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Trucking Industry

On a stretch of National Highway 48 near Jaipur, a routine afternoon delivery took a sudden turn. A mid-sized goods truck delivering agricultural produce veered off course and crashed. The driver was seasoned, but fatigue got to him. This wasn't a spectacle for social media, nor a microcosm of an industry in crisis. It was a stark reminder of the everyday challenges faced by India's vast trucking community. More than 10 million trucks crisscross the nation's arteries, 4.6 billion tonnes of cargo is transported annually covering distances upto 10 trillion kilometres collectively these drivers battling fatigue, tight schedules, and often, bad road conditions. The question comes to mind, did equipment failure play a role? Was driver fatigue a factor? Could better infrastructure have averted this near-miss? The trucking industry works seamlessly in the background and is a lifeline for a nation like India, carrying out one of the most important parts of our country's economy.



Exhibit (1) - Reasons for driver dissatisfaction with their profession

Trucking Industry in India

The trucking industry in India is a crucial component of the country's economy and is responsible for transporting the majority of domestic freight demand. India transports around 4.6 billion tonnes of freight annually, generating a transport demand of 2.2 trillion tonne-kilometers (tonne-km) at the cost of ₹9.5 lakh crore. The demand for goods is rising due to urbanization, population increase, the rise of e-commerce, and rising income levels. As this demand continues to grow, associated road freight movement is expected to increase to 9.6 trillion tonne-km by 2050. Heavy-duty and medium-duty trucks (HDTs and MDTs, respectively) are responsible for most road transportation, accounting for 76% and 21% of the road freight demand. The number of trucks is expected to more than quadruple, from 4 million in 2022 to roughly 17 million trucks by 2050, as road freight travel continues to grow.

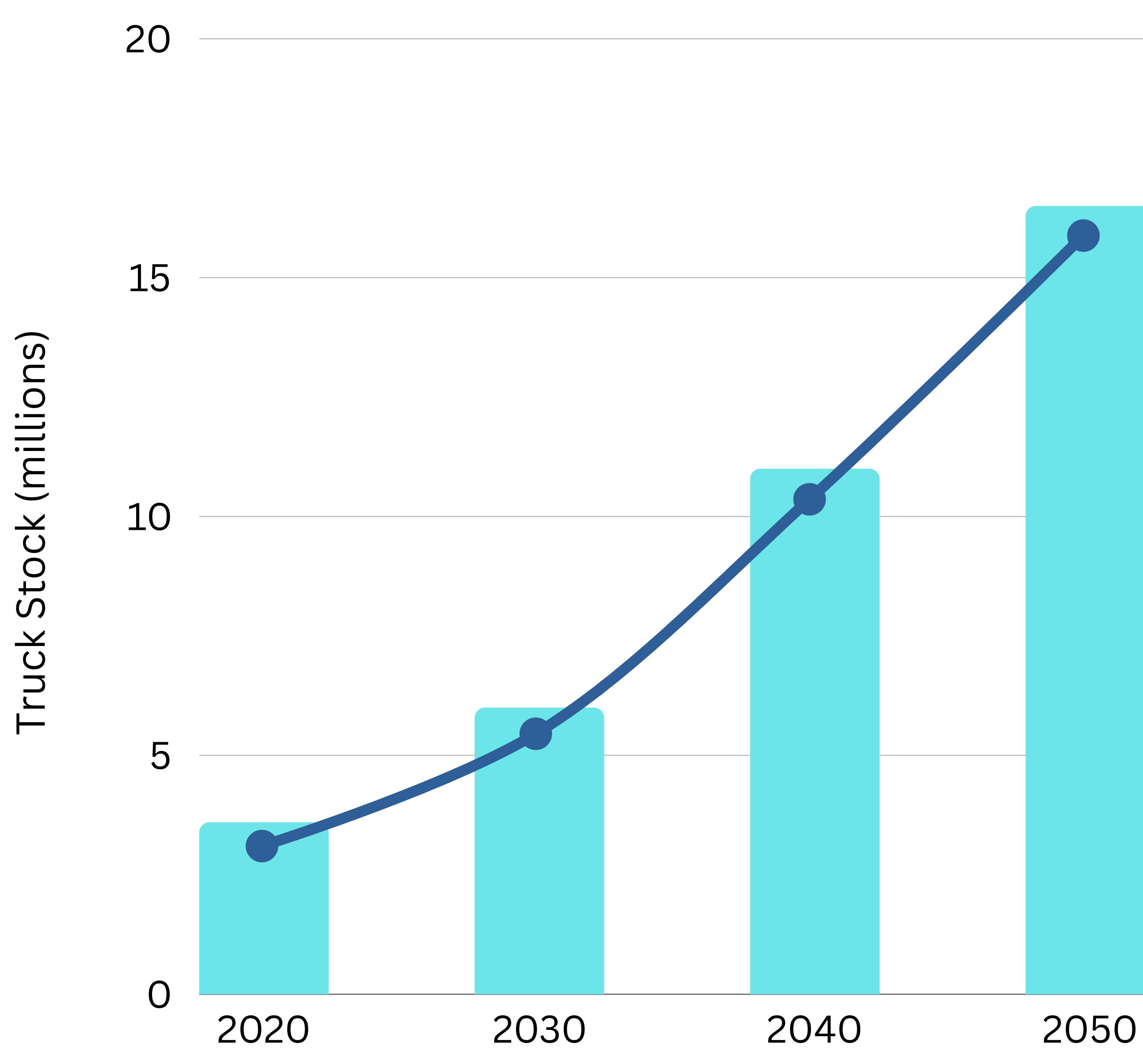


Exhibit (2) - Projected growth in the Indian trucking Industry



XYZ Logistics

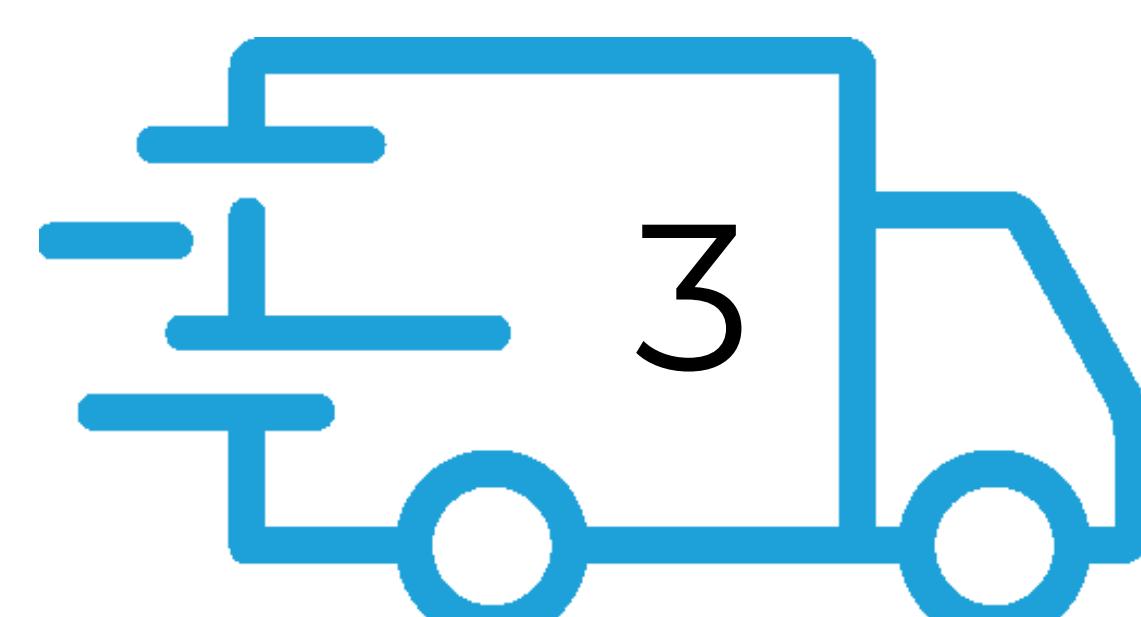
XYZ Logistics wishes to stand out among major logistics players by strongly emphasizing operational flexibility and efficiency. They aim to leverage best practices and technology to ensure a seamless supply chain by having a first-mover advantage. With a mission to create new standards for truck rostering in the face of market fluctuations, XYZ Logistics aspires to showcase adaptability and vision in the dynamic logistics landscape. By focusing on the trucking sector in India, which accounts for 80% of freight transportation, the company strives to contribute to the organization of the industry which is currently dominated by unorganized players.

Organised vs Unorganised

To streamline India's 317.26 billion USD logistics industry, we need to get down to the brass tacks and narrow our lens to a truck operator's demography, including their ownership, efficiency, how they get a load, the number of days they drive in a month and manage their operations.

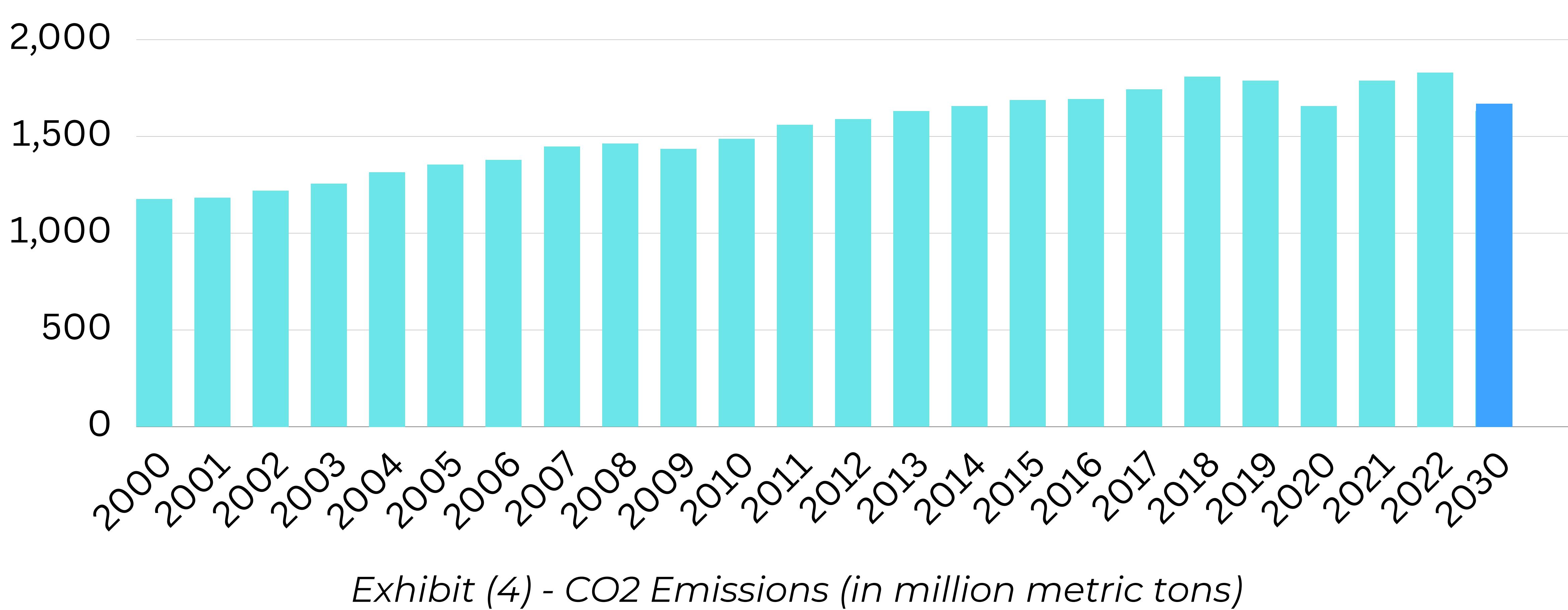
Feature	Organized Sector	Unorganized Sector
Size	14% of total trucking industry	86% of total trucking industry
Structure	Formal structure	No formal structure
Regulation	Subject to government regulations	Not subject to government regulations
Fleet Size	Typically have a fleet of trucks	Typically own a single truck
Driver Training	Typically employ trained drivers	May not employ trained drivers
Services	Offer a wide range of trucking services	May only offer a limited range of trucking services
Cost	More expensive to operate	Less expensive to operate
Efficiency	More efficient	Less efficient
Safety	More likely to engage in safe practices	More likely to engage in unsafe practices
Emergency Response	More equipped to handle emergencies	Less equipped to handle emergencies
Documentation	Provide proper documentation for cargo	May not provide proper documentation for cargo

Exhibit (3) - Organised vs Unorganised Trucking in India



Small fleet operators in India are mainly uneducated and ignored. They are not part of the formal economy and don't even remotely participate in the digital economy. Concerted efforts must go into unlocking the efficiencies of this segment – helping small fleet owners better utilize fleets, achieve optimal diesel consumption, reduce their carbon footprint, better manage payments, increase revenues, and most importantly, uplift their socio-economic status by bringing dignity and pride to the overall trucking community. Digitisation of small fleet operators is the need of the hour for India.

It will take a lot of time and money to digitize the trucking business in India, especially for drivers who work in isolated communities. A strong distribution network is necessary to achieve broad digitalization since truck drivers in India are dispersed over six lakh communities. Furthermore, it is imperative to develop a customized digital offering since fleet operators give priority to solutions that enhance their unit economics. For adoption to be effective, it is crucial to comprehend the particular requirements of these consumers and to concentrate on trust, dependability, round-the-clock assistance, and availability in their chosen language.





Digitalization has the potential to drastically change trucking on a personal, local, and national level. A truck operator's asset utilization may be improved by a well-optimized digital freight network, which can cut idle time by 40-50% and increase revenue by 20-30%. By online trucking operations, operational expenses may be reduced by 10% to 15%, and cash leaks and fuel theft can be significantly reduced. Digitization may have a favorable impact on the success of industry families in addition to financial gains. A simplified digital platform may reduce empty miles by half, lowering carbon emissions and supporting India's decarbonization agenda. This also addresses environmental issues.

The Indian trucking industry is highly fragmented, with small owner-operators controlling over 75% of the market. This leads to intense price pressure and competition, resulting in unsustainable returns for small carriers. In contrast, larger companies in the organized sector leverage industry expertise, comply with regulations, and invest in technology, making them better equipped for the transition to zero-emission deployment and offering a more efficient and sustainable future for the industry in India.

Truckload, Semi-Truckload and Specialized Truckload

Truckload

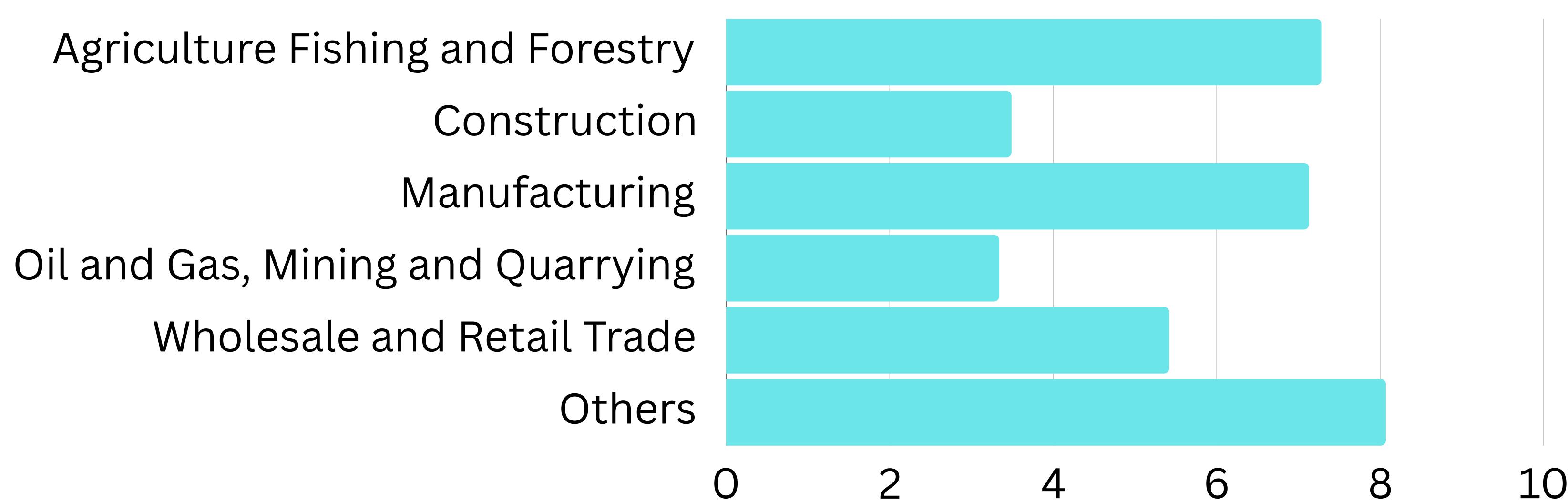
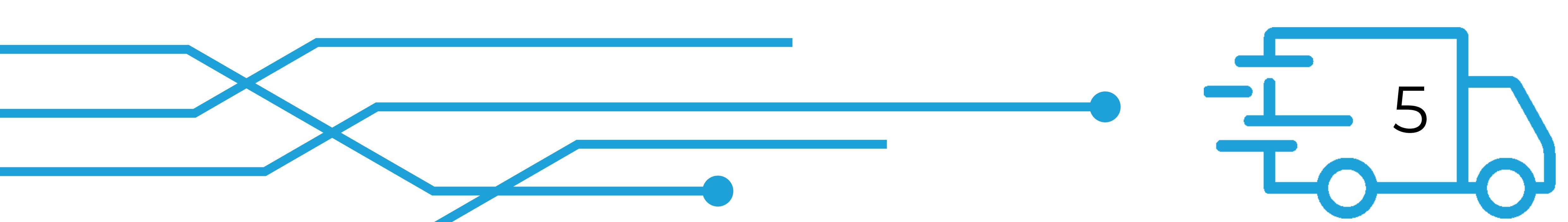


Exhibit (5) -Indian Full Truckload Freight Transport, CAGR %, By End User, 2022 - 2028



In India, truckload shipping serves as the backbone of the nation's intricate logistics network, tailored to meet the diverse requirements of its expansive and varied demographics. This mode of freight transportation involves the exclusive use of trucks, ranging from long-haul trailers to nimble vehicles, adept at navigating the complexities of both congested urban areas and rural landscapes. The full truckload market, while mostly fragmented, is expected to grow from 115 billion dollars to 180 billion dollars within the next five years.

The adaptability of truckload shipping in India extends beyond geographical considerations. It is a cost-effective solution for businesses dealing with bulk commodities, providing dedicated transportation that ensures the security of goods throughout the journey. As India continues its economic growth trajectory, the efficiency and reliability of truckload shipping contribute significantly to the seamless movement of goods, supporting industries ranging from agriculture to manufacturing and playing a vital role in the nation's overall economic development.

Less Than Truckload

In the Indian logistics landscape, less-than-truckload (LTL) shipping emerges as a nimble and efficient solution, particularly suited to the diverse demographic and geographic nuances of the country. Unlike traditional truckload shipping, LTL involves consolidating multiple shipments from different customers within a single truck, optimising resources, and catering to businesses with smaller freight volumes. While the market is mostly fragmented, it is expected to grow from 28.04 billion dollars to 38.09 billion dollars by 2029.

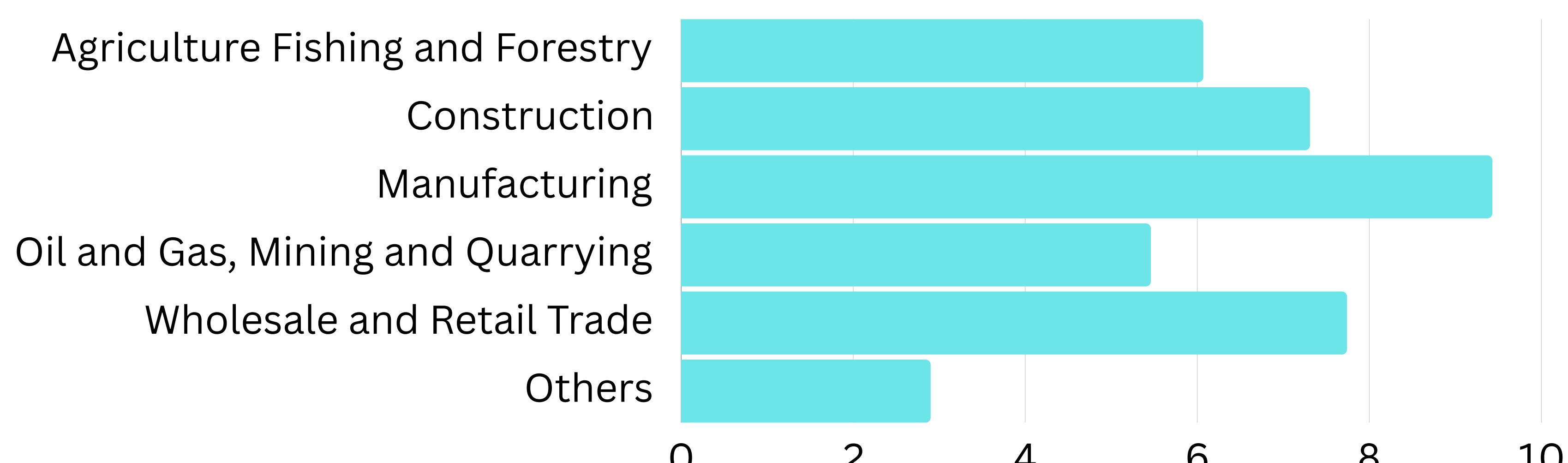
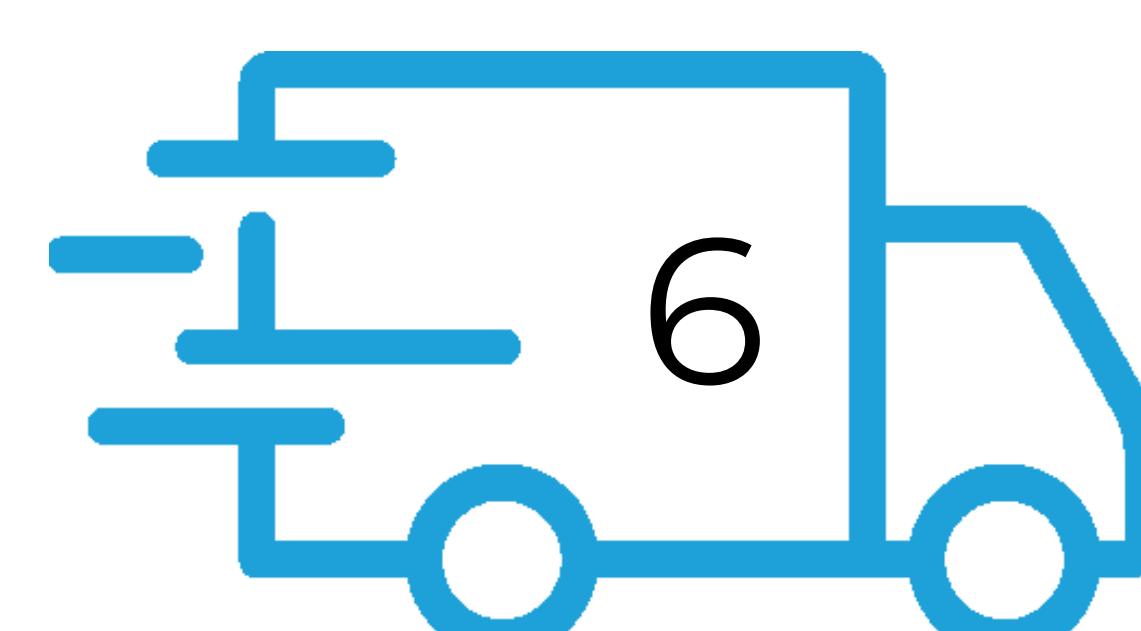


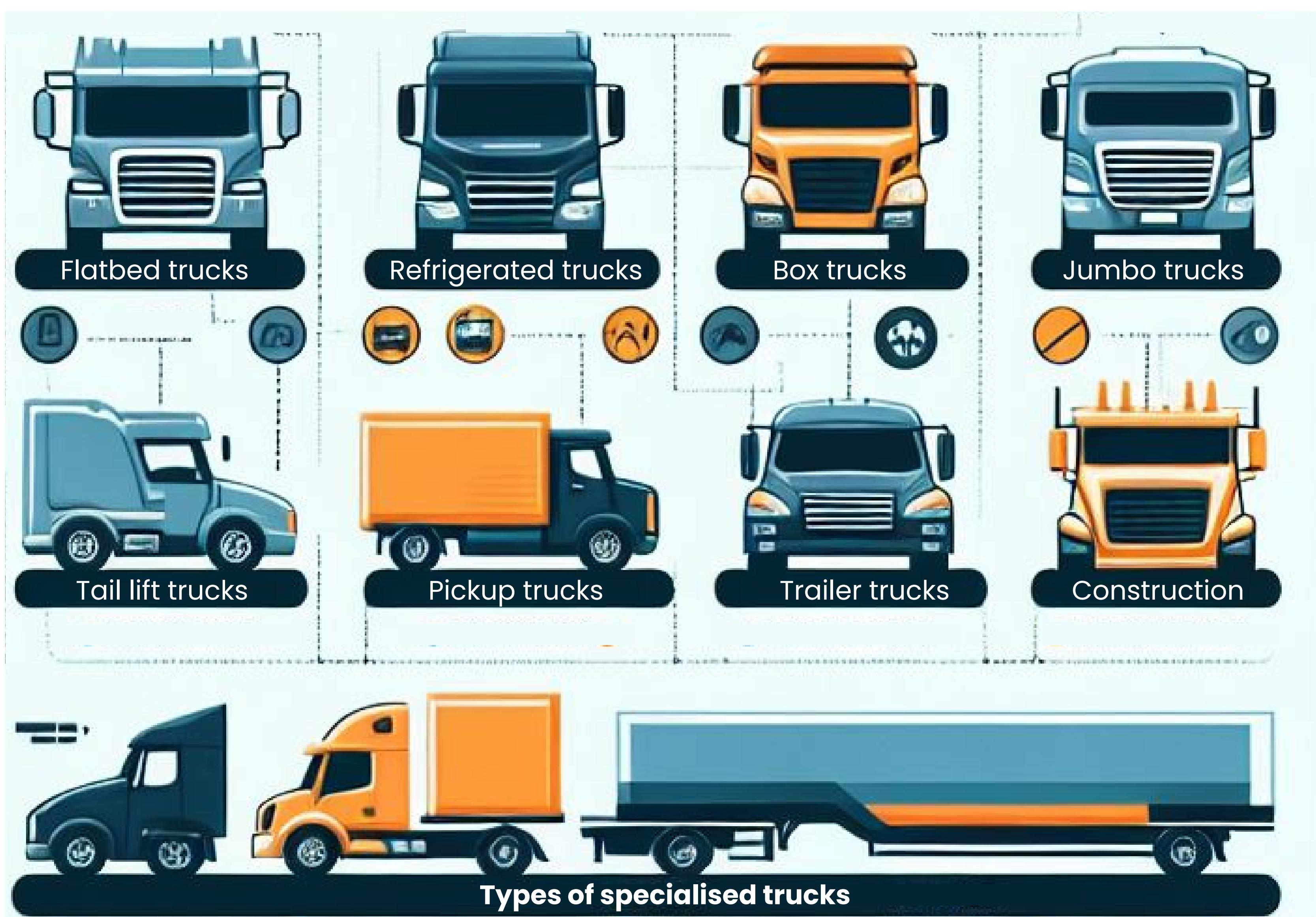
Exhibit (6) - Indian Less than Truckload Freight Transport, CAGR %, By End User, 2022 - 2028



Given India's varied terrain and population distribution, LTL shipping offers a flexible and cost-effective alternative for businesses transporting smaller quantities of goods. This approach is well-suited for navigating congested urban areas and serving regions where dedicated truckload shipments might be impractical. With LTL, businesses can benefit from shared transportation costs, making it an economically viable choice for industries with varying shipping needs nationwide. As India's economic landscape evolves, the adaptability and efficiency of LTL shipping play a pivotal role in meeting its market's diverse and dynamic demands, contributing to the overall growth of the logistics sector.

Specialised Trucking

In the context of India's intricate logistics framework, specialized trucking emerges as a tailored solution, finely attuned to the country's diverse demographics and unique transportation challenges. Specialized trucking involves using vehicles equipped to handle specific types of cargo, such as refrigerated trucks for perishable goods, flatbed trucks for oversized items, or tankers for liquids.



Given India's vast and varied landscape, specialized trucking addresses the specific needs of industries requiring careful handling or specialized equipment for their goods. For instance, in the agricultural sector, refrigerated trucks ensure the freshness of produce during transportation, while flatbed trucks accommodate the unique dimensions of construction materials. This approach allows businesses to meet the distinctive demands of their supply chains, navigating through diverse terrains and reaching both urban centers and remote areas with precision. As India's economy continues to diversify, the role of specialized trucking becomes increasingly crucial in providing customized solutions that align with the varied requirements of different industries, contributing to the overall efficiency and resilience of the logistics sector.

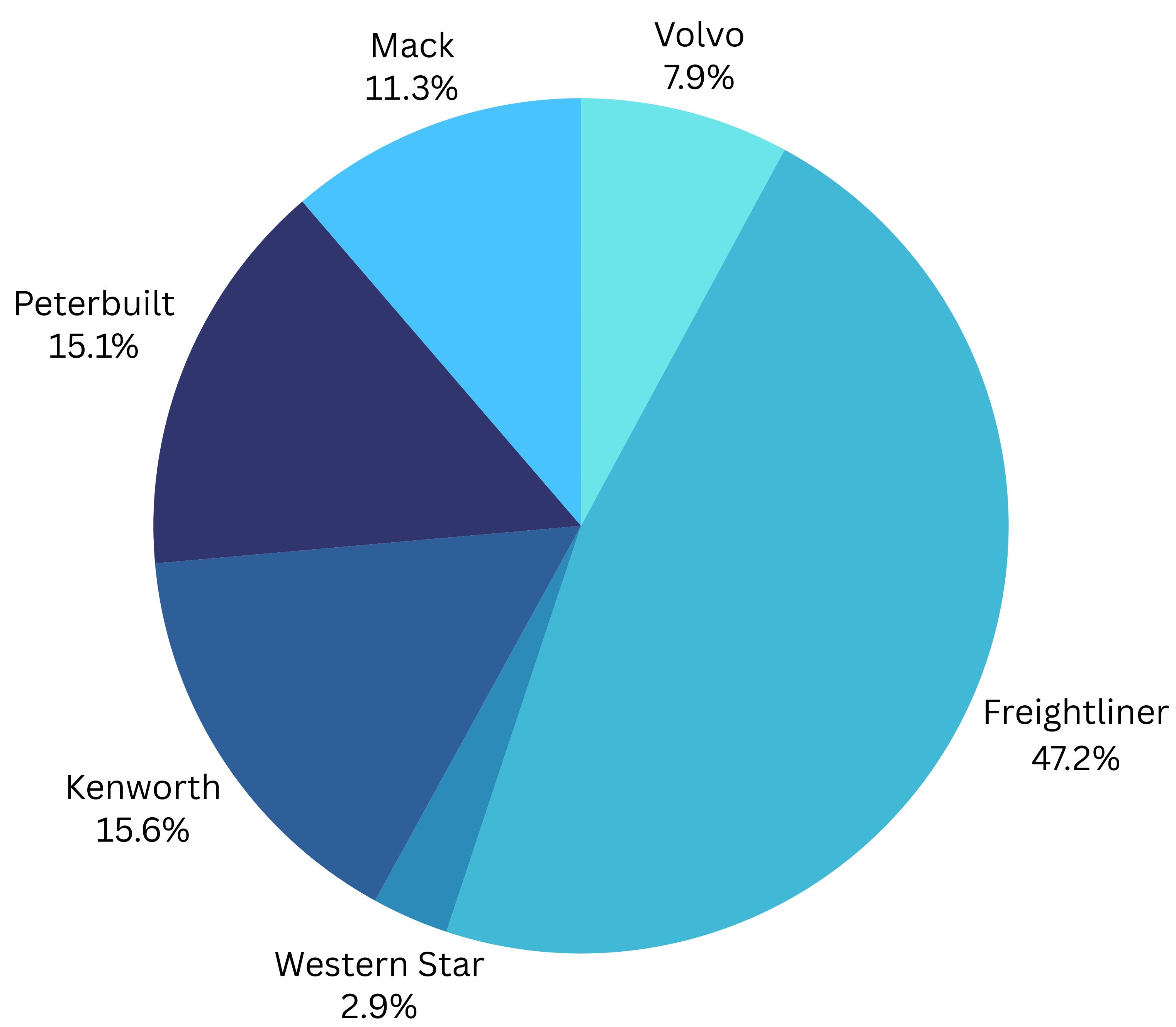
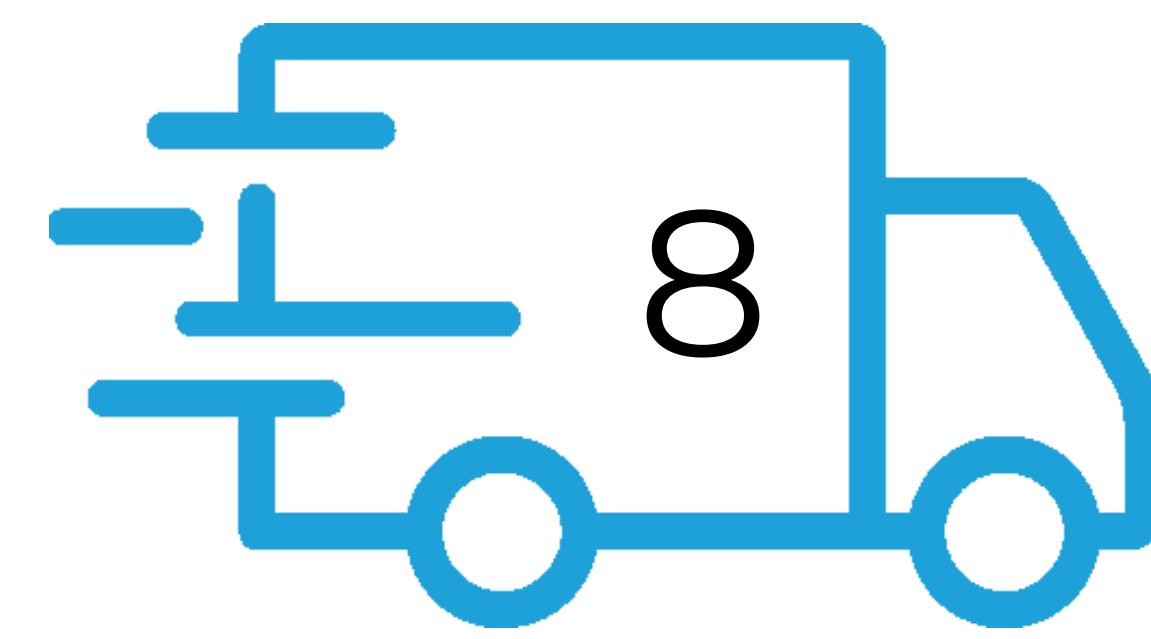


Exhibit (7) -Market share of major international players



Electric vs Diesel

The ongoing discussion between trucks with regular engines (combustion engines) and electric trucks is getting more attention. This reflects the global trend towards being more environmentally friendly. Both types of trucks have pros and cons, and this is shaping how trucks will be used in the future.

Regular trucks with combustion engines have been the most preferred choice in transportation for a while. They use common fuels like diesel or petrol and have a strong support infrastructure, with fueling stations all over the world. They're known for being tough, especially for long-distance trips, providing good mileage and a history of being reliable. However, the obvious downside is they're not great for the environment. They release greenhouse gases and contribute to air pollution, which is a big deal nowadays when everyone is trying to be more eco-friendly.

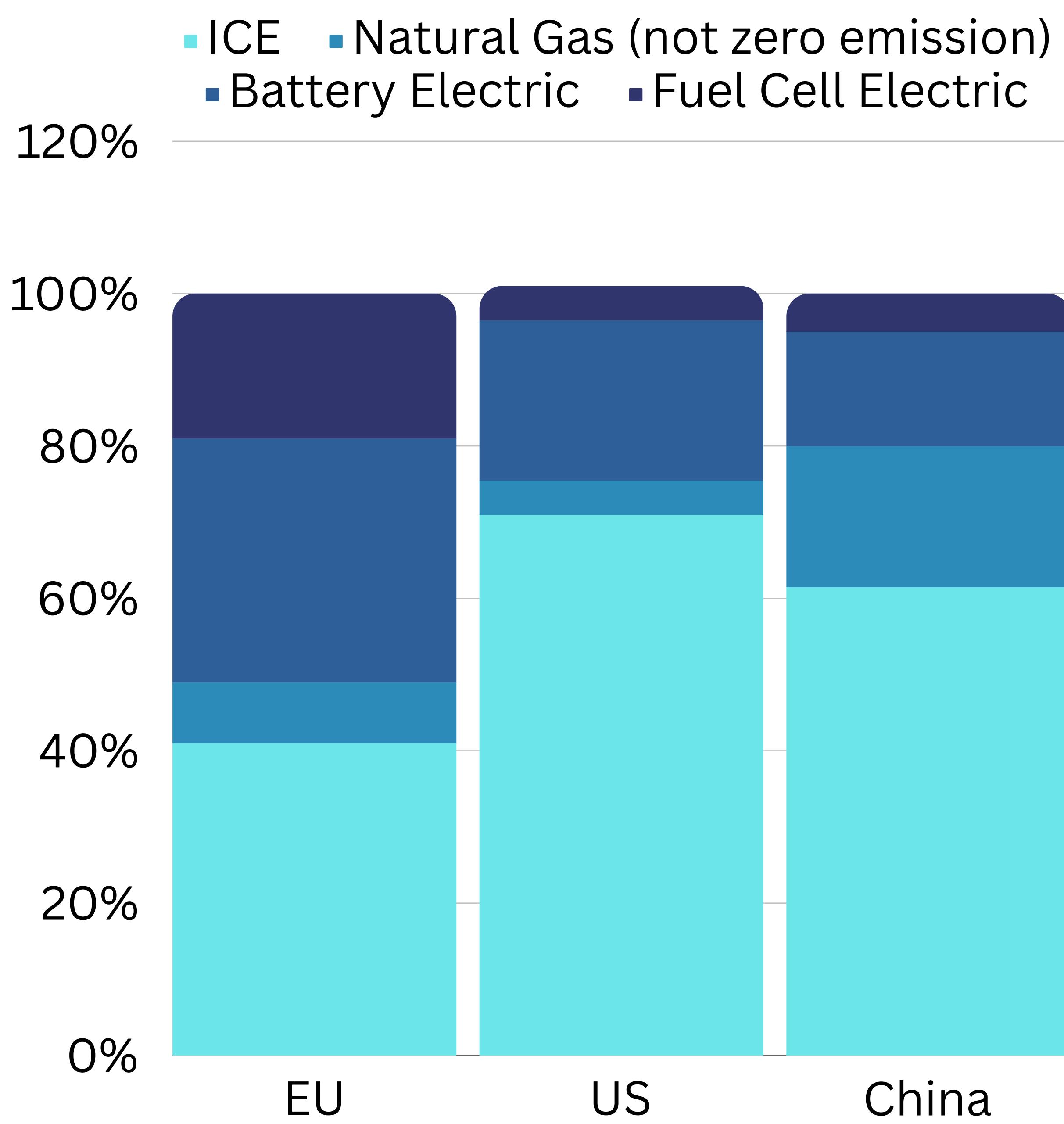
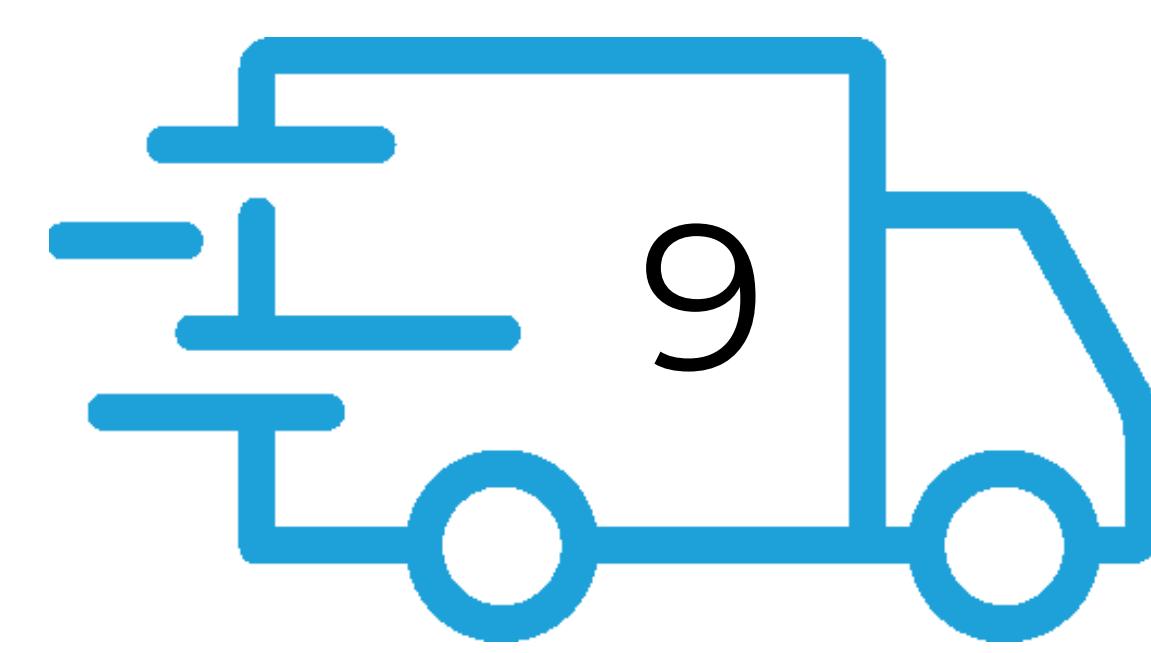


Exhibit (7) - 2030 Forecast of Freight Trucks Market Share by Fuel Type (BCG Analysis)



Conversely, electric trucks offer a revolutionary perspective on freight transportation, driven by the growing focus on environmentally sustainable alternatives. Powered by electric batteries, these trucks operate emission-free, significantly contributing to the reduction of the transportation industry's carbon footprint. Electric trucks excel in short to medium-haul routes and urban deliveries, benefiting from regenerative braking technology that enhances energy efficiency. Nevertheless, their widespread adoption faces challenges such as limited charging infrastructure, higher initial costs, and concerns about the environmental impact of battery production, which have impeded their broader integration into the industry.

When you're comparing regular and electric trucks, it really comes down to what you need them to do and the costs that one can bear. Regular trucks are the go-to for long-distance trips because they have good support and cost less at the beginning. Diesel trucks, whilst popular, can only provide up to 18% tank-to-wheel efficiency, compared to the whopping 82% tank-to-wheel efficiency of electric trucks. Electric trucks, though, are perfect for city driving. Their range and eco-friendly features match well with short trips and lots of stops. However, electric trucks have several pitfalls; for instance, the heavy size of batteries can reduce payload. Moreover, electric trucks carry the added disadvantage of having a charging time that can be as long as 8 hours.

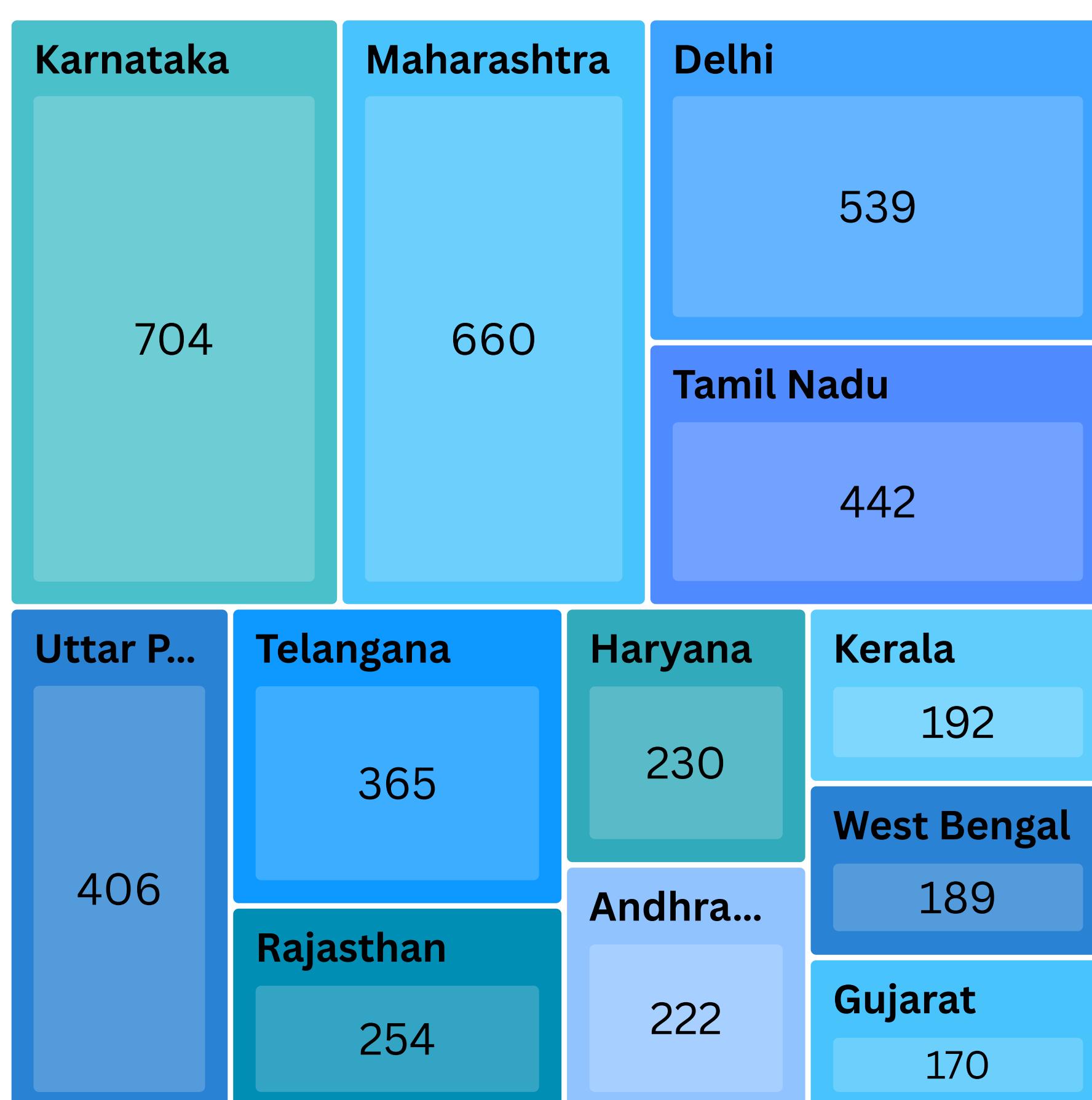


Exhibit (8) - Number of Public EV Charging Stations in India (State-wise)

When it comes to helping the environment, electric trucks are the winners. They're a greener choice compared to the emissions from regular trucks. But, for everyone to switch to electric trucks, we need better batteries, more places to charge them, and a plan for the whole life of these electric vehicles. Fleet operators need to manage their transition to a future powered by zero-emission engines, but it won't be easy. Most incumbents face the dual challenge of ensuring their existing businesses remain profitable even as they tackle the investment-heavy challenges of developing electric powertrains.

Compared with diesel trucks, both BEV (Battery Electric Vehicle) and FCEV (Fuel Cell Electric Vehicle) trucks have more payload restrictions because of the battery's weight or the hydrogen tank's size. At this point, however, many regulators allow for exceptions in vehicle dimensions or weight to balance out these disadvantages.

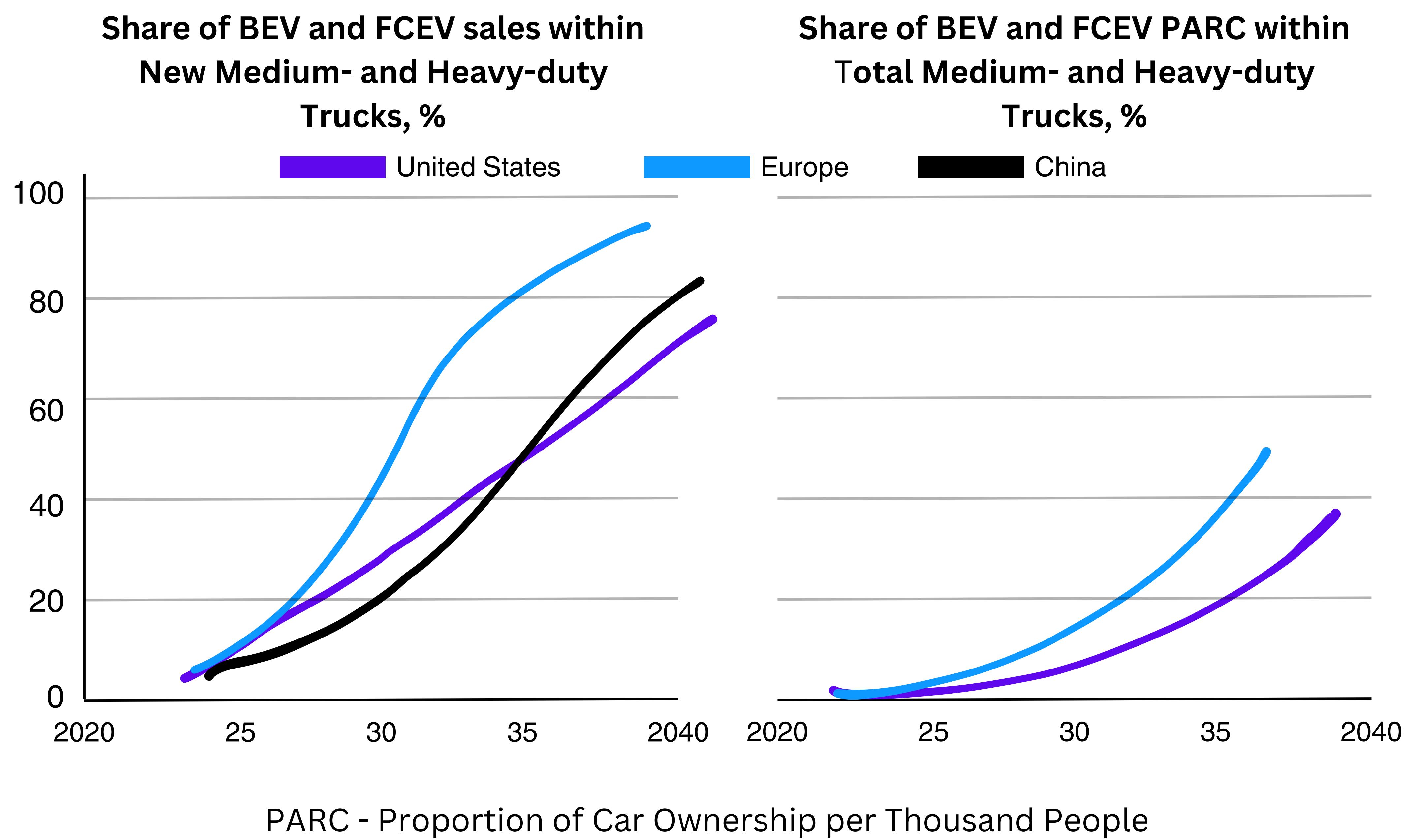
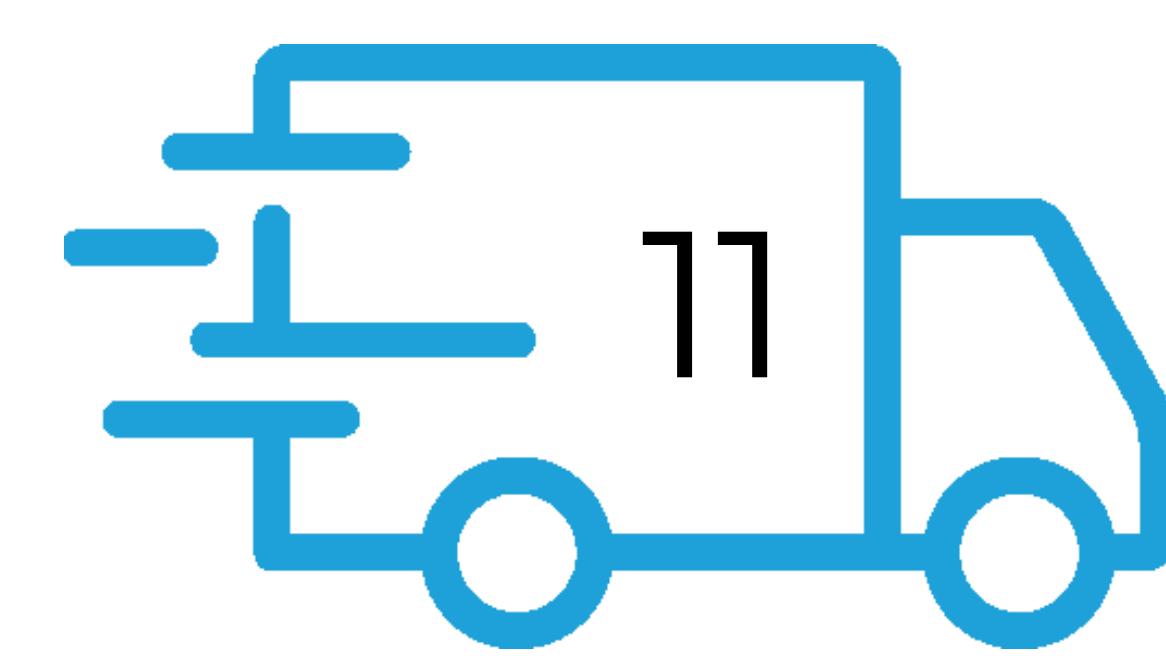


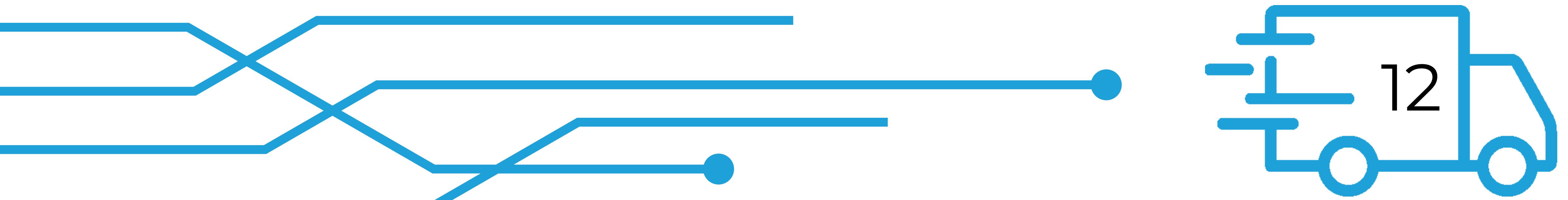
Exhibit (9) - Market Share Forecast of Battery Electric Vehicles (BEV) and Fuel-Cell EVs





Conclusion

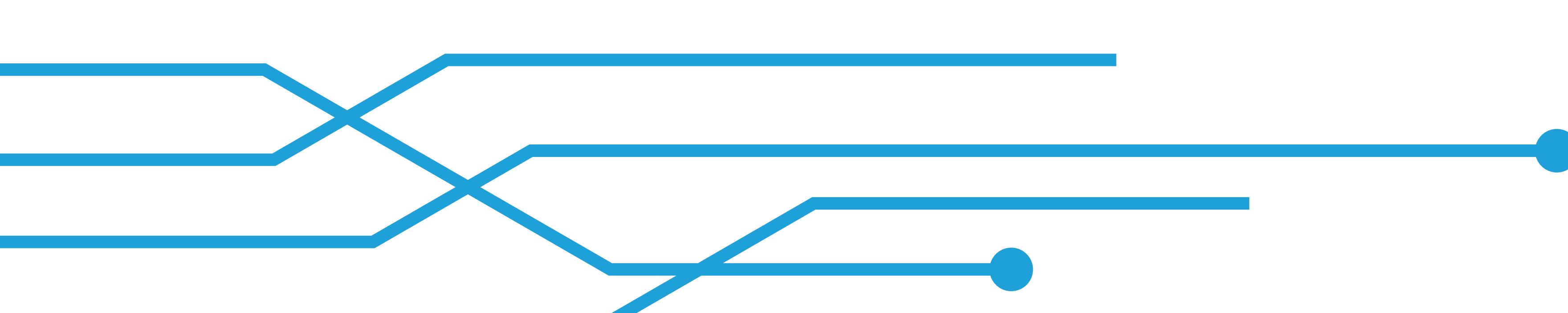
XYZ Logistics presents a groundbreaking opportunity to address the widespread inefficiencies in the transportation industry with its debut in the Indian market. By implementing an organized employment model, XYZ may increase long-term development potential, streamline processes, and increase reliability. A thorough go-to-market strategy that takes into account local relationships and the peculiarities of the Indian market is an essential component of any strategic roadmap. In addition, selecting between truckload, semi-truckload, and specialty deliveries as well as between diesel and electric vehicles requires careful consideration. A wise choice that complies with sustainability objectives and market needs may have a big influence on revenue and operational effectiveness. However, given the uncertain and ever-changing nature of the market and technological landscape, XYZ Logistics must continue to be flexible in adjusting its plans in order to ensure long-term success in this exciting but unpredictably shifting environment.





Questions

- XYZ Logistics company, entering the Indian market, wants to address the inefficiencies in the trucking industry caused by a significant percentage of unorganised employees. What organisational model or strategy should they implement to optimise their operations, foster innovation in the industry, and ensure sustainable growth? Devise a roadmap including a go-to-market strategy for the same. Also, justify the financial feasibility of the model.
- There are many approaches XYZ Logistics has to take to launch its organised transportation services, including choosing between truckload, semi-truckload, and specialised deliveries. They also have a choice between electric trucks and conventional diesel-powered trucks. Analyse all the above choices and provide insight into which would likely generate more revenue and operational efficiency for the company in the market.



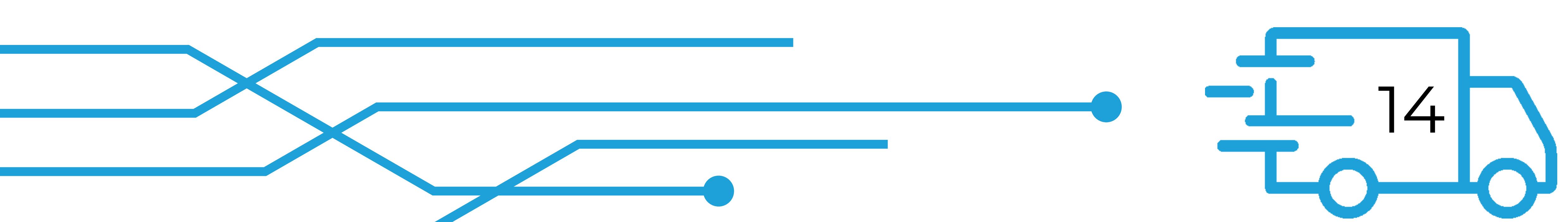


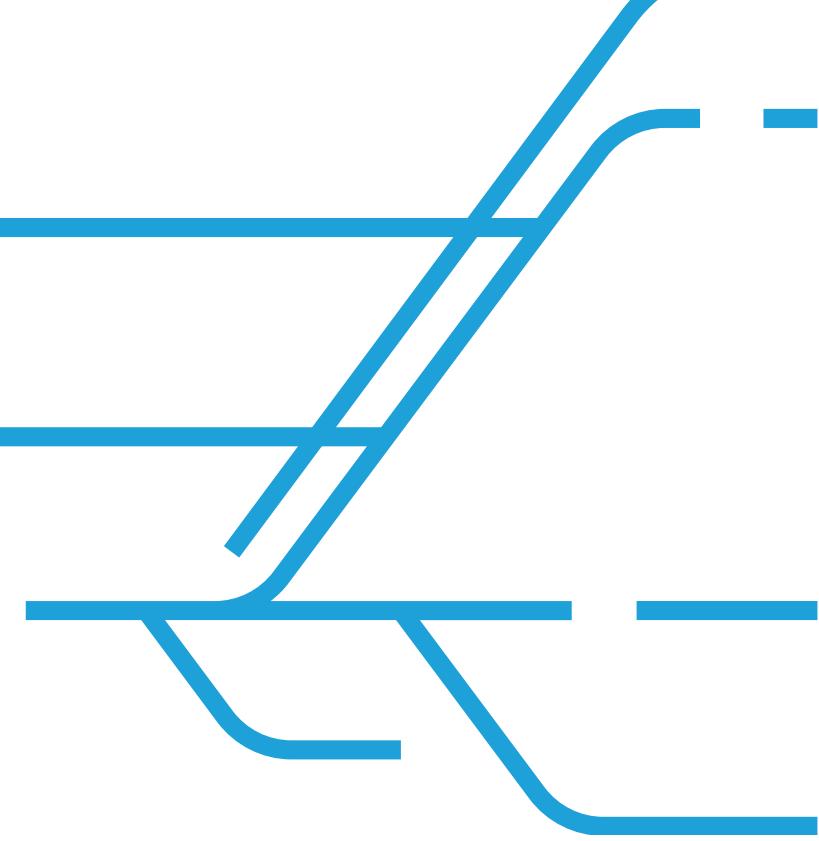
Bonus Question

Real-life optimization of supply chains is difficult, involving manipulating hundreds of constraints and variables to optimize several objectives, including maximizing revenue, ensuring smooth operations, and managing machinery and human resources.

To give a gist of the same, we have provided a bonus problem statement that emulates a real-life truck planning problem. Along with the constraints given below, an Excel sheet with 80 trucks and their age has also been provided. Could you create a daily schedule for the operations of each truck, listing the hours of operation for a month, and keeping the objectives in mind? While the problem can be solved as a standalone, integrating the solution with the abovementioned problems will be seen positively.

The solution to the problem given below will require innovative technical solutions, and based on the solution provided, participants have a chance to get PPOs/PPIs from our sponsor, StrategyTech Advisors.



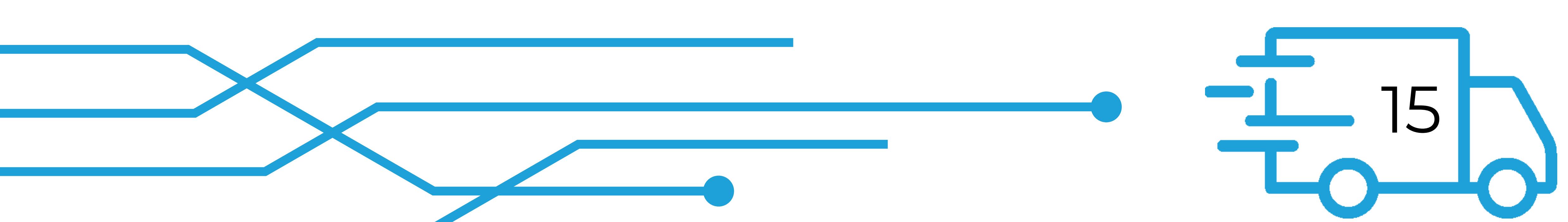


Goods Transportation Dynamics:

Goods transportation is a multifaceted domain influenced by a myriad of factors, ranging from the nature of the cargo to the intricacies of delivery timelines. XYZ Logistics deals with a diverse array of goods, including perishable items, fragile goods, electronics, and general goods. Each category comes with its unique set of challenges, necessitating a nuanced approach to truck rostering.

- 1. Nature of Goods:** Perishable items demand swift and time-sensitive transportation, while fragile goods require delicate handling to prevent damage. Electronics come with their own set of considerations, emphasizing secure transportation to maintain product integrity. General goods, on the other hand, represent a broad category with varied transportation requirements.
- 2. Minimum and Maximum Hour Requirements:** The time needed to transport each type of good varies, adding an additional layer of complexity. From a minimum of 3000 hours for perishable items to a range of 4000-6000 hours for fragile goods, the truck rostering challenge extends beyond mere time management. Striking a balance between meeting these requirements and optimizing the overall fleet utilization becomes paramount.
- 3. Total Monthly Requirement:** XYZ Logistics faces the overarching challenge of fulfilling a total truck travel need of 27,000 hours during the month. This not only necessitates efficient allocation of resources but also demands strategic planning to ensure timely and reliable delivery of goods.

Understanding these goods transportation dynamics provides crucial context to the truck rostering challenge. XYZ Logistics must navigate the delicate balance between diverse goods categories, each with its distinct requirements, to ensure a seamless and efficient transportation process. The intersection of these dynamics forms the backdrop against which XYZ Logistics seeks an advanced truck rostering solution, one that not only meets industry standards but sets new benchmarks for excellence in goods transportation.





Revenue Model

XYZ Logistics employs a sophisticated revenue generation model that reflects a nuanced approach to pricing based on hours traveled, additional earning potential tied to the type of goods transported, and considerations related to the age of the trucks.

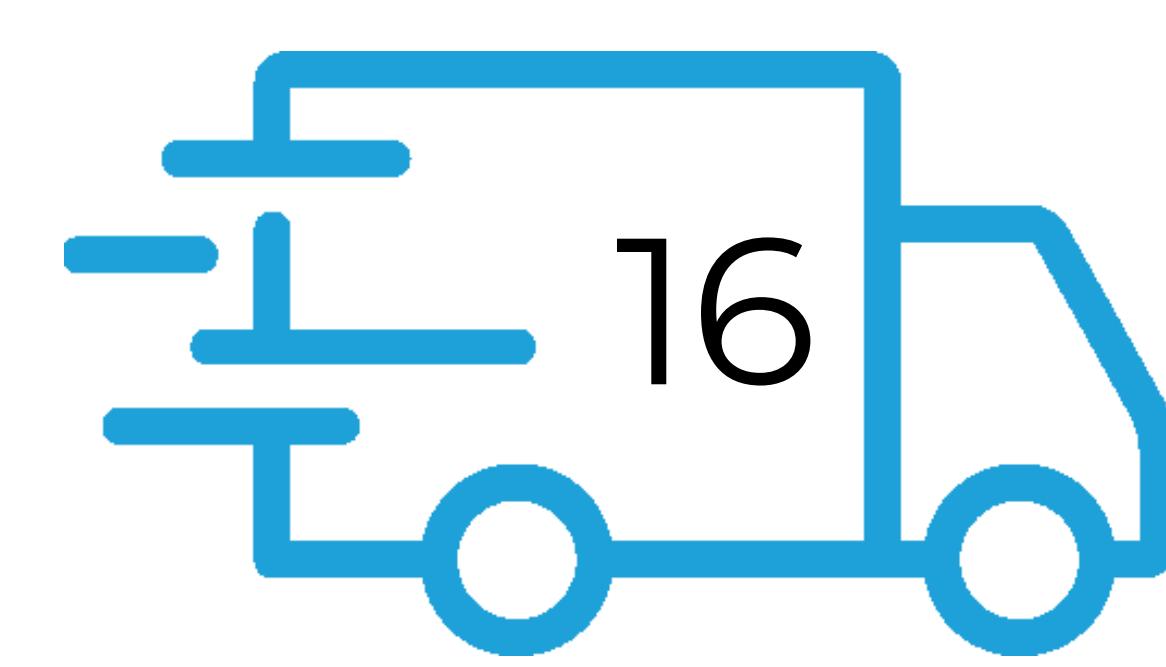
1) Fixed Cost Structure: The revenue earned by XYZ Logistics is structured in tiers based on the hours travelled by each truck. The model distinguishes between various thresholds:

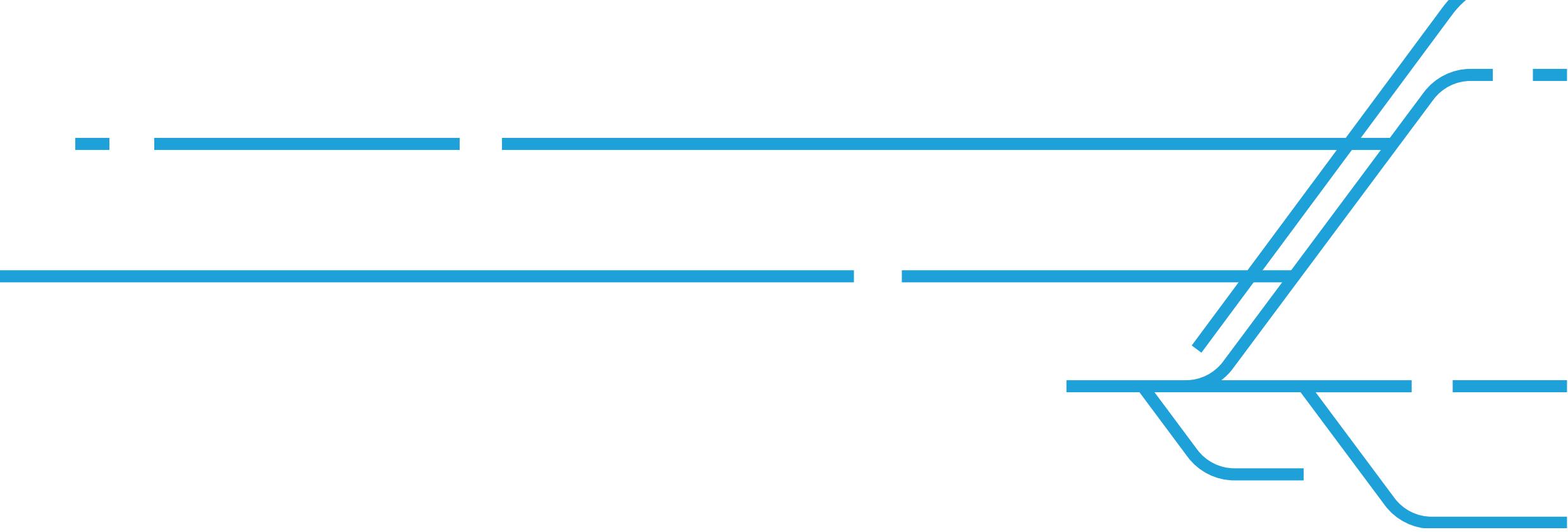
Hours Travelled	Revenue Earned
0-200 hours	INR 500 per hour
201-250 hours	INR 550 per hour
251-300 hours	INR 600 per hour
301-400 hours	INR 700 per hour
>400 hours	INR 800 per hour

The tiered structure ensures that as trucks contribute more to the overall transportation effort, the revenue per hour increases, incentivizing optimal utilization.

2) Additional Earnings Based on Goods Type:

Type of Good	Additional Revenue
Perishable Items	10%
Fragile Goods	8%
Electronics	5%
General Goods	-





Differentiated rates tied to goods types encourage strategic planning in truck assignment, aligning with the specific demands and considerations associated with each category.

3) Additional Earnings Based on Truck Age:

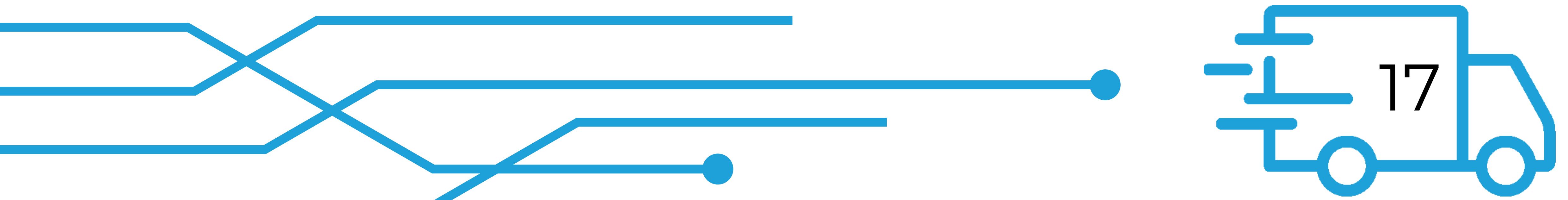
Age of Truck	Additional Revenue
0-2 years	10%
2-5 years	5%
5+ years	-

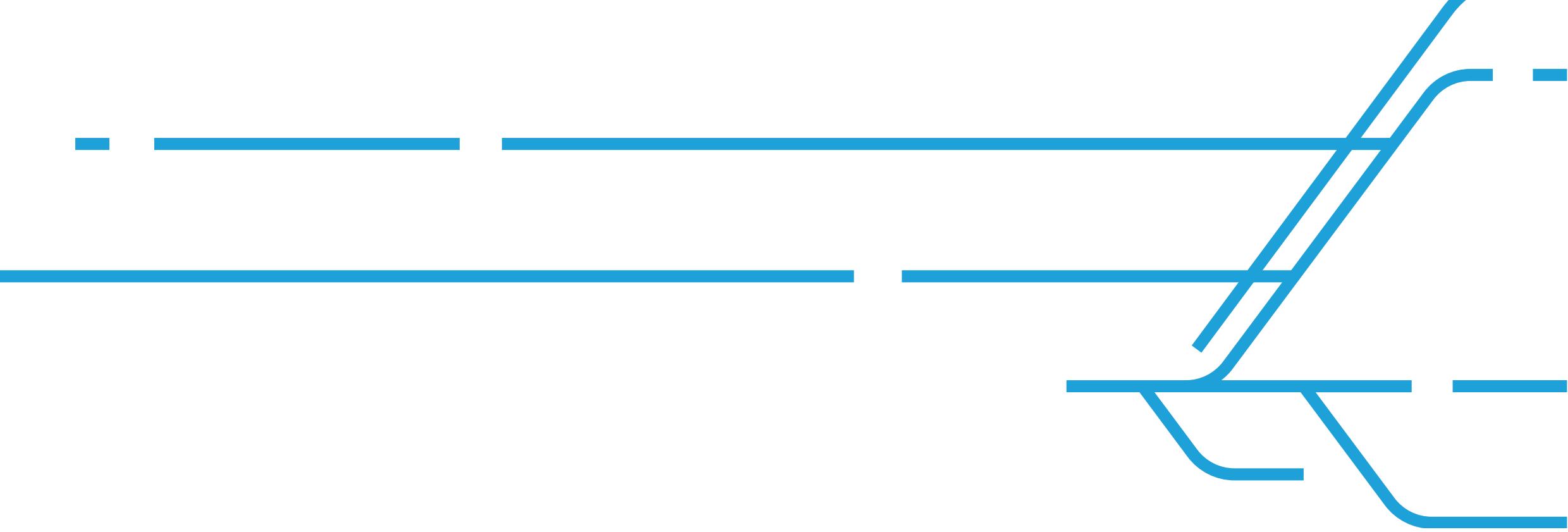
The age-based revenue model acknowledges the potential impact of truck age on performance and reliability, providing an incentive for maintaining a modern and efficient fleet.

This revenue generation model is designed to align incentives with strategic priorities. It encourages efficient resource allocation and management, emphasizes responsiveness to goods categories, and promotes the upkeep of a well-maintained fleet. XYZ Logistics aims not only to meet the transportation needs of its clients but also to optimize revenue generation in a manner that reflects a balance between quality of service and operational efficiency.

Operational Constraints

XYZ Logistics operates within a set of operational constraints to ensure the efficient and sustainable functioning of its truck rostering system. These constraints are designed to strike a balance between maximizing truck utilization and promoting the well-being of drivers, while also considering the overall reliability of the fleet.





1) Maximum Hours of Operation:

1) Truck Daily Limit: Each truck is permitted to operate for a maximum of 16 hours per day. This constraint ensures that drivers do not exceed reasonable working hours, contributing to road safety and driver well-being.

2) Monthly and Weekly Minimum Running Hours:

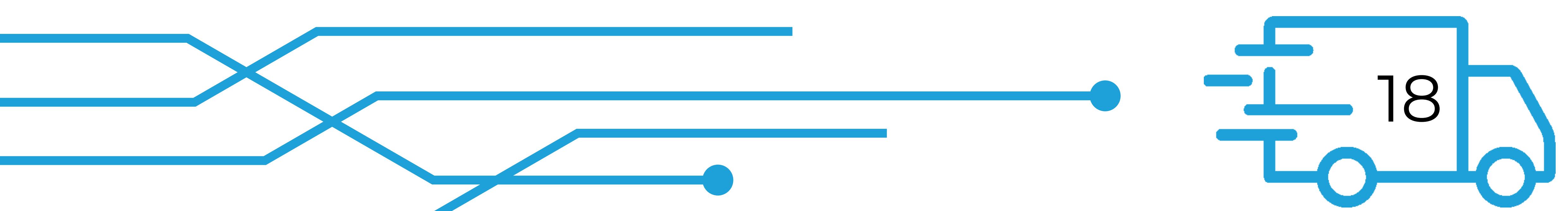
1) Monthly Requirement: To maintain a consistent level of service, each truck should run for a minimum of 200 hours per month. This requirement guarantees that the fleet remains active and available to meet customer demands.

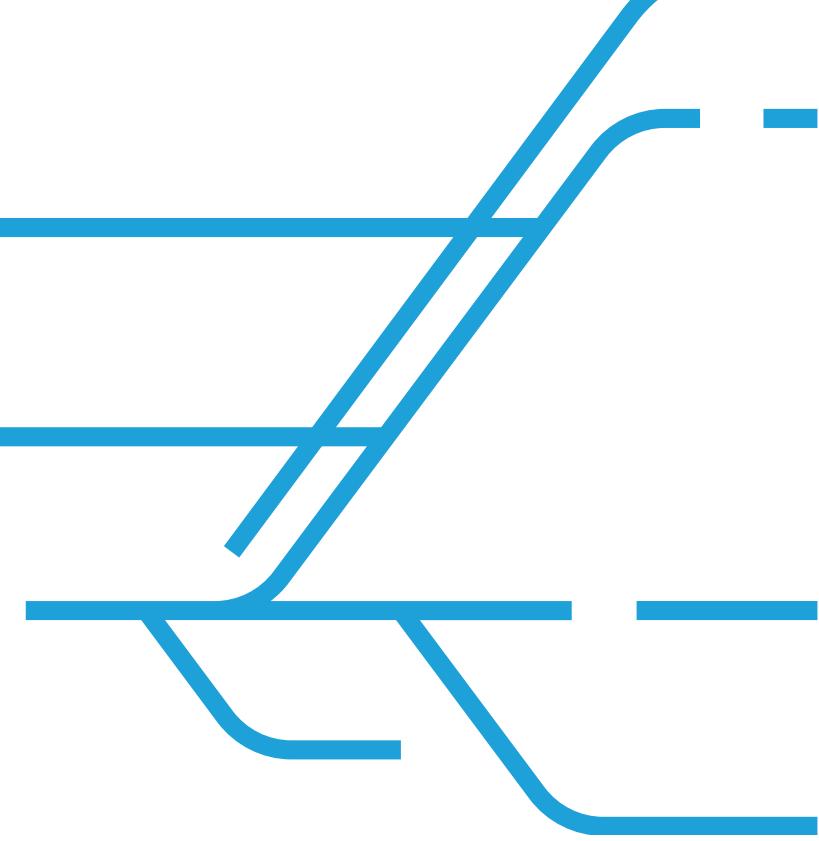
2) Weekly Requirement: Additionally, a weekly minimum running requirement of 50 hours ensures that trucks are regularly contributing to the overall transportation network

3) Goods Type-Specific Constraints:

1) Minimum and Maximum Hours for Goods: The transportation of different types of goods comes with varying time requirements. XYZ Logistics has established specific constraints on the minimum and maximum hours allocated to each type of good, preventing underutilization or overuse of trucks for specific cargo categories.

Type of Good	Minimum hours required	Maximum hours required
Perishable Items	3000	4000
Fragile Goods	4000	6000
Electronics	5000	8000
General Goods	6000	-





2) Break Requirements: To ensure the safety of perishable items, fragile goods, and electronics, there are specified break requirements to prevent any potential damage during transit.

4) Overall Monthly Travel Limit:

1) Total Monthly Need: With an overarching goal of contributing 27,000 hours of truck travel during the month, this constraint sets a limit on the cumulative operational hours for the entire fleet. This cap prevents excessive strain on resources and allows for strategic planning

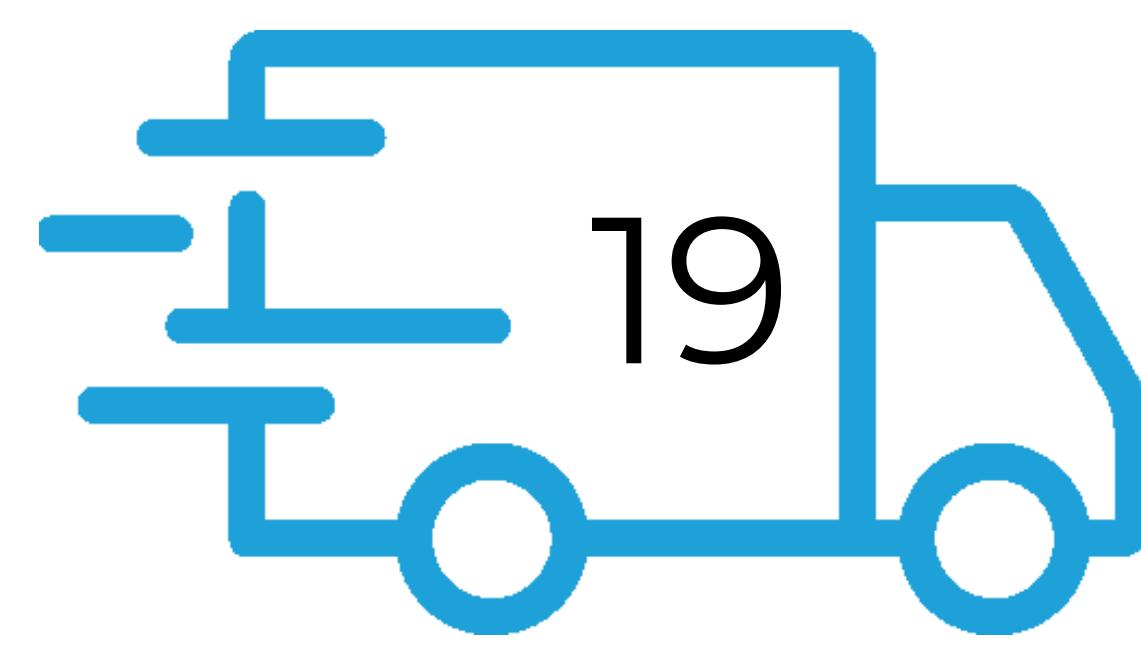
5) Continuous Operation Limitations:

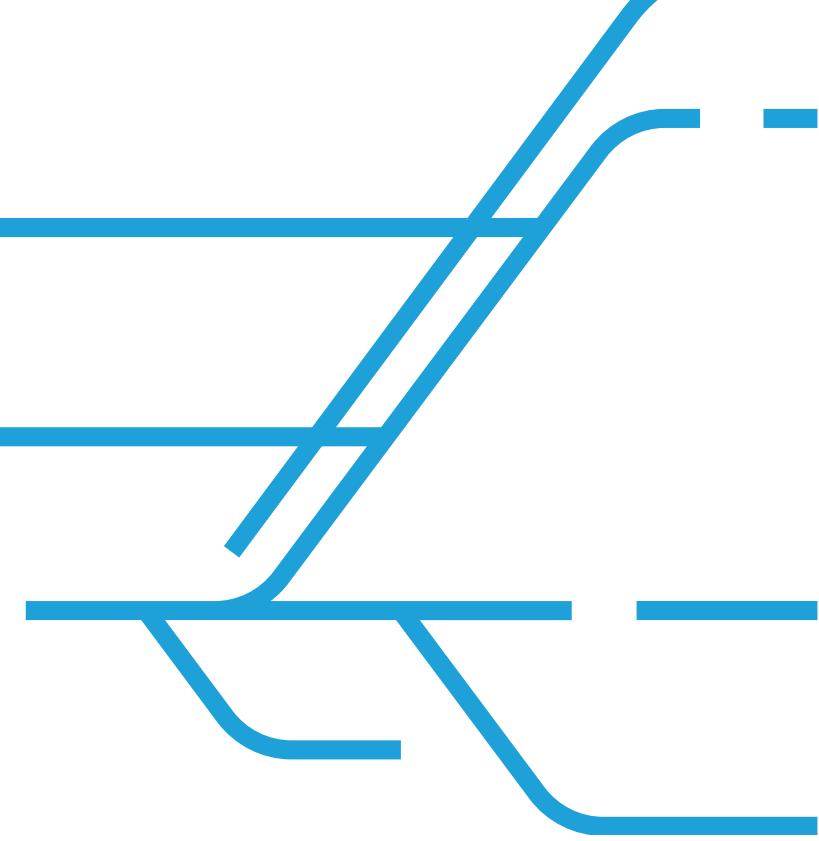
1) Maximum Continuous Days: To prioritize driver rest and avoid potential fatigue-related issues, each truck is restricted from operating continuously for more than three days. After three consecutive days of operation, a mandatory one-day break is required.

2) Frequency of Continuous Operation: Within a month, trucks are allowed to have more than three continuous days of operation only twice. This constraint aims to balance operational efficiency with the well-being of drivers and overall fleet reliability.

These operational constraints collectively define the operational framework within which XYZ Logistics optimizes its truck rostering system. By adhering to these constraints, the company ensures a sustainable, efficient, and responsible transportation service that meets the needs of both clients and drivers.

Efficient truck rostering must adhere to operational constraints, ensuring that trucks are utilized optimally, and the monthly travel requirement is met. The challenge is compounded by the need for dynamic adaptation to changing transportation demands, emphasizing the importance of a flexible and responsive solution.





Decision Variables

The primary decision variables involve the allocation of hours to each truck for transporting each type of goods. This necessitates a sophisticated optimization approach to achieve the desired balance between revenue maximization and operational efficiency.

Objectives

The overarching objectives of XYZ Logistics' truck rostering optimization model are multifaceted, aiming to enhance operational efficiency, maximize revenue generation, and ensure compliance with various constraints. The key objectives include:

1) Maximize Revenue:

The primary objective is to maximize the overall revenue generated by the fleet of trucks during the specified operational hours. This involves optimizing the assignment of trucks to various tasks, considering factors such as the type of goods being transported, the age of the trucks, and the additional revenue components associated with each.

2) Ensure Adequate Truck Utilization:

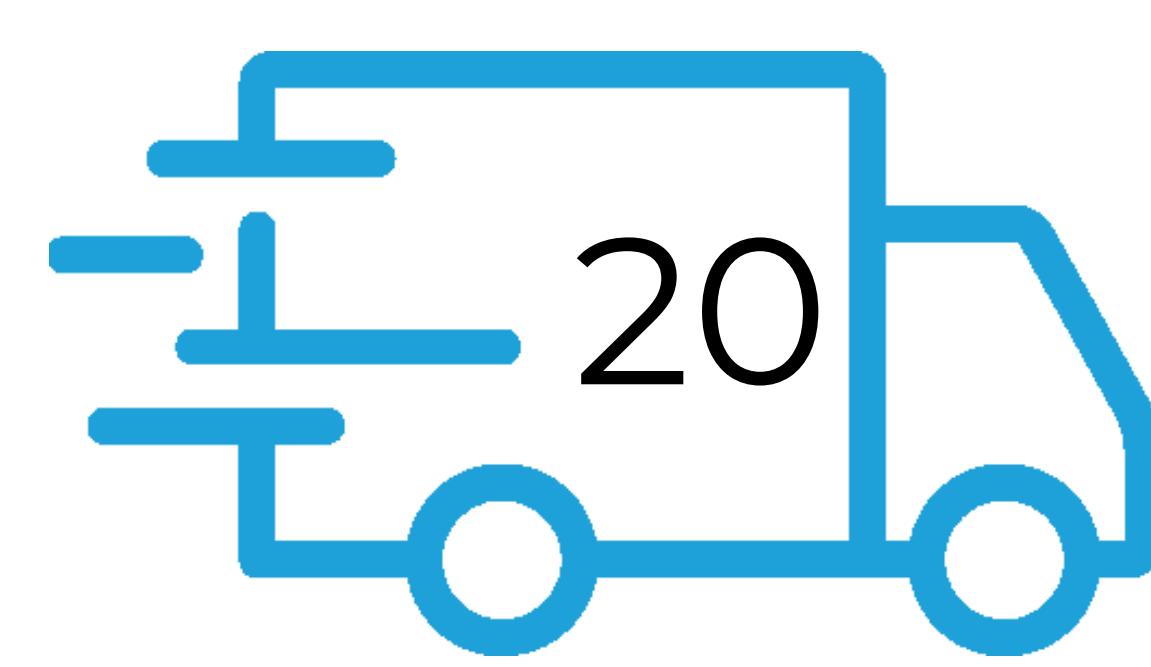
Optimal utilization of each truck is essential to meet the minimum monthly and weekly operating hour requirements. The model seeks to allocate trucks in a manner that ensures they operate for a minimum of 200 hours per month and 50 hours per week while staying within the maximum daily operational limit of 16 hours.

3) Balance Goods Type Allocation:

To diversify revenue streams and respond to varying market demands, the model aims to balance the allocation of trucks to different types of goods. This involves strategically assigning trucks based on the minimum and maximum hour requirements for each goods type.

4) Consider Age-Based Revenue Adjustment:

To reflect the impact of truck age on performance and reliability, the model incorporates an age-based revenue adjustment factor. The objective is to incentivize the use of newer trucks by providing additional revenue, thereby optimizing the overall fleet's performance.





5) Optimize Break and Continuous Operation Patterns:

Adhering to operational constraints related to breaks and continuous operation patterns is crucial for driver and road safety. The model seeks to optimize truck schedules, ensuring that each truck follows the stipulated break requirements and limits on continuous operation to enhance overall safety and compliance.

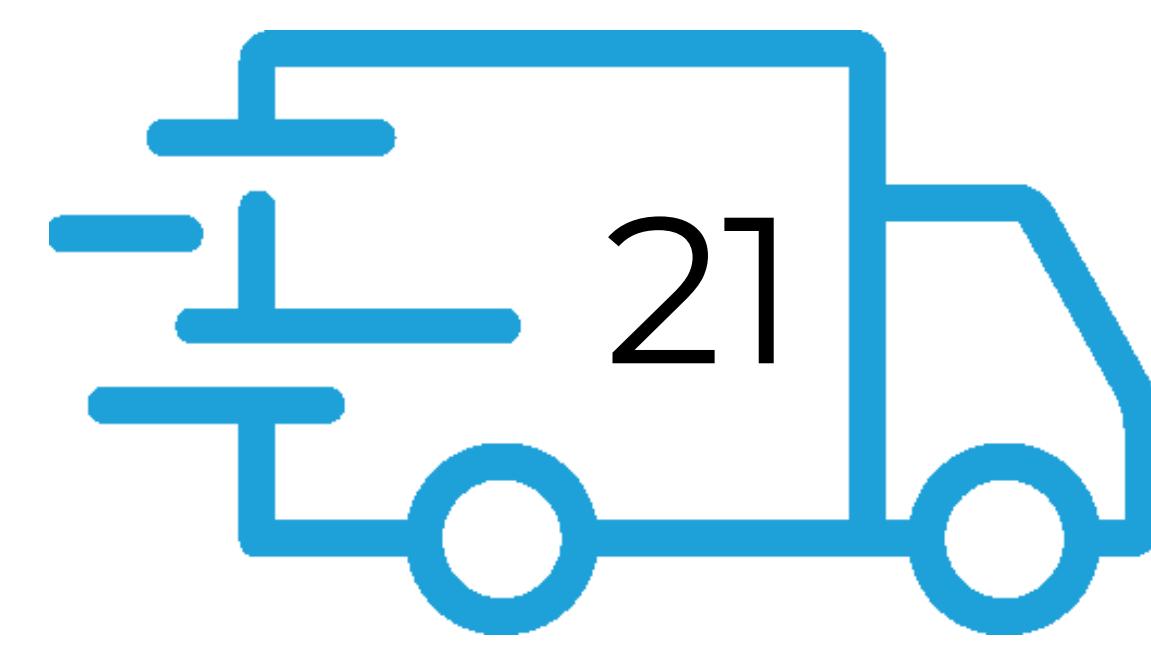
6) Accommodate Revenue Tiering:

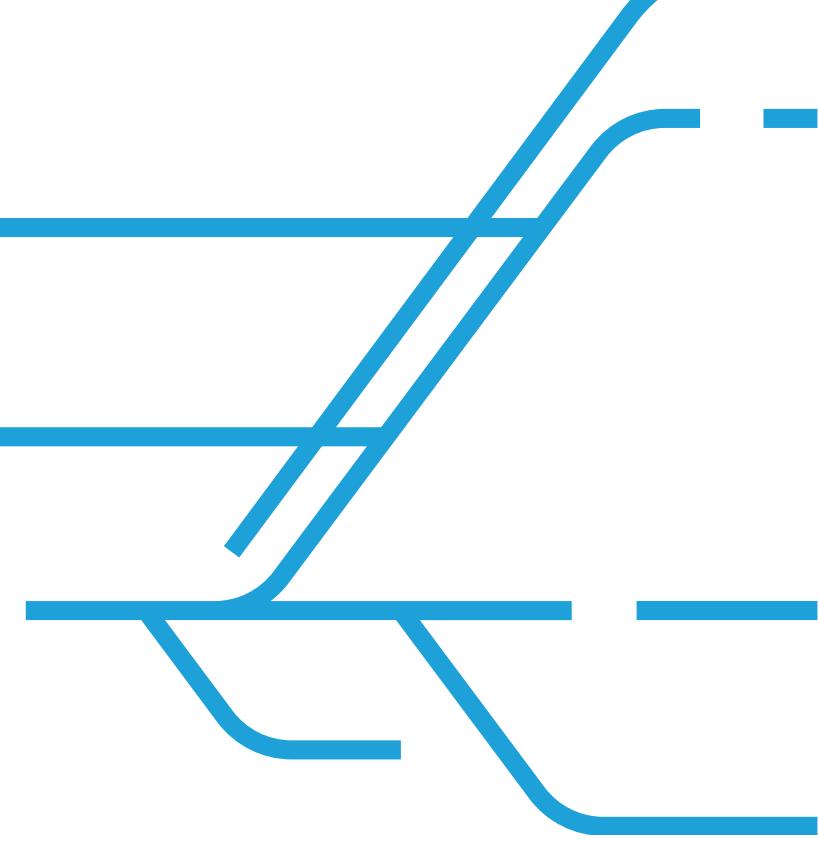
The model considers the tiered revenue structure based on the hours travelled by each truck. By adjusting the revenue earned per hour within specific ranges, the objective is to incentivize higher utilization and reward trucks that exceed certain thresholds.

7) Dynamic Adjustment for Goods Type and Age:

The model allows for dynamic adjustment of revenue based on the type of goods being transported and the age of the trucks. This flexibility accommodates market variations, encouraging strategic decisions in goods transportation and fleet management.

By addressing these objectives, XYZ Logistics aims to implement an agile and responsive truck rostering solution capable of adapting to changing transportation demands that optimize revenue, ensure efficient truck utilization, and align with industry best practices and safety standards.





Rating Criteria and Qualification Requirements

For the final round, the teams will be evaluated on the basis of the following criteria:

- Quality of Analysis
- Creativity
- Feasibility of the Solution
- The overall Presentation of the Case
- Accuracy of the Excel

Note

- Teams must submit their presentation by 6:00 AM, 20th Jan, 2024.
- Submission should be in PPT format only (maximum 15 slides [+ a maximum of 5 slides for optimization] excluding the introduction, final slide, and Appendix) with an accompanying PDF copy of the same presentation.
- The solutions should be mailed to the iccs submissions2024@gmail.com with attachments as .pptx and .pdf.
- Relevant information can be added for the analysis from the web or other suitable resources.
- Any form of plagiarism will be heavily penalized.
- The inclusion of an executive summary slide is mandatory.

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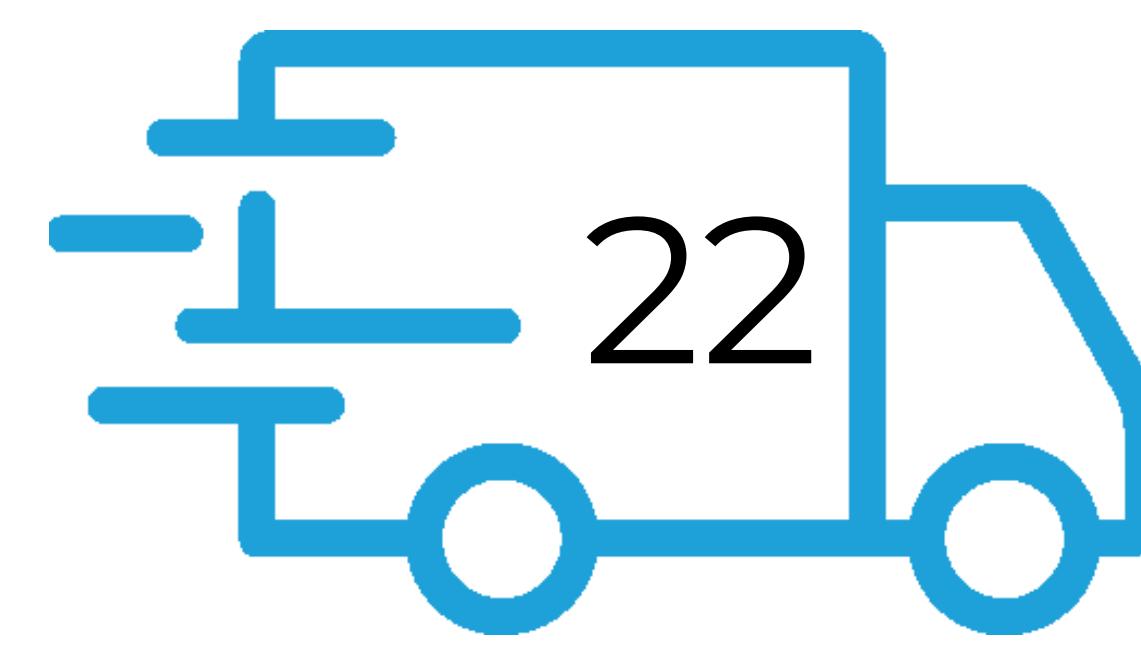
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