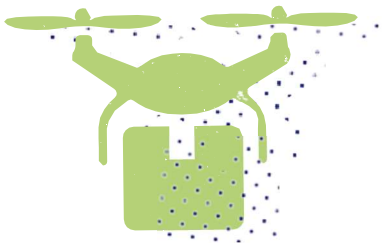
NEXT STOP

THE PROSPECTIVE SERIE BY KEOLIS



Wonderdrone

in the space of just a few years, drones have gone from being a technological curiosity to a solution tested at scale by giants in e-commerce, healthcare, and logistics. People still envision this technology as swarms of quadcopters over rooftops, but the reality is being built more quietly, through targeted and tightly controlled experiments.

Amazon has opened its first delivery corridors in the US and in the UK, UPS has deployed a medical sample transport service in North Carolina, and DHL has trialled regular routes in Germany to deliver to isolated villages.

In all these experiments, the promise is the same: bypassing road congestion and delivering in minutes rather than hours.

Recent studies show the challenge and the conditions for success. The last mile, that segment where costs and nuisances are the highest, represent **"up to 53% of the total shipping cost"** *(ref. 1)*. This is where the drone claims to make a difference but not uniformly. In urban areas, the environmental benefit is not obvious. As researchers at the University of Michigan point out: **"Drones can reduce greenhouse gas emissions, but these benefits depend on the context: influenced by distance, weight and energy used"** *(ref. 2)*. In other words, an electric drone can easily replace a gas engine when it is compares less favourably with a shared fleet of electric vans or cargo bikes delivering dozens of parcels in a single route.

In city centres, the advantage of the drone is speed: direct flights of a few miles help to avoid 15 to 20 minutes of travel during peak hours. A Chinese researcher sums up the issue: « **Drones can bypass traffic jams and offer fast and direct deliveries** » *(ref. 5)*. But this time saving comes with technical and social costs.

Noise remains a major obstacle: even though new rotors reduce the average sound level by **"15.3 decibels with highest reductions of 22.7 decibels"** (ref. 2), perception is still negative, described by residents as an "insect buzz". Furthermore, repeated flights over populated neighbourhoods raise concerns about air quality and privacy.

By contrast, rural areas seem to be the perfect place for drones. Where a delivery driver must travel twenty kilometres to hand over a package, the advantage of a direct flight is huge. Researchers calculated that **"the global warming potential per kilometre of a drone is six times lower than a motorbike delivery."** (ref. 5) Moreover, rural areas offer less congested airspace and more room for situating takeoff and landing zones.
The first use cases have been observed in rural areas: medical transport, medicine delivery, parcel delivery, etc.

Finally, the impact is already visible in consumption patterns. **Being able to be delivered inside in "30 to 60 minutes"** (ref. 6) changes the temporality of purchasing. The act of buying moves from planned orders to instant orders. An Asian study show that the introduction of drone delivery **increased demand by 12 to 20%** for some light, fast-moving products. This leads to premium services but also raises the question of a balloon effect: more speed can mean more flows and consequently more global warming potential if these services are not tightly regulated.

Thus, there is a short-term contrast: clear benefits in rural areas and for medical or urgent uses, speed gains in cities but with nuisances and high costs, and a transformation of consumer expectations from "tomorrow" to "now". It is within these conditions that a forecast to 2024 can be sketched out.

2040: a shared sky

If we extend current trends while taking into account technical advances and regulations in the pipeline, logistics will be transformed between now and 2040,- without however resembling science fiction visions of a sky saturated with swarms of drones. The most credible estimates place the "population effectively covered by a drone delivery service" **between 7% in conservative scenarios and 27-30% in optimal scenarios** *(ref. 7)*. This means that even in 2040 most packages will not be delivered by air, but a significant share of the population will have access to the service, particularly in large metropolitan areas and remote regions.

The main driver of this development will be integration into hybrid systems. Studies tende to agree that "a two-tier architecture – van to hub, then drone to point of delivery – **help reduce energy by 22.6% and costs by 12 to 32%** *(ref. 5)*. In some cases, combining drones with automated parcel lockers reduce operational costs by 23%. By 2040, big cities will likely have combined networks where a electric van restocks a micro-hub, a cargo bike delivers nearby streets and drones fly over obstacles to specific zones or lockers.

This hybridisation will be accompanied by a physical transformation of the city. "Beehives", multi-level structures on which hundreds of drones can take off and land, have already been patented and are being studied for installation on rooftops and garages, shopping centres, or logistics platforms. Rooftops will become strategic logistical assets, much like pavements have become for bike share schemes.

The urban sky will be structured with aerial corridors aligned with main roads and waterways, and exclusion zones around schools, hospitals and parks.

In rural areas, the leap will be even more noticeable. Drones will become the standard mode for many services: deliveries, medicine, spare parts and medical samples. British researchers have claimed that : « **the true potential of drones belong to rural areas, where traditional vehicles are not efficient due to long distances and low population densities"** (ref. 9). By 2040, it will likely be common to see a drone land in a farmyard or in front of an isolated house, reducing the need for individual car trips to pick up packages.

This will have a tangible effect on road traffic. In large urban areas, **delivering 10% of the packages by drones could cut out thousands of van trips**, relieving rush-hour congestion on main roads. Nuisances caused by deliveries could drop sharply, making traffic flow smoother. In rural areas, the impact will be measured in mileage and emissions saved, each direct flight replacing a round trip of several dozen kilometres.

Researchers note that "**the emissions reduction potential is substantial for short-distance traffic if electricity is very low-carbon.**" *(ref. 7)*. In contrast, if the electricity comes from fossil fuels, the benefits will be cancelled out by battery production and recycling, which already accounts for a significant share of the carbon footprint.

For high street shops, the risk of a further loss of economic attraction threatens their business model. For example, clothing stores could face severe competition from drones if shoppers can receive and try on several articles and send back those they do not want to keep, all within the space of ten minutes. Food delivery could continue to compete with restaurants that choose attractive and therefore more expensive locations in city centres where drones may be subject to more regulations.

Social acceptability will be decisive. Noise will remain a key issue, even with technical progress. As one science journal points out: **"noise pollution, especially in urban areas, could have negative effects on human populations and wildlife"** *(ref. 3)*. Coexistence between drones and birds, especially migratory species, will be a major topic in rural areas.

Privacy protection will also be an issue, as most people do not appreciate seeing a drone fly past their window as they are stepping out of the shower. Local usage agreements will need to be established, defining flight corridors, authorised hours, and transparency rules.

Finally, consumption habits will change. Receiving a package in under an hour will no longer be a luxury but a standard option. Instantaneity will become a cultural norm, resetting purchase rhythms and expectations.
As an American researcher sums up: **"the legal framework must adapt to face these challenges"** *(ref. 2)*: the issue will not be only technical or logistical but also societal. More speed and more comfort will require a new balance between environment, noise, privacy and territorial inclusion.

By 2040, drones will reshape logistics without overturning it. In big cities, they will be one of the tools to make things go smoother and faster, with the risk of reducing the appeal of city centre. In rural areas they will correct the imbalance by bringing goods and services closer to residents. And in our daily lives, they will create a new way to consume, with the risk of creating new needs that could counterbalance the expected benefits.

The story

Daniel has been driving Keolis trams and buses in Manchester for 10 years. On this morning in 2040, he is driving on the route between Wythenshawe and Piccadilly Gardens. The journey is familiar to him, but the city has changed since he started at Keolis. Above all, the major difference is the absence of delivery vans that used to obstruct the bus lanes. Daniel can still recall the sudden stops, the tricky manoeuvres, the minutes wasted sounding his horn at or overtaking a delivery van parked in front of a shop.

Nowadays, those vehicles are things of the past. Small packages are delivered by drone, and the lanes have returned to what they were meant to be: smooth roads dedicated to public transport.

Daniel finds his work easier as a result. The commercial speed of buses has increased by nearly 15% in just a few years. Passengers can feel it too: less stress, fewer delays: « it's good not have to share the road with delivery vans anymore" says a regular passenger seated in the front row, Daniel nods silently.

Overhead, however, there's plenty of traffic. When Daniel stops on Deansgate, he looks up and sees drones flying in line formation, about 30 metres above the ground. Dozens of small machines buzz along, following an aerial corridor over the River Irwell. They carefully avoid the city centre, where a drone tax was introduced by the city council in 2035. The idea is simple: limit the density of flights in the pedestrian areas of Piccadilly Gardens and Market Street, to preserve a calm environment, safety and privacy. Drones now bypass the historical centre, creating aerial columns above secondary roads. Daniel finds its both fascinating and disconcerting: a perfectly synchronized mechanical ballet, which brings to mind flocks of migrating birds.

Occasionally, the occupants of sky and road can come into conflict. This morning, a seagull suddenly attacks a drone carrying a small white box. The bird, a resident of the Salford docks, descends on the drone as if it was a rival. The drone loses its balance, pitches, and falls from the sky. It slams into Daniel's windscreen, the impact does not break the reinforced glass, but it startles a few passengers. Daniel gently brakes, pulls in at the next stop and reports the incident to the control centre. This is hardly the first time this has happened: since drones have begun crossing the city, conflicts with birds have become a daily concern. The authorities set higher flight corridors above Salford Quays, but seagulls remain unpredictable. For Daniel, it is a reminder that technology, however advanced it is, does not erase nature.

Morning passes without further incident. Around noon, Daniel parks his bus at the Moss Side depot for his lunch break. He is thinking about his daughter who needs new school supplies - exercise books and pencils - and he completely forgot to buy them. A few years ago, that would have meant running to the corner shop during lunch break or coming home late with bags under his arm. Today, he simply takes out his phone, orders the items and selects the depot's drone platform as the delivery point.

Above a hangar, a large circular platform has been installed: a miniature "beehive" where drones land and drop their packages into secure lockers. While he eats his sandwich at the cafeteria, Daniels looks out through the bay window: a drone approaches, slows to a hover, descends and drops the parcel into the designated compartment.

KEOSCOPIE

Everything is like clockwork, silent, almost invisible. At the end of his lunch break, he goes to collect the package from the locker, with two other drivers who are also picking up last minute purchases. “It's become an everyday thing” thinks Daniel. The depot used to be exclusively for buses and now is a shared logistics hub.

The afternoon goes by quickly. Daniel completes his trips, then parks his bus on time, satisfied to have spent a day without major incidents. He gets into his car and drives home to the suburbs, in Altrincham. His old electric car is starting to show its age. Next time, he'll buy himself a self-driving car, like many of his colleagues. The idea of not having to drive home after ten hours spent behind the wheel is an appealing proposition.

As he turns into his street lined with red-bricked houses, he spots a drone making an approach towards his garden. It has come from Pizza Hub, ordered by his wife. They used to go once a week to an Italian restaurant in the city centre where they had their first date. Today, drones have made life easier, so instead of taking their car into town, they reduced their visits to once a month, then the restaurant went bankrupt. Never mind, Daniel prefers staying in.

The pizza box lands gently on the grass, and the drone immediately flies back to its hub in Hale. Daniel has access to the same services as city residents. His wife often says: “It’s fairer now; we're not being ignored anymore.”

Scenarios

WHITE SCENARIO

The sky in support of the city

In this optimistic future, drones have harmoniously blended into the mobility system. Aeriel corridors have been planned as tramways were: clear, accepted and secure. Thanks to silent rotors, noise levels have dropped, and drones never fly over schools, hospitals or parks.

As a result, there is 10 to 15% less delivery traffic on the roads. Bus lanes and bike paths are no longer blocked by delivery vans. Suburban and rural residents enjoy the same delivery times as city centre residents. There is better balance between communities: “drones have become the social elevator of logistics.” Cities breathe more easily, people save time, and the carbon footprint of the last mile decreases thanks to an optimized multimodal architecture.

GREY SCENARIO

Imperfect coexistence

On this second path, drones have become widespread but without a comprehensive regulatory framework. In some neighbourhoods they ease traffic by reducing the number of delivery vans. In other places, they create noise disturbances and conflicts with birds or residents.

Local taxes have had to be introduced in city centres to limit flight density, leading to diversions through surrounding neighbourhoods.

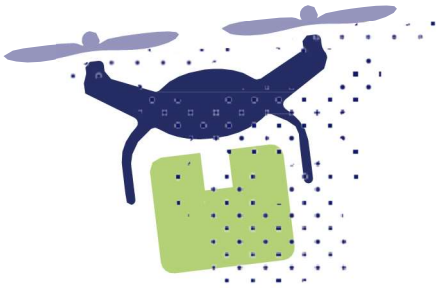
The environmental results are mixed: drones sometimes replace unnecessary road trips, but they also create a balloon effect with an influx of instant deliveries. Residents enjoy comfort supplies, meals or medicine delivered in minutes – but they complain about a sky saturated with buzzing.

BLACK SCENARIO

A crowded sky, a city under pressure

In this pessimistic future, drones have expanded without true governance. Each operator manages its own fleets, and the urban sky became an anarchic space. Lines of drones intersect and there are an increasing number of: collisions with birds, crashes onto the roads, noise pollution. People's security is under threat, and inhabitants are growing increasingly sceptical.

Road deliveries have not disappeared for bigger packages; delivery vans are still there. Consequently, instead of easing traffic, drones are added to the existing system, creating even more saturation. Inequalities increase: only richer areas can afford the additional costs for premium air deliveries, while the suburbs continue to suffer from low quality services. The dream of greener logistics turned into a social and ecological nightmare: higher greenhouse gas emissions, more noise, more conflict and city centres hollowing out, with shops displaying "To Let" signs.



Bibliography

1. CBA of Drone Logistics in E-commerce (2023). Cost-benefit analysis of drone delivery in European e-commerce logistics. Étude académique.
2. Choudhury, A., et al. (2018). Clean Technologies, 7(24): Noise reduction in drone propellers.
3. Boysen, N., Briskorn, D., Schwerdfeger, S. (2021). Drone Integration in Last-Mile Delivery Operations. Transportation Science.
4. Clarke, R. (2021). Drones: an overview of integration in urban and rural logistics. Drones, 9(158).
5. Kumar, A., et al. (2020). Drones for supply chain management and logistics: a review and research agenda. International Journal of Physical Distribution & Logistics Management.
6. Das, S., et al. (2022). Exploring the role of drones and UAVs in logistics and supply chain management: a novel text-based literature review. International Journal of Logistics Management.
7. Guan, W., et al. (2019). Energy and environmental implications of drone delivery. Transportation Research Part D: Transport and Environment, 75.
8. Stolaroff, J., et al. (2018). Energy use and life cycle greenhouse gas emissions of drone-based package delivery. Nature Communications, 9(409).
9. Jiang, Y., et al. (2025). Urban air mobility and last-mile logistics: modelling challenges. Sustainable Cities and Society, 78(44333).
10. Lim, A., et al. (2024). The economics of urban drone logistics hubs (“beehives”). Journal of Transport Geography, 110.
11. Allen, J., Browne, M., et al. (2023). Assessing the impact of drone deliveries on last-mile costs and emissions. International Journal of Logistics Management (IJLM), 34(4).