REVEALING THE SECRET EMISSIONS OF E-COMMERCE

HINT: IT'S ALL IN THE DELIVERY

CLEAN Mobility Collective

STAND .earth

A joint investigation by
Clean Mobility Collective (CMC) and
Stand.earth Research Group
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About Clean Mobility Collective
Clean Mobility Collective (CMC) is a network working to address the growing emissions and public health crisis from the global transport sector. We are a worldwide movement of organisations united around a common vision to achieve fossil-free, healthy and safe cities for all.

About Stand.earth Research Group
Stand Research Group obtains crucial information to help build campaigns on critical issues. We specialise in chain of custody research, identifying and tracking raw materials as they move through complex supply chains. We trace environmental destruction and human rights violations to help hold corporate actors accountable and, ultimately, change corporate practices.

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Executive summary

DHL. FedEx. Amazon. UPS. When we see these vans and motorbikes on streets across the world, we know someone, somewhere is getting another parcel delivered. What few people consider — and companies would like to keep it that way – is the cost to our health, the health of our cities, and ultimately to our planet, from the unprecedented, and largely unregulated, rise of delivery culture.

In 2021, e-commerce accounted for nearly 20% of retail sales worldwide. Forecasts indicate that by 2025, online sales will make up close to a quarter of total global retail sales.[1] As online sales grow, so too do the packages, delivery drivers and delivery vehicles needed to get them to their destination. And with that comes pollution, carbon emissions and unsustainable fossil fuel-powered fleets in their millions.

Until now, very little was known about this part of the e-commerce chain – the stage commonly known as ‘last-mile’ delivery. The term refers to the final stage in a parcel’s journey from distribution depot to doorstep, although this is not necessarily a journey of a mile.

But it is a short journey — especially in comparison to the rest of the item’s lifespan, which can often cross continents. Despite this, the last-mile accounts for up to half of all delivery vehicle CO_2 emissions. These short journeys that millions of delivery vans are making every single day are having a disproportionate effect on pollution, smog, air quality and ultimately our ability to achieve a zero emission future.

Much is still unknown about last-mile courier companies. The majority fail to account for the full extent of their climate

impact – so we have done the math for them. **The methodology outlined in this report allows us to do something that has never been done before: estimate the last-mile carbon emissions of potentially any courier company in the world**.

We researched 90 courier companies across Europe, India and North America. Not one of them openly discloses their last-mile emissions. We discovered that:

- The top six worst polluters are: UPS, FedEx, Amazon Logistics (the courier and logistics division of Amazon.com), DPD, eKart (the courier division of Flipkart), and DHL eCommerce Solutions (the courier division of Deutsche Post DHL Group).

- The last-mile emissions of these companies alone is approximately 4.5 megatons of CO_2. That's roughly equivalent to CO_2 emissions from 600,000 US homes' energy use for one year, or from one million petrol passenger vehicle journeys.

- We estimate that the last-mile courier industry annually emits approximately 500 thousand tonnes of CO_2 in India, three million tonnes of CO_2 in Europe, and four million tonnes of CO_2 in the US.

- The top six polluters account for over two-thirds of total CO_2 emissions across all parent companies in our database. In addition, these six companies are also primarily responsible for subcontracting delivery services to many of the remaining companies in our dataset.

- Europe, India and North America appear to all have similar profiles in terms of carbon emissions per parcel. The difference is that India is currently a very small e-commerce market– yet it is poised to become one of the biggest e-commerce markets in the world.

- E-commerce last-mile delivery practices include sub-contracting and use of gig workers with limited social protection and bare minimum wages.

- A number of the companies analysed in this report, including Amazon, FedEx and UPS, have also been linked by Stand.earth to new research that shows they are using oil from the Amazon rainforest to power their delivery fleets. Overall, 39 million gallons of diesel from the Amazon rainforest was consumed by parcel delivery services in the US in 2020.[2]

Our research reveals a clear and urgent need for companies to be more open with their data — and to commit to zero emission fleets by 2030. Until they step up, we have filled in the missing information based on what can be found about the sector. Correlations are now available between the number of parcels, revenue, employee counts and approximate CO_2 emissions that have not previously been estimated on a global scale.

The database, conversion factors and formulas presented throughout this report provide the foundation for further investigation into the problems with this burgeoning industry, and illuminate the imperative to find creative solutions to reduce its carbon footprint.

Introduction

Fashion, food, footwear, flowers, furniture – there's practically nothing we can't buy online. Amazon, the undisputed leader of the e-commerce pack, sold US$470 billion worth of goods globally in 2021 alone.[3] Sales are regularly boosted by marketing exercises such as Black Friday and Amazon Prime Day. On last year's Prime Day, shoppers across 20 countries spent over US$11 billion on 250 million individual items in just 48 hours.[4] This year, even bigger profits are predicted. The deliveries required to service these sales alone are almost unimaginable.

Over the last decade our appetite for online buying has grown exponentially. Back in 2010, global e-commerce sales were US$572 billion. By 2021, this figure had reached US$4.9 trillion, and it's predicted to grow by 50% over the next four years[5] – buoyed by a surge of online shopping during Covid-19, and a concurrent loss of bricks and mortar premises for retailers.

Millions of purchases mean millions of parcels. And that means millions of deliveries: millions of vehicles and drivers clogging up streets and lungs, creating traffic, fumes and stress throughout our towns and cities. And that's before all the failed deliveries or unsuitable goods are sent back where they came from: an estimated 5-10% of deliveries fail to even reach their final destination.[6]

We have adapted remarkably quickly to the sight of DHL, Amazon and FedEx vans ploughing around our neighbourhoods, idling with motors running as drivers make their deliveries, holding up traffic and spewing out fumes. But the damage these fossil fuel-powered fleets are doing to our lungs and our environment is only just beginning to be understood.

Despite companies' big claims for green fleets and moves towards electiric vehicles (EVs), very few are practising what they preach on sustainability and climate change. Indeed, the commitments of the top six polluting companies in this report – UPS, FedEx, Amazon Logistics, DPD, eKart and DHL eCommerce Solutions – are insufficient to reach zero emission deliveries quickly. Several lack plans and targets entirely, while others lack transparency and shroud the pollution and environmental impact of their parcel delivery operations from the public and consumers. Only one company, Flipkart, despite being a smaller, global south-centric company, has made substantial ambitious commitments. For more on this topic, please see the December 2021 report, *"Parcel delivery on a warming planet"*.[7]

Why our cities are choking

Transport is already the world's largest source of new greenhouse gas emissions, currently responsible for almost 12% of all emissions produced worldwide.[8] If we are to get anywhere near hitting our climate targets, we need to make massive changes to our global transport systems.

When we take a closer look at likely areas of significant growth in transport emissions – and therefore those with the biggest potential for change – all signs point to e-commerce and the associated parcel delivery industry.

As we discussed in *Parcel delivery on a warming planet*, parcel deliveries rose hugely throughout the Covid-19 pandemic,[9] and this growth has resulted in more vehicles, more local pollution, and, as calculated in detail in this current report, more CO_2 emissions. The World Economic Forum projected that the number of vehicles delivering parcels in major cities could increase 36% by 2030, with associated delivery emissions increasing by 32% and congestion[10] rising over 21%.[11] What this growth looks like in specific regions (Europe, India and North America) is discussed later in this report.

The parcel delivery sector is composed of e-commerce behemoths like Amazon, along with highly recognisable parcel delivery companies such as DHL, UPS, FedEx and DPD, and lesser known brands which are more region-centric such as DPD in Europe and eKart in India. With increasing public consciousness of both corporate power and political actors failing to act, now is an opportune time for new research to assist networked corporate and city-level initiatives calling for zero emission deliveries.

As courier companies rarely, if at all, report their last-mile emissions, we took it upon ourselves to develop a methodology to estimate a given company's CO_2 emissions based on other reported values (annual deliveries, or even revenue or employee counts). The methodology and supporting data is presented in the Appendices. While all estimates are by their nature imprecise, **this systematic approach allows us to do something that has never been done: estimate the last-mile carbon emissions of potentially any courier company in the world**.

Underpinning all the calculations in our study is the derivation of the last-mile emissions factor and conversion formulas (see Appendix 1), coupled with the creation of a database of courier companies. Putting these three things together, we estimate the emissions for 90 courier companies/divisions (Appendix 3). Our calculations show that the following six global courier companies emit roughly 4.5 million metric tons of CO_2 from their last-mile operations alone, equivalent to the annual CO_2 emissions from one million petrol passenger vehicles.[12] Combined, these six companies account for over two-thirds of the combined CO_2 emissions of all parent companies in our database:[13]

- **UPS**
- **FedEx**
- **Amazon Logistics** *(the courier and logistics division of Amazon.com)*
- **DPD**
- **eKart** *(the courier division of FlipKart, in turn owned by Walmart)*
- **DHL eCommerce Solutions** *(the courier division of Deutsche Post DHL Group)*

This new research on the last-mile sector demonstrates consistent themes regarding the scale of the climate impacts, the lack of invaluable data, and the identification of the actors most responsible for emissions.

It should also be noted that, while this report focuses on the climate impact of parcel deliveries driven by the growth in e-commerce, there are other human impacts too, which are not addressed in this report. For example, the communities most impacted by the growth of e-commerce in the US are low income, Black and Brown communities in port areas and neighbourhoods where disproportionate levels of fulfilment centres and warehouses are sited in the stages leading up to the last-mile.[14] These areas suffer from increased pollution and traffic congestion associated with hundreds to thousands of trucks and vans regularly rolling through.

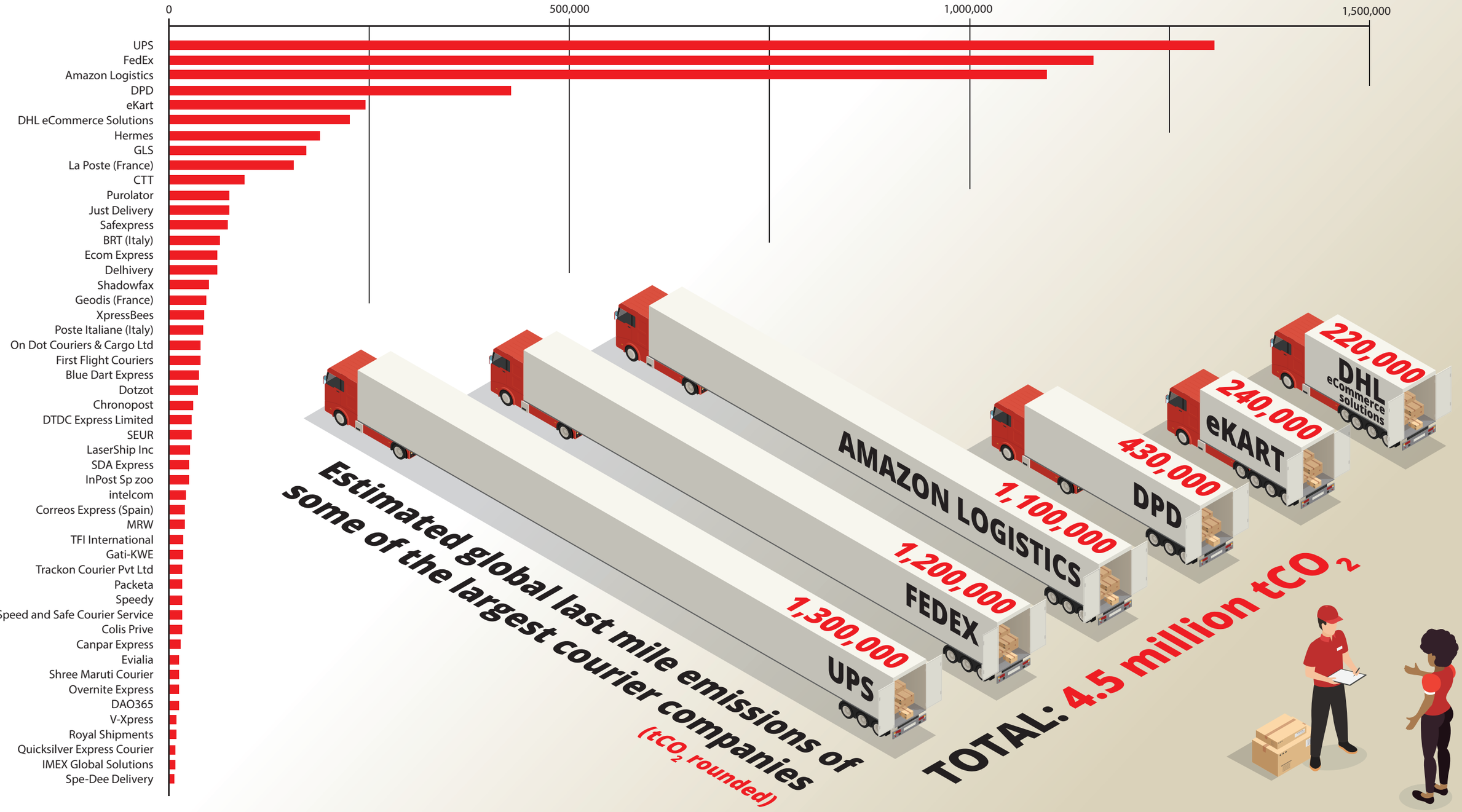
How important is the last-mile?

Globally, the **last-mile accounts for up to half of total delivery carbon emissions**.

Specifically, based on best available data obtained through a literature review, we estimate the last-mile represents approximately 50% of delivery CO_2 emissions in both Europe and India, though the figure could be slightly smaller (or even higher) given data limitations. The sources and methodology are outlined in Appendix 2.5. These are approximations and subject to many variables, variations over time, and company-specific operations. Nonetheless, these figures suggest that the last-mile is highly significant from a climate perspective.

The last-mile portion of delivery logistics is similarly relevant from a financial perspective, as it represents 40-50% of delivery costs (see Appendix 2.6).

Estimated last mile emissions of 50 selected parent courier companies (tCO_2)



As one logistics digital service provider in Europe writes, **"The problem with last-mile delivery is that it is the most complex, time-consuming and expensive step in the shipping process."**[15]

The table below shows estimated last-mile emissions of some of the largest courier companies. Note that this only includes the courier divisions or subsidiaries of selected global companies, where DHL eCommerce Solutions, Amazon Logistics, and eKart are the express courier divisions of DHL, Amazon and Flipkart respectively. This does not include the full emissions profile of Amazon, DHL and FlipKart/Walmart.

Table. Estimated last-mile CO_2 emissions across selected geographies

Company name	Estimated global last mile emissions (tCO_2 rounded)
UPS	1,300,000
FedEx	1,200,000
Amazon Logistics	1,100,000
DPD	430,000
eKart	240,000
DHL eCommerce Solutions	220,000
Total	4.5 million

We estimate the total combined annual last-mile emissions of just these six courier companies is 4.5 megatons of CO_2. That's roughly equivalent to CO_2 emissions from 600,000 US homes' energy use for one year, or one million petrol passenger vehicles.[16]

The full scale of the global courier delivery market is not fully known, but one consultancy estimates that 131 billion parcels were delivered in 2020 across a number of countries representing the parcel delivery market of 3.8 billion people,[17] or about half of the global population. If this is representative of the entire world, then global last-mile emissions could currently be in the vicinity of 50 megatons of CO_2,[18] equivalent to the carbon emissions of 13 coal-powered plants.[19]

How does the last-mile compare across geographies?

For this project, we focused on three example geographies: Europe (EU), India and North America.

Based on published figures for parcels delivered in the US, Germany, India, France and Italy, and extrapolated for the EU as a whole, we estimate the total last-mile carbon emissions per country. We also do the same for selected cities in India, by taking the total number of parcels in the country and multiplying it by the share attributable to the largest cities and extrapolating according to population (see Appendix 2.3 for details). Perhaps unsurprisingly, the combined last-mile courier emissions of the five biggest cities in India have footprints equivalent to the total last-mile emissions of some countries. Most surprising is the expected rate of growth in India, as described on page 16.

Table. Estimated last-mile CO_2 emissions across selected geographies

Geographic region	Annual number of parcels delivered (billion)	Estimated last mile delivery emissions (tCO_2 rounded)
North America	**21.6**	**4,400,000**
US	20.0	4,100,000
Canada	1.6	330,000
European Union	**14.9**	**3,000,000**
Germany	4.1	840,000
France	1.6	330,000
Italy	1.3	270,000
India	**2.6**	**500,000**
Delhi	0.6	110,000
Mumbai	0.4	80,000
Kolkata	0.3	60,000
Bangalore	0.2	50,000
Chennai	0.2	40,000

At about US$600 billion dollars in 2021, the United States is the second-biggest e-commerce market in the world[20] after China, and it is projected to grow to US$1.3 trillion by 2025.[21] Amazon dominates e-commerce, at nearly a quarter of online revenue in the US.[22] In 2021, Amazon shipped 72% of its own packages through its in-house courier division Amazon Logistics, up from less than 47% just two years earlier.[23]

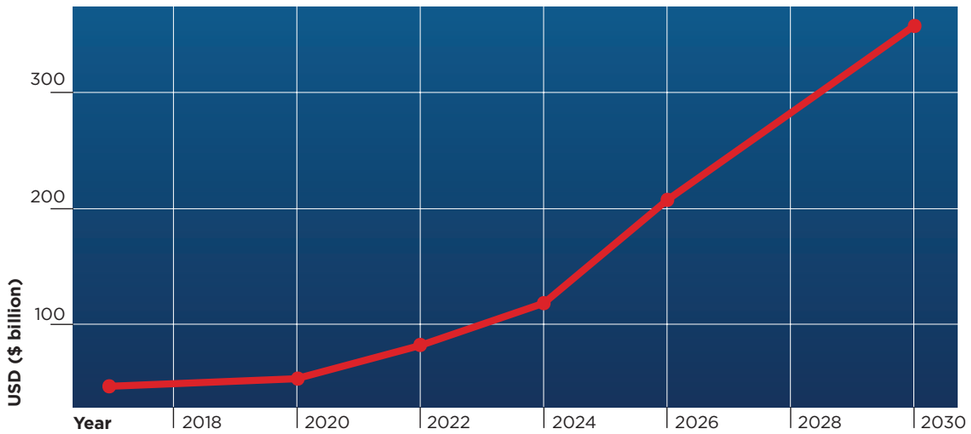
In 2019, Europe's share of global e-commerce was about U$350 billion, or about 10% of the global total of US$3.5 trillion.[24] E-commerce is growing at a faster rate in Eastern Europe.[25] The dominant online marketplaces in Europe are US-based Amazon and Germany-based Zalando.[26] Two European-based courier companies — DHL (specifically their division DHL eCommerce Solutions) and DPD — are within the top six polluters list presented in the previous chapter.

While India currently plays a relatively minor role in e-commerce and last-mile delivery compared to Europe and the US, its growth projections are astounding: the India Brand

Equity Foundation predicts that the Indian e-commerce market will grow from an estimated US$75 billion in 2022 to US$350 billion by 2030, and could become the second-largest e-commerce market in the world after the US by 2034.[27] Every month, there are ten million new active internet users in India, higher than any other country. In many regards, India is one of the world's fastest growing e-commerce markets.[28]

Note that according to some media reports, eKart, a subsidiary of the Indian e-commerce giant Flipkart, may now be delivering 100 million parcels a month,[29] or a billion parcels per year — potentially representing close to half of India's total delivery market of around 2.6 billion parcels. Changes are happening so quickly in India that it is difficult to come up with stable figures to compare, but what is clear is that the climate impact will grow alongside the growth of e-commerce in India.

Chart. Projected rise of the e-commerce industry in India [30]



INDIA RISING

While Europe, India and North America appear to all have similar profiles in terms of carbon emissions per parcel, the difference is that India is currently a very small e-commerce market – yet it is poised to become one of the biggest e-commerce markets in the world. Every month, there are ten million new active internet users in India, higher than any other country.

As India has some of the world's most polluted cities — with 14 of the top 20 most polluted cities in the world — much of the existing research on emissions and delivery is around particulate emissions and their subsequent health impacts rather than exclusively CO_2.[31] As a result, it is difficult to derive accurate greenhouse gas emissions conversion factors for India compared to obtaining such factors for Europe. We nonetheless derived an emissions factor that applies to India, which is presented in Appendix 2.4, based on data from a variety of sources.

The relevance of last-mile as expressed by our calculations for India are roughly in line with CO_2 emissions figures for Europe (our intermediate figures for India are an estimated 285 gCO_2 per parcel and 51% share of total delivery emissions, versus an estimated 194 gCO_2 and 53% respectively for Europe), strongly suggesting that last-mile delivery constitutes a significant share of delivery emissions around the globe. It is important to note that while this figure for India represents the best possible estimate given data limitations, this figure has not been corroborated and the level of uncertainty is unknown; thus we apply the global weighted average of 204 gCO_2 per parcel to all company-level estimate calculations in this study instead. If per-parcel CO_2 emissions are indeed higher in India compared to other countries, as our research suggests might be the case, possible explanations could include longer courier driving distance, older and more inefficient vehicles, and greater congestion in Indian cities.

What does the last-mile subcontractor landscape look like?

Subcontracting is the practice through which courier companies delegate driving and delivery out to third-party groups and drivers, allowing them to reduce employee benefit and overall costs while maintaining effective control over goods' movements. Large companies such as Amazon, FedEx, etc. are not offering transparent information about who they contract with. This leads to gaps in the ability to trace the overall fleet sizes responsible for completing deliveries, and in how emissions information is being reported.

The last-mile delivery subcontractor landscape is vast. According to Dun & Bradstreet data, there are over 50,000 "Couriers or Express Delivery Services" companies in the EU alone.[32]

To start to answer the question of what this courier subcontractor landscape looks like, we reviewed websites and other public-facing materials of each company in our database to determine relationships with the top global courier companies: UPS, FedEx, DHL and DPD. We also explored other approaches typically used by Stand.earth Research Group to determine corporate inter-relationships (for example, customs data analysis), but little information is readily available on subcontractor relationships. Therefore, we approached this exercise as an experiment to determine what kind of information on subcontractor relationships can be found. The results of this experiment are presented in Appendix 3.2.

There are significant social justice issues regarding drivers and the responsibility for transitioning to zero emissions. Drivers that meet the legal standard to be classified as employees but are misclassified as independent contractors earn very low wages and are left on the hook to finance expensive vehicles with high interest loans to comply when new clean vehicle rules are passed.[33]

According to the Labour Centre at the University of Berkeley in California, low road labour practices are widespread in trucking, particularly in the contractor industry segment. Since trucking deregulation in the US in the 1980s, a destructively competitive market environment has forced companies to cut costs, including by reducing compensation to truck drivers. High prevalence of truck driver misclassification is found in local freight trucking, local pickup and delivery, and long-haul trucking.[34] Subcontracting poses a significant challenge in advocacy for zero emission deliveries, and partnerships with workers are essential in a corporate accountability strategy.

In Delhi, India, the majority of last-mile deliveries are made by gig workers who often require financing to buy vehicles.[35] In the US, Amazon contracts over 2,000 companies of a few hundred drivers who are independent contractors, and Amazon leases delivery vans to these contractors.[36] In the UK in 2015, pre-Brexit, almost half of parcel delivery companies had a turnover of less than £50,000,[37] suggesting that the subcontracting industry is dominated by small players there too. All of these examples suggest that subcontracting labour in the last-mile delivery industry is a global phenomenon.

WORKERS BEAR THE BRUNT

Logistics and delivery companies often sub-contract drivers or use gig workers with limited social protections and pay bare minimum wages. In the US, Amazon.com contracts over 2,000 companies of a few hundred drivers who are independent contractors, and Amazon leases delivery vans to these contractors. Low wages and high pressure to perform can lead to extreme working conditions. A 2021 report for the US Guardian reported that Amazon drivers across the country were forced to work 14-hour days and urinate in bottles in their vehicles in order to keep up with delivery rates. In 2021, eKart workers in Mumbai went on strike to demand access to washrooms and a single day off per week.

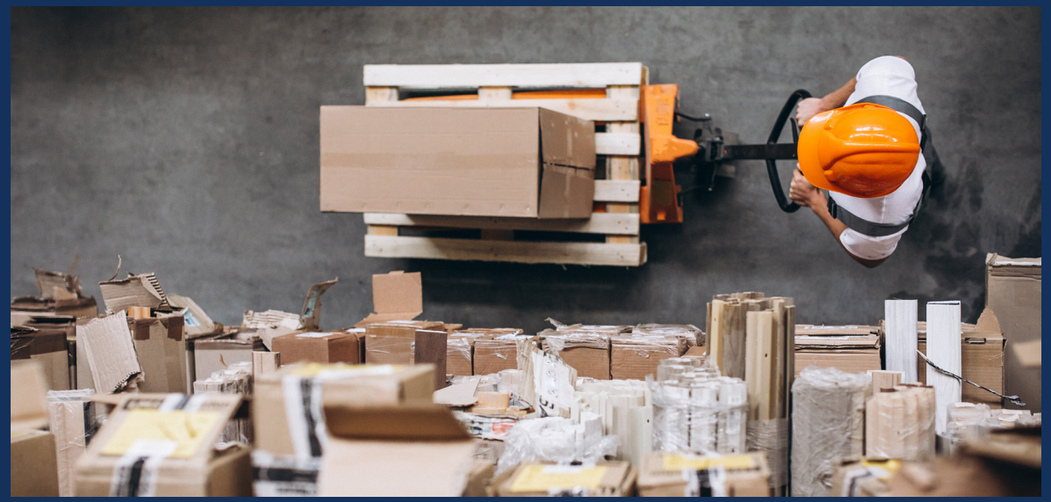
Conclusion and recommendations

Our research clearly shows that last-mile delivery CO_2 emissions are a critical cause for concern, since they contribute up to half of all delivery transport emissions in the e-commerce sector. The significant costs associated with the last-mile sector, coupled with rising fuel costs, provide an added impetus to **companies to adopt greener technologies and measures to reduce both costs and emissions at the same time**.

The last-mile emissions problem is also not a concern limited by geography: the problem exists across regions. The overall carbon emissions from the last-mile delivery sector in the United States, Europe and India indicate that the e-commerce sector is currently a significant contributor to overall emissions in **countries and regions across the world**.

The projected growth of the e-commerce sector across the three regions also highlights the **urgent need for companies and governments to adopt sustainable solutions** including but not limited to fleet electrification. India alone is projected to become one of the largest e-commerce markets in the world.

In addition, significant market consolidation in the e-commerce sector means the biggest courier companies — FedEx, UPS, Amazon Logistics, eKart (owned by Walmart/ Flipkart), DPD and DHL eCommerce Solutions — are also responsible for the bulk of the overall carbon emissions in the last-mile delivery space. This implies **a critical role and responsibility for the largest companies to be at the forefront** of adopting solutions to drastically reduce emissions. None of the companies researched, neither the big global courier companies nor the sub-contractor logistics and delivery companies, disclose any relevant data linked to last-mile emissions. **Greater transparency is the first step** towards informed policymaking by governments. Last-mile emissions could include Scope 1 and Scope 3 emissions, and it is important that companies look at reporting and addressing both these profiles with equal urgency in the last-mile emissions space. Scope 3 emissions in particular are an acknowledged global challenge for companies across sectors, but any adequate time-bound transition plans should adequately address these.



And finally, the **vast presence of sub-contractors**, both companies and gig workers, permits the bigger e-commerce companies to avoid audits and other oversight that would generate useful information about their business practices. The lack of data, especially given the dependence and scale of subcontracting in the last-mile delivery ecosystem, is worrying because it makes it very difficult to hold companies accountable regarding CO_2 emissions, labour rights, and social protections.

This project is essentially proof of concept. Future research can be done to expand the company database, further refine the derived emissions factor and conversion formulas, and expand the geographic scope beyond Europe, India and North America.

Recommendations

1) Companies need to urgently commit to zero emission deliveries by 2030.

2) Companies need to urgently adopt data disclosure measures, including:

a) Report all data linked to last-mile delivery and overall emissions including fleet size, city/provincial level fleet information, break up, subcontractor data, human rights, micro mobility piloting and sustainability, etc.
b) Compliance with CDP reporting for scope 1,2,3 emissions.
c) Detailed zero emission vehicles transition plan and reporting schedules.

3) Companies need to support their subcontractors including gig workers:

a) Support and take responsibility for subcontractor zero emission transition.
b) By supporting better worker conditions — living wages, hours, safety, benefits etc.
c) Regularly report on use of subcontractors and make this information publicly available.

4) Companies need to engage consumers to create awareness:

a) Inform consumers on the shift to sustainable consumption habits, including but not limited to actively providing data to consumers on their choices and their impacts.

5) Governments and companies need to act across geographies to ensure:

a) Strong uptake of EV and non-motorised transport (NMT) measures in the last-mile delivery sector either through voluntary commitments by companies, or by policy or regulatory requirements from governments.
b) Create strong on-ground infrastructure in communities for widespread adoption of zero emissions fleets as part of the pathway to zero emission deliveries.
c) Best practices are shared across the industry and governments.

Appendix 1. Last-mile delivery emissions factor and conversion formulas

The following figures are described in further detail in Appendix 2, including sources and methodology.

Last mile as a share of total delivery transportation CO_2 emissions:

Up to 50%

Last mile per-delivery emissions factor:

204 gCO_2 per parcel

This is the emissions factor used in our calculations to estimate per-company emissions. This is the best possible global estimate given data limitations, but it does not reflect regional variations.

Conversion formulas:

$$D = 10^{0.640 \log(P) + 5.723}$$

$$D = 10^{0.589 \log(R) + 3.052}$$

Where,
D = estimated number of deliveries per year
P = number of employees
R = annual revenue in USD

Appendix 2. Methodology

As courier companies rarely, if at all, report their last-mile emissions, we took it upon ourselves to develop a methodology to estimate a given company's CO_2 emissions based on other reported values (annual deliveries, or even revenue or employee counts). The methodology and supporting data is presented here.

Appendix 2.1 — Limitations

Although logistics research is a well-established field, innovation in e-commerce platforms, unprecedented demand for express and same-day delivery, as well as increased modularity in delivery methods in recent years, has resulted in a space with sparse research and a fractured data landscape. The two main limitations of this research are varying definitions of categories of interest (which affects our ability to compare between regions), and a lack of centralised data sources or methodology that would allow us to reference and corroborate derived figures.

Specifically, there are inconsistent and varying definitions for the various stages and types of delivery, as well the companies involved in that process. For example, there is no established definition for 'last-mile delivery' which is also commonly referred to as 'final mile' or 'on the ground' transportation. In some cases, last-mile refers to the journey from the nearest distribution centre to the customer's home or in other cases it refers to the journey from a regional distribution centre, to a local fulfilment centre, to a customer's home. Of six primary studies we used to derive a global per-parcel emissions estimate, three of them used the term 'last-mile' without even defining what it means. Moreover, depending on the geographical spread and density of a region, a last-mile journey could consist of 5km in a city or 50km – and taking the average of these figures can obscure important regional details. In addition, the types of companies fulfilling last-mile delivery are also not well defined. There is no clear distinction between courier, logistics, postal and express-delivery companies.

It is also unclear if failed deliveries and returns are included in any of the per-parcel emissions figures used in our derivation of 204 gCO_2/parcel figure. An estimated 5-10% of deliveries fail to reach their final destination.[38] These failures result in additional emissions as packages are sent back to a pick-up locker, a local post office or fulfilment centre where customers will have to travel to collect their item. Depending on the mode of transport used by the customer, failed deliveries have the potential to double emissions for a single delivery. Consequently, failed deliveries must be taken into account in initiatives to curb last-mile delivery emissions. Returns of purchased goods also play a large role in increasing the overall emissions of online purchasing. Companies have incentivised larger, and more frequent, purchases with free returns and, depending on the type of purchase, rate of return can range from 10-20% on average, and for fashion can be as high as 55%.[39] Although returns are not exclusive to last-mile, the increased demand facilitated by last-mile delivery speed and convenience requires us to look holistically at how the various stages of the logistics process influence each other and potentially increase overall emissions.

On a company level, we use a combination of self-reported or media-reported parcel delivery figures, revenue or number of employees from which we apply our equations and emissions conversion factors. These figures are often approximate, and may result in inaccuracies in our estimates.

We have requested, but have not received at the time of writing this report, additional data from a number of sources. Adding additional data will improve the model over time and allow for more accurate CO_2 emissions estimates and projections.

Appendix 2.2 — Literature review

To gain a sense of the field of last-mile delivery research we collected a combination of peer-reviewed and grey literature, including self-reporting by companies, on the topic across a few select regions (namely Europe, India, and the USA). We used Google Scholar to find peer-reviewed research using a combination of the terms *emissions*, *last-mile, final mile, delivery,* and *logistics* with added country and regional specifications. We focused on research primarily from the last four years (2018-2022). The general method for finding literature was to start with the most specific phrase of interest (i.e. last-mile delivery emissions in India), and then broaden the search if no papers/not relevant were found (i.e. delivery/logistics emissions India). To find grey literature, the same method was used in multiple web search engines (to ensure variety in results that were not biased by previous searches) and reports, briefs or news articles that linked to grey literature were collected and recorded. Other research to supplement aggregate statistics such as finding the number of parcels delivered to estimate emissions per parcel were conducted on an ad-hoc basis based on data gaps found in the existing literature.

Appendix 2.3 — Parcel delivery figures

We use Pitney Bowes (2021) as a source for parcel figures for a number of countries. The exception is India, where our indirect calculations suggest that their estimate is too low. For India we use RedSeer (2021) instead, which provides a slightly higher estimate. For the EU total, we extrapolate from Pitney Bowes figures for France, Germany and Italy using population estimates.

For certain cities in India, we estimate parcel delivery figures using a national figure (2.552 billion) from the consultancy RedSeer, CSTEP research on the proportion of national parcels ordered by Delhi, Mumbai, Kolkata, Chennai and Bangalore (65%), and a ratio of parcels consumed by each of those cities based on the proportion of their population of the five cities listed.

On a company level, we use self-reported parcel delivery figures where available (Annual Report, Sustainability Reports, website, etc.). Where these are not available, we derived a formula for estimating a given company's deliveries based on other self-reported figures (revenue or number of employees). This is described in greater detail below. Note that while there is no reason to believe that these self-reported delivery, revenue or employee figures are incorrect, they are often approximate, and may result in inaccuracies in our estimates.

It is important to note that despite careful attention to detail, there will always be a level of imprecision due to conflicting source data. For example, Postnord estimates that 1.0 billion parcels were delivered in France in 2020,[40] while Pitney Bowes Parcel Shipping Index provided a value of 1.6 billion parcels in the same year. This discrepancy demonstrates just how difficult it is to find reliable figures for parcel delivery counts. Another example: the courier company Hermes claims to deliver "more than 250 million" parcels annually.[41] However, Pitney Bowes estimates that Hermes represented 14% of 4.1 billion parcels delivered in Germany in 2020. If this is the case, it would mean that Hermes delivered about 470 million parcels in Germany alone, nearly double the global volume cited on Hermes' website.

Table. Estimated annual parcel delivery figures for selected geographies

Region or Country	No. parcels (billion)	Source
North America	**21.6**	**Pitney Bowes (2021)**
US	20.0	Pitney Bowes (2021)
Canada	1.6	Pitney Bowes (2021)
UPS	6.4	UPS Annual Report 2021
EU	**14.9**	**Extrapolated from Pitney Bowes (2021) and population estimates[42]**
Germany	4.1	Pitney Bowes (2021)
France	1.6	Pitney Bowes (2021)
Italy	1.3	Pitney Bowes (2021)
India	**2.552**	**RedSeer (2021)**
Delhi	0.56	Estimated using RedSeer (2021), CSTEP (2021) and population[43]
Mumbai	0.39	Estimated using RedSeer (2021), CSTEP (2021) and population
Bangalore	0.23	Estimated using RedSeer (2021), CSTEP (2021) and population
Chennai	0.20	Estimated using RedSeer (2021), CSTEP (2021) and population
Kolkata	0.28	Estimated using RedSeer (2021), CSTEP (2021) and population

Appendix 2.4 — Last-mile CO_2 emissions per delivery

We estimate that the global weighted average per parcel CO_2 emissions is in the range 190-215 gCO_2. For use in company-level emissions estimates, we calculate this figure to be 204 gCO_2, ignoring margins of error.

As all values were derived using independent sources, have geographical variation, and are of the same order of magnitude we feel confident that, although an estimate, this conversion factor can be used to roughly approximate company-level emissions. The last-mile emissions per delivery (per parcel) conversion factor was derived using existing literature and varied by region, as the majority of the literature is regionally specific. Across all sources, the last-mile emissions per parcel figures proved to be relatively consistent across all information sources and geographies, ranging from approximately 140 gCO_2/parcel to 300 gCO_2/parcel. Various additional sources not used in this study also all fall within this range (these figures were not used because the geographies are outside the scope of this project and/or we consider the information sources to be too old). The *intermediate* values used to derive this global average are described in the following paragraphs.

The most robust figure is that for Europe, where we took the average of eight values, four of which originate from a single study, to arrive at a final estimated *intermediate* value of 194 gCO_2 per parcel. Although these studies are not peer reviewed and report figures without standard errors, with the exception of one figure derived from one company's self-reported data, the range of values across the studies was approximately 80 gCO_2 with the largest and smallest values coming from the same study suggesting that our per parcel emissions estimate is reasonable.

A case could be made to calculate the European figure differently, for example by applying a weighting to each of the eight sources. Unfortunately, the number of data gaps is significant (for example, the number of national deliveries is not known for all regions) such that a justifiable weighting could not be determined, and thus an unweighted average was used instead.

Our *intermediate* estimate for the company UPS is coincidentally similar at 196 gCO_2/parcel. This number is derived from three data points: the ratio of 2020 emissions per parcel compared to that of 2010 (.85), 2010 per parcel total emissions (2.68 lbs CO_2 = 1216 gCO_2), and their reported ratio of "pickup and delivery" emissions to total CO_2e emissions (19%). Unfortunately this ratio is from 2011 as UPS no longer reports this percentage. We consider only UPS' annual deliveries when calculating the global weighted average. Note that UPS has nearly a 40% market share of private courier volumes in the US[44] (i.e. excluding the US Postal Service). The similarity of 196 gCO_2/parcel to 194 gCO_2/parcel for Europe may be a coincidence, however, because the margin of error in our calculations is unknown due to the proprietary nature of many of the source figures.

In India, last-mile delivery emissions per parcel is based on emissions figures from Delhi,

which is likely more accurate for large cities in India rather than rural regions within the country. We derive an *intermediate* per parcel emission value for India as 285 gCO_2 using last-mile delivery emissions estimates from RMI India and an estimate for the number of parcels delivered in Delhi.

The figures for Europe, US (a proxy for the US), and India are combined by taking the average weighted by number of parcels, as described in the table below. The unweighted figures for Europe are also outlined in the figure and subsequent table below.

Table. Figures used to derive global last mile emissions factor

Geography or company	Emissions (gCO_2)	Parcels (billion)
EU	194	14.9
India	285	2.55
UPS	196	6.4
World (weighted average)	204	

Figure. Illustration of comparative figures used to derive global last-mile emissions factor of 204 gCO_2/parcel

Table. Intermediate last-mile carbon emissions per parcel comparative figures used in the global weighted average calculations above

gCO_2	Geography or company	Year	Source
Europe			
138	France	2020	Oliver Wyman (2021)
213	Italy	2020	Oliver Wyman (2021)
221	Germany	2020	Oliver Wyman (2021)
210	Spain	2020	Oliver Wyman (2021)
183	Germany	2018	Derived using data from Sesam Gmbh (2018)
139	Europe	N/A[45]	Last Mile Experts (2022)
147	Netherlands	2020	van Eijkelenburg (2020)
299	DPD	2020	Derived using data from DPD Group[46]
194	**Europe**		**Unweighted average of the above eight figures**
India			
285	Delhi / India	2020	Estimated using data from RMI (2022), RedSeer (2020), CSTEP (2021), and population estimates.[47] Note that while the above figure for India represents the best possible estimate given data limitations, and suggests that per- parcel emissions may be higher in India compared to other countries, this figure has not been corroborated and thus we apply the global weighted average (above) to all subsequent calculations in this study instead, including for Indian companies and cities.
North America:			
196	UPS	2010+	Estimated using data from UPS (2010, 2011, 2020)[48]
Not used (geography not relevant to this report and/or information is too old)			
244	UK	2020	Oliver Wyman (2021)
181	UK	2009	Edwards (2009)
208	Royal Mail, UK	2020	Royal Mail (2020) — total CO_2 per parcel
112	China (food)	2020	Xie (2020)
164	Jordan	2015	Nabot (2016)
134	Netherlands	2015	Estimated using data from Ernst & Young (2015)
300	Poland	2014	Bilik (2014)

Appendix 2.5 — Last-mile as a percent of total parcel delivery CO_2

We estimate that the last-mile represents up to 50% of total parcel delivery CO_2 emissions.

It is essentially impossible to come up with a more specific estimate. No two independent data sources provide a full picture. Furthermore, all of the studies are proprietary and the supporting datasets have not been made public, making it extremely difficult to independently verify their findings.

The EU figure of 53% is perhaps the most accurate: it is the average of percentages calculated for France, Germany, Italy and Spain based on figures reported by the consultancy Oliver Wyman. Although their data is proprietary, the numerator was corroborated with multiple other studies as described above. We therefore expect their data to be relatively accurate.

For India, we use figures for Delhi as a proxy. We take the percentage of final mile delivery emissions of road transport (23%) as reported by RMI India, and divide this by the average of all estimated percentages of freight emissions of total transport emissions (approximately 41.3% based on seven different methodologies) as reported by ICCT. Then, as the EU figure includes air and ocean freight in its estimate, we apply an estimated adjustment to account for these factors to yield a final rough estimated figure of 51%.

It is not possible to do an equivalent calculation for the US as there is insufficient data.

No companies directly report this breakdown, nor are we able to calculate this percentage solely based on indirect emissions data reported by any one company. The one exception is DPD where we can estimate it to be 41% based on informal figures reported by the company in their sustainability report.

Table. Last-mile as a share of total parcel delivery CO_2 emissions

Percent	Geography	Year	Source/methodology notes
53%	Europe	2020	Derived using data from Oliver Wyman (2021). Numerators (last-mile emissions) corroborated above.
51%	India	2020	Estimated using data from RMI (2022), ICCT (2022), and applying a vessel/air adjustment.[49]
41%	DPD	2020	Derived using data from DPD Sustainability Report.[50]

Appendix 2.6 — Last-mile as a percent of total delivery costs

Various figures are also available on the last-mile as a share of total parcel delivery cost. These generally lie in the 40-50% range, echoing the emissions figures above.

Table. Last-mile as a share of total parcel delivery cost

Percent	Geography	Year	Source
53%	Unspecified	2020	European Commission/Citibox (2020) and other sources
45-50%	India	2018	KPMG (2018)
30-50%	Europe	N/A	Last Mile Experts (2022)
About 50%	Unspecified	N/A	McKinsey&Company (2016)

A study of supply chains by Capgemini Research Institute based on interviews with industry executives conducted in 2018 concludes that last-mile delivery accounts for 41% of the overall supply chain cost globally, higher than all other supply chain aspects including warehousing, sorting, and parcelling.[51] While a different measurement than parcel delivery costs and not directly comparable, this nonetheless points to the high business stakes of the last-mile.

Appendix 2.7 — CO_2 emissions per vehicle

There is insufficient data to make any meaningful conclusions about average annual emissions per vehicle. Depending on the data sources, our estimates range from 0.4 tCO_2 per vehicle in India to 3.4 tCO_2 globally.[52] This paper therefore makes no attempt to extrapolate emissions from reported vehicle fleet sizes.

Appendix 2.8 — Conversion formulas derived using courier data

As described in the report, companies appear to rarely, if ever, report their last-mile emissions. To answer questions on the CO_2 emissions of specific companies we need a way to relate each company to one of the conversion factors above (i.e. either number of parcels delivered or number of vehicles). However, many of the many of the logistic,

courier, and e-commerce companies listed in the database did not have public information on the number of vehicles or the number of deliveries so we had to develop a method to extrapolate existing information from companies that do report some details to develop a model to predict those values for companies that don't report. From observation, most companies listed the number of employees and revenue even if they reported no other information. Thus, we concluded that a model could be built based on looking at the number of employees or revenue and relating it to the other variables of interest. Since we were only able to derive a reliable figure for emissions per parcel we focused on linking revenue and number of employees with the number of parcels.

First, the data was analysed visually using scatterplots and since the range of values was quite large as there were often a few large companies that dominated the national delivery market, all variables were transformed logarithmically. These plots are reproduced below. As the data set was relatively small, the plots appeared to present a linear relationship, and we did not want to overfit the data, we estimated the relationship between the logarithmically transformed variables to be linear. Thus, we performed two total regressions where revenue and employees were the independent variable respectively and the number of deliveries as the dependent variable. The conversion formulas we derived are as follows:

$$D = 10^{0.640 \log(P) + 5.723}$$

$$D = 10^{0.589 \log(R) + 3.052}$$

Where,

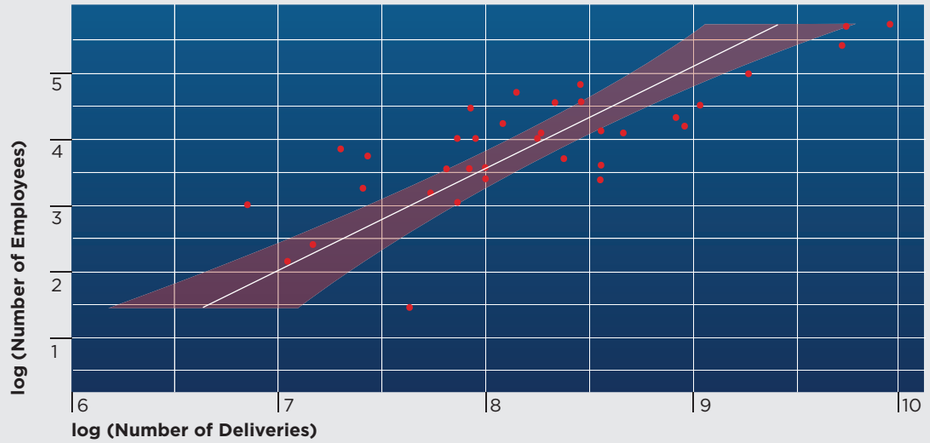
D = estimated number of deliveries per year
P = number of employees
R = annual revenue in USD

To test these conversion formulas, we compare with values indirectly reported by some of the large courier companies. This is shown in the table below. None of these companies actually report 'last-mile' emissions, making it impossible to do a direct comparison, but we have extracted data figures whose definitions vaguely resemble that of the last-mile. For example, UPS reports emissions per fuel type, including gasoline (petrol), so assuming that last-mile delivery vans are primarily gasoline-powered, we use this figure to compare with our estimate based on the number of parcels delivered per year, and we find that the results are reasonably similar. The same applies to all other companies in the table below. All figures in this table are well within an order of magnitude, demonstrating that our predictive formulas are realistic.

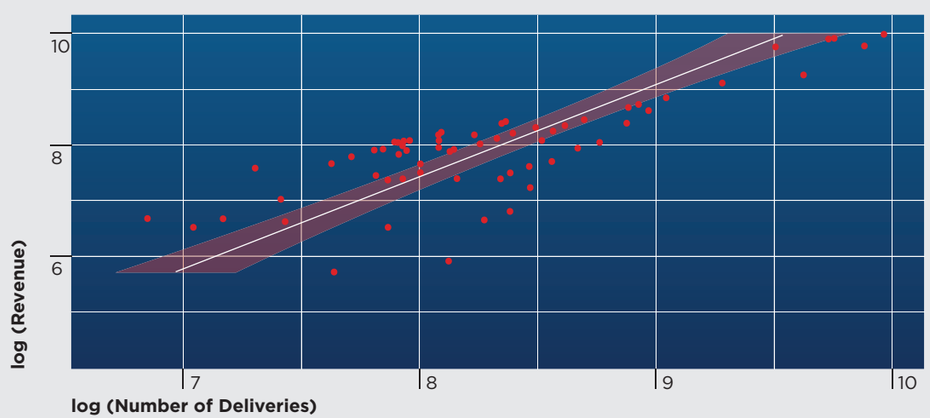
Table. Comparison of last-mile CO_2 emissions estimates using our methodology with similar figures reported by each company

Company name	Estimated last mile (tCO_2)	Similar figures reported by each company (tCO_2)	
UPS	1,306,000	1,646,000	All gasoline-powered ground vehicles
FedEx	1,154,000	1,565,000	50% of total vehicle emissions (3,130,000 tCO_2)
Amazon Logistics	1,096,000	NO DATA	
DPD	428,000	567,000	Derived using data from DPD Group, pickup and delivery combined [53]
eKart	245,000	NO DATA	
DHL eComerce Solutions	224,000	NO DATA	

NUMBER OF EMPLOYEES vs. NUMBER OF DELIVERIES



REVENUE vs. NUMBER OF DELIVERIES



Appendix 2.9 — Literature review bibliography

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Appendix 2.10 — Company database

The core of this project was the creation of a proof-of-concept database of courier companies, including an assortment of both large global players as well as small and medium-sized regional subcontractors. Characteristics of this database include:

- Of the 90 companies, 44 are in the EU, 23 in India, and 23 in North America
- 64 are parent companies and 26 are local branches or subsidiaries
- Of the parent companies, 27 are in the EU, 22 in India, and 15 in North America

The conversion formulas and per-parcel emissions factor were applied to this database to generate all CO_2 emissions estimates in the tables in Appendix 3. For revenue figures, we used the most recently available amount for each company's fiscal year. In order to make comparative analysis easier, we converted each figure into USD using the average exchange rate for 2021.

We do not expect this database to be complete: as described elsewhere in this report, a full list would necessarily include tens of thousands of companies, not to mention independent unregistered self-employed drivers. Further, this list is not without errors. As much as possible we used each company's own reported figures, but even these figures are sometimes self-contradictory, and where such figures are unavailable, we looked to other public sources such as media articles or industry reports. This list should be viewed as a snapshot of what the courier ecosystem looks like, and its approximate associated carbon emissions.

Note that the figures in the tables below may not add up to national figures presented elsewhere in this report due to rounding, and because of overlapping figures due to subcontracting. Furthermore, there are different source figures from which the various emissions estimates are derived, and each has their own inherent margins of error (some of this is described in Appendix 2.1).

Appendix 3. Data tables

Appendix 3.1 — Delivery companies

Table. Top-six global delivery companies

Company name	Country of headquarters	Approx. revenue (USD million)	Number of employees	Annual deliveries (million)	Estimated global last mile emissions (tCO_2)
UPS	USA	$97,300	543,000	6,400	1,306,000
FedEx	USA	$83,959	499,000	5,658	1,154,000
Amazon Logistics	USA	$80,440	260,000	5,374	1,096,000
DPD	France	$13,012	97,000	1,900	428,000
eKart	India	$890	200,000	1,200	245,000
DHL eCommerce Solutions	Germany	$7,013	32,099	1,100	224,000

Table. Selected European courier companies

Company name	Country of headquarters	Approx. revenue (USD million)	Number of employees	Annual deliveries (million)	Estimated last mile emissions (tCO_2)
DPD	France	$13,012	97,000	1,900	428,000
DHL eCommerce Solutions	Germany	$7,013	32,099	1,100	224,000
Hermes	Germany	$4,140	15,563	928	189,000
GLS	Netherlands	$5,424	21,000	840	171,000
La Poste (France)	France	$4,700		763	156,000
Hermes (Germany)	Germany	$1,080		574	117,000
UPS (Germany)	Germany	$2,808		492	100,000
CTT	Portugal	$882	12,234	466	95,000
DPD (Germany)	Germany	$2,200		410	84,000
GLS (Germany)	Germany	$1,200		328	67,000
BRT (Italy)	Italy	$2,000		308	63,000
TNT (Germany)	Germany	$1,600		246	50,000
Geodis (France)	France	$2,400		222	45,000
Poste Italiane (italy)	Italy	$1,300		210	43,000
Chronopost	France	$971	2,000		30,000
SEUR	Italy	$445			29,000
Amazon Logistics (italy)	Italy	$800		138	28,000
UPS (italy)	Spain	$768		135	28,000
GLS (italy)	Italy	$8		132	27,000
TNT (France)	France	$1,500		120	24,000
SDA Express Courier SpA	Italy	$651	1,544		24,000
InPost Sp zoo	Poland	$627	1,642		24,000
Correos Express (Spain)	Spain	$437	1,271		19,000
MRW	Spain	$1,183	10,000	89	18,000
FedEx (italy)	Italy	$768		87	18,000
UPS (France)	France	$952		84	17,000
TNT (italy)	Italy	$672		81	17,000
DHL (italy)	Italy	$1,100		78	16,000
Packeta	Czech Republic	$231	1,100	73	15,000
Speedy	Bulgaria	$158	1,934		15,000
Colis Prive	France	$276	3,500	65	13,000
FedEx (France)	France	$789		64	13,000
Envialia	Spain	$66	2,300		12,000
DAO365	Denmark	$120	1,011		11,000
DHL (France)	France	$600		51	10,000
Royal Shipments	Poland	$5	28	43	9,000
GLS (France)	France	$450		42	9,000
GEL Express	Germany	$48	155		5,000
ELTA Courier	Greece	$377	7,000	20	4,000
Correos Express (Portugal)	Spain	$20	136		4,000
Easy Mail	Greece	$7	163		3,000
Express One	Hungary	$33	140	11	2,000
Venipak	Lithuania	$46	1,000	7	1,000
Comet Hellas	Greece	$0.1	17		400

Table. Selected Indian courier companies

Company name	Approx. revenue (USD million)	Number of employees	Annual deliveries (million)	Estimated last mile emissions (tCO_2)
eKart	$890	200,000	1,200	245,000
Just Delivery		4,000	365	74,000
Safexpress	$495	2,400	360	73,000
Ecom Express	$170	36,000	292	60,000
Delhivery	$404	66,348	289	59,000
Shadowfax	$63	5,000	240	49,000
Amazon Logistics (India)	$310		240	49,000
XpressBees	$243	35,000	219	45,000
On Dot Couriers & Cargo Ltd	$661	11,750		40,000
First Flight Couriers		10,000		39,000
Blue Dart Express	$44	12,200	186	38,000
Dotzot		8,400		35,000
DTDC Express Limited	$250	50,000	143	29,000
Gati-KWE	$243	3,520	84	17,000
Trackon Courier Pvt Ltd	$32	10,000	73	15,000
Speed and Safe Courier Service		2,000		14,000
Shree Maruti Courier		1,577		12,000
Overnite Express		1,500	55	11,000
V-Xpress		1,000		9,000
The Professional Couriers	$20	200		4,000
Bombino Express	$8	129		3,000
Palande Courier Services			6	1,000
Pushpak Courier		16		600

Table. Selected North American courier companies

Company name	Country of headquarters	Approx. revenue (USD million)	Number of employees	Annual deliveries (million)	Estimated last mile emissions (tCO_2)
UPS	USA	$97,300	543,000	6,400	1,306,000
FedEx	USA	$83,959	499,000	5,658	1,154,000
Amazon Logistics	USA	$80,440	260,000	5,374	1,096,000
UPS (US)	USA	$60,000		4,800	979,000
Amazon Logistics (US)	USA	$18,000		4,200	857,000
FedEx (US)	USA	$58,000		3,200	653,000
Purolator	Canada	$1,755	13,000	365	74,000
UPS (Canada)	Canada	$2,600		230	47,000
Purolator (Canada)	Canada	$1,500		170	35,000
LaserShip Inc	USA	$725	2,000		26,000
FedEx (Canada)	Canada	$1,200		120	24,000
intelcom	Canada	$315	2,500	100	20,000
TFI International	Canada	$1,122	28,884	85	17,000
TFI International (Canada)	Canada	$830		70	14,000
Canpar Express	Canada		1,700		13,000
TNT (US)	USA	$138	625		10,000
Quicksilver Express Courier	USA	$49	600		7,000
IMEX Global Solutions	USA	$73	205		7,000
Spee-Dee Delivery	USA	$103	1,800	26	5,000
Express Courier International	USA	$47	250	15	3,000
SKY Postal	USA	$12	35		2,000
Services Art Solution Inc	Canada	$2	10		800
489424 B C Ltd	Canada	$1	6		600

Appendix 3.2 — Example courier subcontractors

Table. Example last-mile subcontractors to UPS, FedEx, DHL and DPD in Europe

Company name	Estimated last mile emissions (tCO_2)	UPS	FedEx	DHL	DPD
Packeta	15,000	√	√	√	√
Royal Shipments	9,000	√			√
AlleKurier	2,000	√	√	√	√

Table. Example last-mile subcontractors to UPS, FedEx, DHL and DPD in India

Company name	Estimated last mile emissions (tCO_2)	UPS	FedEx	DHL	DPD
Just Delivery	74,000		√	√	√
Delhivery	59,000		√		
First Flight Couriers	39,000	√			
Blue Dart Express	38,000			√	
InXpress	No data	√	√	√	
King Worldwide Courier	No data	√		√	
Zipping Logistics	No data		√		√
Airwings Courier Express	No data			√	
Super Fast Logistics	No data				√

There is no example table demonstrating subcontractor relationships in the US simply because no such information was apparent in any of their public materials that we reviewed. As this part of the research was not exhaustive by design, no conclusions can be drawn from this.

Appendix 3.3 — Example e-commerce courier companies

The following table lists examples of courier companies that partner with the e-commerce companies Amazon and Flipkart.

Table. Example courier companies with identified delivery relationships with Amazon.com and Flipkart

Location of headquarters	Company name	Amazon	Flipkart
Europe	DPD	√	
Europe	DHL eCommerce Solutions	√	
Europe	Hermes	√	
Europe	GLS	√	
Europe	Colis Prive	√	
North America	UPS	√	
North America	FedEx	√	
North America	Purolator	√	
North America	LaserShip Inc	√	
North America	intelcom	√	
North America	SKY Postal	√	
North America	TForce Logistics	√	
North America	JoeyCo	√	
India	Gati-KWE	√	
India	Blue Dart Express	√	√
India	Just Delivery	√	√
India	Ecom Express	√	√
India	Delhivery	√	√
India	Super Fast Logistics	√	√
India	eKart		√
India	Shadowfax		√
India	EpressBees		√
India	Zipping Logistics		√

Endnotes

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43 2.552 billion deliveries * 65% in these in Delhi, Mumbai, Bangalore, Chennai, Kolkata * each city's share of the combined population of these five cities

44 According to Pitney Bowes (2021), UPS represents 24% of US carrier volumes, and the US Postal Service has a 38% share. 24 / (100-38) = 39%

45 139 gCO_2 in 2032 in the "No EV adoption" scenario

46 786 gCO_2 per parcel * 38% pickup and delivery as a share of total emissions = 299. Informal data from 2020 Sustainability Report.

47 0.16 $MtCO_2$ [RMI, corrected] * 10^{12} / (2.552 billion parcels nationally [RedSeer] * 65% [Chennai, Delhi, Mumbai, Kolkata, Bangalore as a share of national, CSTEP] * 33.8% [Deli population share of these five cities])

48 2.68 lbs CO_2e per domestic parcel in the US * 453.592 g/lb * 19% "pickup and delivery" as a share of total emissions * 0.85 [15 percent reduction from 2010 to 2020]

49 23% [RMI, final mile emissions share of road transport] / 41.3% [average of all 7 estimates of freight as a share of road transport, from ICCT] * 0.914 [vessel/air adjustment factor derived from European data] = 51%. Note: the pre-adjustment figure is 56%.

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