

# Background study on Two-wheeler Last-Mile Delivery Services toward Inclusive, Low-carbon Transport Transformation in Thailand



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# Introduction

## Overview of Thailand

Thailand is situated in mainland Southeast Asia with a total land area of about 514,000 km<sup>2</sup> (Figure 1). As of 2023, the total population of Thailand was nearly 72 million, with more than 53% living in rural areas (World Bank Data, 2024). The country has diverse ecosystems typically observed in hilly forested areas, fertile agricultural fields, broad plateaus, coastal zones, and so on.

Located in a tropical region, Thailand is affected by a distinct tropical monsoon climate regime. From the middle of May until the middle of October, the warm southwest monsoon is prevalent, carrying humid air masses from the Indian Ocean and thereby causing high amounts of rainfall. Accordingly, this season is called the wet or rainy season. The remaining six months of the year belong to the dry season, which can be divided into two sub-seasons: local winter and local summer. During the local winter (November and February), the northeast monsoon prevails, bringing cool and relatively dry air to the country and causing cooler weather conditions. The local summer, occurring from March to April, is dry and hot with distinctly high temperatures.

There are several large urban areas in the country. The Bangkok Metropolitan Region (BMR), including Bangkok's capital city and six surrounding provinces, is the most important economic hub of the country. It is also the most attractive tourist area in Thailand. In addition, there are other relatively large economic and tourism cities, such as Chiang Mai (Northern Thailand), Nakhon Ratchasima, Khon Kaen, Udon Thani (Northeast Thailand), and Pattaya and Hat Yai (Southern Thailand).

The Thai economy is mainly based on agriculture, industry, and service sectors. Before the 1960s, the country's economy was primarily based on agricultural activities, including rice and other food production mainly for domestic consumption. By adopting the first National Development Plan in 1963, Thailand's economy was considered one of the fastest growing in the world, which was attributable to the shift from agriculture to industry from 1963 until 1997. During the 1980s and 1990s, the country also had numerous export-oriented emerging industries. The government has actively promoted the tourism industry and service sector since the early 1980s, and they are now contributing significantly to the nation's gross domestic product (Britannica, 2023).



**Figure 1:** Administrative boundary of Thailand.

## Environmental Impacts of Transportation

According to the International Energy Agency (IEA), the world still depends mainly on internal combustion engines using fossil fuels for motorized transport on land, sea, and air (IEA, 2024). The annual average growth rate of emissions from the transport sector from 1990 to 2022 was 1.7% and was faster than that of any other end-use sector, except for industry growing at around 1.7% (IEA, 2024). In 2019, transport accounted for nearly one-fourth of the total greenhouse gas (GHG) emissions (8.7 GtCO<sub>2</sub>-eq) from end-use sectors of the energy sector worldwide (Jaramillo et al., 2022). It is because the sector continues to rely on oil products, comprising nearly 91% of its final energy in 2019 (IEA, 2024). Among the transport modes, about 70% of direct transport-related GHG emissions are from on-road vehicles, while rail, shipping, and aviation share 1%–12% each (Jaramillo et al., 2022). Approximately 20%–30% of a city's CO<sub>2</sub> emissions are sourced from last-mile deliveries (LMDs).

In addition to exhaust emissions, non-exhaust emissions include those from on-road transport, including road dust resuspension and brake and tire wear. In developing countries, road dust resuspension may contribute more significantly to the total particulate matter (PM) emissions because of road conditions (i.e., high proportion of unpaved roads and damaged paved roads mostly in suburban and rural areas), high traffic volume, few dust mitigation measures for road cleaning, and so on. However, non-exhaust emissions are also normally omitted in most of the comprehensive emission databases in these countries.

According to Verkehrswende (2024), the road motorization rate in Thailand was 667 road motor vehicles per 1,000 capita for the year 2022. Meanwhile, the passenger and freight transport volumes were 932,677 million passenger-km and 157,474 million tonnes-km, respectively (Verkehrswende, 2024). In the same year, the total CO<sub>2</sub> emissions from fuel combustion were nearly 248 Mt/year, with the transport sector sharing nearly one-third of the total (32%). Under a business-as-usual scenario, emissions from the transport sector are projected to increase by 24% and 58% by 2030 and 2050, respectively, relative to the 2020 levels (Verkehrswende, 2024). The total CO<sub>2</sub> emissions per capita for the transport sector in Thailand was 0.93 tonnes CO<sub>2</sub>/capita and increased to 1.26 tonnes CO<sub>2</sub>/capita (Verkehrswende, 2024). In particular, transportation is one of the key emission sources, especially in large metropolitan regions. For example, Chi and Kim Oanh (2021) compiled emission inventories from 12 source sectors for different species in the BMR (consisting of Bangkok and its five surrounding provinces) for the base year 2016. On-road transport was the largest contributor of nitrogen oxides (NO<sub>x</sub>, 71%), carbon monoxide (CO, 48%), and PM with an aerodynamic diameter not above 2.5 µm (PM<sub>2.5</sub>, 59%).

With the expansion of the parcels and food delivery industry in Thailand, on-road delivery has emerged as the most favored model of transportation, with motorcycles being preferred for food delivery (Thaithatkul et al., 2023). However, this primary mode of parcel and food delivery is also a concern because they emit different harmful pollutants into the atmosphere and contribute to poor air quality (Comi et al., 2021). In the platform-to-consumer delivery supply chain, LMD services substantially contribute to air pollution and cause more severe traffic congestion in urban areas (Gevaers et al., 2014; Viu-Roig et al., 2020). On average, LMD is the most important contributor, contributing about 32% to the total CO<sub>2</sub> emissions associated with e-commerce (Duarte et al., 2016).

The surge in parcel and food delivery demand in Thailand has raised concerns about the environmental and social sustainability of LMD practices in the country. People have increasingly focused on the issue of sustainability in the parcel and food delivery industry, recognizing the importance of customers' perception of companies' sustainability and corporate social responsibility in shaping their reputation (Dospinescu et al., 2020). Therefore, companies in the sector must start paying more attention to the sustainability of their actions and strategies. LMDs have enormous impacts on urban areas, emphasizing environmental problems even more (Gevaers et al., 2014).

## Overview of the Delivery Service Industry in Thailand

### Thailand E-commerce

E-commerce (electronic commerce) refers to commercial activities that include the buying and selling of products and services on online platforms (Laudon and Traver, 2014).

In Thailand, e-commerce activities have been booming recently, and the majority of purchases occur in urban areas such as BMR. Delivery straight to customers' doorsteps is the main e-commerce fulfillment method. The key driving factors behind the growth of e-commerce activities in the country include the increase in internet access and mobile phone use, improved and widely distributed logistics, and convenient e-payment systems, all of which enable consumers to conveniently and confidently shop online (International Trade Administration, 2024). Even before the COVID-19 pandemic, many Thai retailers had been making good progress on digital transformation by creating different online channels for their customers to complete transactions. They had also used data analytics to better understand customer needs. Starting in early 2020, the enforcement of social distancing, lockdowns, and other pandemic-related measures caused spikes in online shopping businesses, especially in business-to-consumer (B2C) sales and business-to-business (B2B) e-commerce (International Trade Administration, 2024).

The surging growth of e-commerce in Thailand has a positive impact on the country's economy. With the rapid digital transformation, the number of people with access to online applications has increased, resulting in a surge in online shipping. However, this progress also poses a burden to the environment; for example, it increases plastic consumption for packages, including food and beverage packages; atmospheric emissions from logistics activities; and so on.

In Southeast Asia, Thailand is ranked as the second-largest digital economy after Indonesia. Nearly half of its population uses e-commerce platforms regularly. Younger people (aged 17–36 years) make up 62% of the market, followed by people aged 37–50 (33%) and 51–71 (5%) years (International Trade Administration, 2024). Fashion items (clothes and footwear) share 60% of the total e-commerce market, followed by personal care (43.2%) and food and beverage (34.6%) (International Trade Administration, 2024). The e-commerce market value in 2022 was \$23.4 billion and was estimated to reach \$26.5 billion by 2023 and \$32 billion by 2025. More than 80% of total online sales in Thailand are conducted through mobile devices. Regarding transactions, mobile wallets account for 23% of the total and are projected to reach 63% by 2025 (International Trade Administration, 2024). About 30% of Thailand's e-commerce market is cross-border (relating to activity across a border between two countries), with 50% of online shoppers having cross-border e-commerce purchases.



The top e-commerce sites include the brands listed below. All are seller platforms with advanced logistics and delivery infrastructure.



## E-commerce Categories in Thailand

### Parcel delivery

In Thailand, 3.5 billion parcels were delivered in 2020, with the Thailand Post (the largest post company in the country) delivering approximately 2.4 billion parcels nationwide (Techwire Asia, 2022). Parcel delivery can be within the country and across borders. According to Bangkok Post (2022), the volume of delivered parcels and delivery fees are expected to increase by 7%–9% and 4%–6% annually.

According to Captain Move (2024), there are about 30 parcel delivery companies in Thailand, and they include the following:

1. **Thailand Post:** The national postal service, which provides nationwide and international shipping services, including EMS, E-SHOP, and express parcel services. Thailand Post provides LMD services through its extensive network of post offices.
2. **Kerry Express:** A courier company with a nationwide delivery network that offers parcel tracking services.
3. **J&T Express:** A rapidly growing express parcel delivery service provider that is continuously expanding its network nationwide.
4. **SCG Logistics:** A transportation company that is part of the SCG group and offers heavy and oversized cargo transportation services along with a tracking system.
5. **Captain Move:** A transportation service that offers various services nationwide, including delivery by hired trucks.
6. **Thai Airways Cargo:** The cargo division of Thai Airways; it provides international and domestic freight transportation services.
7. **Lalamove:** Provides express delivery services in major urban areas with a convenient delivery application.
8. **Nim Express:** A domestic express parcel delivery service provider that focuses on speed and convenience.
9. **Grab Express:** A fast parcel delivery service provider through the Grab application that is available in major urban areas and provincial regions.
10. **Siam Express:** A logistics company that offers domestic and international parcel delivery services.
11. **Best Express:** A courier company with a nationwide network and package tracking service.
12. **Alpha Fast:** An express parcel delivery service provider that focuses on speed and offers a variety of delivery options.

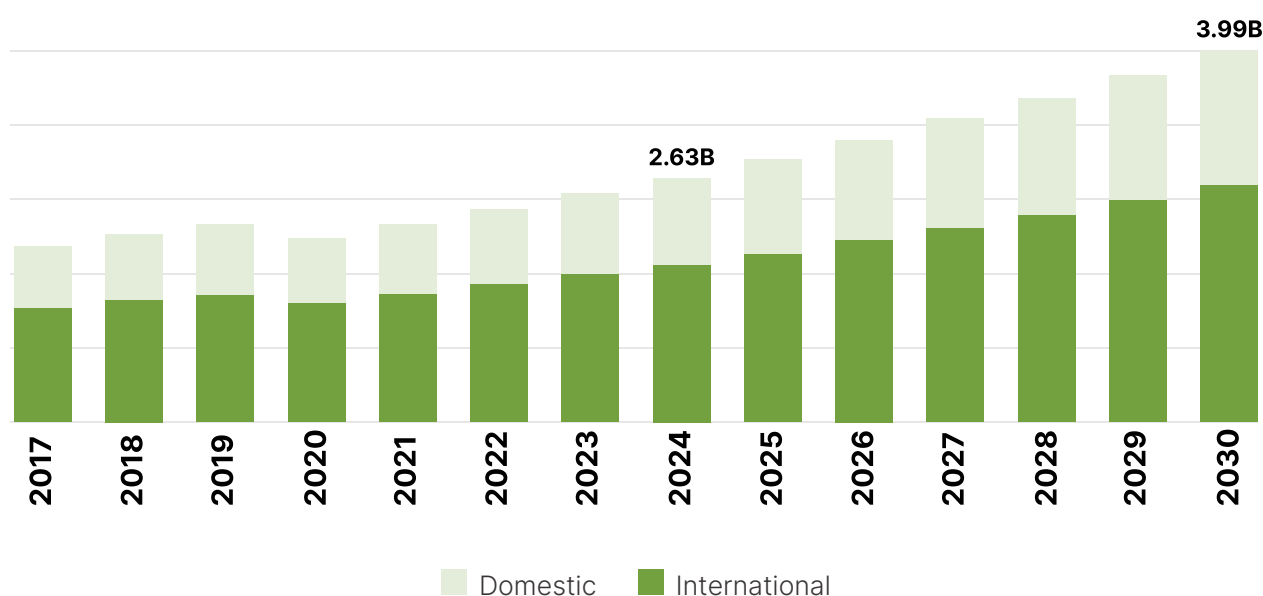


- 13. Fastway:** A logistics company that provides parcel delivery services both domestically and internationally and uses an efficient tracking system.
- 14. Caring Logistics:** A transportation company offering express parcel delivery and logistics management services.
- 15. DHL eCommerce:** A part of DHL; it focuses on the transportation of e-commerce goods both domestically and internationally. DHL offers premium LMD services in Thailand, catering to high-value and time-sensitive shipments.
- 16. Skybox:** An international shipping and delivery service provider, especially for products ordered from abroad.
- 17. Metro Delivery:** A transportation company that offers express parcel delivery services in major cities and surrounding areas.
- 18. Gogovan:** A parcel delivery service provider that focuses on fast delivery in major cities through an application.
- 19. J&T Cargo:** Provides fast and reliable delivery services for parcels and large goods.
- 20. Lynk & Co:** A transportation service provider focused on goods delivery with an advanced tracking system.
- 21. M-Delivery:** A parcel delivery service provider that focuses on speed and has an extensive network.
- 22. Logistics Service Center:** A company that provides comprehensive transportation and logistics services.
- 23. TSD Express:** A courier company that offers express parcel delivery and 24-hour customer service.
- 24. Thai Cargo:** Offers domestic and international shipping services.
- 25. ZALORA Express:** A part of ZALORA that provides logistics services for fashion and e-commerce.
- 26. Eagle Express:** A parcel delivery service provider that focuses on speed and customer service for businesses and individuals.
- 27. Apex Logistics:** Provides transportation and logistics services with a convenient tracking system.
- 28. Panda Shipping:** A parcel delivery service provider that focuses on fast and convenient service.
- 29. DHL Supply Chain:** A part of DHL that focuses on logistics management and large-scale freight transportation.
- 30. Transpo Logistics:** Provides heavy goods transportation and logistics services, along with efficient delivery services.

According to Mordor Intelligence (2024), the size of the courier, express, and parcel (CEP) market in Thailand was estimated to be US\$ 2.63 billion in 2024 and is projected to increase to \$US 3.99 billion by 2030, reflecting an annual growth rate of 7.20% during the period of 2024–2030 (Figure 2). The major players include DHL Group, FedEx, Flash Express, J&T Express, and Thailand Post, which occupies approximately 53.74% of the market. The CEP market in Thailand includes different models, such as B2B, B2C, and consumer-to-consumer (C2C), with the B2C model having the fastest growing market (i.e., 9.35%). In 2023, lightweight shipments contributed nearly 58% of the value share (Mordor Intelligence, 2024). This includes the delivery of online orders for goods like groceries and fashion items, which is leading the segment's growth in the country.

More than 36.6 million Thai residents purchased consumer goods through online platforms in 2022 (Mordor Intelligence, 2024). Domestic e-commerce sellers are increasing, sharing 68% of the e-commerce market in Thailand in 2022, resulting in an increase in the volume of e-commerce sales in the country (Figure 2). The remaining is shared by cross-border e-commerce (i.e., 32%), with the top three overseas sales destinations being China, Japan, and the United States.

### Value of Courier, Express, and Parcel (CEP) Market by Destination (USD) Thailand 2017 - 2030



**Figure 2:** Thailand's courier, express, and parcel (CEP) market trend (2017–2030).

**Source:** Mordor Intelligence (2024)

## Food delivery

Since 2018, the food delivery market in Thailand has undergone substantial transformation, characterized by an annual average growth rate of 10 % (USDA Foreign Agricultural Service, 2020). The main drivers include evolving lifestyles and the prevalence of smartphone usage in the country. Moreover, with the evolving consumer preferences, people in urban areas who normally have tight schedules tend to order food online more than their rural counterparts (Chotigo et al., 2021). The online food delivery market in Thailand is anticipated to undergo substantial expansion in the forthcoming years. In 2023, the online food delivery market in Thailand was valued at approximately US\$ 3.97 billion, with an annual growth rate of 13%, and is projected to be US\$ 6.58 billion in 2027 (Statista, 2022).

Before the COVID-19 pandemic, the food delivery market in Thailand had been experiencing a notable increase, attributable to the high number of smartphones and access to different online ordering platforms. Since 2020, different pandemic-related measures in the country have caused spikes in online food order demand (Aday et al., 2020).

There are several major online food delivery service providers in Thailand, and they include GrabFood, Line Man, Foodpanda, Shopee Food, and Robinhood (Statista 2023). According to Techwire Asia (2022), there were 27 million users for online food delivery in 2020, with Grab having 50% of the market, followed by Foodpanda. In Bangkok alone, food delivery orders via online food delivery applications were estimated to reach US\$ 20 million as of 2020 (USDA Foreign Agricultural Service, 2020). In Thailand, food delivery companies are focusing on BMR but are trying to expand their operations to cover other major cities, such as Chiang Mai (in northern Thailand) and Phuket (in southern Thailand). According to a survey by Thailand's Electronic Transactions Development Agency in March 2020, 85% of 376 respondents used online delivery services. In addition, 88% of consumers ordered food online via Thailand's existing food delivery applications.

## Delivery Services in Thailand

According to Bangkok Post (2022), the LMD business in Thailand is expected to grow 10%–15% annually, reaching 98 billion baht in 2022. With their size, speed, and cost-efficiency, motorcycles provide parcel food delivery services with a valuable contribution, making them a popular choice for many product and service providers (Figure 3).



**Figure 3:** Last-mile delivery business in Thailand is forecasted to grow in line with the rise of e-commerce. **Photo credit:** Bangkok Post

Different from food delivery (Section 2.2.2), parcel delivery has more delivery modes (truck, pick-up, personal cars, and motorcycles). Some companies such as Lazada and Shopee have policies to allow customers to cancel deliveries, return parcels, etc. In addition to direct deliveries to customers, parcel drop-off at smart lockers or pick-up and drop-off kiosks is an alternative mode in Thailand, allowing customers to pick up delivered items at lockers or kiosks at any time at their convenience.

Food and beverage delivery is mainly done through motorcycles. In 2020, the number of food delivery riders in Thailand was estimated at 225,000 to 250,000, and over 100,000 of them are based in Bangkok (USDA Foreign Agricultural Service, 2020). In Bangkok alone, this fleet of food delivery riders executed more than 20 million deliveries in 2020, averaging a travel distance of 46 km per day (Allen

et al., 2021). When all these numbers are added up, the total CO<sub>2</sub> emissions from these 100,000 riders reach approximately 27.5 million tonnes/year (Morgan, 2018). Approximately 108 million trees would need to be planted annually to offset the carbon footprint engendered by Bangkok's internal combustion engine motorcycles, signifying the magnitude of this ecological challenge.

Delivering food sustainably in the last mile is challenging because resources are limited and economic, social, and environmental goals often conflict with one another (Neghabadi et al., 2019). Moreover, last-mile costs generally account for more than 50% of the total delivery costs, tightening this last supply chain step even more (Joerss et al., 2016). Since LMD represents the most challenging and energy-consuming step of the supply chain, together with financial and environmental costs and consumers' expectations, logistical challenges must be examined in more detail (Bosona et al., 2020).

## Last-Mile delivery (LMD)

LMD may involve different on-road transportation fleets (trucks, pick-ups, personal cars, and motorcycles). Motorcycle transportation modes include passenger transport (Win), food delivery, convenience store goods delivery (Mart or grocery), and parcel delivery (Express).

## Key Players in LMD in Thailand

### Major LMD for grocery and parcel delivery services

#### Overview

Thailand's logistics market is growing rapidly and expected to increase by US\$18.89 billion between 2021 and 2026 (Ground News, 2021). There are about 30 LMD companies for grocery and parcel delivery services in Thailand. Attended home delivery (AHD) and unattended home delivery (UAHD) are the two basic modes of LMD in the country. Thailand Post, Kerry Express, and Lazada Express, which dominated parcel market share by approximately 80% in 2020, are the top 3 LMD service providers in Thailand (Kamonmarn and Punyapob, 2020). In particular, Thailand Post delivered approximately 2.4 billion pieces of parcels in 2020 (Ground News, 2021).

#### Key players

The top 8 LMD service providers for grocery delivery in Thailand are Kerry Express, Flash Express, SCG Express, Thailand Post, DHL, Lalamove, Ninja Van, and Best Express (Bangkok Post, 2022; DHL, 2024a). Kerry Express and Flash Express are the most well-known companies because they deliver products from Lazada and Shopee, the two largest online shopping platforms. Nevertheless, each of the top 8 companies has its own advantages that the customers can select depending on their preferences.

1. **Kerry Express:** Offers an extensive network and affordable rates.
2. **Flash Express:** Offers fast delivery services and convenient pickup locations.
3. **SCG Express:** Leveraging its parent company's logistics expertise, this company offers a range of LMD solutions.



4. **Thailand Post:** As the national postal service, it provides LMD services through its extensive network of post offices.
5. **DHL:** A global logistics giant, this company offers premium LMD services in Thailand, catering to high-value and time-sensitive shipments.
6. **Lalamove:** Offers on-demand delivery services, including same-day delivery and courier services.
7. **Ninja Van:** Provides delivery services for e-commerce businesses.
8. **Best Express:** Offers affordable delivery services for small and medium-sized businesses.

## Operation mode/Business model and overall management levels

**Thailand Post Co., Ltd. or Thailand Post Co., Ltd.:** The largest logistics service network in Thailand in terms of revenue and number of specialists. This company, which has been operating for 138 years, is composed of 31,154 highly skilled personnel, including 17,572 employees, 2,539 full-time employees, and 11,043 temporary employees, who employ customers and transfer their experience according to Thailand Post's core values through 1,283 units nationwide, 251 counters, and 3,324 licensed offices.

**Flash Express (Thailand) Company Limited:** An integrated e-commerce service provider established in 2017. It offers door-to-door pickup and delivery service and uses its fully in-house developed technology to streamline the delivery process and offer competitive prices. It also provides allied business solutions under its business name Flash Group. The service solutions include Flash Logistics for large items delivery service, Flash Fulfillment for goods storage, Flash Home for parcel delivery agent service, and Flash Money for financial service. It has more than 10,000 employees worldwide.

**Skootar:** Developed in mid-2014 in Thailand, Skootar has the sole purpose of easily assigning businesses with nearby delivery partners. This unique logistics solution is favorable for SMEs and independent e-commerce sellers for same-day pickup/delivery who operate locally. Their main promise is express delivery within 2 hours. Skootar's app acts as a delivery agents' marketplace connecting motorcycle messengers instantly. The service is easy to use, fast, and reliable. Users can also track the job status. All drivers are screened, trained, and controlled by ratings from peer users. Its services include logistics, e-commerce, cross-border e-commerce, cold chain logistics, express delivery services, cross-border logistics, and full-cargo service.

**Kerry Express:** Offers three types of parcel delivery services (B2B, B2C, and C2C). B2B provides services that deliver parcels from one business to another or from a business to its retail stores. B2C provides service between online vendors, television channel vendors, or multi-level marketing vendors and their end users. C2C serves individuals who wish to ship a parcel to another individual. Kerry offers next-day parcel services to C2C clients with a nationwide coverage.

**Lalamove:** Offers LMDs with a focus on on-demand express delivery services. Clients can book a parcel service immediately or in advance on the app. The booking information is then sent to a transporter within the network who will pick up the parcel from the clients at the time of their booking and transport it to the designated address within 2–3 hours. Nowadays, Lalamove offers different services, including urgent deliveries of food, drinks, fresh flowers, or high-value goods. The number of deliveries varies daily. Thus, this delivery service works around the clock for flexibility. Lalamove helps clients deliver parcels within the same day in a cost-effective manner.

## Company's policies/initiatives/best practices on low-carbon transport

**DHL** is actively working toward a more sustainable future in logistics. The company has established zero-emission logistics hubs in various European cities and has set an ambitious goal of achieving carbon neutrality by 2050. These initiatives demonstrate DHL's commitment to reducing its environmental footprint and promoting sustainable practices in the industry (DHL, 2024b).

**Thailand Post** is actively working toward a more sustainable future by implementing various initiatives. The company is transitioning to electric vehicles (EVs) for its delivery fleet, reducing emissions and promoting cleaner transportation. Additionally, Thailand Post is integrating renewable energy sources into its logistics hubs, further minimizing its environmental impact. By adopting digital solutions, the company is reducing paper usage and streamlining operations. Thailand Post is also committed to international standards, adhering to ISO 14001 for Environmental Management Systems and ISO 14064 for Greenhouse Gas Accounting. These efforts demonstrate Thailand Post's dedication to sustainable practices and environmental responsibility (Thailand Post, 2022).

**Kerry Express** is taking steps to improve its environmental performance by adopting sustainable practices. The company is deploying electric and hybrid vehicles in its fleet, reducing emissions and promoting cleaner transportation. Additionally, Kerry Express utilizes smart logistics solutions to optimize delivery routes, minimizing fuel consumption and reducing carbon emissions. The company is also certified to ISO 50001 for Energy Management, demonstrating its commitment to efficient energy use and continuous improvement in energy performance. These initiatives highlight Kerry Express Thailand's dedication to sustainability and its role in building a greener future (Kerry Express, 2024).

**Flash Express** is committed to sustainable practices and is actively implementing various initiatives to reduce its environmental impact. The company is adopting electric motorcycles for its delivery fleet, minimizing emissions and promoting cleaner transportation. Additionally, Flash Express is transitioning to paperless systems in its logistics operations, reducing paper waste and streamlining processes. The company is also actively seeking partnerships to integrate renewable energy sources into its operations, further enhancing its sustainability efforts. By adhering to ISO 20400 for Sustainable Procurement, Flash Express ensures that its procurement practices align with environmental and social responsibility principles. These initiatives demonstrate Flash Express's dedication to a sustainable future and its role in contributing to a greener environment (Flash Express, 2024).

**J&T Express** is actively working toward a more sustainable future by implementing various environmental initiatives. The company is introducing EVs into its fleet, reducing emissions and promoting cleaner transportation. Additionally, J&T Express is optimizing its delivery routes to minimize emissions and improve efficiency. By adhering to ISO 14001 for Environmental Management, the company demonstrates its commitment to environmental responsibility and continuous improvement. These efforts highlight J&T Express Thailand's dedication to sustainability and its role in contributing to a greener future (J&T Express, 2024).

**Grab Thailand** partners with seven companies to accelerate EV adoption among drivers and delivery partners (Grab, 2023). The initiative, dubbed “Grab EV-LUTION,” aims to make EVs more accessible and affordable, ultimately contributing to a greener future. The key partnerships and initiatives include the following:

- **Drive-to-Own:** A revenue-based financing model offered in collaboration with Moove and Rever Automotive, allowing drivers to own EVs through daily installments.
- **End-to-End EV Bike Rental:** A partnership with STROM, H SEM Motor, and Swap & Go to provide affordable electric motorcycle rental services for delivery partners.
- **Targeting 10% EV Fleet by 2026:** Grab Thailand aims to have 10% of its fleet powered by EVs by 2026.
- **EV Vehicle Options:** A wide range of electric cars and motorcycles from various manufacturers.
- **Financial Solutions:** Flexible financing options to make EVs more affordable.
- **Charging Infrastructure:** Expanded charging network to support EV usage.
- **Technical Support:** Expert assistance and maintenance services for EVs.

## Major LMD for food delivery services

### Overview

The food delivery market has been rapidly growing in recent years in Thailand, with the rise of food delivery apps providing a convenient way for consumers to order food from their favorite restaurants. Some of the most popular Thailand food delivery apps include Line Man, GrabFood, and Foodpanda (EcomEye, 2024). In addition to the well-established players, several emerging food delivery apps in Thailand that are gaining traction include Robinhood and Get. Thailand food delivery apps from globally famous fast-food chains, such as McDonald’s and KFC, are also available. These apps offer new features and unique selling propositions to attract consumers. On-demand delivery rapidly grew in Thailand, especially during the COVID-19 outbreak, which increased food delivery orders by 150% (Kasikorn Research Center, 2020).

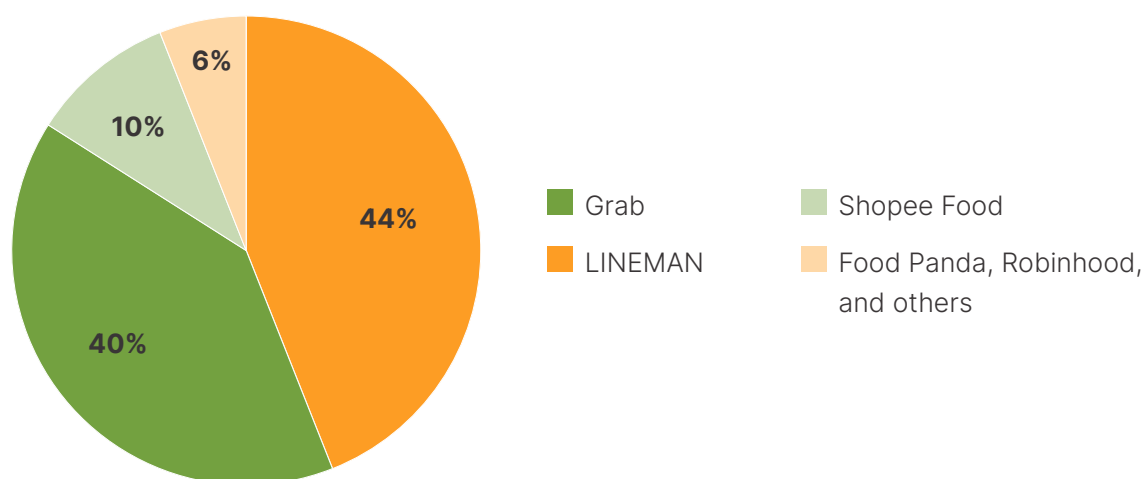
### Key players

Major LMD food delivery companies in Thailand include the following:

1. **LINE MAN** is the No. 1 Thailand food delivery application that includes more than 500,000 restaurants in 77 provinces throughout Thailand.
2. **GrabFood** is the leader among Thailand’s food delivery companies.
3. **ShopeeFood.**
4. **Foodpanda**, founded in 2012, provides food and grocery delivery services.
5. **Robinhood** is a subsidiary of Siam Commercial Bank. The app service includes food delivery, grocery delivery, and hotel accommodation. However, the business was ceased in July 2024.

The market share of last-mile food delivery in 2024 is presented in Figure 4. Lineman has climbed to the top position with the highest market share of 44%, surpassing GrabFood with a 40% market share. In third place is ShopeeFood with 10%, followed by other groups with approximately 6%, comprising

Foodpanda and Robinhood (Thairath Money, 2024; and Bangkokpost, 2024a). Lineman's market share increased to first rank with the shutdown of Robinhood. Robinhood, the commission-free application for on-demand food delivery, hotel booking, and other services, ceased operations on July 31, 2024 (Bangkokpost, 2024b).



**Figure 4:** Market Share of Food Delivery in Thailand, 2024

## Operation mode/Business model and overall management levels

The food delivery business model in Thailand has gained significant traction with the rise of smartphone penetration, urbanization, and consumer demand for convenience. Below is an outline of a common food delivery business model in the Thai context.

### 1. Key components of the business model

The food delivery ecosystem encompasses various players: restaurants, including traditional eateries and delivery-only cloud kitchens; delivery platforms such as GrabFood, Foodpanda, and Lineman, which connect consumers to food providers; and logistics, involving delivery riders and their fleet of vehicles. While this ecosystem offers convenience to consumers, it also presents some challenges, such as maintaining food quality, ensuring timely deliveries, managing rider operations, and optimizing costs. Opportunities for growth lie in market expansion, technological advancements, value-added services, strategic partnerships, data-driven insights, and sustainable practices. By addressing challenges and capitalizing on opportunities, businesses in this sector can thrive and meet the evolving needs of consumers (Grab Thailand, 2024).

Motorcycles are the most commonly used vehicle types by Grab partners, accounting for 64% of the total (mainly for food delivery). Cars follow with 35%, whereas other vehicles such as e-scooters or bicycles make up a minor 1%. In terms of services, delivery services, including food and package delivery, dominate the market, constituting 77% of Grab's operations. Transportation services, such as ride-hailing, represent the remaining 23%.



## **2. Gender equality**

The food delivery services in Thailand are aligned with gender equality. For example, Grab Thailand has implemented several initiatives to promote gender equality among its GrabBike riders, particularly in food and goods delivery. These initiatives include the Women's Programme, which aims to empower women by providing equitable access to earning opportunities, safety measures, and training programs. Additionally, the Women Passengers Preferred (BETA) feature allows women drivers to prioritize matching with women passengers, enhancing safety for both parties. Furthermore, the WomenWelcome campaign highlights Grab's commitment to providing equal opportunities for women and encourages them to join the platform. These efforts demonstrate Grab's dedication to creating a more inclusive and equitable environment for women in the gig economy (Grab, 2024a). Although female Grab partners (14%) are significantly outnumbered by their male counterparts (86%), their proportion is steadily increasing (Grab, 2024b).

## **3. Revenue streams**

The revenue model for food delivery platforms is multifaceted. They earn commissions from restaurants on each order, typically ranging from 15% to 30% (Grab Thailand, 2024). Consumers contribute through delivery fees, which vary based on factors such as distance, time, and peak demand. To incentivize customer loyalty, platforms often offer subscription plans with free or discounted deliveries. Additionally, restaurants can invest in advertising on the platform, such as banner ads or top-listing positions, to increase their visibility and attract more orders.

## **4. Customer segments**

The food delivery market caters to a diverse range of customers. Urban millennials, driven by convenience and tech-savviness, are a key demographic. Expats and tourists, especially in popular cities such as Bangkok, Phuket, and Chiang Mai, also contribute significantly to the market. Office workers rely on food delivery services for quick and easy lunch and snack options during work hours. Finally, families often utilize these services for group meals, particularly during evenings and weekends.

## **5. Value proposition**

Food delivery platforms offer significant value to consumers and restaurants. For consumers, these platforms provide unparalleled convenience by allowing them to order from a diverse range of restaurants and have their food delivered right to their doorstep, saving valuable time. Additionally, consumers benefit from exclusive promotions and discounts offered through the platform's app. Meanwhile, restaurants can expand their customer base without the need for additional dine-in infrastructure. They can increase their brand visibility through app listings and targeted advertising, reaching a wider audience and attracting new customers.

## 6. Marketing and growth

Food delivery platforms employ various marketing and growth strategies to attract and retain customers. They offer enticing promotions and discounts, such as first-time user discounts, cashback offers, and loyalty rewards. To tap into local markets, they collaborate with local influencers and participate in cultural festivals. A strong social media presence on platforms such as Facebook, Instagram, and TikTok is essential for engaging with customers and building brand awareness. Ultimately, the most powerful marketing tool is word-of-mouth. By consistently delivering high-quality food and timely deliveries, these platforms encourage satisfied customers to recommend their services to friends and family (Thailand Business News, 2024; The Story Thailand, 2023).

## 7. Challenges

The food delivery industry faces several challenges. Intense competition from established players such as GrabFood and Foodpanda makes gaining market share difficult for new entrants. Managing a large network of delivery riders, especially in densely populated urban areas, is logistically complex. To attract and retain customers, platforms often rely on promotions and discounts, which can significantly impact profit margins. Adapting to local tastes and ensuring strict food safety standards is crucial for maintaining customer trust. Additionally, economic factors such as inflation and fluctuating fuel prices can directly affect delivery costs, impacting both the platform and the consumer (Thailand Business News, 2024).

## 8. Opportunities

The food delivery industry presents several opportunities for growth. Expanding into second-tier cities and rural areas, where competition is less intense, can open up new markets. Catering to the rising demand for healthy and organic food options can attract a niche market. Integrating food delivery with e-commerce platforms for grocery or household goods can create synergies and increase customer convenience. Finally, adopting sustainable practices, such as using eco-friendly packaging and promoting carbon-neutral deliveries, can enhance brand reputation and appeal to environmentally conscious consumers (Thailand Business News, 2024).

## Company's policies/initiatives/best practices on low-carbon transport

Food delivery companies have existing policies/initiatives/best practices targeting low-carbon transport.

Grab Thailand is actively working toward a more sustainable future by implementing various initiatives. The company has introduced an EV leasing program for its delivery partners, encouraging the adoption of cleaner vehicles. Additionally, Grab Thailand promotes eco-friendly packaging for merchants, reducing plastic waste and minimizing its environmental impact. By offering a cutlery opt-out option, the company further reduces plastic waste and promotes sustainable practices. Grab Thailand is also certified to ISO 14064 for Greenhouse Gas Accounting, demonstrating its commitment to measuring and managing its carbon footprint. These initiatives highlight Grab Thailand's dedication to sustainability and its role in contributing to a greener future (GrabFood, 2024).

Foodpanda Thailand is actively working toward a more sustainable future by implementing various initiatives. The company is promoting the use of e-bikes for urban deliveries, reducing emissions and promoting cleaner transportation. Additionally, Foodpanda encourages vendors to use biodegradable packaging, minimizing plastic waste and promoting sustainable practices. The company is also tracking its carbon footprint to identify areas for improvement and reduce its environmental impact. By adhering to ISO 14064 for Greenhouse Gas Accounting, Foodpanda demonstrates its commitment to measuring and managing its carbon emissions. These initiatives highlight Foodpanda Thailand's dedication to sustainability and its role in contributing to a greener future (Food Panda, 2024).

## Policies, Regulations, and Initiatives in Thailand related to the Transportation Sector

At present, Thailand lacks specific, targeted policies directly addressing motorcycle emissions in LMD services. **Table 1** summarizes the broader initiatives that indirectly influence this service.

Table 1: Policies/regulations/initiatives related to the transportation sector in Thailand		
No.	Policy/regulation/initiative in Thailand	References
1	<b>Thailand has implemented both national and local legislation</b> to minimize transportation-related greenhouse gas (GHG) emissions in accordance with environmental targets, including reaching net-zero emissions by 2065 and a 40% reduction in GHG emissions by 2030.	Thansettakij (2024)
2	<b>Thailand's Long-Term Low-Emission Development Strategy (LT-LEDS):</b> Outlines a comprehensive approach to reducing GHG emissions. Key elements related to the transport sector: an enhanced Nationally Determined Contribution with a target of reducing emissions by 30%–40% by 2030 compared with 2020 levels; focus on specific actions in key sectors such as energy, transport, industry, agriculture, forestry, and waste management; the promotion of electric vehicles (EVs), particularly motorcycles.	UNFCCC (2022); FAO (2022)
3	<b>Energy Conservation Promotion Act B.E. 2535 and Energy Conservation Promotion Act (No. 2) B.E. 2550 (2007):</b> These acts have provisions that indirectly impact the energy efficiency of vehicles, including mandating energy efficiency labeling for vehicles and setting minimum energy performance standards for vehicles.	EPPO (2024)
4	<b>Thai Motorcycle Law:</b> Sets the Thailand emission standard for motorcycles by the Pollution Control Department, Ministry of Natural Resources and Environment of Thailand.	PCD (2020)

**Table 1:** Policies/regulations/initiatives related to the transportation sector in Thailand

No.	Policy/regulation/initiative in Thailand	References
5	<p><b>Promotion of EVs:</b> The government is seriously supporting the use of EVs through tax reductions, tax breaks for manufacturers and importers, and promoting infrastructure such as charging stations to help reduce CO<sub>2</sub> emissions from road transport, which is the largest source of GHG emissions in the transportation sector. Local manufacturers are actively contributing to the growth of the electric motorcycle market. Some companies are exploring battery-swapping technology as a convenient alternative to traditional charging.</p>	TDRI (2023)
	<p>Partnerships between the government, industry, and academia are fostering innovation and accelerating the development of electric motorcycle technology. The government has laid out ambitious plans to have 690 charging stations and 1.2 million EVs nationwide by 2036 (DHL, 2020).</p> <p><b>EV 3.0 Promotion Scheme and public-private partnerships:</b> Further drive the adoption of electric motorcycles, particularly in the motorcycle taxi segment.</p>	
6	<p><b>Development of public transportation systems:</b> Involves expanding the subway system and improving urban transportation efficiency to reduce the use of private cars and motorcycles.</p>	TDRI (2023)
7	<p><b>Support for alternative energy:</b> such as the development of hydrogen-powered vehicles and the use of sustainable fuels in the aviation industry.</p>	TDRI (2023)
8	<p><b>Green logistics measures:</b> The government supports reducing energy costs through the use of alternative energy vehicles and adapting to a green economy to enhance international trade opportunities.</p>	Smart City Thailand (2024)
9	<p><b>Subnational-level initiatives:</b> Bangkok Metropolitan Administration (BMA) The BMA has implemented various initiatives to improve air quality, such as promoting public transportation and encouraging the use of EVs. While these initiatives do not directly target motorcycle last-mile delivery (LMD), they can indirectly contribute to reduced emissions.</p> <p><b>EV promotion:</b></p> <ul style="list-style-type: none"> <li><b>Subsidies and tax incentives:</b> The Thai government has introduced various incentives, including tax breaks and subsidies, to encourage the adoption of EVs, including electric motorcycles.</li> <li><b>Charging infrastructure:</b> The city is expanding its charging infrastructure, although specific policies targeting LMD may not be in place yet.</li> </ul>	Bangkok Global Law (2024); Bangkok Post, (2023); Thailand Board of Investment (2024)



**Table 1:** Policies/regulations/initiatives related to the transportation sector in Thailand

No.	Policy/regulation/initiative in Thailand	References
	<p><b>Air quality management:</b></p> <ul style="list-style-type: none"> <li>• <b>Emission standards:</b> Bangkok has stringent air quality standards and emission regulations for vehicles, including motorcycles. However, enforcement and monitoring mechanisms may vary.</li> <li>• <b>Vehicle inspection and maintenance programs:</b> Regular vehicle inspections and maintenance programs are in place to ensure vehicles, including motorcycles, meet emission standards.</li> </ul> <p><b>Urban planning and traffic management:</b></p> <ul style="list-style-type: none"> <li>• <b>Road Network Optimization:</b> Efforts are underway to optimize traffic flow and reduce congestion, which indirectly benefits LMD services by minimizing idling time and fuel consumption.</li> <li>• <b>Public transportation development:</b> Expanding public transportation options, such as the BTS Skytrain and MRT, can reduce the reliance on personal vehicles, including motorcycles, for LMD.</li> </ul> <p><b>Industry partnerships and collaborations:</b></p> <ul style="list-style-type: none"> <li>• <b>Public-private partnerships:</b> Collaborations between the government, private sector, and logistics companies can accelerate the adoption of cleaner technologies and sustainable practices.</li> <li>• <b>Industry-led initiatives:</b> Logistics companies and delivery platforms are increasingly adopting eco-friendly practices, such as optimizing delivery routes, using fuel-efficient vehicles, and promoting EVs.</li> </ul>	
10	<p><b>Subnational-level initiatives: Pattaya</b></p> <p>Pattaya lacks specific, localized policies solely targeting LMD emissions. It actively pursues broader sustainable transportation initiatives that indirectly impact this sector. The city also has some initiatives similar to Bangkok. In addition, its green initiative called “Pattaya Go Green” promotes eco-friendly practices, which could encourage businesses to adopt greener LMD solutions.</p>	Toyota Asia (2024)

## Estimation of GHG Emissions

In Thailand, LMD, the final stage of a product's journey from a warehouse to a customer's doorstep, has become increasingly reliant on motorcycles. This mode of transportation offers flexibility, efficiency, and affordability, especially in urban areas with congested traffic. However, the growing number of motorcycles engaged in LMD also contributes to GHG emissions, air pollution, and climate change. This report aims to estimate the GHG emissions from LMD by motorcycles in Thailand, focusing on popular motorcycle models and typical delivery distances for food and goods in Thailand.

LMD riders could be classified into part-time and full-time workers. Part-time riders take 3–5 hours on weekdays and 6–8 hours on weekends, whereas full-time riders take at least 6–8 hours to more than 10 hours per day with the starting hour at 6:00 am. However, most full-time riders start at around 8:00–10:00 am and end at around 20:00–22:00. For food delivery, the peak hours are 6 am–9 am, 11 am–13 pm, and 18 pm–20 pm. The number of LMD riders in Thailand was provided in 2020 by the Department of Business Development and Thansettakij (T-OSH, 2022); hence, this study aims to estimate GHG emissions for the base year 2020 only. The total number of LMD riders is approximately 965,000, with 600,000; 100,000; 200,000; 50,000; and 15,000 for Foodpanda, Grab, Line Man, Gojek, and Robinhood, respectively.

A survey of interviewees, social media platforms, and company webpages shows that the distances of food delivery for part-time riders are 20–40 and 44–64 km on weekdays and weekends, respectively, and 44–64 and 80–160 km for full-time riders on weekdays and weekends, respectively (Table 2). The distance of each order is from 3 km to more than 10 km, and most orders not over 3 km share about 80%. Full-time/part-time riders account for 71% while full-time riders account for 29% of all riders.

**Table 2:** Description of distance of food delivery by motorcycles in Thailand

Types	Working hours	Number of orders	Distance (km)	Average (km)
<b>Part-time riders</b>	3–5 (weekdays)	5–10	20–40	30±10
	6–8 (weekends)	11–16	44–64	54±10
<b>Full-time riders</b>	8–17 (weekends)	20–40	80–160	120±40
	6–8 (weekdays)	11–16	44–64	54±10

The estimation of vehicle kilometers traveled (VKT)/year of motorcycles for food delivery in Thailand is presented in Table 3.

**Table 3:** VKT in unit of average (range) of motorcycles for food delivery in Thailand

Categories	One rider				Total riders	
	VKT/day		VKT/ week	VKT/ year	No. of riders	VKT/year (10 <sup>9</sup> km)
	Weekdays	Weekends				
<b>Full-time</b>	120 (80–160)	54 (44–64)	708 (488–928)	36,816 (25,376– 48,256)	685,150	25.2 (17.4–33.1)
<b>Part-time</b>	30 (20–40)	54 (44–64)	258 (188–328)	13,416 (9,776– 17,056)	264,850	3.6 (2.6–4.5)
<b>Total</b>			<b>966 (676– 1256)</b>	<b>50,232 (35,152– 65,312)</b>	<b>950,000</b>	<b>28.8 (20.0–37.6)</b>

We assumed that all the motorcycles use gasoline as fuel for LMD in Thailand. The fuel consumption of a 4-stroke motorcycle by an average of all sizes is 37.64 km/L or 0.027 L/km (TGO, 2022a). The estimated total fuel consumption used for last-mile food delivery in Thailand in billion liters was 0.78 (0.54–1.01). The emission factors for estimating key GHG (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) emissions from motorcycles are derived from the IPCC report (kg/TJ), as reported in TGO (2022b). The net calorific value is 31.48 MJ/liter (TGO, 2020b). The total energy consumption is 24,460 (16,978–31,914) TJ/year. Table 4 presents the total GHG (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) emissions and total CO<sub>2</sub>-equivalent emissions from LMD by motorcycles in Thailand.

**Table 4:** GHG emissions from LMD by motorcycles in Thailand

Parameter	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
<b>EF (kg/TJ)</b>	69,300	33	3.2
<b>Emissions (Gg/year)</b>	1695 (1177–2214)	0.81 (0.56–1.05)	0.08 (0.05–0.1)
<b>CO<sub>2</sub>-equivalent metric</b>	1	72	289
<b>CO<sub>2</sub>-eq (Gg/year)</b>	1695 (1177–2214)	58 (40–76)	23 (16–30)
<b>Total CO<sub>2</sub>-eq (Gg/year)</b>	1776 (1233–2319)		

## Challenges and opportunities in engaging LMD services to transition/adopt a low-carbon transport fleet

The adoption of internal fuel combustion motorcycles as the preferred mode of transport for two-wheeler LMD has resulted in environmental issues. As the e-commerce and food delivery market expands, the demand for two-wheeler LMD increases the burden on the environment in Thailand. In addition, it exacerbates other issues, such as traffic congestion and plastic waste problems.

As environmental concerns continue to rise, sustainability has also become a crucial factor in LMD. Consumers are increasingly conscious of the environmental impact of LMD services and expect businesses to adopt greener practices. Thai businesses should explore eco-friendly delivery options to meet these expectations.

For example, companies can invest in EVs for deliveries, use bicycle couriers for shorter distances, or partner with eco-friendly logistics providers. By adopting EVs for LMD, the transportation sector could achieve reductions in costs and emissions compared with the use of fuel combustion engine vehicles (Anderluh et al., 2017). For example, DHL Express has made a firm commitment to achieving complete emission elimination by 2050. It has implemented various initiatives, such as EV use to achieve a minimum target of 60% EVs for LMDs by 2030; sustainable aviation fuel (SAF), which decreases the reliance on heavy fuel oil by switching to SAF; and GoGreen Plus, which reduces carbon emissions from air transportation by transitioning to SAF. These initiatives not only contribute to environmental conservation but also resonate with eco-conscious customers, helping businesses build a positive brand image internationally (DHL, 2024c).

## Alternative solutions

### Adoption of electric delivery vehicles

The adoption of electric delivery vehicles for parcels and food and beverage delivery has gained significant attention in recent years. For example, several projects have implemented EVs in urban logistics, particularly in LMD, i.e., for food delivery in China (Yan et al., 2023; Lebeau et al., 2013).

DHL Express Thailand got a head start with its recent addition of 50 electric motorcycles to its delivery fleet. According to one of their representatives, “The launch of these new electric motorcycles reflects DHL’s commitment to cutting our logistics-related emissions to zero by 2050. Enabling greener deliveries will also help in reducing air and noise pollution levels in a region still nascent in its electrification journey” (DHL, 2024d).





**Figure 5:** Electric motorcycles at DHL Thailand. **Photo credit:** DHL Bangkok

## Adoption of cargo bikes

According to a case study in London, using electrically assisted cargo bikes contributes to a reduction of 20% in VKT and 54% in CO<sub>2</sub> equivalent emissions (Browne et al., 2011). Gnewt Cargo Company, which delivers about 9,500 parcels/day in London, can achieve a reduction of 20% in VKT and 67% in emissions per parcel using a fleet of electric vans and electric tricycles compared with the use of fuel combustion delivery vehicles (Schliwa et al., 2015).

## Improving delivery services

The competition among delivery businesses has dramatically increased, with parcel delivery companies adapting their businesses to create beneficial customer service by discovering solutions to avoid traffic congestion while reducing the city's pollution. Therefore, companies are focusing on creating values of customer service and market competitiveness. For example, Kerry Express provided a parcel counter service (C2C) in 2013 by opening a local community parcel shop, with the service using Bangkok's Sky train station. Moreover, it opened the first parcel shop in Asoke Tower to cover communities in Bangkok. The Thailand Post Office and DHL also play significant roles in delivering parcels to their customers by avoiding congestion in the city through measures such as using parcel lockers (Amchang and Song, 2018).

## Conclusions

In Thailand, e-commerce activities have been booming recently, and the majority of purchases occur in urban areas such as BMR. In Southeast Asia, Thailand is ranked as the second-largest digital economy after Indonesia. The CEP market size in Thailand was estimated at \$US 2.63 billion in 2024 and is projected to be \$US 3.99 billion by 2030, with an annual growth rate of 7.20% in 2024–2030. In 2023, the online food delivery market in Thailand was approximately US\$ 3.97 billion, with an annual growth rate of 13%, and is projected to be US\$ 6.58 billion in 2027.

Thailand Post, Kerry Express, and Lazada Express are the top 3 LMD service providers in Thailand. These companies dominated the parcel market share by approximately 80% in 2020. The most popular Thailand food delivery apps include Line Man, GrabFood, and Foodpanda. Several delivery companies in Thailand have policies/initiatives/best practices on low-carbon transport. At present, Thailand has several policies that can indirectly address the emissions from motorcycles, especially those for providing LMD services. The parcel and food and beverage delivery industry in Thailand is faced with sustainability challenges, including air pollution. The total estimated CO<sub>2</sub> emissions from food delivery services in Thailand was 1,776 (1233–2319) Gg/year for 2020.

The adoption of internal fuel combustion motorcycles as the preferred mode of transport for LMD by motorcycles has resulted in concerning environmental issues in Thailand. The adoption of electric delivery vehicles, cargo bikes, and improved delivery services are some of the alternative solutions to reduce the emissions from two-wheeler LMDs in Thailand.

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