care of filling capacity and skills gaps however, in a small business, one may find the business owner being the one who has to undertake the task of finding the right people with the right skill fit.
- **Fleet Management**
  The physical vehicles being used for city logistics. A switch to zero emission means that a business needs to either invest in their own vehicles or make use of a service provider that does.

- **Operations**
  This is the planning and execution of work, meaning the route planning and support services required to ensure that goods are delivered timeously, in the right quantities and at the right place.
- **Finance**
  This relates to the costs and revenue of a company, a company planning to make investments will probably have a forecasted budget for the resources, calculations for the total cost of ownership as well as return on investment.
- **Purchasing/Partnership**
  Some companies may opt to buy a vehicle, others may opt to use the services of an LSP, either way, there is a need to identify potential suppliers and create agreements with them, for zero-emission operations, this may include compliance clauses to ensure that the service provider follows certain guidelines. Table 3: Zero-Emission City Logistics Maturity Model delves deeper into what each level entails per area of transformation.

Table 3 Zero-Emission City Logistics Maturity Model

Area of Transformation	Personnel	Fleet Management	Operations	Finance	Purchasing
Level					
0. Oblivious	No knowledge of ZECL or any external environmental changes due to ZE regulations	No knowledge of ZECL or any external environmental changes due to ZE regulations	No knowledge of ZECL or any external environmental changes due to ZE regulations	No knowledge of ZECL or any external environmental changes due to ZE regulations	No knowledge of ZECL or any external environmental changes due to ZE regulations
1. Awareness	HR is aware of ZECL however has not explored the impacts of ZE on employees and their skills	Fleet manager has awareness of ZECL, however they have may have reservations. Fleet may comprise of Euro 5-6 trucks (infrastructure)	Operations manager has awareness of ZECL, however they have may have reservations	Finance manager has awareness of ZECL, however they have may have reservations	Purchasing manager has awareness of ZECL, however they have may have reservations

2. Interest	HR has conducted research on ZECL and identified skills gaps, training needs and capacity requirement.	Fleet manager undertakes research on the types of ZE vehicles and may have purchased a few (<10%) zero-emission vehicles to supplement of the fleet. Fleet may also comprise of new Euro 6 trucks	The operations manager has commissioned a research (by intern, employees or consultancy) on the feasibility of ZECL. There is also possibly a trial implementation, capacity gaps are identified.	The financial need for ZE has been forecasted and a TCO calculation has been completed. Funds are availed for purchasing ZEV	Purchasing manager has conducted research on ZE vehicle types and capabilities. There is also an overview of capacity gaps and subcontractors which can be used to fill those gaps.
3. Managed	The training needs of the ZECL employees are catered to and employees are open to discuss their progress and issues with the training with HR	Fleet is composed of a couple of ZE vehicles for city logistics use. In addition to mainly Euro 6 trucks.	The outcomes of the research have resulted in a trial implementation which is integrated into the normal operations. There are defined KPI's	Actual ROI becomes clearer vs forecasts. Investments are made in accordance to TCO figures	Vehicle suppliers, mechanics and subcontractors have been found, partnership agreements are signed, operations are running however they may not be fully integrated
4. Established	There are a set series of trainings on ZECL. Staff is knowledgeable about ZE operations.	Fleet is composed of mostly ZE vehicles for city logistics use. The Euro 6 vehicles are being phased out	There are SOP's on the support systems for ZECL (Loading docks, charging stations, planning) ZE trucks are responsible for 60-80% of city logistics. ZECL is integrated into normal operations.	Funds are availed for upscaling ZECL. The ROI on the initial vehicles is monitored	Subcontractors and suppliers are privy to company data in order to improve their operations, there is a level of integration and transparency. Green logistics policies are enforced on subcontractors.
Optimized	ZES is fully integrated into the corporate culture, the ZES vision is fully part of trainings and corporate culture	The City Logistics fleet is completely Zero-emission	KPI monitoring is automated, there is a focus on continuous improvement. 100% of inner-city movements are zero-emission. There is a focus on network thinking, therefore shared loads and city hubs become a norm.	Inner city fleet is completely turned over to zero-emission, the project budget is reviewed and the need for further funding for research is assessed	Suppliers and subcontractors are integrated into the companies ERP system and there is a high level of transparency. The subcontractors work in a network

The above model Table 3: Zero-Emission City Logistics Maturity Model has undergone a process of validation via interviews with logistics companies, subject matter experts and use in QuickScans by students in various phases.

1. Design
The first stage of validation was interviews with companies operating within the logistics fraternity. The result of these interviews was that the forerunners explained the stages at which they are in terms of ZEZ preparation, this allowed the verification of the higher levels of ZE maturity as displayed in the model.

2. Expert validation
The model and QuickScan was further validated in consultation with Dr. Ron van Duin and Guy Somers who created the Synchromodality maturity model. This was done iteratively over a couple of meetings where Dr. Hans Quak and Dr. Nilesh Anand, urban logistics experts supported the process by reviewing the changes in the model.

3. Business Validation
Once the established model was ready, the model was tested by 12 Hogeschool Rotterdam distribution minor students from the 21/22 cohort led by Alexander de Vries. These students were tasked with conducting QuickScans in the Rotterdam area and filled out the business maturity, the feedback from the 30 companies which were visited by the students was that the scan was geared more towards medium to large enterprises than smaller hobby shops, the model was then adjusted to reflect business functions as opposed to company departments.

Phase 4. Further Development
Thus far, 3 supply chain masters students from Hogeschool Rotterdam have completed their theses on urban logistics maturity models, with two focussed on the municipalities rolling out zero emission zones and one focused on business maturity, the feedback from their theses has supported the development of the ZECL maturity model and validated the levels with various industry partners, experts as well as businesses.

Data Collection
Data collection was done using a QuickScan which required students to go into the city, identify SMEs and conduct interviews using a standard questionnaire related to the scan as well as take pictures of the surroundings.

Zero-Emission Maturity QuickScan as an educational tool
The focus of the QuickScan for this research is to establish the status quo of the city logistics operations from the perspective of businesses located in the city centres with a particular interest in their awareness of the upcoming zero-emission zones and their impact on business. The QuickScan is a "**limited investigation** within an organisation. The aim is a global evaluation, in which the most important **opportunities, bottlenecks and opportunities for improvement are identified**" (Vollenhoven, n.d.). The Quickscan is comprised of a questionnaire with 3 sections;

- **General**: These are indexing questions used to categorize businesses according to their size, location and the volumes received
- **Fleet Details:** These questions are about the fleet size, fleet composition as well as presence of zero emission trucks, vans and cargo bikes
- **Awareness Scan:** 20 true or false quick fire questions to gauge the awareness and whether companies are making changes aligned with zero emission logistics operations

The QuickScan method was chosen due to the difficulty in accessing the entrepreneurs as they do not see themselves as city logistics players since logistics is not their core business, the retail businesses include but are not limited to bakeries, boutique shops, as well as hobby stores. These shops engage in logistics as a support function and not their core business, therefore it is necessary to employ a more proactive approach towards them as they likely will not respond to surveys sent via mail. The QuickScan method also succeeds in providing the entrepreneurs with an insight into the municipal plans in addition to having an individual (the student) who they can probe on the possibility of conducting further research. Another aim of conducting research at a university of applied sciences is to bridge the gap between what is covered in the logistics curriculum and what is happening in the industry. So the maturity QuickScan for zero-emission city logistics maturity allows students to get out of the classroom and experience how logistics is perceived in day-to-day business. As such, this method succeeds on three facets: 1. The access to entrepreneurs who would usually not be accessible due to the nature of their business; 2. Its use as an educational tool for students; 3. The facilitation of data collection.

For data collection, the first group of students (12) was sent to the Rotterdam zero-emission zone in September 2021, this group collected 30 scans from businesses in the inner city which indicated a low maturity among businesses in Rotterdam. The second group of students (8), who have been collecting data from April 2022 have interviewed 65 companies in the 4 top municipalities in Noord Brabant as pictured in Figure 4: Scans conducted in B4 Municipalities, this second group's findings, although still underway, will be delved into in the next section.

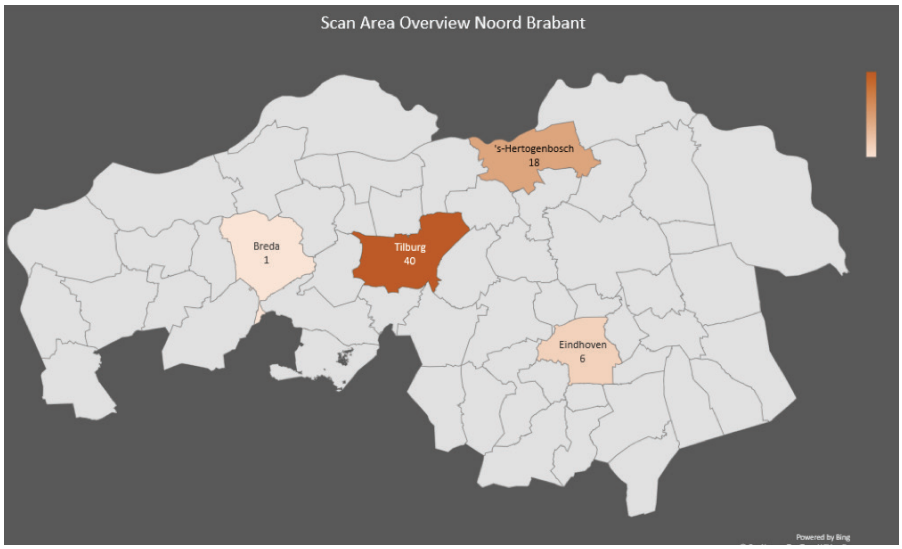

Figure 4 Scans conducted in B4 Municipalities

Preliminary Results and Discussion

This section covers the preliminary results of the maturity QuickScans conducted in the province of Noord Brabant, the Netherlands. Since this part of the data collection continues until the end of June 2022, this serves as a precursor to the final report.

It is vital to establish the city logistics activities conducted by the businesses to ensure that they are indeed the target market for information on zero-emission zones, this was done by querying their use of transport to which they responded as per Figure 5 & 6: Fleet size

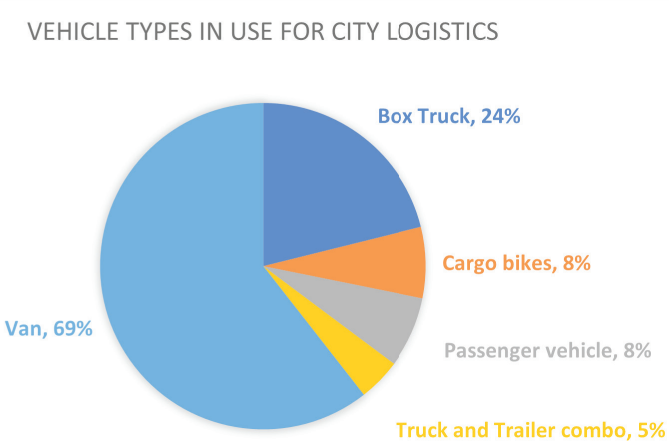

Figure 5 Vehicle types

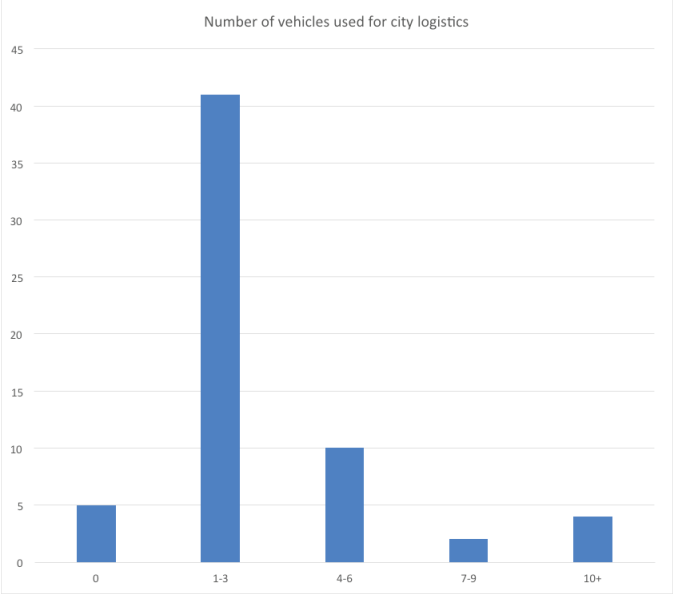

Figure 6 Fleet Size

'Figure 5: Vehicle types' illustrated that that the respondents do make use of commercial vehicles the most commonly used vehicle type being vans (69%), followed by box

trucks (24%) respectively. Fewer indicated the use of passenger vehicles, which may still be allowed into the zero-emission zones within certain limitations as set by the local government, those who indicated the use of passenger vehicles happen to fall into the facility logistics segment as indicated in the questionnaire. Most respondents indicated that they own between 1-3 vehicles and five respondents indicated that they do not own any vehicles, which may be taken to assume that they use logistics service providers as these are businesses that operate in the retail space. Only 8% of respondents indicated that they make use of cargo bikes for city logistics, and this is a great indicator as cargo bikes are the low hanging fruit of zero-emission city logistics since they are widely available, encourage physical activity and do not need any additional infrastructure as the Netherlands is already designed to be bike-friendly. For this option there is a caveat, the capacity of the cargo box is often less than 1m3 which is quite restrictive for businesses which require larger delivery volumes.

When questioned about whether the respondents made use of zero-emission vehicles (cargo bikes, electric vehicles etc.) in their fleet, 40.3% responded that they did indeed make use of these zero-emission vehicles, considering that some of the respondents function in the restaurant business which is dominated by delivery cyclists for UberEats and Thuisbezorgd, that comes as no surprise, however, the main questions geared towards zero-emission zone awareness shed light on another aspect of this.

> See figure 7: Bar graph indicating Zero Emission Awareness , page 138

As part of the QuickScan, the awareness survey which is constructed from 20 true or false questions, gives an insight into what is being done on the ground to bring zero-emission city logistics awareness to businesses and employees. The result of the awareness survey indicates that there is low awareness of the impending zero-emission zone implementation, with only 22% of respondents indicating that they are aware of the impending regulations, however, none of the companies offering training to their employees on how to move towards a more sustainable manner of conducting city logistics operations. A low 16% of companies have discussed the impacts of zero-emission zones on their operations, of the 16%, the respondent was either in a management position or the company is already making use of zero-emission vehicles for a portion of their deliveries

This indicates is that companies who are aware of the impacts of zero-emission zones have taken the appropriate steps to ensure that they are ready and realise the sense of urgency around zero-emission transportation in the designated zones.

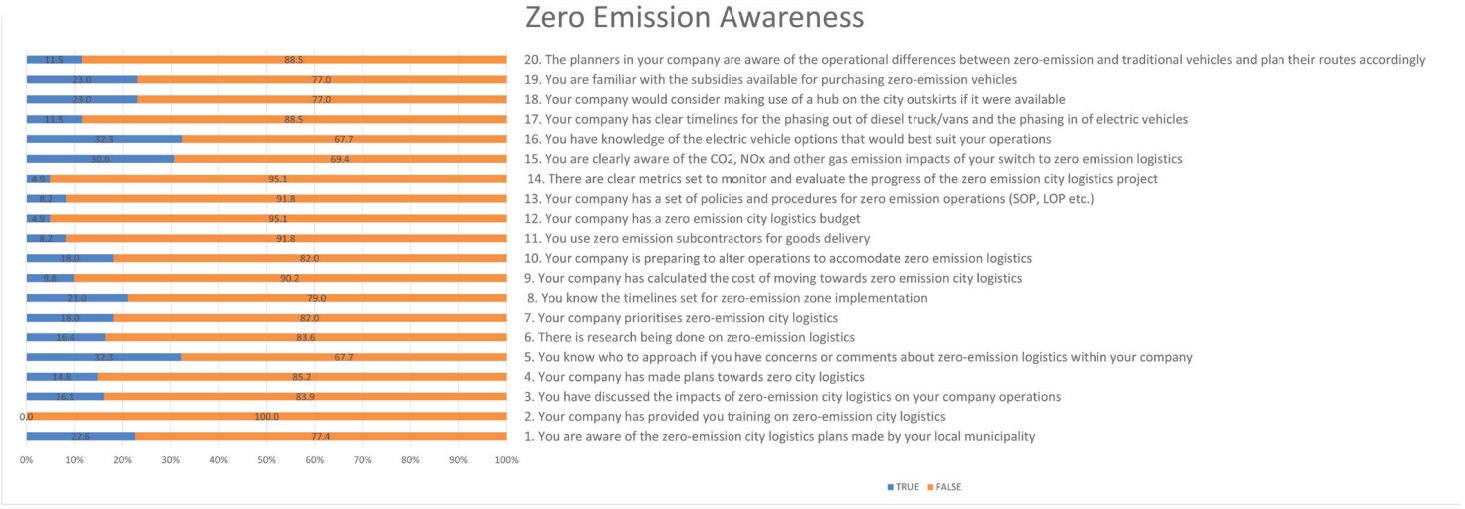

Figure 7 Bar graph indicating Zero Emission Awareness

A factor that may sway a number of businesses in the financial aspect of going zero-emission, the scans indicated that the majority of scanned businesses have not set a budget aside for the purchase of ZE vehicles with only 4.9% making plans towards ZE purchases and even though 23% have said that they have heard of the AanZET which subsidises electrical vehicle costs up to 37% with a maximum of €137 000.00 (RVO.nl, 2022) or the SEBA subsidy scheme, the subsidy scheme requires that businesses be willing to pay 95% of the cost of purchasing the vehicle as the subsidy only covers 10% of the cost of electric vehicles and is capped at €5 000.00 euros (RVO.nl, 2020).

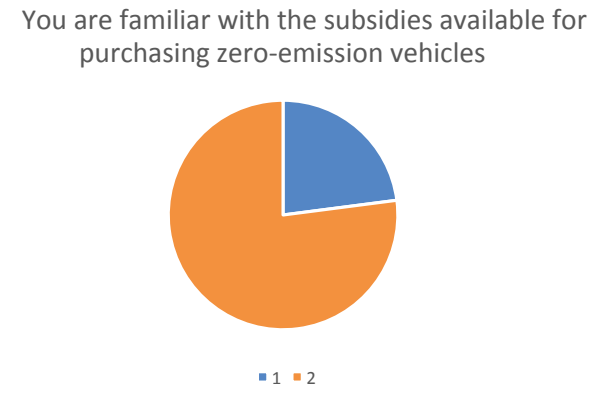

Figure 8 SEBA awareness

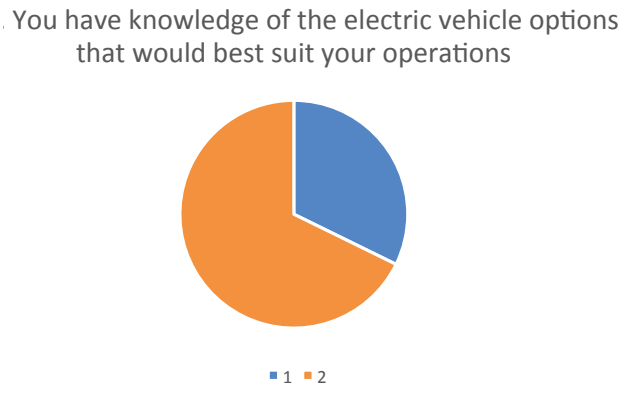

Figure 8 SEBA awareness

The financial aspect is also exacerbated by the fact that over 200 000 SMEs in the Netherlands are facing bankruptcy (KVK, 2022) due to having to pay back the government bailouts offered during the corona pandemic, this is particularly visible in the HORECA industry which dominates the inner city. This is a cause for concern as the zero-emission zones are set to be rolled out in 2025. Failure to prepare sufficiently for smooth running zero emission city logistics operations could foist many more businesses into unsavoury circumstances which is avoidable.

The previous maturity QuickScans held in Rotterdam (Quak et al, 2021) have indicated that enterprises that opt to use logistics service providers who are zero-emission fared better in terms of their maturity level and the capital costs are lower as the service provider is paid per delivery as opposed to vehicle ownership which requires that the vehicle costs be covered whether or not the vehicle is in use. Considering that only 8.9% of respondents alluded to using an LSP which prioritise zero-emission operations, a drive-in this direction would increase the ease of transfer towards zero-emission city logistics, especially since only 32% have an idea of the electric vehicle options available to them. In addition to this, almost a quarter indicated that they would opt for the use of city hubs if they were available, this option seems to be one of the best as the use of hubs also means that route planning can be done centrally for multiple businesses in the same vicinity thus lowering the number of trips, service providers and increasing efficiency by bundling goods.

The outlook is bleak for small businesses who are just managing to survive coming out of the pandemic. Furthermore, the rise in the prices of goods due to the conflict between Ukraine and Russia, exacerbated by a shrinking economy and inflation hikes proves to be a great challenge. For most small businesses, the priority is to recover from the effects these macro-environmental issues have had on business.

The upcoming zero-emission zones are added pressure as a lot of businesses will have to adjust their way of working to continue meeting consumer demands. This means that they are left no choice but to seek innovative solutions for their city logistics operations, which could be as simple as bundling loads with their neighbours or as complex as investing in new technologies. One thing is clear, entrepreneurs need communication from the municipalities about what the rollout means for them and what options are available for zero-emission transport.

Collective Zero Emission City Logistics Maturity

From the information collected in the QuickScan, it's possible to create a snapshot of the collective maturity level of companies as visualized in Table 4: Maturity Level of SME's in Noord Brabant.

Table 4 Maturity Level of SME's in Noord Brabant

Area of Transformation	Personnel	Fleet Management	Operations	Finance	Purchasing
Level					
0. Oblivious	No knowledge of ZECL or any external environmental changes due to ZE regulations	No knowledge of ZECL or any external environmental changes due to ZE regulations	No knowledge of ZECL or any external environmental changes due to ZE regulations	No knowledge of ZECL or any external environmental changes due to ZE regulations	No knowledge of ZECL or any external environmental changes due to ZE regulations
1. Awareness	HR is aware of ZECL however has not explored the impacts of ZE on employees and their skills	Fleet manager has awareness of ZECL, however they have may have reservations. Fleet may comprise of Euro 5-6 trucks (infrastructure)	Operations manager has awareness of ZECL, however they have may have reservations	Finance manager has awareness of ZECL, however they have may have reservations	Purchasing manager has awareness of ZECL, however they have may have reservations
2. Interest	HR has conducted research on ZECL and identified skills gaps, training needs and capacity requirement.	Fleet manager undertakes research on the types of ZE vehicles and may have purchased a few (<10%) zero-emission vehicles to supplement of the fleet. Fleet may also comprise of new Euro 6 trucks	The operations manager has commissioned a research (by intern, employees or consultancy) on the feasibility of ZECL. There is also possibly a trial implementation, capacity gaps are identified.	The financial need for ZE has been forecasted and a TCO calculation has been completed. Funds are availed for purchasing ZEV	Purchasing manager has conducted research on ZE vehicle types and capabilities. There is also an overview of capacity gaps and subcontractors which can be used to fill those gaps.
3. Managed	The training needs of the ZECL employees are catered to and employees are open to discuss their progress and issues with the training with HR	Fleet is composed of a couple of ZE vehicles for city logistics use. In addition to mainly Euro 6 trucks.	The outcomes of the research have resulted in a trial implementation which is integrated into the normal operations. There are defined KPI's	Actual ROI becomes clearer vs forecasts. Investments are made in accordance to TCO figures	Vehicle suppliers, mechanics and subcontractors have been found, partnership agreements are signed, operations are running however they may not be fully integrated

4. Established	There are a set series of trainings on ZECL. Staff is knowledgeable about ZE operations.	Fleet is composed of mostly ZE vehicles for city logistics use. The Euro 6 vehicles are being phased out	There are SOP's on the support systems for ZECL (Loading docks, charging stations, planning) ZE trucks are responsible for 60-80% of city logistics. ZECL is integrated into normal operations.	Funds are availed for upscaling ZECL. The ROI on the initial vehicles is monitored	Subcontractors and suppliers are privy to company data in order to improve their operations, there is a level of integration and transparency. Green logistics policies are enforced on subcontractors.
5. Optimized	ZES is fully integrated into the corporate culture, the ZES vision is fully part of trainings and corporate culture	The City Logistics fleet is completely Zero-emission	KPI monitoring is automated, there is a focus on continuous improvement. 100% of inner city movements are zero-emission. There is a focus on network thinking, therefore shared loads and city hubs become a norm.	Inner city fleet is completely turned over to zero-emission, the project budget is reviewed and the need for further funding for research is assessed	Suppliers and subcontractors are integrated into the companies ERP system and there is a high level of transparency. The subcontractors work in a network

The majority of companies fall into the awareness level for the different departments because inasmuch as they have heard news about the changes, they are not certain of the impacts for them. 'Fleet management' manages to score higher since from the 1st January 2022, Euro 5 lorries have been banned in certain city centres and in addition to this, some businesses have been using cargo bikes and a few have purchased one or two electric powered vans. Even though the purchases and use of these vehicles was not specifically motivated by the zero emission zones, this does indicate a move in the right direction.

Conclusion

City logistics is one of the pillars of a regions economic health. Every day hundreds of commercial vehicles traverse the narrow streets to supply goods and services to individuals and your favourite stores, however, this is not without issues. Cities are plagued with traffic jams, obstructions, bad air quality all of which commercial vehicles contribute towards. The most concerning are the noxious emissions stemming from the use of fossil fuels, which lends to city logistics contributing 3.6 megatonnes of carbon dioxide to the atmosphere annually in the Netherlands.

Changes are being made as new regulations are being implemented by local governments in the Netherlands by way of restricting traditionally fuelled vehicles access to certain areas of the city, these areas, called zero emission zones will be found in 30-40 Dutch municipalities between 2025 and 2030, as of May 2022, this number is at 27 and more municipalities are set to announce their zero emission zones in the next few years.

Zero-emission zones are set to make a great impact on reducing the carbon emissions and increasing liveability among city dwellers but what about the small to medium enterprises that make up the landscape of central business districts?

Businesses have stated that there is little sense of urgency to switch to zero emission city logistics as they claim that the government is continuously changing the regulations which leaves them vulnerable if they make the purchases too soon, some business owners have stated that they would like to wait it out. The tough economic situation also makes it difficult for small businesses to make investments at short notice, which indicates the need for a big information drive which will equip business owners with the knowledge of what zero-emission zones are, their potential impacts and guidelines on how to go zero-emission. Local authorities and the cooperating interest groups and the Dutch Ministry of Transport also need to increase efforts in communicating the planned zero-emission city logistics policies.

The application of ZEZ-maturity model has shown that the overall maturity for the Noord Brabant 4 (Breda, s'Hertogenbosch, Eindhoven and Tilburg) is low at level 1, based on the current sample of QuickScans, however, since the QuickScan studies are ongoing the outlook may change as municipalities inform their residents about the outlook on zero-emission zone rollouts.

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References

Alons, K., Fontys, H., & Somers, G. (2019). The current state of Synchromodality: an application of a synchromodal maturity model on case studies Autonomous truck driving project. https://www.researchgate.net/publication/338774168

Kerzner, H. (2002). Strategic planning for project management using a project management maturity model. John Wiley & Sons.

KVK. (2022). 200,000 companies are about to collapse. Den Haag: https://www.rtlnieuws.nl/economie/bedrijven/artikel/5300156/kvk-ondernemers-faillissementen-stopzetting.

McNamara, S. R. (1972). Address to the United Nations Conference on the Human Environment. Stockholm: World Bank.

Nabielek, K., Hamers, D., & Evers, D. (2016). Cities in the Netherlands. https://www.pbl.nl/sites/default/files/downloads/PBL-2016-Cities-in-the-Netherlands-2470.pdf

Paulk, M. C., Curtis, B., Chrissis, M. B., Bamberger, J., Kasse, T. C., Konrad, M., Perdue, J. R., Weber, C. V, Withey, J. V, & Averill, E. L. (1991). AD-A240 603 Capability Maturity Model for Software.

Quak, H., Motloung, T., Anand, N., & Duin, R. (2021, 11 05). The Development of the Zero Emission Maturity Model for City Logistics. Breda: Breda University of Applied Science.

Rijksoverheid. (2019). Nederlandse Klimaatakkord. Den Haag: Rijksoverheid.

Rijksoverheid. (2020). Uitvoeringsagenda Stadslogistiek. Rijksoverheid.

Rosemann, M., & De Bruin, T. (2005). Towards a business process mangement maturity model. Proceedings of the 13th European Conference on Information Systems, Information Systems in a Rapidly Changing Economy, ECIS 2005.

RVO.nl. (2022). Purchase subsidy for Zero-Emission Trucks (AanZET). https://www.rvo.nl/subsidies-financiering/aanzet#budget

RVO.nl. (2022). Subsidy scheme for zero emission commercial vehicles (SEBA) | Business.gov.nl. https://business.gov.nl/subsidy/zero-emission-commercial-vehicles-seba/

TNO. (2020). CO 2-uitstoot van de logistiek in Nederland. www.topsectorlogistiek.nl

United Nations. (2015). Paris Agreement. Paris: United Nations.

Vollenhoven, C. S. (n.d.). QuickScan. Retrieved from Leansixsigmagroep.nl: https://leansixsigmagroep.nl/consultancy/quickscan/