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# GOODS ON THE MOVE

EFFICIENCY AND SUSTAINABILITY IN  
INDIAN LOGISTICS



# Authors and acknowledgements

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# 01.

## Importance of logistics for development



Improving efficiency of the logistics sector is of high importance for the country's economy as it boosts economic growth, grows exports through global supply chains and generates employment. While India's passenger and freight mobility sectors are becoming more efficient and the logistics sector is growing at CAGR of 10.5%<sup>1</sup> and expected to reach about USD 215 billion in 2020<sup>2</sup>, there are a set of interconnected problems in the system, which need to be addressed to further enhance efficiency. Logistical inefficiencies lead to reduced employment opportunities, perpetuate a poverty cycle for rural populations, make roads and highways unsafe, and contribute to pollution. Conversely, enhancing the efficiency of logistics can create high quality economic growth and employment opportunities, improve safety and public health, and support India's successful fulfilment of international commitments towards climate change.

India is currently the fastest growing major economy globally<sup>3</sup>, with GDP growing by 6.6% in 2017–2018 and expected to accelerate to 7.3% in 2018 and 2019. As a result of this rapid growth, India is poised to become the third largest economy in the world by 2030<sup>4</sup> and the second largest, after only China, in terms

<sup>1</sup> The Economic Times (January 2018), 'India's logistics sector to reach USD 215 bn by 2020: Survey', <https://economictimes.indiatimes.com/industry/transportation/ship-ping/-/transport/indias-logistics-sector-to-reach-usd-215-bn-by-2020-survey/articleshow/62693817.cms>. Last accessed on August 22, 2018

<sup>2</sup> NITI Aayog, 'Indian Logistics Sector: On the Path of Transformation'

<sup>3</sup> IBEF (2018), 'About Indian Economy Growth Rate & Statistics', Available <https://www.ibef.org/economy/indian-economy-overview>. Last accessed on June 30, 2018

<sup>4</sup> Hindustan Times (2017), 'India's economy to become 3rd largest, surpass Japan, Germany by 2030'. <https://www.hindustantimes.com/business-news/india-s-economy-will-become-third-largest-in-the-world-surpass-japan-germany-by-2030-us-agency/story-wBY2QOQ8YsYcrk12A4HuK.html>. Last accessed on June 30, 2018

of Purchasing Power Parity (PPP) by 2040<sup>5</sup>. In order to realize these projections, the Government of India (GoI) has launched the “Make in India” initiative with an aim to support the manufacturing sector of the Indian economy and elevate its contribution to GDP from the current 17% up to 25%. Efficient logistics are a cornerstone for the continuation of India’s economic development over the coming decades. The robust growth in manufacturing envisioned through the “Make in India” initiative will demand high levels of logistical efficiency, which means that goods must not only be produced, they must also be efficiently transported to markets at reasonable prices.

While the growth in GDP created by logistics improvements is important, even more important is the quality of that growth and the employment and income it creates, especially for the most economically vulnerable segments of the population. World Bank research in Latin America showed that reducing the share of logistics costs in the final price of goods by 14% can increase demand for those goods by 8–18% and increase employment in that sector by 2.5%–16%<sup>6</sup>. Such an impact is particularly important for micro small and medium enterprises<sup>7</sup>, which employ over 110 million Indian citizens<sup>8</sup>. Specifically for agricultural products, another critical sector of the Indian economy, the same reduction in logistics costs to 14% of final prices increased demand by 12% and increased agricultural employment by 6%<sup>9</sup>—boosting both rural incomes and nutrition and food security for the entire country.

## **Government of India (GoI) has launched the “Make in India” initiative with an aim to support the manufacturing sector of the Indian economy and elevate its contribution to GDP from the current 17% up to 25%**

Logistics efficiency can also benefit farmers through reduction in loss and wastage of produce during transportation to markets. In OECD countries, the loss of agricultural products during shipment is on the order of 2% to 3%, while many developing countries experience losses of up to 25%<sup>10</sup>. Currently, India loses 40% of agricultural production to wastage in the supply chain<sup>11</sup>. Reducing that wastage could both provide an income boost to farmers and also lower overall prices for produce, creating better access to high quality food for Indian citizens.



<sup>5</sup> Hindustan Times (2017), ‘India to outpace US to emerge as second largest economy by 2040, PwC says’. Available <https://www.hindustantimes.com/business-news/india-to-outpace-us-to-emerge-as-2nd-largest-economy-by-2040-pwc-says/story-nD4SEUZfQTKYZvgs6MoLeJ.html>. Last accessed on June 30, 2018

<sup>6</sup> Julio Gonzalez, et al. Improving Logistics Costs for Transportation and Trade Facilitation. World Bank, Mar. 2008.

<sup>7</sup> SME Venture (June 2018), ‘National Logistics segment: supporting the MSME Sector’s Backbone’, <http://www.smeventure.com/national-logistics-segment-supporting-msme-sectors-backbone/>. Last accessed on August 22, 2018

<sup>8</sup> “India - Number of Employees at MSMEs 2015 | Statistic.” Statista, <https://www.statista.com/statistics/719607/india-number-of-employees-at-msmes/>. Accessed 24 Aug. 2018.

<sup>9,10</sup> Julio Gonzalez, et al. Improving Logistics Costs for Transportation and Trade Facilitation. World Bank, Mar. 2008.

<sup>11</sup> Ernst & Young, National Center for Cold Chain Development, ‘Refrigerated transportation: bottlenecks and solutions’

Employment in the Indian logistics industry, particularly as a truck driver, is a hard life. Truck drivers typically spend long periods away from home and family; more than 25% of drivers return to their home base only after eight days, reducing quality of life and leading to poor outcomes in both physical and psychological health<sup>12</sup>. Around 50% of the truck drivers face driving-related health issues<sup>13</sup>. In 2017 approximately 67% of truck drivers did not have any medical check-up<sup>14</sup>. Truck drivers are also poorly paid, earning only half as much as cab drivers. Furthermore, poor logistics practices often lead to unsafe practices such as overloading of trucks, which compromise road safety both for truck drivers and those with whom they share the road—over 20% of the 1.4 lakh fatalities in 2014 were truck drivers<sup>15</sup>. This combination of factors—low pay, high risk and low quality of life is driving a decline in the number of truck drivers. From 900 truck drivers per 1000 trucks in 2002 the number fell to 600 truck drivers per 1000 trucks in 2017<sup>16</sup>. Resolving key issues in logistics can enhance safety and health and reduce the overall requirement for truck drivers while providing higher quality employment opportunities in other sectors.

## **Beyond providing broad social benefits to farmers and low-income workers, efficiency in logistics can also enhance the quality of life for practitioners within the logistics industry.**

Finally, improved logistics can bring about important environmental benefits. Currently, the share of CO<sub>2</sub> emissions from logistics is around 7% of the total CO<sub>2</sub> emissions in India<sup>17</sup>, which will undoubtedly grow as “Make in India” accelerates. In Delhi, freight amounts to 67% of the total PM2.5 emissions from the transport sector, 61% of the total SO<sub>2</sub> emissions from the transportation sector, and 62% of the total NOx emissions from the transportation sector<sup>18</sup>. Improving the efficiency of logistics can rein in growing demand for trucking services, helping India to meet its international climate commitments while simultaneously reducing pollution in India’s most populated cities. This report explores various dimensions of long haul and urban freight transportation in India. It looks into opportunities and existing barriers within goods transportation



<sup>12</sup> National Transport Development Policy Committee (NTDPC) (2014), ‘India Transport Report : Moving India to 2032’, [http://planningcommission.nic.in/sectors/index.php?sectors=National%20Transport%20Development%20Policy%20Committee%20\(NTDPC\)](http://planningcommission.nic.in/sectors/index.php?sectors=National%20Transport%20Development%20Policy%20Committee%20(NTDPC)). Last accessed on August 22, 2018

<sup>13</sup> The Times of India (June 2018), ‘Over 50% Indian truck drivers face health issues’, <https://timesofindia.indiatimes.com/auto/miscellaneous/over-50-indian-truck-drivers-face-health-issues-study/articleshow/64667437.cms>, Last accessed on August 22, 2018

<sup>14</sup> Castrol (2018), ‘Driving the economy: Health & Well-being of Truck Drivers’

<sup>15</sup> Business Today (May 2016), ‘The Case of the Vanishing Drivers’, <https://www.businesstoday.in/magazine/features/road-transport-decline-due-to-high-demand-for-truck-drivers/story/232028.html>, Last accessed on August 22, 2018

<sup>16</sup> Ibid.

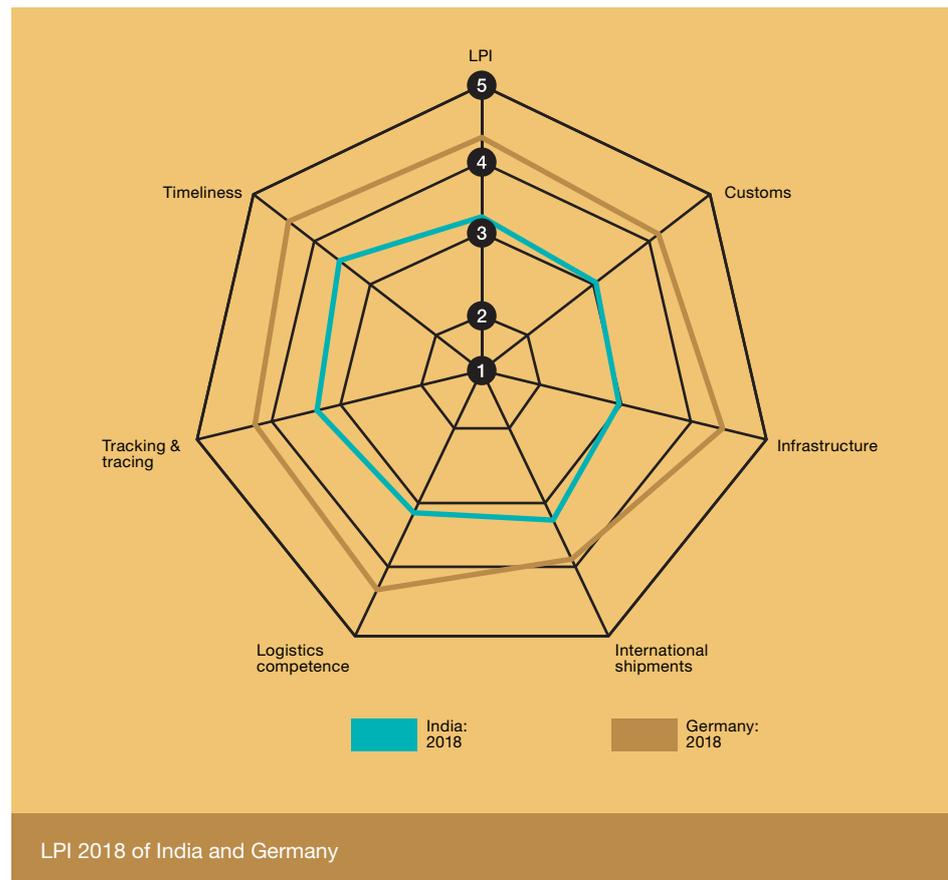
<sup>17</sup> Based on RMI’s calculations and data collected from OECD and NTDPC.

<sup>18</sup> Rahul Goel, Sarath K. Guttikunda, May 2014, ‘Evolution of on-road vehicle exhaust emissions in Delhi’, Atmospheric Environment

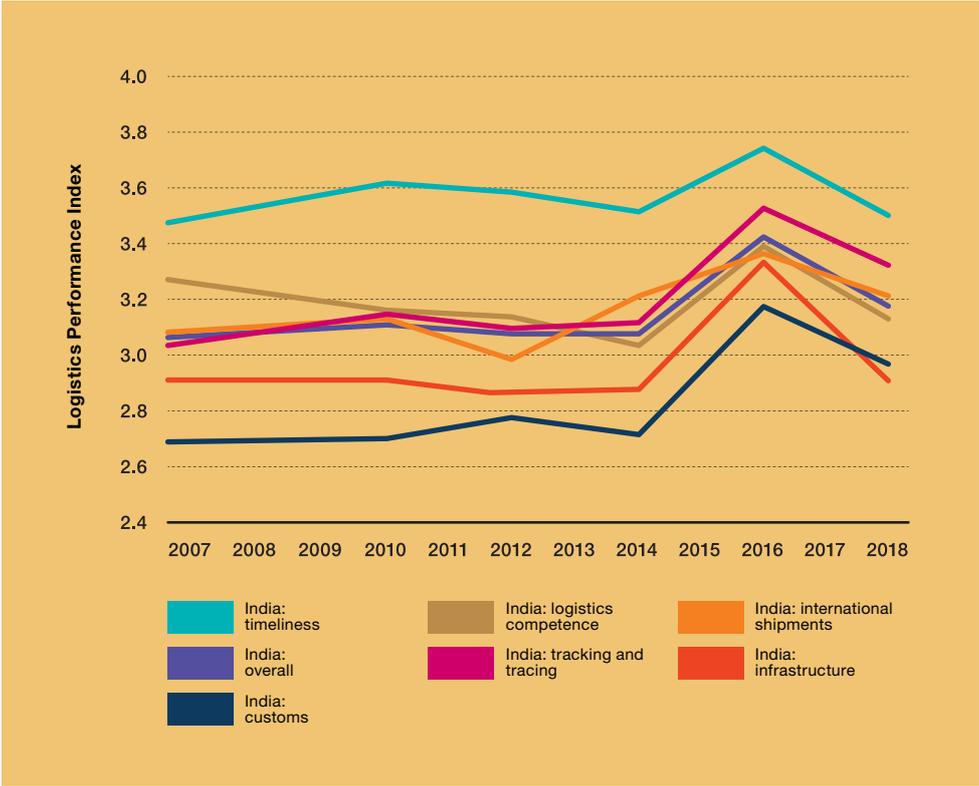
and inventory management as well as their economic, environmental and social impact. The report also does a deep dive into potential solutions to promote a shift to more efficient modes, reduce high inventory costs, improve low truck productivity and enhance the efficiency of urban distribution.

### India's Logistics Performance Index<sup>19</sup>

Logistics Performance Index (LPI), an interactive benchmarking tool developed by World Bank, scores countries based on the efficiency of domestic and international freight logistics. Some of the criteria to score a country are logistics service quality, timeliness of delivery, quality of infrastructure, ability to track and trace consignments, efficiency of customs and border management clearance and ease of international shipment. LPI 2018 gives relative ranking of 160 countries across the globe.



<sup>19</sup> LPI, The World Bank, <https://lpi.worldbank.org/>. Last accessed on August 22, 2018



Logistics Performance Index of India<sup>20</sup>

India's LPI had improved from rank 54 to 36 between 2014 and 2016 due to improvements in infrastructure, programs like Make in India and technological and digital improvements in the logistics supply chain. However, India is ranked 44 in LPI in 2018 with a score of 3.18 while Germany has the highest score of 4.2. India's LPI can be further improved by reducing clearance time, optimizing border procedures (i.e. speed, simplicity and predictability of formalities) and improving quality of infrastructure (e.g. improving quality of roads, rail and ports, developing intermodal hubs, digitization and technological advancements). India can understand focus areas for investments and policy initiatives through a thorough analysis of LPI trends.



<sup>20</sup> International Scorecard, LPI, The World Bank, <https://lpi.worldbank.org/international/scorecard/line/254/C/IND/2018#chartarea>. Last accessed on August 22, 2018

# 02.

## Opportunities and barriers



A common, albeit imperfect, proxy for logistics efficiency is the ratio of logistics cost to GDP. As of 2017, India's logistics share of GDP was 13.5% and on average embodied logistics costs accounted for 18% of the final price of goods<sup>1</sup>. In developed economies logistics share of GDP is typically 8–10% and logistics costs as a share of the final price of goods are typically on the order of 9–10%<sup>2</sup>. Bringing Indian logistics cost to OECD levels in the face of rising incomes represents a powerful pathway to ensuring robust economic growth in the Indian manufacturing sector.

Decomposing logistics costs into its constituents can offer some indication of what categories of cost savings are available and the steps required to achieve them. Broadly speaking, logistics costs comprise transportation, inventory and overhead. In developed countries, it is common to see 5–6% of GDP in transportation costs, 2–3% in inventory costs and 0.5–1% in administrative and overhead. In India transportation is approximately 7%, inventory 6.3% and admin and overhead 0.7%<sup>3</sup>. Pursuing a strategy to reduce inventory and transportation costs, while keeping a lid on admin costs and other overheads, can enable India to further boost its growing economy, improve quality of life of its citizens and fight environmental degradation through lower pollution and CO<sub>2</sub> emissions.

<sup>1</sup> Livemint (June 2016), 'Govt aims to leverage technology to reduce logistics costs', <https://www.livemint.com/Politics/toZXPgdfgxCsRyXS6YOvN/Govt-aims-to-leverage-technology-to-reduce-logistics-costs.html>. Last accessed on August 22, 2018

<sup>2</sup> Julio Gonzalez, et al. Improving Logistics Costs for Transportation and Trade Facilitation. World Bank, Mar. 2008.

<sup>3</sup> Rocky Mountain Institute Analysis

## 2.1 Reducing inefficiencies in inventory management

The perceived potential of logistics cost reductions through inventory efficiency in India is consistent with the development path of logistics in many developed markets. For example, in 1982 the United States had total logistics costs in excess of 14% of GDP of which 7.2% were inventory costs, 6.8% transport costs and 0.5% overhead—very similar to India’s current composition. 20 years later, in 2002, logistics costs were under 9% of GDP with inventory accounting for 2.8%, transport 5.5%, and overhead 0.4%<sup>4</sup>. That drastic reduction in inventory costs over two decades was a core element of the revolution of logistics efficiency in the U.S. and is also a critical pathway through which India can gain logistics efficiency. Broadly speaking, two main avenues exist to gain inventory efficiency—decreasing the total amount of inventory in the distribution system at a given time and decreasing the amount of inventory that is lost. Obtaining available inventory efficiency could avoid inventory loss and reduce inventory holdings by half, reducing inventory’s share of logistics cost from 40% to 16%<sup>5</sup>, good for savings of over 2% of GDP.

### 2.1.1 Reducing inventory loss

One of the major causes of high inventory costs is inventory loss. While all supply chains suffer loss to some extent due to theft, damage and obsolescence, the issue of loss is particularly important in supply chains for perishable goods such as fresh foods or temperature sensitive medications. Avoiding losses in these types of supply chains not only brings economic benefits, but also helps to meet the basic needs of Indian citizens, particularly rural residents, for nutrition and healthcare. Currently, loss rates in perishable supply chains are high, up to 40% for agricultural goods<sup>6</sup>. A key reason for this situation is the lack of effective refrigerated supply chains, known as cold chains. Cold chains are a collection of refrigerated trucks, warehouses, and processing facilities which quickly move perishable items from point of origin to point of sale. In the U.S., 80–85% of the fresh fruits and vegetables are transported through cold chain logistics, whereas in India, this number is a mere 4%<sup>7,8</sup>. The total value of India’s wasted fruit and vegetables is INR 44,000 crore per year<sup>9</sup>. India faces various challenges in the cold chain market—lack of reefer vehicles and cold



<sup>4</sup> US Department of Transportation Federal Highways Administration. “Logistics Costs and U.S. Gross Domestic Product—FHWA Freight Management and Operations.”

<sup>5</sup> Livemint (June 2016), ‘Debunking India’s logistics myths’, <https://www.livemint.com/Opinion/QwB4qFUMhwpQCQob0okhMN/Debunking-Indias-logistics-myths.html>. Last accessed on August 22, 2018

<sup>6</sup> International Trade Administration, ‘2016 Top Markets Report Cold Chain Country Case Study’, [https://www.trade.gov/topmarkets/pdf/Cold\\_Chain\\_India.pdf](https://www.trade.gov/topmarkets/pdf/Cold_Chain_India.pdf). Last accessed on August 22, 2018

<sup>7</sup> Ernst & Young, National Center for Cold Chain Development, ‘Refrigerated transportation: bottlenecks and solutions’

<sup>8</sup> Rais M and Sheoran A, February 2015, ‘Scope of Supply Chain Management in Fruits and Vegetables in India’

<sup>9</sup> Cold Star, August 2014, ‘Food Wastage Solution: Cold Chain’, <http://coldstarlogistics.com/blog/reduce-food-wastage/>. Last accessed on August 22, 2018

<sup>10</sup> Ernst & Young, National Center for Cold Chain Development, ‘Refrigerated transportation: bottlenecks and solutions’

chain logistics providers, non-standardized vehicle boxes, scarcity of skilled operators and drivers of the reefer vehicles<sup>10</sup> and high industry fragmentation, with more than 3500 unorganized players<sup>11</sup>.

## Avoiding losses in supply chains not only brings economic benefits, but also helps to meet the basic needs of Indian citizens, particularly rural residents, for nutrition and healthcare.

A similar problem is the wastage of vaccines due to lack of proper cold chain logistics infrastructure. India loses 2 million lives each year to vaccine-preventable deaths<sup>12</sup>. At least 25% of the vaccines get wasted before they can be put to actual use by doctors<sup>13</sup>. Lack of cold chain and inefficient last mile distribution have restricted basic vaccines penetration to 60–70%<sup>14</sup>. Efficient logistics and supply chain management can improve the quality of life of many Indians by making vaccines accessible to everyone.

### 2.1.2 Eliminating excess inventory holdings

Inventory is the buffer between the production and putting of a good to use, and so is a necessary part of any distribution system. However, inventory also ties up firms' working capital, requires facilities for storage and subjects firms to risks of inventory loss or devaluation. To reduce those costs, firms typically seek to hold the minimum amount of inventory possible and save on inventory charges, while not compromising their ability to effectively serve clients.

Two main opportunities exist to reduce inventory holdings—reducing cycle stock inventory and reducing buffer stock inventory.

1. **Cycle stock inventory** is the inventory that firms hold on hand in order to satisfy normal sales demand. Reducing cycle stock is usually accomplished by moving from infrequent large orders to smaller, more frequent orders—known as just-in-time (JIT) replenishment. However, without real-time visibility into inventory holdings and the ability to rapidly and automatically share that information up the supply chain, JIT ordering practices become impossible. In order to implement JIT strategies, firms must first build the digital capabilities to track inventory drawdown in real time and also the digital links up and down the supply chain to rapidly transmit that information



<sup>12</sup> Vikas Bhadoria, et al. Transforming India's Vaccine Market—Saving Lives Creating Value. McKinsey & Company, 15 Sept. 2012, [https://www.mckinsey.com/~/media/mckinsey/dotcom/client\\_service/pharma%20and%20medical%20products/pmp%20new/pdfs/transforming\\_indias\\_vaccines\\_market.ashx](https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/pharma%20and%20medical%20products/pmp%20new/pdfs/transforming_indias_vaccines_market.ashx).

<sup>13</sup> "25% of Vaccines Go Waste due to Lack of Cold Chain." The Times of India, <https://timesofindia.indiatimes.com/India/25-of-vaccines-go-waste-due-to-lack-of-cold-chain/articleshow/52999274.cms>. Accessed 22 Aug. 2018.

<sup>14</sup> Vikas Bhadoria, et al. Transforming India's Vaccine Market—Saving Lives Creating Value. McKinsey & Company, 15 Sept. 2012, [https://www.mckinsey.com/~/media/mckinsey/dotcom/client\\_service/pharma%20and%20medical%20products/pmp%20new/pdfs/transforming\\_indias\\_vaccines\\_market.ashx](https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/pharma%20and%20medical%20products/pmp%20new/pdfs/transforming_indias_vaccines_market.ashx).

to distribution centers and suppliers to keep a dynamic inbound replenishment supply. Major autoplayers in India, like Ashok Leyland and Maruti Suzuki, have pioneered JIT inventory replenishment techniques. Maruti has a Dealer Management System that manages finances, sales, inventory and administration for auto-manufacturers. At Ashok Leyland, a JIT system is in place, with adequate infrastructure with the vendors and rest of the downstream supply chain and an effective communication channel between the manufacturer and the vendor to ensure that there is no disruption in supply<sup>15</sup>.

- 2. Buffer stock inventory** is a guard against variability, both in consumer demand and in the time it takes suppliers to deliver goods, known as lead times. One key approach to dealing with variance in consumer demand is to better understand the root causes of variance and anticipate it, known as demand forecasting. However, in India's highly fragmented and relatively immature distribution system, that point of sale visibility is often impossible to create and many of the smaller less advanced suppliers would not be in a position to effectively use that visibility, both of which pose a major barrier to buffer stock reductions. Another approach to dealing with demand variability is to insulate the supply chain from it. As long as demand variance from different points of sale is independent, having a single inventory stock cover many points of sale will diversify away the variance created by any single point of sale and reduce the total buffer stock in the distribution system. Gaining this diversity benefit by holding inventory at a small number of large distribution centers, known as inventory centralization, is a major driver of distribution network design for many sophisticated firms. However, in order to gain this diversity benefit, a distribution center holding the buffer stock must be able to reliably and cheaply serve a large geographic area.

#### **Effect of GST on logistics movement:**

Until recently the main barrier against seamless movement of goods was the practice of collecting taxes at state borders. Moving goods across state borders incurred tax charges that more than outweighed the financial benefits of inventory centralization. As a result, supply chains were designed to be tax efficient, not inventory efficient<sup>16</sup>. After the implementation of GST, that barrier has largely been removed and industry is beginning to react to new opportunities for efficiency.

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<sup>15</sup> N Madhavan. Ashok Leyland Plans JIT Production to Slash Costs. Mar. 1999, <http://expressindia.indianexpress.com/fe/daily/19990316/fco16013.html>.

<sup>16</sup> India Warehousing Market Report. Knight Frank, 2018, <http://content.knightfrank.com/research/677/documents/en/india-warehousing-and-logistics-india-warehousing-market-report-2018-5326.pdf>.

Removal of check posts has led to reduction in transit times of trucks by almost 30%<sup>17</sup>, enabling a larger DC service footprint, and reducing transport costs by 3-7%<sup>18</sup>. Also, a change in optimal network design after GST has helped in forming bigger warehouses instead of small warehouses in every state. This leads to 30% reduction in inventory levels and 40% increase in inventory turnover, hence increasing profitability<sup>19</sup>.

While GST was a major step forward in improving the landscape for Indian supply chains, other barriers remain to effective regional supply chains. One important remaining barrier is the ability of firms to obtain transportation services that deliver goods to a large DC footprint with sufficient speed and reliability. In lean operations, short lead times are critical, customers require orders to be filled shortly after they are placed. That means that transport companies must quickly contract for, load, and deliver freight. Many times, in India both transport companies and transport infrastructure are not up to the task. The issues faced by transport companies are discussed below.

## 2.2 Reducing inefficiencies in transportation

Beyond savings on inventory, transportation costs also represent a significant opportunity for logistics efficiency. Furthermore, because transportation is the primary user of energy in most supply chains, resolving issues of inefficiency in goods transport can also reduce carbon emissions and air pollution caused by goods movement.

While goods transportation is a complex topic, savings typically fall into three broad categories—modal shift, productivity, and efficiency. For certain types of commodity flows, increasingly developing and deploying lower cost modes such as rail, water and pipeline can reduce transport cost. For goods movements which are not amenable to modal shift, it is critical to bring down the unit (per tonne-km) cost of transport through efficiency and productivity. Gaining productivity reduces unit fixed costs by spreading them over more revenue generating driving. Efficiency, on the other hand, lowers variable costs per kilometer driven.



<sup>17</sup> "GST: Truck Movement Picks up Pace as Border Check Post Starts Disappearing." The Economic Times, 10 July 2017. <https://economictimes.indiatimes.com/industry/transportation/shipping/-/transport/gst-trucks-movement-picks-up-pace-as-border-check-posts-starts-disappearing/articleshow/59519167.cms>.

<sup>18</sup> India Warehousing Market Report. Knight Frank, 2018, <http://content.knightfrank.com/research/677/documents/en/india-warehousing-and-logistics-india-warehousing-market-report-2018-5326.pdf>.

<sup>19</sup> *ibid*

### 2.2.1 Modal split

Currently, freight transport in India is road-dominated—accounting for 59% of freight movement. 35% of freight demand is met by rail, 6% by waterways and less than 1% by air. A healthy mode share is the optimal deployment of all of the modes of transportation:

- » **Rail and waterways:** Historically suitable only for long distance haul of large, regular flows of low value density goods between fixed origin/destination points with less fragmentation. Modern intermodal services are increasing the ability of these modes ability to compete with trucks for low-medium value shipments
- » **Road:** Offers greater flexibility in terms of final destination and volume of goods to be transported but has higher per tonne-mile cost as compared to rail or water
- » **Air:** Suitable for goods with very short turn-around time but is has very high cost and pollution intensity
- » **Pipeline:** Suitable for liquids and gases and any stable chemicals (e.g. water, oil, natural gas, biofuels etc.)

Due to significant economies of scale which create low variable costs and intrinsically higher energy efficiencies, modes such as rail, water and pipeline, offer the potential to move goods much more cost effectively than trucks and with far lower energy consumption and CO<sub>2</sub> emissions. Cost of freight movement by road is INR 2.58/ton–km as compared to INR 1.41/ton–km for rail and INR 1.06/ton–km for waterways<sup>20</sup>. However, while rail, water and pipeline perform well under certain conditions, they are not a universal solution for goods transport. They typically are only able to transport goods cost effectively on high volume corridors over long distances. Furthermore, those low cost modes have longer transit times and are less reliable than truck<sup>21</sup> making them inappropriate for time sensitive transport of high value goods due to the higher inventory costs they create. An effective mode share, therefore, is one which minimizes total transport cost while meeting the operational requirements of goods shippers.

Moving beyond the concept of an efficient mode share and attempting to quantify that concept becomes difficult. For example, some publications suggest truck use could be as low as 5%<sup>22</sup>, while others espouse considerably



<sup>20</sup> Omair Ahmad. "The Perils and Opportunities of Water Based Transport." The Wire, 1 July 2017, <https://thewire.in/diplomacy/perils-opportunities-water-based-transport>.

<sup>21</sup> Aparna Khandelwal. Sustainable Transport: Greener Route for Navigating India Inc.'s Logistics. [http://sblf.sustainabilityoutlook.in/file\\_space/SBLF%20Summit%20Presentations%202014/Sustainable%20freight%20transport\\_Sustainability%20Outlook.pdf](http://sblf.sustainabilityoutlook.in/file_space/SBLF%20Summit%20Presentations%202014/Sustainable%20freight%20transport_Sustainability%20Outlook.pdf). Sustainable Business Leadership Forum. Accessed 22 Aug. 2018.

<sup>22</sup> National Transport Development Policy Committee. India Transport Report—Moving India to 2032. 2014.

higher estimates. While this report does not seek to define a specific ‘target’ mode share, India’s freight geography features a high landmass to coastline ratio, significant inland economic activity, relatively long lengths of haul<sup>23</sup>— attributes that typically favor rail transport<sup>24</sup>. Furthermore, of the commodities contributing to significant freight movement in India, such as coal, iron ore, steel, cement, food grains, fruits and vegetables etc., most are distributed into regional clusters of supply and/or demand. Hence commodity composition, with large shares of heavy bulk products and long average lengths of haul, suggest that rail and truck are likely to be the dominant modes of transport. In other countries that share similar geography and freight compositions, such as China and the US, truck shares are as low as 40% and 30% of total tonne–kilometers, compared to 60% in India<sup>25</sup>. That suggests that India has substantial room to shift freight from truck to rail.



While India’s geography appears to favor rail, waterways, when they exist, such as rivers or coastal shipping routes, can also be a highly efficient mode of transport. Inland waterways can be a part of multimodal transport when connected well with dedicated freight corridors and agriculturally dense areas<sup>26</sup> and coastal shipping can play important roles in long distance bulk transport as well as container transshipping. 14,500 km of navigable inland waterways currently exist in India and could be utilized better by improving infrastructure and by incentivizing inland water transportation for cargo transportation<sup>27</sup>.



<sup>23</sup> Ibid. Table 2.9

<sup>24</sup> Vassallo, Jose Manuel and Mark Fagan. “Nature Or Nurture: Why do Railroads Carry Greater Freight Share in the United States Than in Europe?” *Transportation* 34(2), (2007): 177.

<sup>25</sup> RITES, China Statistical Yearbook, Bureau of Transportation Statistics

<sup>26</sup> “Developing India’s First Modern Inland Waterway.” World Bank, <http://www.worldbank.org/en/country/india/brief/developing-india-first-modern-inland-waterway>. Accessed 22 Aug. 2018.

<sup>27</sup> Saha, Jagannarayan & Padmanabhan, Sudipta. “Flowing down the Waterways.” <http://www.thehindubusinessline.com/opinion/flowing-down-the-waterways/article23384237.ece>. Accessed 22 Aug. 2018.

While India has significant potential for modal shift, three major barriers stand in the way—insufficient infrastructure capacity, incomplete infrastructure connectivity and insufficient cost advantage for efficient modes.

1. **Insufficient infrastructure capacity:** India’s railways network is currently substantially over its maximum capacity on many key freight corridors. The eastern corridor comprising of Howrah-Delhi and Western Corridor comprising of Delhi–Mumbai have line capacity utilization ranging between 115% to 150%<sup>28</sup>. Around 66% of the sections on the high density network (Golden Quadrilateral and diagonals connecting Delhi, Mumbai, Chennai and Kolkata) have line capacity utilization of more than 100%<sup>29</sup>. Long haul corridors in India carry highest freight volumes. National highways along the seven corridors (connecting Delhi, Kolkata, Chennai, Kochi, Mumbai and Kandala) account for less than 0.5% of the road network capacity but still carry more than 40% of the freight movement by road<sup>30</sup>. Rail network on these corridors is also oversaturated—accounting for around 27% of the rail network capacity yet carrying over 50% of rail freight<sup>31</sup>. While the extreme case of a physical inability to put more freight on a capacity constrained network is an obvious barrier to greater rail use, capacity shortages also inhibit mode shift by deteriorating service quality. As networks become saturated service levels deteriorate and delays become greater. Captive shippers, such as miners of heavy commodities like iron ore and coal will continue to ship products via rail because they have no other options—trucking is simply too expensive. However, products that

## Three major barriers stand in the way of modal shift—insufficient infrastructure capacity, incomplete infrastructure connectivity, and insufficient cost advantage for efficient modes.

can be shipped by truck, for example, wet bulk products like oil products and chemicals or higher value containerized freight will quickly shift to truck in the face of unacceptable service levels. As a result, capacity must be thought of not only as a physical metric, but also an operational metric which varies by the type of commodity being moved. Capacity that is useful for a coal mine, may not be useful for an intermodal shipper



<sup>28</sup> Dedicated Freight Corridor Corporation of India Ltd, “Need for Dedicated Freight Corridor Project.”, [http://dfccil.gov.in/dfccil\\_app/Background](http://dfccil.gov.in/dfccil_app/Background). Accessed 22 Aug. 2018.

<sup>29</sup> National Transport Development Policy Committee. India Transport Report—Moving India to 2032. 2014.

<sup>30</sup> Rajat Gupta, et al. Building India: Transforming the Nations Infrastructure. McKinsey & Company, [https://www.mckinsey.com/~/media/mckinsey/industries/travel%20transport%20and%20logistics/our%20insights/transforming%20indias%20logistics%20infrastructure/building\\_india%20transforming\\_the\\_nations\\_logistics\\_infrastructure.ashx](https://www.mckinsey.com/~/media/mckinsey/industries/travel%20transport%20and%20logistics/our%20insights/transforming%20indias%20logistics%20infrastructure/building_india%20transforming_the_nations_logistics_infrastructure.ashx). Accessed 22 Aug. 2018.

<sup>31</sup> *ibid*

of automotive parts running a lean supply chain. As India addresses capacity constraints it will be important to do so with an eye on what types of shipments a given rail line can capture and what levels of service they will require to defect from truck use.

**2. Incomplete rail connectivity:** While capacity is one infrastructural barrier to mode shift, another is connectivity. In order for goods to shift to rail modes, the rail network must serve both the origin and destination points. This issue is particularly pronounced in rail transport of containerized freight. As India increasingly shifts towards a manufacturing oriented economy, the geography of freight demand is shifting, but the rail network has not always kept up with demand. This situation exists both in serving freight origin points where, for example, newly designated industrial zones are not well integrated with the rail network, as well as with destination points, for example many Indian container ports that also are not effectively integrated with the mainline rail network. Maintaining connectivity amidst a rapidly evolving demand geography will be important for arresting, and eventually reversing, the decline in rail market share.

**3. Insufficient cost advantage for efficient modes of transport:** Beyond issues of capacity and connectivity of the Indian Railway network, which makes mode shift physically and operationally infeasible, cost issues oftentimes make mode shift economically infeasible. Due to the increased transit times and lower reliability of rail, which create inventory costs for shippers, rail typically must be heavily cost dominant over road in direct transportation costs to gain market share. While rail in India enjoys a significant cost discount over road on a per kilometer basis, that cost advantage is actually smaller than it could be and may not be sufficient to incentivize modal shift. Currently, rail freight in India costs INR 2 per ton-km less than road<sup>32</sup>, whereas in U.S. which has a rail system that competes fiercely with trucks for freight, the cost difference between road and rail is around INR 15 per ton-km<sup>33</sup>. Three main factors combine to compress the cost advantages of rail over truck.

**a. High price of freight movement through rail:** One main reason for the high rail price for freight movement is cross subsidization between passenger and freight movement. This reduces the demand for rail carriage of freight and inhibits the flow of non-governmental capital to fund improvements into the freight rail system.



<sup>32</sup> National Transport Development Policy Committee. India Transport Report—Moving India to 2032. 2014.

<sup>33</sup> US Bureau of Transportation Statistics. Table 3–17. Average Freight Revenue per Ton-Mile (Current Cent) [https://www.bts.gov/archive/publications/national\\_transportation\\_statistics/2000/3-17](https://www.bts.gov/archive/publications/national_transportation_statistics/2000/3-17). Accessed 22 Aug. 2018.

**b. Artificially low trucking price:** The second factor is trucking costs which are artificially low. In many developing markets, India included, pressures on trucking firms to provide low costs are immense. To win business in those hyper competitive markets, truck operators commonly resort to illegal tactics such as overloading and driving more hours per day than permitted under hours of service regulations. While these practices are illegal, enforcing them in highly fragmented markets is very difficult. As these types of practices become universal, the market clearing price adjusts downwards. This issue is discussed more in depth in the trucking productivity section of this paper. Here it is sufficient to note that, unregulated competition in trucking markets allows trucks to achieve a level of competitiveness with rail that would not be possible in a well regulated market.



**c. Excess inventory cost and low service quality:** The third source of high costs in rail is excess inventory costs incurred by shippers when using rail versus using truck. As discussed above, inventory is a major element of logistics costs and firms hold more inventory as uncertainty in lead times increases. The reliability of rail in India is typically substantially lower than trucks, leading to higher buffer stocks to guard against uncertainty. Shippers incur similar costs due to longer rail transport times through costs associated with inventory in transit; the quicker firms can get inventory to customer shelves, the less inventory they hold in their own system and the less inventory costs they incur. This excess inventory in transit and buffer stock charges all contribute to the overall cost proposition of rail. To make rail economically competitive with trucks, both the direct transport costs and the extra indirect inventory costs incurred through rail use must be substantially reduced.

### 2.2.2 Low productivity and efficiency in long haul and regional trucking

Trucking costs are the key drivers in the transportation component of total logistics cost accounting for more than 65% of that cost<sup>34</sup>. To reduce these costs a three pronged strategy can be adopted: reducing the overall number of kilometers driven by the fleet by eliminating wasteful driving created by empty running or underloaded trucks, reducing the cost of each remaining kilometer driven, primarily through improvements in fuel economy of trucks; finally spreading the remaining, cheaper kilometers over a smaller overall trucking fleet, lowering total fixed costs such as depreciation, interest, insurance and driver wages. On a high level, implementing this strategy requires that three broad categories of barriers—regulatory, operational, and infrastructural—be addressed.

While the barriers reducing efficiency in Indian trucking are complex and interconnected, insufficient regulatory enforcement is at the root of the problem. In India, and in many emerging economies including major manufacturing hubs such as China and Vietnam, small trucking firms reduce costs through illegal and dangerous operation of trucks, such as overloading, hours of service violations and poor maintenance<sup>35,36,37</sup>. These types of behavior lower the price of trucking services to such a level that a firm legally operating a truck is loss making and law abiding operators, typically large efficient fleets, are unable to continue operations.

Addressing operational causes of low productivity and efficiency in trucking focuses on creating economies of scale. Large scale logistics providers reduce transport cost in many ways, but the most important may be through increasing productivity by efficient dispatching and scheduling. Efficient dispatch is the most important component to reducing empty running and a key factor in increasing utilization. With efficient dispatch a truck can get from a drop off to its next pick up point with a minimum of empty running and then pick up its freight and be on the way with minimum of wasted time. It is important to note however, that achieving scale in dispatch and scheduling need not necessarily be equivalent to large trucking fleets. For example, in the U.S., 90% of trucks belong to fleets of less than 10 vehicles, comparable to in India where fleets of 5 trucks or less own 75% of the market share and large fleet with more than 20 trucks own just 11% of the market<sup>38</sup>. In the US, small fleets and owner operators have gained efficiency in dispatch via third party logistics firms, which oftentimes own no physical assets, but can aggregate trucking capacity and achieve similar outcomes.



<sup>34</sup> Based on RMI calculations and data collected from NTDP Report, OECD Freight Data, Statista

<sup>35</sup> Parikh, Jyoti, and Gayatri Khedkar. The Impacts of Diesel Price Increases on India's Trucking Industry. 2013.

<sup>36</sup> G. Raghuram. An Overview of the Trucking Sector in India: Significance and Structure. India Institute of Management, Dec. 2015, <https://web.iima.ac.in/assets/snippets/working-paperpdf/12319057932015-12-02.pdf>.

<sup>37</sup> Planning Commission Transport Division. Report of the Working Group on Logistics. Government of India, [https://drive.google.com/drive/folders/1iUV9UFL7VP5GZuDX\\_0BhQ-siO--xslnLJ](https://drive.google.com/drive/folders/1iUV9UFL7VP5GZuDX_0BhQ-siO--xslnLJ). Accessed 23 Aug. 2018.

<sup>38</sup> Adding Wheels—Investing in the Indian Transportation and Logistics Industry. KPMG, 2010, [https://www.in.kpmg.com/SecureData/aci/Files/Adding\\_Wheels%5B1%5D.pdf](https://www.in.kpmg.com/SecureData/aci/Files/Adding_Wheels%5B1%5D.pdf).

Another important component in efficiency is load size, because large, fully loaded trucks transport more freight per kilometer driven. High loading efficiency can be achieved in two ways, first by moving towards larger trucks and second by aggregating small loads into large ones to fill those trucks. There is ample evidence from countries like the U.S. and the U.K. that larger trucks reduce costs without compromising safety or infrastructure life<sup>39,40</sup>. India is in the process of adopting new regulations, recently increasing the load carrying capacity of trucks by 20–25%. This move is expected to curb the problem of overloading, which is estimated to be as high as 33% of trucks which are responsible for around 50% of the road accidents in India<sup>41</sup>, and decrease logistics costs by 2%<sup>42</sup>. While larger trucks help accommodate large loads cost effectively, they end up adding cost when loads are too small. Rather than maintaining a large fleet of smaller trucks to transport small loads, which would lower average utilization and increase cost, the most typical response is to consolidate smaller loads to achieve greater fill rates. Similar to dispatch and scheduling, consolidation is best performed by large scale supply chain managers with both the technical expertise and tools as well as large volumes of freight under management or by specialized industry players, such as aggregators of less than truckload or parcel transport companies who have developed both the infrastructure and the operational expertise to consolidate small loads into large ones.

While large, fully-loaded trucks dispatched by technologically and operationally sophisticated logistics is the optimal state of affairs. Large trucks require sufficient infrastructure, particularly roads, to enable their effective operation. In India, most of the roads are inadequately maintained<sup>43</sup>, narrow and heavily congested. These infrastructural shortfalls, combined with stops for inspections and other factors mentioned above, cost the Indian economy \$21.3 billion annually<sup>45</sup>.

Issues of infrastructure, operational expertise and enforcement conspire to reduce utilization and efficiency of use. These conditions also affect the fuel efficiency of the vehicle itself. Typically higher quality trucks are more expensive, but also cheaper to operate because they consume less fuel.



<sup>39</sup> McKinnon, Alan C. "The Economic and Environmental Benefits of Increasing Maximum Truck Weight: The British Experience." *Transportation Research Part D: Transport and Environment*, vol. 10, no. 1, Jan. 2005, pp. 77–95.

<sup>40</sup> US Department of Transportation. *Comprehensive Truck Size and Weight Study*. <http://www.fhwa.dot.gov/policy/otps/truck/finalreport.cfm>.

<sup>41</sup> Cooshalle Samuel. "Overloaded Trucks Are Death-on-Wheels." *Hindustan Times*, 26 Nov. 2007, <https://www.hindustantimes.com/india/overloaded-trucks-are-death-on-wheels/story-IJCXleXs67kTW3SRbeqZyH.html>.

<sup>42</sup> "Govt Increases Load Carrying Capacity of Trucks by up to 25% - Times of India." *The Times of India*, <https://timesofindia.indiatimes.com/business/india-business/govt-increases-load-carrying-capacity-of-trucks-by-up-to-25-per-cent/articleshow/65029326.cms>. Accessed 23 Aug. 2018.

<sup>43</sup> National Transport Development Policy Committee. *India Transport Report - Moving India to 2032*. 2014.

<sup>44</sup> Arora, Rajat, and Dheeraj Tiwari. "India Incurs \$21.3 Billion Loss due to Delay on Roads: Study." *The Economic Times*, 7 June 2016. *The Economic Times*, <https://economictimes.indiatimes.com/news/economy/finance/india-incurs-21-3-billion-loss-due-to-delay-on-roads-study/articleshow/52639128.cms>.

In the current situation in India, where utilization is low, a focus on minimizing fixed costs, by minimizing capital cost and fixed driver wages, is the highest priority. As utilization increases, variable costs increasingly dominate the cost structure. With greater utilization, the investment in a high quality fuel efficient truck operated by a well-trained driver becomes more compelling. Breaking the cycle of rule flouting, enforcement of the law, and improvements in operational inefficiency will be ways to reduce cost, ensure driver safety, health and satisfaction, as well as reduce carbon emissions.

**Issues of infrastructure, operational expertise and enforcement conspire to reduce utilization and efficiency of use, and affect the fuel efficiency of the vehicle itself. Higher-quality trucks are more expensive, but also cheaper to operate because they consume less fuel.**

**2.2.3 Inefficiencies in final mile**

The pathways to efficiency in urban logistics, which is to minimize the number of truck kilometers driven and the costs of each remaining truck kilometer by removing the geographical, operational and infrastructural barriers to gaining efficiency, are similar to long haul trucking. However, the similarities end there. Urban logistics or the process of delivering products to the shelves of stores or the doorsteps of consumers themselves, involves different driving patterns, different vehicles, and a different geography from long distance trucking. This unique context of urban logistics demand that it be analyzed separately from long distance trucking. Another reason for separately discussing urban logistics is that despite it being a very short link in supply chains, it is a critically important component for three reasons. First, it is very high cost, for example, in e-commerce supply chains, the final mile accounts for approximately 53% of total logistics costs<sup>45</sup>. Second, it is growing very rapidly due to accelerating urbanization, which increased from 29% in 2007 to 34% in 2017<sup>46</sup> and is projected to reach 60% the by 2050<sup>47</sup>. This increased urbanization has led to an explosion of consumer demand, particularly in e-commerce, where the market is projected to grow from its current INR 2.6 trillion to INR 13.6 trillion by 2026<sup>48</sup>. Thirdly, it creates significant externalities such as congestion and air pollution.



<sup>45</sup> KPMG. Fulfilled! India's E-Commerce Retail Logistics Growth Story. Aug. 2016, <https://assets.kpmg.com/content/dam/kpmg/in/pdf/2016/08/E-commerce-retail-logistics-India.pdf>.

<sup>46</sup> "India - Urbanization 2017 | Statistic." Statista, <https://www.statista.com/statistics/271312/urbanization-in-india/>. Accessed 23 Aug. 2018.

<sup>47</sup> India Express, July 2016, "60 per cent Indians to live in cities by 2050: govt" ,<https://indianexpress.com/article/india/india-news-india/60-per-cent-indians-to-live-in-cities-by-2050-govt-2938430/>

<sup>48</sup> India Brand Equity Foundation. E-Commerce. <https://www.ibef.org/download/E-Commerce-June-2018.pdf>.

Opportunities to reduce truck driving in urban logistics cannot be discussed in terms of load size, load factor and empty running, as in long haul, because urban delivery is typically carried out through multi-stop delivery tours. Instead, the focus is to maximize the amount of freight which can be delivered on an average tour. Several potential causes of tour inefficiency exist, the first is simple inefficiency on the part of urban logistics operators. The planning of delivery tours is a complex activity that seeks to optimize truck loads and delivery points in a tour. This would not only minimize total driving but also improve customer service. However, like in other areas of the logistics market, urban delivery in India is often highly fragmented and relatively immature. Those firms often lack both the operational and technical tools as well as the economies of density required to dispatch delivery trucks on highly efficient urban tours.

It is not only fragmentation in carriers that creates a barrier to efficiency in urban delivery, but also fragmentation in receivers. In Indian cities consumer goods and food are typically sold at a vast collection of retail outlets serving their immediate neighborhoods. The unorganized sector dominates the retail market with 12 million kirana shops in the country<sup>49</sup>, which provide employment to many small business owners. However, they also account for 60% of all goods deliveries in urban areas, typically from a multitude of small independent carriers, creating an enormously complex and inefficient system that lowers the efficiency of goods delivery<sup>50</sup>. A similar issue exists with e-commerce fulfillment, where discretization of delivery points is even more pronounced than restocking small stores.

Fragmentation of delivery points is one geographical barrier to urban logistics efficiency, another is the location of warehouses and distribution centers from which shipments originate. As land values rise in cities, lower value uses, such as logistics, tend to migrate towards suburbs outside of the city. This phenomenon, known as 'logistics sprawl,' increases the amount of driving needed to arrive at the first delivery point and begin the delivery tour. The traffic created by logistics sprawl increases the amount of congestion going into and out of cities and also increases the amount of time needed to complete the tour, potentially reducing the amount of deliveries that can be accomplished in a single tour. In major Indian cities, the process of logistics sprawl is already underway. According to a National Transport Development Policy Committee report, increases in land prices and strategies adopted by larger cities are forcing the logistics establishments and exchanges to the outskirts of cities, leading to more pollution and congestion<sup>51</sup>.



<sup>49</sup> Vedant Goyal. Urban Freight and Logistics: The State of Practices in India. GIZ, Oct. 2016, [http://www.sutp.org/files/contents/documents/resources/C\\_Case-Studies/GIZ\\_SUTP\\_CS\\_Urban-Freight-and-logistics\\_India.pdf](http://www.sutp.org/files/contents/documents/resources/C_Case-Studies/GIZ_SUTP_CS_Urban-Freight-and-logistics_India.pdf).

<sup>50</sup> *ibid*

<sup>51</sup> National Transport Development Policy Committee. India Transport Report—Moving India to 2032. 2014.

Limited logistics sprawl can also increase the uptake of electrified two and three wheeled delivery vehicles, which are more efficient, low cost and easily electrified. In India, final mile delivery for e-commerce sector in urban areas is greatly served by two-wheelers. Two wheelers are used for urban deliveries of a wide range of goods, from food and beverages to apparel and electronics. However, while two and three wheeled delivery is an efficient and desirable practice in urban freight, it is currently lacking an effective regulatory framework in Indian cities. As per Motor Vehicles Act, two wheelers fall under non-transport vehicles and are only permissible for private use. Permits are mandatory for commercial use of all vehicles; but there is no provision for registration and licencing two wheelers for commercial use<sup>52</sup>. There is a high need to regularize and formalize this sector.

As with other areas of goods transport in India, underdeveloped infrastructure also creates problems in urban logistics. Two main infrastructural issues conspire to impose time constraints on delivery tours. The first is congestion, which increases the time spent driving to, from and between delivery points and the second is a lack of availability of parking and unloading spaces, which increases the time needed to make a delivery. Indian cities are among the most congested in Asia<sup>53</sup> due to high population density, lack of transportation network planning and growing private car ownership. The second issue is a lack of unloading bays in a majority of Indian cities which leads to ubiquitous illegal parking, increasing congestion and leading to increased travel times, costs, and emissions<sup>54</sup>.

A final barrier to efficient urban delivery is the regulatory environment in which trucks operate. Because trucks tend to produce significant negative externalities, a common policy response is a blanket ban on trucks entering the city during daytime hours. The goal of this approach is to shift truck travel to times of low residential use and therefore minimize conflicts with other uses. However, these policies greatly increase the cost of urban logistics by forcing receivers to take delivery at night. Furthermore, in many cases truck bans are counter-productive because the market reacts by delivering the same goods using passenger cars or vans during daytime hours. Because those passenger vehicles have smaller loading capacities, their use increases the overall urban traffic load for goods deliveries<sup>55</sup>.



<sup>52</sup> Aparajita Ray. "After Aggregators, Food Delivery Bikes under RTO Lens." The Times of India, 13 Apr. 2016, <https://timesofindia.indiatimes.com/city/bengaluru/After-aggregators-food-delivery-bikes-under-RTO-lens/articleshow/51802293.cms>.

<sup>53</sup> Vincent Chin, et al. Unlocking Cities—The Impact of Ridesharing across India. Boston Consulting Group, Apr. 2018, [http://image-src.bcg.com/Images/BCG-Unlocking-Cities-Ridesharing-India\\_tcm9-185213.pdf](http://image-src.bcg.com/Images/BCG-Unlocking-Cities-Ridesharing-India_tcm9-185213.pdf).

<sup>54</sup> Mamatha P. Raj, and Madhu Chand K.R. "Spaces of Mobility in the City Centre, Bangalore—The Role and Impact of Transportation Infrastructure." ITPI Journal, vol. 4, no. 2, 2007, pp. 52–59.

<sup>55</sup> Creyts, Jon, Dave Mullaney, Jiayin Song, and Zhe Wang. Efficient Urban Logistics in Beijing: Laying the Groundwork for a Low-Carbon Urban Freight Strategy. Rocky Mountain Institute, 2018.

# 03.

## Solutions



For India to successfully create a best-in-class logistics system, a portfolio of solutions will need to be implemented which address the complex, interdependent set of barriers discussed above. Action will be required both from the public sector, such as improving market structures, regulation and enforcement, as well as from the private sector, such as improving operational capabilities and investing in new equipment and technologies. Additionally some solutions will require public private partnership, such as mobilizing capital to fund new infrastructure. Broadly, the universe of potential solutions falls into three categories: (a) physical assets, such as infrastructure and equipment (b) policy reforms (c) operational and technical improvements.

### 3.1 Infrastructure and equipment solutions

Development of infrastructure for transportation and inventory management is imperative for improving modal share and reducing inventory cost. The solutions under this category range from improving capacity and network of road and rail infrastructure to development of multimodal hubs and warehouses.

#### 3.1.1 Potential solutions to high inventory cost

- 1. Improved quality of warehousing:** India's current stock of warehousing is both insufficient in quantity and quality. In response to that need, industries have begun to invest heavily in new warehousing facilities across the country. Ensuring that this warehousing stock is up to the challenge of lean supply chains is critical. For example, automation of typically manual warehousing operations such as 'pick and sort' and

warehouse configurations that allow for fast and efficient cross docking can support lead time and inventory reductions. Similarly, for perishable goods applications, ensuring the availability and efficiency of refrigerated transport, storage and processing facilities for medical and agricultural goods can contribute greatly to decreased loss and wastage.

- 2. Improved siting of warehousing:** High quality physical infrastructural stock can support the implementation of lean supply chains and avoid wastage. Equally important to the quality of that infrastructure is its location. Warehouses and distribution centers should have quick, high-throughput access to multiple transportation modes and be well located to cover large areas of consumer demand. Easy access to transport and collocation to demand all serve to shorten lead times and increase the service area of a distribution center, supporting the ability to centralize inventory and meet short customer lead time requirements. As India's warehousing stock grows it must be sited to meet the needs of lean, low inventory supply chains in order to support the development of an efficient logistics system.

### 3.1.2 Potential solutions to mode shift

- 1. Increase rail network capacity:** Capacity in a rail network is a complex phenomenon. There are many potential measures to increase rail network capacity such as building reinforced bridges, improving rail quality, introducing longer trains through distributed motive power, dedicated freight corridors, which must be tailored to the needs of the network. India is already in the process of implementing many of these solutions, however capacity remains drastically short. To address those issues rail network managers should remain focused on continuous improvement of the rail network and targeted investments to increase capacity on India's most congested freight corridors.
- 2. Improve infrastructure for coastal shipping:** While geography suggests that rail will be the dominant non-truck mode in India, long coastlines and major urban hubs along those coastlines showcase the potential for coastal domestic freight. This not only can support a more efficient modal share, it can also support decongestion of the rail network, allowing for superior service quality and the potential to compete directly with truck through intermodal services. However, currently both the ports and vessels providing coastal shipping services are not able to effectively meet the demand. Investments to resolve those capacity issues are ongoing and, similar to rail network capacity, should be viewed as initial steps in an ongoing process of continuous improvement.
- 3. Promote double-stack clearance of key intermodal corridors:** The ability to stack containers two high on intermodal trains is a key cost reduction measure for intermodal transport. However, double stacking containers requires raising clearances of bridges and tunnels and the

removal of overhead obstacles such as electric and telecommunication lines as well as overhead catenary wires on corridors that use electric locomotives. Identifying high potential intermodal corridors and raising their clearances to accommodate double stacked containers can increase the cost advantage of intermodal over truck and support modal shift. Indian railway recently introduced double stack dwarf container service in Rajkot<sup>1</sup>. The dwarf containers are shorter but wide than regular containers, thus alleviating the need for raising the height of overhead wires<sup>2</sup>.

- 4. Continue build-out of intermodal logistics parks:** Intermodal transport demands quick and reliable shifts between modes, accomplished at intermodal logistics parks. India is already in the process of creating a system of 34 intermodal logistics parks to serve its new system of dedicated freight corridors<sup>3</sup>. The government is investing Rs. 2 lakh crore to build out these logistics parks and state governments have provided land for the build outs. The government envisions that these parks will enable freight aggregation and enhance integration of rail, water, and road modes.

To maximize the effectiveness of that intermodal park network, India should ensure that parks have both the space and facilities to allow for manufacturing and warehousing operations to be located on the premises. Furthermore, policy makers should continue to identify and build more intermodal logistics parks along corridors with freight transport demand that is well suited to rail intermodal and ensure that they are well integrated into the rail network to minimize the costs of modal shift.

## Government envisions these parks to enable freight aggregation and distribution between different modes of transport like rail, waterways and road.

- 5. Identify and resolve gaps in rail network connectivity:** Beyond capacity, another infrastructural issue affecting mode share is the physical connectivity of the rail network. Oftentimes, the ability to extract raw materials out of the ground is not the bottleneck for production. Rather, the barrier is the inability to move the raw material from the site of production to the facilities where they are further processed. These connectivity gaps both

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<sup>1</sup> Vishwas Kothari. "Indian Railways Introduces First Double Stack Dwarf Container Service from Rajkot Division." The Times of India, 10 July 2018, <https://timesofindia.indiatimes.com/India/indian-railways-introduces-first-double-stack-dwarf-container-service-from-rajkot-division/articleshow/64934998.cms>.

<sup>2</sup> ibid

<sup>3</sup> Rajat Arora. Infrastructure: Government Approves Plan to Build 34 Mega Multi-Modal Logistics Parks at an Investment of Rs 2 Lakh Cr - The Economic Times. 21 July 2017, <https://economictimes.indiatimes.com/news/economy/infrastructure/government-approves-plan-to-build-34-mega-multi-modal-logistics-parks-at-an-investment-of-rs-2-lakh-cr/article-show/59690653.cms>.

add cost to the system and also generate substantial amounts of truck driving. These inefficiencies can be reduced by improving rail connectivity between the origin/source of raw material and processing units. For example, in the recent past, India has identified under-served sources of coal production and integrated them into the main rail network through coal-dedicated lines.

### 3.1.3 Potential solutions to low truck efficiency and productivity

- 1. Continued investment into the road network:** India's current road network hasn't kept pace with the growth of freight demand. Continuous investment in road infrastructure is imperative to enhance trucking productivity. The Government of India has focused heavily on road infrastructure for the Union Budget of FY18–19. The budget allocation for roadways has increased at a CAGR of 21% from FY09 to FY19. For FY18–19, \$18.69 billion has been allocated for roadways by the government, out of which 59% is allocated for national highways. Focus has been given to rural development as well, with the government allocating \$2.93 billion for rural roads under the Pradhan Mantri Gram Sadak Yojana in order to increase urban-rural connectivity. Various MoUs with investment potential worth \$29.74 billion were signed by the Ministry of Road Transport and Highways last year with private and public companies. Government will also invest \$107.82 billion over 2018–2022 for construction of new highways and roads<sup>4</sup>.
- 2. Standardization of logistics practices:** Logistics involves the movement of both physical goods as well as information between many parties. Standardizing both physical assets and information allows seamless movement of goods from one party to the next and is critical for truck productivity. For example, harmonization of pallet and truck standards allows for high load factors, standardization of trucks and trailers allows for drop-and-hook operations, and standardization of data allows for automation of admin processes. In the case of data standardization, which has been a critical component of the logistics revolution of recent decades, a range of players are involved in the production, transport, storage and sale of goods; efficient supply chain management requires seamless communication between those players. Easily shareable, real time data updates enable reduced inventory, better management of asset such as pallets or truck trailers, better dispatch of trucks, reduced paper documentation and faster completion of admin tasks.



<sup>4</sup> Indian Logistics Industry: Gaining Momentum. India Brand Equity Foundation, Nov. 2013.

GST reforms that enable modern supply chains combined with India's high level of domestic technical expertise will create a demand for increased standardization to capture potential efficiency.

### 3.1.4 Potential solutions to low efficiency in urban distribution

- 1. Parking and loading bays:** The inability to find an unloading spot leads to illegal parking and congestion. Creating sufficient parking and unloading infrastructure is a key enabler of efficiency in urban delivery, but one that cities often struggle with because urban space is always at a premium. Several innovative approaches have yielded results globally. One is multi-use lanes, under which lanes of road in high density commercial and residential districts change use over the course of the day. During peak times, they are typically reserved for public transit such as BRT; at night, they are open for residential parking and during non-peak daytime hours they are reserved for loading and unloading of urban trucks. Another approach is the use of codes to mandate the construction of sufficient truck parking. Under this approach, businesses which generate commercial traffic such as restaurants and stores, are required to build off street loading and unloading spaces as a condition for zoning approvals.



2. **Truck routes:** Most roads in a city are not suitable for truck traffic—bridge clearances may be low, turning radii might be too tight or there could be conflicts with pedestrian or residential uses. Experience with truck routes in other cities have been positive. When well designed, they can provide practically universal access to freight generating establishments while using only a very small, and appropriate, share of road infrastructure. Observed benefits have been reduced air pollution in residential areas, the near elimination of trucks from residential roads and even, in some cases, increased operational efficiency as trucks no longer unintentionally end up on roads that are unable to accommodate them<sup>5,6</sup>.
  
3. **Consolidation centers:** Consolidation centers are among the highest potential infrastructure solutions to urban logistics inefficiency. Consolidation centers are cross-docking infrastructure which aggregates deliveries going into urban centers and regroups them into consolidated shipments which allow for greatly enhanced loading and routing efficiency of delivery trucks. In practice consolidation centers have reduced truck travel in urban cores by 50%<sup>7</sup> or more. However, they typically meet with resistance from logistics firms because they increase lead times and are costly to use. In international experience, despite the greatly reduced truck travel they can enable, they typically fail after subsidies are withdrawn.
  
4. **Urban logistics spaces:** A less intrusive means of achieving consolidation is through urban logistics spaces. Urban logistics spaces are cross-docking facilities serving a single supply chain, often large parcel delivery firms, with a strong necessity for easy access to the urban core. Similar to a consolidation center, urban logistics spaces can greatly increase loading and routing efficiency, and can also enable the use of smaller, less polluting vehicles for final mile delivery. Because they are well-integrated into the distribution network of the company operating them, urban logistics spaces do not increase lead times and reduce delivery reliability as urban consolidation centers do. As a result, urban logistics spaces are typically welcomed, rather than resisted, by logistics firms. However in normal situations, the cost of land in urban cores is typically beyond what logistics firms are willing to pay. For that reason, urban logistics spaces are typically only successful when they can be built on low value brownfield land such as abandoned industrial facilities or underutilized parking facilities.



<sup>5</sup> New York City Department of Transportation. New York City Truck Route Management and Community Impact Reduction Study. Mar. 2007. <http://www.nyc.gov/html/dot/downloads/pdf/execsum.pdf>.

<sup>6</sup> EU SUGAR. City Logistics Best Practices: A Handbook for Authorities. Nov. 2011.

<sup>7</sup> *ibid*

5. **Pack stations:** As discussed above high discretization of delivery points, particularly in parcel delivery, makes delivery tours much more complex and longer. Pack stations are banks of lockers, placed at heavily trafficked locations such as office buildings, public transit stations or grocery stores, that allow recipients to collect those parcels over the course of normal daily activities, such as commutes, rather than taking delivery at home. This provides both a benefit to carriers, as the destination points they must serve are much fewer, and also to consumers who no longer have to deal with failed deliveries when they are out and no one is available to sign for the package.

### 3.2 Technological, Digital and Operational Solutions

Digitization is the backbone and technology is the key enabler of efficient supply chain. Currently, India ranks 146 out of 190 countries in the “Trading across Borders” component of Doing Business initiative by World Bank<sup>8</sup>. Doing Business analyses the process of exporting or importing a shipment of goods and scores a country based on the time and cost spent on documentary compliance, border compliance and domestic transport. Digitization, equipped with adequate technology, can be a solution to low productivity practices, high inventory costs, and inefficient urban distribution. A digitized platform to integrate supply chain, right from demand forecasting to load consolidation and truck routing and dispatch scheduling, can reduce the delivery time and costs.



### 3.2.1 Potential solutions to high inventory cost

1. **Demand forecasting through big data:** Inventory holdings cannot be reduced to such an extent that they frequently result in products being unavailable for sale to clients. To avoid such 'stock out' events, firms typically hold extra inventory, called buffer or safety stock, to ensure service quality in the event of unexpected surges in client demand for products. Being able to effectively project demand surges can enable firms to build up extra inventory to meet demand rather than permanently holding excessive safety stock to meet non-random demand surges. To date, demand forecasting has grown more accurate primarily by gaining visibility into point of sale data through supply chain digitization and improving data analysis to turn that data into accurate demand projections. In the future, visibility beyond the point of sale into direct consumer behavior through data enabled internet of things (IoT) holds the potential to further improve demand projections and reduce safety stock holdings.

**A digitized platform to integrate supply chain, right from demand forecasting to load consolidation and truck routing and dispatch scheduling, can reduce the delivery time and costs.**

2. **Deploying big data in distribution network design:** Variance in customer demand is not always forecastable. While random demand fluctuations cannot be forecasted, they can be smoothed out through diversification. Like a portfolio of stocks, diversification of demand can reduce the overall volatility of demand. Growing the 'portfolio' of demand streams in logistics network is typically accomplished by moving to network designs that feature a smaller number of very large distribution centers which serve a large collection of customers, rather than a larger set of small distribution centers each serving a small number of customers. While the theory of inventory centralization and resultant cost minimization is straightforward, the design of an optimal distribution network is not. Network design that minimizes total cost is a complex computational process with significant data demands. Mobilizing rich data sets around demand composition, transport capacity, transport price and the seasonality of all the above allows logistics managers to rapidly simulate huge numbers of network configurations and select one that minimizes cost.
3. **Digitization and automation of warehouse processes:** Warehouse management systems (WMS) seek to reduce inventory costs both by increasing the efficiency of how goods move through and are stored in warehouses. The applications of WMS are broad, including optimizing



<sup>8</sup> World Bank Group. Trading Across Borders—Doing Business. <http://www.doingbusiness.org/data/exploretopics/trading-across-borders>. Accessed 23 Aug. 2018.

pick and sort operations, automatic inventory counts and replenishments, and KPI monitoring and reporting. These types of software systems, and the automated processes they enable, can both reduce operating costs within warehouses but are also an important element of lean supply chains as they can help to identify and resolve inefficiency and waste that lead to higher inventory levels.

- 4. Lean mindset in supply chain management:** The implementation of JIT and other lean supply chain principles is oftentimes referred to building a culture rather than a set of actions. The firms that have most successfully implemented lean principles typically adopt a culture of zero waste and continuous improvement from top management down to workers on the warehouse floor. For example training employees to continually identify the areas of standardization, simplification, automation and re-engineering of operational processes and procedures should be addressed prior to the implementation of JIT<sup>9</sup>. While suggestions of improving company culture are often dismissed as soft or abstract, the fact remains that the leanest, lowest cost supply chains have adopted a lean culture and reward employees financially for implementing that culture.

### 3.2.2 Potential solutions to mode shift

- 1. Digitization of blocks and signals in the rail network:** The largest potential cost reductions in goods transport in India is through modal shift, especially to rail. Currently Indian rail suffers from a severe shortage of capacity on key freight corridors in its rail network. In addition to the construction of needed physical infrastructure, digital solutions can improve the use of physical infrastructure, which also creates network capacity. A major determinant of network capacity are the blocking and signaling systems used in the rail network. In current analog solutions, a block is a physical section of track which only one train may occupy at a given time and a signal is typically a physical sign or light indicating whether a train may or may not enter a given block. Digitizing the physical blocking systems through virtual moving block systems, can enable maximum network throughput by computing minimum train following distance based on real time information about train location, speed and braking distance, while increasing safety and reliability.
- 2. Digitized container management in intermodal transport:** Another potential digital enabler of mode shift is by enabling seamless delivery of intermodal transport, which allows rail to compete for transport of higher value goods that is traditionally dominated by trucks. In order to compete with trucks, intermodal transport must compete not only price but also on



<sup>9</sup> V. Vijaya Lakshmi, and G.V. Chalam. "Just In Time Approach: It's Application in Indian Industries." International Journal of Management, vol. 7, no. 7, Dec. 2016, pp. 82–89.

<sup>10</sup> [https://www.mckinsey.com/~/media/mckinsey/industries/travel%20transport%20and%20logistics/our%20insights/transforming%20indias%20logistics%20infrastructure/building\\_india%20transforming\\_the\\_nations\\_logistics\\_infrastructure.ashx](https://www.mckinsey.com/~/media/mckinsey/industries/travel%20transport%20and%20logistics/our%20insights/transforming%20indias%20logistics%20infrastructure/building_india%20transforming_the_nations_logistics_infrastructure.ashx). Accessed 22 Aug. 2018.

transit time, reliability and visibility. Delivering that service requires constant knowledge of the location of an intermodal container and the ability to use that information to efficiently manage transition between modes. RFID tracking systems on intermodal containers, data standards to make those RFID signals universally usable and the computing ability to turn that information into high quality service can greatly expand the contestable market share of rail intermodal.

### 3.2.3 Potential Solutions to low truck efficiency and productivity

1. **Digitization of loading information:** The process of finding and contracting for a load is time consuming and reduces the average utilization of trucks –an important driver in the overall cost of trucking. In traditional logistics processes, data about available loads is held by brokers and contracting for loads is an analog process involving phone calls and large quantities of paper documentation. Digitizing the process of finding and contracting for loads, potentially through applying shared mobility business models to trucking markets, can keep trucks on the road moving freight and generating revenue.
2. **Digitization of truck routing and dispatch:** Dispatching and routing trucks is a complex optimization that in traditional logistics operations is typically carried out by a dispatcher by phone calls with individual truck drivers in a fleet. The solutions arrived at by this manual process are typically far less efficient than those arrived at by computerized dispatch systems. By using GPS coordinates of trucks and loads as well as other variables such as delivery time windows and real time traffic data, computers can greatly increase the efficiency of truck dispatch and routing. Historically these types of transportation management system software solutions have been expensive and cumbersome to implement, making them relevant only for the largest and most sophisticated of logistics firms. However, with the growth of cloud computing and software as a service (SaaS) business models, the potential efficiency gains from improved truck management are increasingly becoming available to the broader market.

### 3.2.4 Potential solutions to low efficiency in urban distribution

1. **Intelligent transportation systems (ITS):** Intelligent transportation systems use information technology to improve the efficiency of transportation<sup>11</sup>. Various solutions under ITS include Weight-In-Motion (WIM) systems, vehicle location and condition monitoring systems, traffic controlling and monitoring systems, delivery space (for parking) booking systems, route planning systems, location monitoring systems and freight status monitoring systems<sup>12</sup>. For example, weigh-in-motion (WIM) devices can quickly and effectively identify overloaded trucks. This enables enforcement of individual violations as well identification of habitually offending carriers for ongoing monitoring and enforcement. WIM

identifies overloaded vehicles with 95% accuracy, allowing for targeted inspections that catch overloaded trucks, without unduly reducing truck productivity and traffic fluidity. Another example is freight location monitoring system that allows freight movement to be controlled and recorded using RFIDs. Such systems help to effectively plan loading and unloading and manage resources better<sup>13</sup>. Delivery space booking systems allow optimized and effective allocation of parking spaces for a specific time period for loading and unloading.

- 2. Digitization of parking and unloading infrastructure:** Effective provision of infrastructure to park and unload trucks is a substantial determinant of the efficiency of urban delivery. Providing and appropriate supply of that infrastructure is a key step in enabling efficient unloading, but the value of that infrastructure can be even greater if its use is optimized. A few digital solutions can enhance the productivity of unloading spaces. First is the ability to find open parking in advance of a delivery by an app rather than driving a truck around in circles looking for it. Second is the ability to pay for and schedule that parking space in advance, allowing trucks to guarantee that a suitable space is available in advance of arrival. Finally, digitized parking enforcement, identifying and enforcing fines on vehicles that illegally park in delivery bays, can ensure that trucks actually have access to the infrastructure built for them.

## Intelligent transportation systems use information technology to improve the efficiency of transportation.

- 3. Electric delivery vehicles:** Noise and air pollution are two of the main external costs created by urban delivery trucks. Moving towards electric delivery can completely eliminate truck tailpipe emissions and nearly eliminate noise. Urban delivery duty cycles are uniquely suited to electrification. Urban delivery trucks typically spend long stretches of time in the same depot allowing for centralized charging operations, delivery routes are typically short allowing for small battery packs, and duty cycles are typically stop-and-go playing to the relative strengths of electric drive trains. As a result, electrification of urban delivery can also reduce overall urban delivery costs by substantially reducing the fuel costs of carriers at an acceptable upfront capital cost.



<sup>11</sup> Fatemeh Ranaiefar. "Intelligent Freight Transportation Systems." Institute of Transportation Studies, Spring 2012, [http://freight.its.uci.edu/sites/default/files/cee298\\_presentations/rfatemeh/Intelligent%20Freight%20Transportation%20Systems\\_Fatemeh.pdf](http://freight.its.uci.edu/sites/default/files/cee298_presentations/rfatemeh/Intelligent%20Freight%20Transportation%20Systems_Fatemeh.pdf).

<sup>12</sup> ibid

<sup>13</sup> Vahid Mirzabeiki. "An Overview of Freight Intelligent Transportation Systems." International Journal of Logistics Systems and Management, vol. 14, no. 4, 2013, pp. 473–89.

### 3.3 Policy and Regulatory Solutions

Policy and regulatory reforms can translate the key solutions discussed above into actionable next steps. A broad set of policy and regulatory solutions can improve infrastructure connectivity and capacity, reduce idle time of trucks, and promote and incentivize digitization and other best practices in logistics sector. As a result, the Ministry of Commerce & Industry has identified a need to develop an Integrated National Logistics Action Plan to improve transparency and enhance efficiency in logistics operations<sup>14</sup>. In order to address various issues in logistics system, MoCI has suggested launching integrated IT platforms, reducing time spent on clearance and documentation, promoting ITS, standardizing logistics practices and improving skill sets of human resources<sup>15</sup>.

#### Logistics Ease Across Different States (LEADS)<sup>16</sup>

While implementing policy and regulatory solutions, it is imperative to identify key enablers and establish performance metrics. The Transportation & Logistics team at Deloitte, State Cell, Department of Commerce, the Ministry of Commerce and Industry, Government of India recently developed a framework called LEADS (Logistics Ease Across Different States) to measure the logistics performances of 22 different states in India. The goal of the study is to highlight the best practices and key enablers for efficient goods movement across various states. Key indicators of LEADS index are:

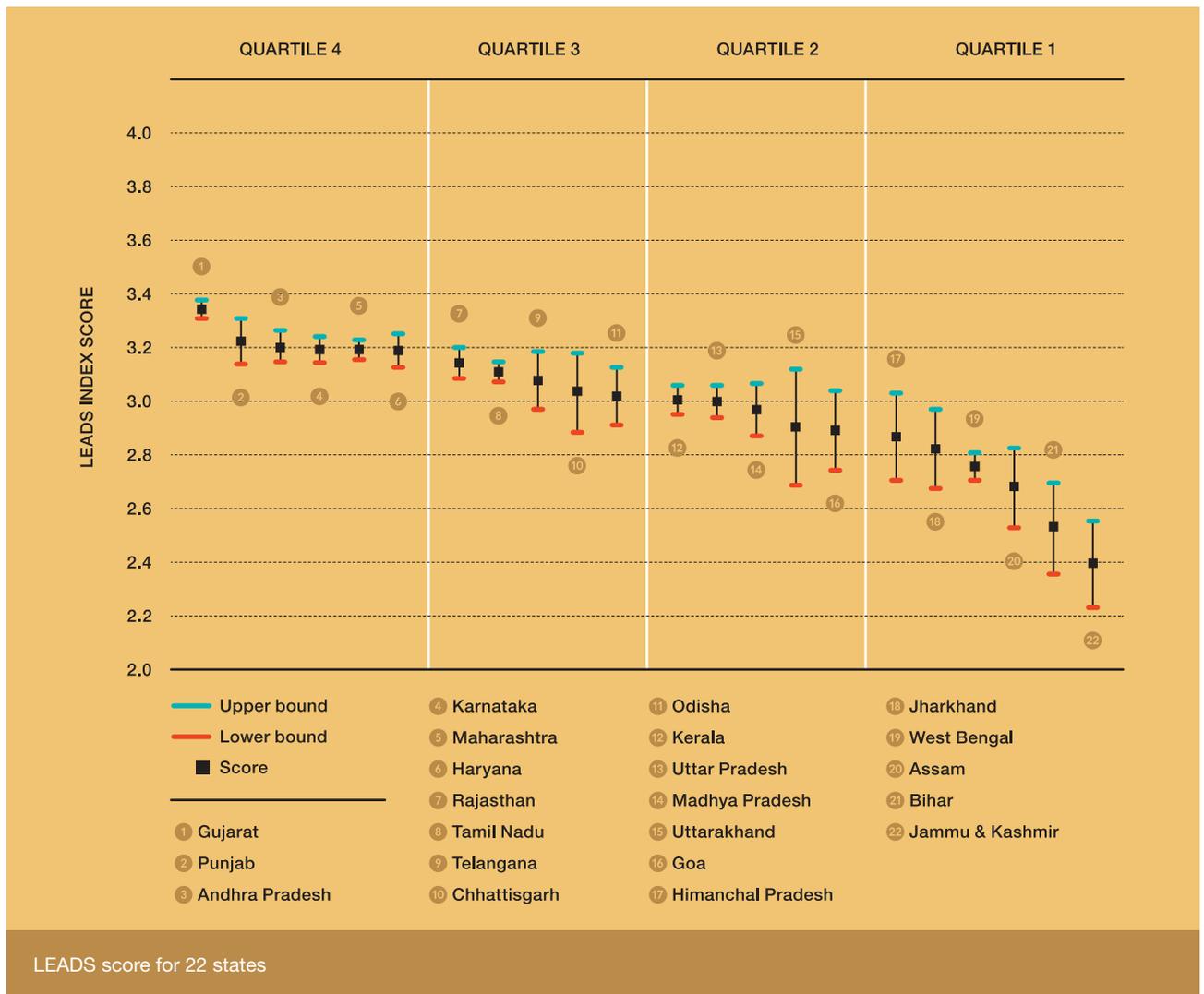
- » Quality of transport and logistics infrastructure (capacity and connectivity)
- » Quality of services offered by logistics service providers (availability, competence, efficiency and ease of access)
- » Efficiency of regulatory processes (speed, simplicity, transparency in processing, ease of documentation)
- » Favorability of operating environment
- » Ease of arranging logistics at competitive rates
- » Timeliness of cargo delivery
- » Safety and security of cargo movement
- » Ease of track and trace

Based on these indicators, Gujarat ranks the highest followed by Punjab, Andhra Pradesh, Karnataka, Maharashtra and Haryana. The states in quartile 4 have strong manufacturing hubs and are well connected agricultural and industrial corridors. The quality of infrastructure and the quality of services offered by logistics service providers in these states is higher than those in rest of the quartiles. Another highlight of these states is better timeliness of cargo delivery i.e. frequent delivery of cargo within scheduled or expected delivery time with minimum delays. The key solutions suggested in the study focus on digitization of supply chain, human resource capacity building, infrastructure network and capacity enhancement and unified processes.

<sup>14</sup> Ministry of Commerce & Industry, Department of Commerce, Logistics Division. RFP for Engaging a Consultant for Working out Integrated Logistics Plan for the Country. Jan. 2018, [http://www.commerce.gov.in/writereaddata/tenders/MOC636530768556730736\\_RFP\\_forengaging\\_Consultantfor\\_Logistics\\_Action\\_Plan\\_Final-31-1-2018.pdf](http://www.commerce.gov.in/writereaddata/tenders/MOC636530768556730736_RFP_forengaging_Consultantfor_Logistics_Action_Plan_Final-31-1-2018.pdf).

<sup>15</sup> *ibid*

<sup>16</sup> Deloitte. "Logistics Ease Across Different States (LEADS)" January 2018



**1. Digital enforcement:** As discussed above, rampant rule breaking has a deleterious effect on price formation mechanisms in the logistics industry and necessitates operational practices that impose high external costs on society. In response, regulators commonly stop trucks to inspect and penalize illegal operators. These common stops, however, negatively affect both truck utilization and reliability. Both increasing costs of trucking as well as adding to variance in lead times and therefore creating extra buffer stock requirements. Moving to digital enforcement strategies, such as weigh-in-motion (WIM) equipment to identify overloaded trucks, can prescreen trucks for illegal operation and only stop those who are likely violators. In a WIM scheme implemented in the Netherlands, trucks roll over scales built into the road which are able to detect violations with 95% accuracy<sup>17</sup>. Trucks suspected of overloading are instructed by electronic signage to enter a physical inspection station where they are weighed with more precise equipment. Cameras in the WIM system also capture the license

<sup>17</sup> Federal Highway Administration Office of International Programs. Effective Use of Weigh-In-Motion Data: The Netherlands Case Study. Oct. 2017, <https://international.fhwa.dot.gov/pubs/pi07028/pi07028.pdf>.

plate and registration information of the truck, allowing authorities to fine trucks that do not stop for inspections and also digitally identify firms who are habitual violators for further monitoring and sanctions. This system effectively enforces regulations without reducing productivity of law-abiding carriers. Similarly, digitizing government mandated paperwork can reduce enhance efficiency. Currently in India, the electronic way (e-way) bill under GST, necessary for movement of goods, can be generated from the e-way portal, SMS, or through a mobile phone application. NHAI has also launched two apps—MyFASTag and FASTag Partner—for e-toll collection<sup>18</sup>.

2. **Zoning and land use for logistics:** Logistics firms invest considerable resources in optimizing the geography of their distribution networks. However, they can only do so effectively to the extent that the land they need is available to them to build those facilities. Integrated land planning with designated spots for large scale multimodal logistics hubs can reduce inefficiencies. In land use policy, there are two main outcomes which can support efficient logistics. The first is connectivity—land should be made available for logistics development at major modal intersections that are in proximity to significant freight generating areas, such as cities or industrial clusters. The second is density—logistics facilities that are clustered with other logistics facilities can create economies of density that lower transport costs and increase efficiency<sup>19</sup>.
3. **Zoning for logistics sprawl:** The natural tendency for logistics land uses to locate increasingly far from the city center both increases truck kilometers traveled and creates congestion at major urban access points. Using zoning policy to reserve suitable land for urban logistics purposes, as discussed above with urban logistics spaces, can help slow or reverse logistics sprawl. Zoning logistics uses into urban cores should be done with care as many logistics uses are in fact unsuitable for urban environments. However, a zoning policy which permits suitable logistics uses on suitable land, for example urban logistics spaces for parcel delivery, can actually enhance urban quality of life for urban residents by giving them superior access to goods and services while simultaneously reducing truck travel into and out of cities.
4. **Nighttime deliveries:** While mandatory nighttime deliveries often produce undesirable waste and inefficiency, the concept behind them, that avoiding congested time periods can enhance delivery efficiency is sound. International experience suggests that the best way to implement night deliveries is through incentives, not mandates, and the ones who should be receiving the incentives are the receivers of goods. While incentives for receivers can enable the uptake of night deliveries, substantial benefits



<sup>18</sup> Rohini Singh. "GST E-Way Bill Roll-Out in India." India Briefing News, 30 Mar. 2018, <https://www.india-briefing.com/news/gst-e-way-bill-generate-roll-out-april-1-16457.html>.

<sup>19</sup> Sheffi, Yossi. "Logistics-Intensive Clusters: Global Competitiveness and Regional Growth." Handbook of Global Logistics, Springer, 2013, pp. 463–500.



accrue to carriers as well. The time between stops is reduced because congestion is lower and the time spent at each delivery point is also lower because better parking is available and sidewalks are empty, making for an easy transfer of goods off the truck and into the store or business receiving the goods. This enables carriers to deliver substantially more goods per tour, reducing the unit delivery costs. Furthermore, firms making night deliveries often also make daytime deliveries, allowing for much greater productivity of urban delivery trucks.

- 5. Congestion feebates:** A common approach to congestion mitigation is congestions pricing. While congestion pricing mechanism has been effective for reducing congestion in passenger mobility in some parts of the world, it also has the potential to elevate prices for goods that urban residents need. In international experience with congestions pricing, a common observation is that trucks do not alter their driving patterns in response to congestion pricing, they pass the cost through to customers<sup>20</sup>. As discussed above, off hours deliveries can reduce logistics costs, but often require incentives to induce both carriers and receivers to adopt them in mass scale—a potentially costly proposition. Applying a feebates concept to urban access would charge trucks to enter the city during congested periods while incentivizing them enter during nighttime hours, with both costs and savings likely being passed through to the receivers of those goods. Such an approach would not only reduce the cost of goods delivery made off hours, crucial for small shops with thin margins serving customers with limited budgets, but would also reduce overall congestion within the city both by reducing traffic during peak times as well as by reducing illegal parking.

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<sup>20</sup> Andrea Broaddus, et al. Sustainable Freight: Impacts of the London Congestion Charge and Low Emissions Zone. Aug. 2014

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## Conclusion



Logistics is the backbone of a country's economy and development. With India's growing economy, it is imperative to invest in robust logistics infrastructure and efficient supply chains. The success of Government of India's 'Make in India' initiative rests heavily on an efficient logistics system. The objective of 'Make in India' is to strengthen India's manufacturing sector and build state of the art manufacturing infrastructure in the country. To support this vision, logistics and supply chain can be improved and made more efficient.

**Efficient logistics can improve the lives of rural households and farmers and generate more employment opportunities.**

While existing logistics systems in India have inefficiencies in inventory management, modal split, truck productivity and final mile solutions, they can be addressed by a set of whole system solutions targeting technological, digital, infrastructure, policy and regulatory components. Inventory cost can

be brought down by improving the quality and siting of warehouses, accurate forecasting, digitized inspection systems and digitized warehouse processes. Worsening mode share can be addressed by improving connectivity and capacity of rail and waterway networks, and building out heavy haul as well as intermodal corridors. Truck productivity can be enhanced by truck standardization, efficient loading and unloading practices and digitization of routing and dispatch. Urban deliveries can be optimized using intelligent transportation systems, efficient routing and scheduling practices and improvement in infrastructure like consolidation centers, loading bays etc.

Using the solutions discussed in this paper, logistics can be made more efficient, creating a 10% decrease in indirect logistics costs and 5-8% growth in exports<sup>1</sup>. Efficient logistics can improve the lives of rural households and farmers and generate more employment opportunities. With improved connectivity to rural areas and availability of efficient cold chain logistics, necessities such as vaccines would be available in all rural areas thus preventing deaths. This would also improve farmers' income with decreased wastage of fresh fruits and vegetables. Improvement in logistics infrastructure and efficiency will lead to a decrease in logistics costs, improved air quality, more employment opportunities, decrease in road accidents, and accelerated economic growth. Hence, sustainable and balanced growth of the logistics sector in India can enable social and economic development and environmental benefits for the country.



<sup>1</sup> Ravinder Goyal, and Shashvat Singh. Indian Logistics Sector: On the Path of Transformation. <http://niti.gov.in/content/indian-logistics-sector-path-transformation>. Accessed 23 Aug. 2018.



