Urban Freight and Logistics: The State of Practices in India

Experiences and Lessons
Case Studies in Sustainable Urban Transport #10

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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>APMC</td>
<td>Agricultural Product Marketing Committee</td>
</tr>
<tr>
<td>BEST</td>
<td>Brihanmumbai Electric Supply and Transport Undertaking</td>
</tr>
<tr>
<td>btkm</td>
<td>billion tonne-kilometre</td>
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<tr>
<td>CAGR</td>
<td>Compound Annual Growth Rate</td>
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<tr>
<td>CCD</td>
<td>Café Coffee Day</td>
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<tr>
<td>CO</td>
<td>Carbon monoxide</td>
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<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
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<tr>
<td>CoD</td>
<td>Cash on Delivery</td>
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<td>Core</td>
<td>is a unit in the Indian numbering system equal to ten million</td>
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<td>CTS</td>
<td>Citywide Traffic Report</td>
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<tr>
<td>DDA</td>
<td>Delhi Development Authority</td>
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<td>DRFC</td>
<td>Dedicated Rail Freight Corridor</td>
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<tr>
<td>EMU</td>
<td>Electric Multiple Units</td>
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<tr>
<td>EZ</td>
<td>Environmental Zones</td>
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<tr>
<td>FDI</td>
<td>Foreign Direct Investment</td>
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<td>GCMMF</td>
<td>Gujarat Cooperative Milk Marketing Federation</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GHG</td>
<td>Greenhouse gases</td>
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<td>HC</td>
<td>Hydrocarbons</td>
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<tr>
<td>HCM</td>
<td>Heavy commercial vehicles</td>
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<tr>
<td>HoReCa</td>
<td>Hotel/Restaurant/Café</td>
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<tr>
<td>JNPT</td>
<td>Jawaharlal Port Trust</td>
</tr>
<tr>
<td>JnNURM</td>
<td>Jawaharlal Nehru National Urban Renewal Mission</td>
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<tr>
<td>Lakh</td>
<td>is a unit in the Indian numbering system equal to one hundred thousand</td>
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<tr>
<td>LCV</td>
<td>Light commercial vehicles</td>
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<td>MCV</td>
<td>Medium commercial vehicles</td>
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<td>MM</td>
<td>Maximum Mass</td>
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<tr>
<td>MMR</td>
<td>Mumbai Metropolitan Region</td>
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<tr>
<td>MMRDA</td>
<td>Mumbai Metropolitan Region Development Authority</td>
</tr>
<tr>
<td>MMt</td>
<td>Million Metric tonnes</td>
</tr>
<tr>
<td>MSRDC</td>
<td>Maharashtra State Road Development Corporation Limited</td>
</tr>
<tr>
<td>MUIP</td>
<td>Mumbai Urban Infrastructure Project</td>
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<tr>
<td>MUTP</td>
<td>Mumbai Urban Transport Project</td>
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<tr>
<td>NCR</td>
<td>National Capital Region of India</td>
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<tr>
<td>NH</td>
<td>National Highway</td>
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<tr>
<td>NO₂</td>
<td>Nitrogen oxides</td>
</tr>
<tr>
<td>NSM</td>
<td>New Sabzi Mandi</td>
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<td>NTPDC</td>
<td>National Transport Development Policy Committee</td>
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<tr>
<td>Octroi</td>
<td>is a local tax collected by the state/city government on articles brought into a town for local use</td>
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<td>PM</td>
<td>Particulate Matter</td>
</tr>
<tr>
<td>PMₚ</td>
<td>Particulate Matters</td>
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<tr>
<td>QSR</td>
<td>Quick service retail</td>
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<tr>
<td>SO₂</td>
<td>Sulphur dioxide</td>
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<tr>
<td>TQM</td>
<td>Total Quality Management</td>
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<td>TTSS</td>
<td>Total transport system studies</td>
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<tr>
<td>UCC</td>
<td>Urban consolidation centres</td>
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<tr>
<td>ULBs</td>
<td>Urban local bodies</td>
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<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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<tr>
<td>VKT</td>
<td>Vehicles kilometres travelled</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<td>WMS</td>
<td>Warehouse Management System</td>
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1. Introduction to the Urban Freight Transport System

1.1 Background

India has witnessed rapid ‘economic’ growth in the last two decades. One of the main factors in sustaining such accelerated economic growth has been the investment and development of critical infrastructure such as the transport systems — road, railways, ports and civil aviation. These investments have helped to connect rural areas to urban and regional centres. The accelerated development of transport modes has also helped to reduce economic disparity, poverty and social deprivations within the country.

The drive to develop and improve transport infrastructure is especially apparent in Indian cities, which are being considered the drivers of the Indian economy (Planning Commission, 2012). The planning commission – the policy think-tank of the Government of India – states that Indian cities now contribute the majority to the ‘gross domestic product (GDP)’ of the country. It further predicts that by the year 2030, cities will contribute about 70% of India’s total GDP compared to 60% at present (Planning Commission, 2012).

Transport plays a very vital role in the development of a country’s economy, in determining overall productivity, quality of life of citizens, access to goods and services and the pattern of distribution of economic activity. (NTPDC, 2014).

Figure 1 shows the performance of the road transport sector with respect to India’s GDP. It can be observed from the figure that since the year 1991, the total freight traffic moved by road outpaced the GDP growth (NTPDC, 2014). Much of such observed trend could be linked to the economic liberation undertaken by the government.

Compared to the 1990s, when the demand for transport grew at an annual rate of 10%, the demand in the transport and logistics industry grew along with the accelerating Indian GDP in the last decade (EBTC, 2012). Especially in cities, the growing middle class will
determine future developments in the transport sector. The rapidly growing need for domestic and international products and demand for large-scale mobility for the working population will require the provision of adequate transport facilities.

Looking at the urban freight sector, this paper provides an overview of the goods movement taking place within the context of urban India. It reviews existing conditions of the freight sector in India and looks at a wide range of national and international case studies, thereby highlighting potential pitfalls that it needs to avoid along with best practices and success stories.

1.2 Growing importance of road transport

Though the Indian domestic market is being served by a wide variety of transport modes, the road transport industry has emerged as the dominant segment within India’s transportation sector in the last few decades (Figures 2a, b). It now occupies the lion’s share of 4.8% of India’s GDP in comparison to rail sector that had a meagre 1% share of GDP in 2011-12 (NTPDC, 2014). Road transport in India has shown an increase in shares of both passenger and freight traffic vis-à-vis other modes of transport (NTPDC, 2014). The main advantage of road transport compared to any other mode is its ease of accessibility, its operational flexibility, its ability to provide door-to-door service, and its reliability.

At the micro-level, i.e. on the city scale, roadways cater to almost 80% of the total land transport demand. This explosion in demand has led to an increased utilisation of land transport modes – predominantly private vehicles. As a result, Indian cities are witnessing an increase in congestion levels and a reduction in mobility access, whilst pollution, use of fossil fuels and road safety incidents such as occurrence of accidents and road traffic related fatalities are all on the rise.

Figures 2a, b: Comparison of Freight Traffic carried by rail and road. © NTPDC, 2014
1.3 The challenge: negligence of the urban freight sub-sector

While road traffic levels and their impact on the liveability index of Indian cities has received growing attention in recent years, much of this attention has been directed at passenger traffic, mainly public transport and private car traffic. In relation, little consideration has been paid to urban freight transport, despite the fact that urban freight transport has a very close association with the overall liveability aspect of the urban area. There are many reasons for such neglect, however one prime reason is the lack of a single institution or department responsible for efficient management of freight movement within the city, state or national framework. This makes this sector much more complex than, for instance, passenger traffic.

Writing almost 20 years ago Ogden (Ogden, 1992 p. 3) mentions, “No urban area could exist without a massive, sustained and reliable flow of goods to, from, and within it.”

The statement still holds true, especially in the context of Indian cities where many farmers residing in the outskirts travel to city markets to earn their livelihood as well as provide products that serve urban dwellers’ daily needs. The movement of these produced goods plays a critical role in the economic sustainability of the local urban areas, as it not only provides employment to many people but it is also a source of income generation (Russo and Comi, 2010 in Moazami and Noroozi, 2011).

Previous studies have suggested that urban freight costs are comparable to the cost of transporting people within the urban limits. Moreover, the costs of transporting goods increases at a much higher rate compared to passenger transport (Ogden, 1992). Figure 3 shows the relationship between transport costs and distance for the freight sector (NTPDC, 2014).

“While overall road transport cost are low (relative to international experience) and have been stable, there has been a rapid increase in transport costs across relatively short distances across metropolitan areas and between cores and suburbs of the largest metropolitan areas. For instances, freight rates between Delhi and Chandigarh (a distance of 260 km) increased from INR 1.2 per tonne-km in 2001 to INR 2.7 in 2011. Prices are even higher for shorter distance between cores and suburbs of metropolitan areas.”

The NTPDC report also states that the India’s metropolitan freight cost are twice as expensive as the national average and almost three times as expensive as transport products in China (NTPDC, 2014).

Without suitable interventions, such trends will pose a serious economic threat to the potential trade movement of growing cities in India. Hence, there is a need to think carefully about transport systems that are responsive not only to passengers’ but also to shippers’ needs. The movement of goods between the urban areas should not only be just safe and cost-effective, but also responsive enough to meet the evolving social and economic geography.

1.4 Importance of urban freight

Scholars such as Meyburg and Stopher (1974), Hassel, Foulkes and Robertson (1978), Browne, Piotrowska, Woodburn and Allen (2007), and Ogden (1992) have highlighted the importance of urban freight transport. A few
of the most significant reasons their work discusses are provided below:

- **Environmental effects** – the negative impacts of urban freight movement, i.e. energy use and its environmental impacts in the form of air pollution, noise pollution and visual intrusions, and congestions;
- **Economic efficiency** – if the total cost of freight transport and physical distribution is significantly higher in some parts of the region/area, then this has a direct effect on the efficiency of the economy;
- **Key to sustaining urban lifestyles** – the existence of any urban area depends upon the flow of commodities into, out of, and within its boundaries;
- **Driver of the local economy** – efficient freight movements allow urban areas to retain industrial and trading activities that generate wealth;
- **Regional development** – an efficient freight sector increases the competitiveness of the industry sector in a region.

### 1.5 Impacts of urban freight

In general, road freight vehicles used for the freight delivery, such as light commercial vehicles (LCV[1]) (e.g. utility vehicles, vans, and min-vans) and heavy commercial vehicles (HCV[2]) (e.g. commercial trucks, buses, and on-road vocational vehicles like refuse haulers and cement mixers) emit a greater proportion of SOX, NOX, COX pollutants than their passenger vehicle counterparts (e.g. cars and motorcycles).

Broadly, the impacts of freight are similar to the impacts of passenger transport systems and can be classified into three main sections:

1. **Economic** – The primary and perhaps the biggest share of loss stems from congestion on the roads. A study sponsored by Transport Corporation of India (TCI), estimates that the annual cost of delays to the Indian economy was INR 270 billion (USD 5.5 billion) (Mitra, 2012). The study also estimated that because of such delays, the road transport fleets utilises additional fuel consumption worth INR 600 billion (USD 12 billion) per annum. Even though the study focused on delay-related losses incurred in the complete supply chain of the product, it would be fair to assume that urban freight system will also by significantly affected.

Other economic losses may be due to (i) a decrease in operational efficiencies due to increased stoppage time at toll plaza’s or permit cycles, (ii) escalation in resource cost resulting from inflation, (iii) banning heavy goods vehicles in urban areas, and (iv) restrictions on the times of delivery and pick up.

2. **Social** – Social impacts of urban freight include (i) side effects of the above mentioned pollution on public health and the loss of livelihoods, (ii) the injuries and deaths resulting from traffic accidents, (iii) noise pollution (vibrations), (iv) visual intrusion, and (v) other quality of life issues, including the loss of greenfield sites and open spaces in urban areas as a result of transport infrastructure developments.

3. **Environmental** – Environmental impacts encompass (i) the emission of greenhouse gases like CO2 (the road freight sector emits over 50% of all CO2 road transport related emissions in India), (ii) too much reliance on non-renewable fossil fuels, (iii) the dispersion of automobile waste products such as oils and tyres, and (iv) the conversion of urban land into transport infrastructure.

As noted by Plowden (1995), “Freight transport is essential to the modern economy. An efficient system must provide the customer with a good service at a reasonable cost.”

However, increasing congestion levels in urban areas have called into question our ability to achieve high levels of efficiency and as the FTA (2003) rightly observed:

“While industry has achieved significant success in improving vehicle productivity and utilisation, urban congestion imposes major constraints on further improvements.”

Despite its importance there has been a general lack of active research looking into urban freight transport issues. The majority of past and recent studies have focused on the safety side of transportation using HCVs, vehicle efficiency and/or promoting eco-driving techniques. Moreover, urban freight transport has been ignored to a larger extent during city development planning exercises. As a result, there is a complete lack of knowledge, statistical information and, more

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[1] Light commercial vehicles, or LCVs, are generally classified as those vehicles that have a Gross Vehicle Weight (GVW) of up to 7.5 metric tonnes.

[2] Heavy commercial vehicles, or HCVs, are generally classified as those vehicles that have a GVW of above 16.2 metric tonnes.
importantly, a lack of awareness about the contribution of urban freight transport to the development of sustainable urban areas.

1.6 Purpose of the study

The aim of the study is to document existing practices and measures related to the urban section of the goods movement across India. That way, this desk study attempts to determine whether a meaningful and reasonable urban goods movement action plan has been implemented across different cities in India, and to assess its extent and form.

The study’s objectives can be classified into two parts:

- To review existing and planned practices and measures for an efficient urban goods movement at the city and national level, but particularly focus on the local level where practical implementation is undertaken;
- To provide conclusions and practical recommendations for making the urban freight distribution system more sustainable.

The overall objective of this study is rooted within the vision of the National Urban Transport Policy (NUTP, 2006) “to make our cities liveable and enable them to become the ‘engines of economic growth’ that power India’s development in the 21st century”. This means identifying measures and promoting strategies for the complete supply chain of goods distribution in urban areas, which maximise the economic efficiency, while minimising its impact on environmental and social dimensions.

1.7 Scope of study

The geographic scope of the study consists of the Union of India and includes best practices and measures adopted in different Indian cities.

We assume that the majority of the urban freight activity (from the warehouse to the end consumers) is completed using surface roads and the study thus focuses on surface transport modes.

1.8 Approach and methodology

The urban freight sector in India is predominantly operated by the private sector or by private entrepreneurs. Therefore, it is important to understand the private sector perspective and examine the economic drivers

Figure 4: Vegetables carried by farmers to nearest city market. Jamshedpur. © Vedant Goyal
for optimising the urban freight distribution system. A brief consultation with public and private organisations performing in the freight sector thus complements the research in order to better understand the reality of and experiences in securing and establishing a sustainable urban freight distribution network.

In India, the urban freight sector is highly competitive in nature, as it involves a large number of private operators. Many of the operators specialise in transporting only one category of goods. The freight operators usually respond to any fluctuation in the markets either by changing their strategy towards goods distribution and/or passing the risk directly onto the consumer in the form of monetary costs. It thus becomes necessary to firstly understand the distribution system, followed by broadly categorising the market sector before ultimately framing general measures.

In the end, the recommendation made should not be biased and should not offer any advantage position to the operator based on its operating strength or the market in which it serves (MDS Transmodal Limited, 2012).

Following is the list of the market categories that this document investigates:

- Retail Industry;
- Express, courier and post industry;
- Hotel, restaurant and catering industry;
- Construction industry;
- Waste management industry.

1.9 Structure of the report

The report is divided into eight chapters. Chapter 2 explains the complex relationship between urban development and goods transportation in cities. It provides a brief overview of the urban development and goods movement in India. Chapter 3 provides an overview of each of the negative externalities of moving urban goods and discusses its impacts on urban dwellers. Chapter 4 mentions the approaches that could be adopted, and highlights side effects of urban goods movement through an active dialogue between both public and private sector stakeholders. Chapter 5 focuses on the sources of demand for urban freight movement and its supply in terms of the main distribution practices that can be observed in urban areas. It provides an overview of each sector, the existing logistical practises alongside challenges faced by the sector in terms of urban goods movement. Chapter 6 draws attention to practises that have been successfully adopted within the urban goods movement framework in India and which are sustainable in nature. Chapter 7 describes ways in which cities can respond effectively to the requirements of modern urban economies thus resulting in reduced local conflicts between economic, social and environmental issues. Ultimately, Chapter 8 highlights the role of national/state governments towards making the urban goods movement greener. Quoting selected examples from around the world this final chapter explains different ways in which the environmental impacts of the urban goods movement operations could be minimised.
The relationship between urban development and goods transportation is complex in nature. It is difficult to say whether movement of goods leads to urban development or concentration of people at one particular place develop the need to transport goods from one point to another.

2.1 The history of urban developments and freight

Historically, civilisation has flourished near places that allow society to access trade. Most of the early human settlements were located near water to allowed merchandise to be transported in an easy and efficient manner. Cities like Varanasi, Patna, Agra, Kanpur, Delhi, Allahabad, and Madurai — all at the centre of the economic, social, cultural and religious life of the Indian people — later developed as key trade centres enabled by water transport gateways and easy access to tradesmen, shops, and warehouses.

During the colonial era, port cities like Mumbai, Kolkata and Chennai began to flourish as they allowed easy access to sea-going vessels to the Indian peninsula as well as inland waterways. With the expansion of the rail network, fortified factories with dwellings for merchants and other facilities developed in the vicinity of existing settlements. These hybrid cities attracted more commercial opportunities and thus became the central points for offering amenities such as entertainment, medical, transportation and postal services. Because early freight and service delivery modes were pedestrian or horse-powered, prominent citizens tended to live near services in the city centre.

2.2 Urban goods movement

The world is witnessing a long-term migration of people from rural to urban areas, leading to even greater concentrations of people residing in already saturated and densely populated urban areas (UNFPA, 2014). In 2009, the number of people living in urban areas (3.42 billion) surpassed the number living in rural areas (3.41 billion) as a majority of the world’s population now lives in cities (UN, 2014).

In general, freight transport is less likely to be influenced by urban form factors than passenger journeys, both differ in nature of the operations and their purpose. While passenger journeys are decided on (in terms of origin and destination, mode, timing and frequency of travel) by individuals for a multitude of reasons, freight journeys have a single purpose of transporting goods from one point in the supply chain to another.

Allen & Browne, Considering the relationship between freight transport and urban form, 2010

In 2014, the world population was 7.25 billion people, of which the global urban population comprised 3.9 billion (UN, 2014). The Population Division of the United Nations Department of Economic and Social Affairs predicts that the urban population will increase to 6.4 billion by 2050, with 37% of that growth to come from three countries: China, India and Nigeria (UN, 2014; UNFPA, 2014).

There are multiple diverse definitions of what comprises an urban area. According to the Census in India, an urban area is defined as follows (Census India, 2011):  
1. All places with a municipality, corporation, cantonment board or notified town area committee, etc.
2. All other places which satisfied the following criteria:  
   a. A minimum population of 5,000;
   b. At least 75% of the male main working population engaged in non-agricultural pursuits; and
   c. A density of population of at least 400 persons per km².

Regardless of how the term ‘urban’ is defined around the world, all towns and cities require supply of goods and services, and the removal of waste products and hence are dependent on urban freight transport. The capacity of urban transportation infrastructure in Indian cities has not been able to keep up with the rate of urban development. The urban design and regulations have also
failed to keep pace with the growing demand for goods and services. Thus the challenge is to develop an efficient goods distribution system, which adapts to the environmental, social and economic changes.

2.3 How goods move

Once urban areas start to get commercialised, efficient movement and management of goods becomes part of a business function. The logistic business continues to evolve towards a more integrated process, which attempts to link the previously independent functions such as material sourcing and procurement, manufacturing, inventory management, distribution, and transport. As the science of logistics evolved into what is known as supply chain management today, businesses re-focused from just delivering products to reducing inventory and contributing to a company’s bottom line (Rhodes, et al., 2010).

The Indian logistics industry has come a long way from being a labour-intensive system during 60’s to the present technology-oriented system that provides a wide range of logistics services. The concept of third party logistics companies (3PL)[3] is in a nascent stage in India. Traditionally, manufacturing companies in India used to manage their own logistics requirements in-house. Nowadays, Indian organisations have begun to outsource those operations. Subsequently basic services such as transportation and warehousing are primarily outsourced to different service providers also known as the Second-Party Logistics (2PL) service providers. Due to an increasing demand, the service providers started offering integrated services together with other value-added services, while the organisations focus on the core competencies and streamline their supply chain (Chandra & Jain, Indian Institute of Management Ahmedabad, 2007).

2.4 Who is moving your goods?

Except of a few urban services such as waste removal, private-sector companies have taken on the distribution of most of the goods and services. The private-sector freight services differentiate between private and for-hire services. Private providers own and operate their own transport fleets to move products. Most private carriers operate truck fleets; however, some industries (such as mining companies, agricultural businesses, or producers of time-sensitive products) may also operate their own railroad or road line assets, or aircraft services (Rhodes, et al., 2010). The Indian freight service providers are highly fragmented, often consisting of very small companies, often also in the form of small family businesses.

Businesses that exist for the sole purpose of providing transportation services are classified as for-hire carriers. For-hire carriers include trucking companies, railroads, ship operators, and air cargo providers that move freight for various businesses and industries (Rhodes, et al., 2010).

The growing Indian economy has put enormous pressures on existing physical infrastructure like roads, ports, water, power, etc. It has resulted in logistic service infrastructure having to perform beyond its capabilities. The pressure has also led to an adoption of innovative practices, which support higher growth rates. The focus is now towards the provision of integration of the transport services, i.e. the ability to smoothly transition freight shipments from one mode to another.

The concept of intermodal freight transportation draws its success from economic synergies gained by integrating the best attributes of each individual mode. Working together, each mode performs most efficiently the task it does best. Typically, railroad transportation costs less and is more fuel-efficient than trucking over long distances (e.g. the movements between ports and the urban area). Railroads frequently move shipments between urban centres, or between a major port/site and an urban/economic centre. Trucks then deliver the shipment directly to the receiver’s facility. Light commercial vehicles (LCVs) and Medium commercial vehicles (MCVs[4]), with their greater flexibility and universal access to industrial and commercial locations, are used for the last mile of the supply chain.

---

[3] A 3PL provider is a company which supplies and/or co-ordinates logistics functions across multiple links in the supply chain. The company acts as a “third party” facilitator between seller/manufacturer (the “first party”) and buyer/user (the ‘second party’).

[4] Medium commercial vehicles, or MCVs, are generally classified as those vehicles that have a GVW between 7.5 and 16.2 metric tonnes.
Joint services offered by more than one mode take advantage of each mode’s inherent economy; however are much more complicated than single-mode movements because of the specialised equipment, terminals, and coordination among multiple parties that is required.

Figure 5 illustrates the relationship between costs and service levels associated with a spectrum of common freight transport modes (Rhodes, et al., 2010).

Figure 5: Cost/Performance Relationships for Inland Freight Transportation Modes. ©Zumerchik, Rodrigue & Lanigan, 2011

2.5 What moves: supplying urban populations

In India, the efforts for integrated investment planning in the transport sector has always been handicapped by the lack of up-to-date performance level data for major mechanised modes of transport. To address this deficiency, the Planning Commission has undertaken ‘total transport system studies (TTSS)’ since 1978, which provide important inputs for their respective five-year plans. The TTSS conducted in the year 2007–2008 acted as a base-input to the 12th Five Year Plan (Planning Commission, 2014).

The 2007–08 total transport system study summarises and analyses commodity-wise traffic flows by major mechanised modes of transport, namely railways, highway, coastal shipping and airways. Table 1 provides details of the top 21 commodities transported by road. Careful analysis of the type of commodities carried indicates that most of the daily-required products, such as household goods, grams & pulses, electrical goods, milk products, heavy machinery, tractors, and paper products are transported on roads. The share of eleven commodities is over 95% of the total individual commodity flow. However, it needs to be noted here that miscellaneous good items (including an assortment of goods, generally termed as “parchun”) appear the highest in terms of volume, though lower than the commodities listed above in terms of percentage share of total commodity traffic by all modes.

2.6 Why freight moves: supporting the new economy

In recent decades, the Indian economy has undergone a significant structural shift: in the early 1980s,
### Table 1: Top 21 commodities by volume moved by road and comparative rail share

<table>
<thead>
<tr>
<th>#</th>
<th>Commodity name</th>
<th>Total (all modes)</th>
<th>Modal share</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Million tonnes</td>
<td>Road</td>
<td>Rail</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Million</td>
<td>% of total</td>
<td>Million</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>tonnes</td>
<td></td>
<td>tonnes</td>
</tr>
<tr>
<td>1</td>
<td>Parcels, Misc, Others</td>
<td>227.17</td>
<td>201.59</td>
<td>88.70</td>
<td>22.29</td>
</tr>
<tr>
<td>2</td>
<td>POL Products (Liquid)</td>
<td>189.56</td>
<td>128.14</td>
<td>67.60</td>
<td>35.13</td>
</tr>
<tr>
<td>3</td>
<td>Building Materials</td>
<td>121.13</td>
<td>116.08</td>
<td>95.83</td>
<td>5.05</td>
</tr>
<tr>
<td>4</td>
<td>Iron &amp; Steel (all types)</td>
<td>134.49</td>
<td>107.18</td>
<td>79.69</td>
<td>27.31</td>
</tr>
<tr>
<td>5</td>
<td>Provision &amp; household goods</td>
<td>80.93</td>
<td>80.75</td>
<td>99.77</td>
<td>0.19</td>
</tr>
<tr>
<td>6</td>
<td>Cement and cement structures</td>
<td>157.86</td>
<td>75.98</td>
<td>48.13</td>
<td>78.83</td>
</tr>
<tr>
<td>7</td>
<td>Fruits and vegetables</td>
<td>71.81</td>
<td>69.83</td>
<td>97.37</td>
<td>1.89</td>
</tr>
<tr>
<td>8</td>
<td>Coal</td>
<td>415.37</td>
<td>68.35</td>
<td>16.46</td>
<td>331.77</td>
</tr>
<tr>
<td>9</td>
<td>Containers (loaded &amp; empty)</td>
<td>85.44</td>
<td>56.60</td>
<td>66.25</td>
<td>27.09</td>
</tr>
<tr>
<td>10</td>
<td>Rice (all types)</td>
<td>69.54</td>
<td>47.12</td>
<td>67.76</td>
<td>22.43</td>
</tr>
<tr>
<td>11</td>
<td>Chemicals (powder and liquid)</td>
<td>34.91</td>
<td>33.80</td>
<td>96.82</td>
<td>1.11</td>
</tr>
<tr>
<td>12</td>
<td>Grams &amp; pulses</td>
<td>33.84</td>
<td>33.21</td>
<td>98.14</td>
<td>0.63</td>
</tr>
<tr>
<td>13</td>
<td>Wood, timber, plywood</td>
<td>33.91</td>
<td>32.77</td>
<td>96.64</td>
<td>1.14</td>
</tr>
<tr>
<td>14</td>
<td>Heavy machinery &amp; Agr. Equip</td>
<td>31.17</td>
<td>31.09</td>
<td>99.74</td>
<td>0.08</td>
</tr>
<tr>
<td>15</td>
<td>Wheat and wheat flour</td>
<td>41.67</td>
<td>29.36</td>
<td>40.46</td>
<td>12.31</td>
</tr>
<tr>
<td>16</td>
<td>Milk &amp; products</td>
<td>27.72</td>
<td>27.64</td>
<td>99.75</td>
<td>0.07</td>
</tr>
<tr>
<td>17</td>
<td>Edible Oils</td>
<td>26.36</td>
<td>25.26</td>
<td>95.86</td>
<td>1.09</td>
</tr>
<tr>
<td>18</td>
<td>Granite, marbles &amp; other stores</td>
<td>31.97</td>
<td>25.18</td>
<td>78.76</td>
<td>6.79</td>
</tr>
<tr>
<td>19</td>
<td>Electricals (incl. wires)</td>
<td>23.35</td>
<td>23.33</td>
<td>99.96</td>
<td>0.01</td>
</tr>
<tr>
<td>20</td>
<td>Iron ore</td>
<td>154.68</td>
<td>23.30</td>
<td>15.06</td>
<td>121.80</td>
</tr>
<tr>
<td>21</td>
<td>Paper &amp; paper products</td>
<td>21.39</td>
<td>21.02</td>
<td>98.27</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td><strong>Sub-total</strong></td>
<td><strong>2,014.27</strong></td>
<td><strong>1,257.59</strong></td>
<td><strong>62.43</strong></td>
<td><strong>697.38</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total all commodities</strong></td>
<td><strong>2,386.97</strong></td>
<td><strong>52.69</strong></td>
<td><strong>29.22</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: RITES, 2012
agriculture was the leading sector of the Indian economy. Nowadays, the agricultural and allied activities are declining with the share of Gross Domestic Product (GDP) shrinking to 17.5% in 2011–12, compared to 18.3% in the year 2007–08. The service sector which includes construction, telecommunications, software and information technologies, infrastructure, tourism, education, health care, travel, trade, and banking industries is growing the fastest and has a larger percentage share of GDP. The manufacturing industry has held a constant share of its economic contribution.

An efficient movement of transport goods and service has played a significant role in such a turnaround. The logistics revolution, combined with public and private transportation investment, has allowed businesses to reduce inventories, while simultaneously achieving greater economies of scale in a globally competitive environment. These dual efficiency gains for the business are only possible because of efficient transportation. Inventory reduction is often supported by increased shipments to reduce the possibility of stock shortfalls, leading to more transportation services. In order to lower transportation costs, firms consolidate production and distribution facilities from many to few, but consolidation then results in a longer average length of shipment haul.

Thus economies of scale are achieved only at the expense of more frequent transportation services (Lakshmanan, Anderson, & January, 2002).

Average lead-distance\(^{[5]}\) (in km) of the 52 commodities by the four modes under study are given in Table 2. In the case of railways, 23 out of 52 commodities display lead-distances of more than 1,100 km. The lowest lead is that of sugar cane (88 km) and the highest one (2,489 km) relates to Tyre & Tubes. The overall lead for 52 commodities using rail is 661 km. In the case of road transport, the lowest lead is of sugar cane (136 km) and the highest (810 km) for cars/vans. In India, the average lead – distance is 453 km compared to 67 km in China (Kumar, 2014). This provides ample scope for rebalancing the modal freight choice and providing efficient multimodal alternatives.

\(^{[5]}\) Lead-distance — Distance travelled by the freight vehicle to transport goods from the point of origin to its destination. It is essential variable which helps in determining the productivity of transport operation.
<table>
<thead>
<tr>
<th>#</th>
<th>Commodity</th>
<th>Mode wise average leads (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rail</td>
</tr>
<tr>
<td>1</td>
<td>Rice (All Types)</td>
<td>1,294</td>
</tr>
<tr>
<td>2</td>
<td>Wheat and Wheat Flour</td>
<td>1,375</td>
</tr>
<tr>
<td>3</td>
<td>Other Food grains</td>
<td>895</td>
</tr>
<tr>
<td>4</td>
<td>Grams &amp; Pulses</td>
<td>1,261</td>
</tr>
<tr>
<td>5</td>
<td>Sugar and Khandsari</td>
<td>997</td>
</tr>
<tr>
<td>6</td>
<td>Sugar Cane</td>
<td>88</td>
</tr>
<tr>
<td>7</td>
<td>Oil Seeds (All Types)</td>
<td>1,155</td>
</tr>
<tr>
<td>8</td>
<td>Cotton (Raw &amp; Mfd)</td>
<td>1,633</td>
</tr>
<tr>
<td>9</td>
<td>Jute and Coir (Raw &amp; Mfd)</td>
<td>1,585</td>
</tr>
<tr>
<td>10</td>
<td>Rubber (Raw &amp; Products)</td>
<td>1,888</td>
</tr>
<tr>
<td>11</td>
<td>Fodder</td>
<td>1,742</td>
</tr>
<tr>
<td>12</td>
<td>Fruits and Vegetables</td>
<td>1,653</td>
</tr>
<tr>
<td>13</td>
<td>Tea and Coffee</td>
<td>478</td>
</tr>
<tr>
<td>14</td>
<td>Tobacco &amp; Products</td>
<td>250</td>
</tr>
<tr>
<td>15</td>
<td>Wood, Timber, Plywood, etc.</td>
<td>737</td>
</tr>
<tr>
<td>16</td>
<td>Iron Ore</td>
<td>437</td>
</tr>
<tr>
<td>17</td>
<td>Ores other than Iron</td>
<td>478</td>
</tr>
<tr>
<td>18</td>
<td>Coal</td>
<td>581</td>
</tr>
<tr>
<td>19</td>
<td>POL Products (Liquid)</td>
<td>658</td>
</tr>
<tr>
<td>20</td>
<td>Coal tar and Bitumen</td>
<td>1,204</td>
</tr>
<tr>
<td>21</td>
<td>Limestone &amp; Dolomite</td>
<td>676</td>
</tr>
<tr>
<td>22</td>
<td>Salt</td>
<td>1,452</td>
</tr>
<tr>
<td>23</td>
<td>Granite, Marbles &amp; other stones</td>
<td>331</td>
</tr>
<tr>
<td>24</td>
<td>Cement and Structures</td>
<td>557</td>
</tr>
<tr>
<td>25</td>
<td>Building materials</td>
<td>327</td>
</tr>
<tr>
<td>26</td>
<td>Chemical Manures &amp; Fertilisers</td>
<td>834</td>
</tr>
<tr>
<td>27</td>
<td>Iron &amp; Steel (All Types)</td>
<td>936</td>
</tr>
<tr>
<td>28</td>
<td>Metals other than Iron &amp; Steel</td>
<td>575</td>
</tr>
<tr>
<td>29</td>
<td>Edible Oils</td>
<td>1,519</td>
</tr>
<tr>
<td>30</td>
<td>Chemicals (All Types)</td>
<td>943</td>
</tr>
<tr>
<td>31</td>
<td>Paints &amp; Dyes</td>
<td>758</td>
</tr>
<tr>
<td>32</td>
<td>Electricals (Incl. Wires)</td>
<td>810</td>
</tr>
<tr>
<td>33</td>
<td>Cloths</td>
<td>1,629</td>
</tr>
<tr>
<td>34</td>
<td>Leather &amp; Goods (Incl. Bones)</td>
<td>564</td>
</tr>
<tr>
<td>35</td>
<td>Gas Cylinder – All Types</td>
<td>151</td>
</tr>
<tr>
<td>36</td>
<td>Paper &amp; Paper Products</td>
<td>2,044</td>
</tr>
<tr>
<td>37</td>
<td>Plastic &amp; Plastic Goods</td>
<td>2,070</td>
</tr>
<tr>
<td>38</td>
<td>Car, Vans, etc.</td>
<td>2,025</td>
</tr>
<tr>
<td>39</td>
<td>Cycle &amp; Cycle Parts</td>
<td>729</td>
</tr>
<tr>
<td>40</td>
<td>Heavy Machinery (Agriculture Equip.)</td>
<td>1,345</td>
</tr>
<tr>
<td>41</td>
<td>Three Wheelers</td>
<td>739</td>
</tr>
<tr>
<td>42</td>
<td>Two Wheelers</td>
<td>728</td>
</tr>
<tr>
<td>43</td>
<td>Tyre and Tubes</td>
<td>2,489</td>
</tr>
<tr>
<td>44</td>
<td>Spare Parts (All Types)</td>
<td>1,763</td>
</tr>
<tr>
<td>45</td>
<td>Empty Tins, Bottles, Drums, etc.</td>
<td>311</td>
</tr>
<tr>
<td>46</td>
<td>Provisions &amp; Household Goods</td>
<td>2,095</td>
</tr>
<tr>
<td>47</td>
<td>Containers (Loaded &amp; Empty)</td>
<td>1,250</td>
</tr>
<tr>
<td>48</td>
<td>Fish/Egg/Meat</td>
<td>476</td>
</tr>
<tr>
<td>49</td>
<td>Livestock</td>
<td>1,529</td>
</tr>
<tr>
<td>50</td>
<td>Milk &amp; Products</td>
<td>2,223</td>
</tr>
<tr>
<td>51</td>
<td>Scrap (All Metals)</td>
<td>1188</td>
</tr>
<tr>
<td>52</td>
<td>Parcels, Misc, Others, etc.</td>
<td>720</td>
</tr>
</tbody>
</table>

Average of all modes 661 453 1,450 545

(RITES, 2012)
Table 3: Comparative overview of inter-regional transport output along with average leads (km)

<table>
<thead>
<tr>
<th>Years</th>
<th>Total interregional traffic (btkm)</th>
<th>Railways</th>
<th>Highways</th>
<th>Coastal shipping</th>
<th>Airways</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Traffic</td>
<td>Average lead (km)</td>
<td>Traffic</td>
<td>Average lead (km)</td>
</tr>
<tr>
<td>1977–78</td>
<td>189</td>
<td>150</td>
<td>(79.2)</td>
<td>810</td>
<td>34</td>
</tr>
<tr>
<td>1986–87</td>
<td>299</td>
<td>100</td>
<td>(66.5)</td>
<td>778</td>
<td>91</td>
</tr>
<tr>
<td>2007–08</td>
<td>1,300</td>
<td>508</td>
<td>(39.1)</td>
<td>661</td>
<td>706</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Note: Figures in parentheses indicate percentage modal share.

A comparison of the average leads of freight traffic by rail and road is presented in Table 3. The average lead of freight traffic by rail has declined over time while it has increased for road. However, the average lead by rail is still higher than that of road and rail transport is preferred for long haulage. At the same time, the average lead in trucking has increased nearly 12% between 1986–87.

While the study doesn’t further classify leads for long-distance and short-distance, it would be safe to assume that in many cases urban land-use decisions have also pushed road goods terminals and distribution hubs further out on the fringes of cities, thereby increasing the distance required to supply business in the urban core.

It is the responsibility of shippers to contemplate how goods will move, and what mode(s) can be used to get goods from the production site to where they are consumed. As goods can be transported by air, water, pipeline, and largely by truck or train, selecting a mode for how goods move becomes a function of multiple factors, including time required, network availability, and total logistical costs incurred. The total logistical cost also depends upon several different factors: kilometres travelled (lead traffic), weight of the goods, packaging and product handling, number and size of shipments, customer preference, and shipment value.

Much of the goods movement in urban areas essentially consists of short- to medium-distance trips. In order to avoid the congested citywide road network, and parking or route restrictions, many of the freight operators place their warehouses and distribution facilities in or near urban areas.

The majority of goods within urban areas are transported by trucks, tempo trucks and minivans, two-wheelers, and bicycles – especially for the final stages of goods moving to consumption. In general, manufacturing plants and distribution facilities in mega cities like Delhi or Mumbai receive large shipments by rail, ships, jet, or pipeline, which are then delivered by truck for the so-called “last mile” of the delivery. Similarly, package couriers are using passenger vehicles such as cars, bikes or rail (EMU) services in core and densely populated areas.

Broadly speaking, urban truck traffic can be sub-divided into different types based on the origin and destination of the journey and the purpose of the trip:

- Journeys to an urban area from elsewhere;
- Journeys from an urban area to elsewhere;
- Journeys within an urban area;
- Journeys that do not start or finish in an urban area but which pass through it (i.e. transit journeys – these have become less common over time due to the construction of bypasses, highways and express roads);
- Construction and emergency vehicles (e.g. cement mixers, dump trucks, construction cranes, fire brigade);
Utility and other residential service vehicles (e.g. garbage/waste collection trucks).

Much of the urban goods traffic falls within business-to-business (B2B) activities, which utilise the city-wide road network and thus contribute towards the changes within an urban environment. In addition to population density, goods movements in the urban environment are also directly dependent on the level of economic activity taking place in a region.

2.7 Where freight moves in the city — “the last mile”

Before a finished product is made commercially available, its raw materials and other components travel through various stages such as production, processing, warehousing, or distribution before arriving at the final destination, i.e. the place of consumption. The “last mile” — or, more accurately, the first and the last mile — is what distinguishes urban goods movement from other categories of goods movement. The majority of ‘places of consumption’ are concentrated in the urban area. Typically, urban freight/goods movement is all about moving goods efficiently into dense mixed-use areas, which requires an optimum number of shipments organised onto the smallest vehicles possible. Furthermore, movements include pickups and deliveries that are vertical as well as horizontal. Goods must travel vertically to high-rise office buildings and rooftop restaurants, as well as, horizontally on sub-urban trips to deliver or pick-up consignments while managing road congestion (Rhodes, et al., 2010).

Urban goods deliveries to commercial areas – restaurants, residences, offices, and departmental stores – also share similar patterns. Getting the goods to their final destination often presents difficulties such as high-rise buildings with limited docking sites, delivery bays, and absence of dedicated freight elevators (Rhodes, et al., 2010). Narrow streets with a tight turning radius and low clearances are common obstacles for delivery drivers (Rhodes, et al., 2010).

From a transport planning perspective, the horizontal and vertical “last mile” inefficiencies need to be minimised. Providing kerbside space can provide a solution to increased congestion arising because of delivery trucks blocking traffic while searching for parking space. Furthermore, parking issues can be addressed by restricting the length of time for which a vehicle can park, proper enforcement, and the introduction of a variable daytime parking fee. However, given that parking reforms are politically motivated, these trends are difficult to properly implement. An alternative could be to update the design standards in order to match loading docks to existing and newly designed truck configurations. Introducing and enforcing standards could address vertical obstacles, such as inadequate freight elevators (Rhodes, et al., 2010).

To accommodate the increasingly tight confines of road geometrics in dense “last mile” urban areas, trucking companies often use smaller or more agile truck configurations (Rhodes, et al., 2010).

The following shows types of trucks found in the Indian truck industry:

- Haulage trucks: heavy-duty carriers used to carry parcels, and courier items. May be used to transport cars, two- and three-wheelers, bricks, sand and coal, or as water/petrol tankers.
- Rigid trucks: used as transit mixers, containers, acid tankers, recovery trucks, self-loading cranes and even as liquefied petroleum gas containers.
- Tippers: robust vehicles used for tipping operations in industries such as construction and building, mining and quarrying industry, and the public service sector. They can be used for on- or off-highway needs.
- Dumpers: trucks used by municipal corporations and the building industry.
- Cabs, utility vehicles, delivery vans and trailer trucks: used to carry goods.

Furthermore, commercial vehicles could also be classified into following categories:

- Light Commercial Vehicles (LCVs) (Gross Vehicle Weight < 7.5 tonne); and
- Medium & Heavy Commercial vehicles (M&HCVs) (Gross Vehicle Weight > 7.5 tonne).

The classification can also be based on aligned as per SIAM weight categories [6]. Segmentation of buses and trucks as per SIAM classification, major applications of vehicles and the key players in each category are shown in Table 4:

---

[6] SIAM classifies and collects data for commercial vehicles by sub-dividing them into finer weight categories.
Table 4: Segmentation of trucks/goods carriers by Gross Vehicle Weight (GVW)\(^1\)

<table>
<thead>
<tr>
<th>Vehicle categories</th>
<th>Application</th>
<th>Key players</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Light Commercial Vehicles (LCVs)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5 ≤ MM</td>
<td>Intra-city goods transportation</td>
<td>1. Tata Motors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Force Motors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Mahindra and Mahindra</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Hindustan Motors</td>
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<tr>
<td></td>
<td></td>
<td>5. Piaggio Vehicles</td>
</tr>
<tr>
<td>3.5 &lt; MM ≤ 5</td>
<td>Inter-city and intra-city goods transportation (Daily delivery load – milk</td>
<td>1. Tata Motors</td>
</tr>
<tr>
<td></td>
<td>and fruit crates, vegetables, bottled water)</td>
<td>2. Ashok Leyland</td>
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<tr>
<td></td>
<td></td>
<td>3. Mahindra &amp; Mahindra</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Force Motors</td>
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<tr>
<td></td>
<td></td>
<td>5. SML Isuzu</td>
</tr>
<tr>
<td>5 &lt; MM ≤ 7.5</td>
<td>Intra-city buses for school, staff and executives</td>
<td>1. Tata Motors</td>
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<tr>
<td></td>
<td></td>
<td>2. Force Motors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Mahindra &amp; Mahindra</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. VE CVs – Eicher</td>
</tr>
<tr>
<td><strong>Medium &amp; Heavy Commercial Vehicles (M&amp;HCVs)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.5 &lt; MM ≤ 10</td>
<td>Parcel &amp; courier, intercity logistics, agri-perishables</td>
<td>1. Tata Motors</td>
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<tr>
<td></td>
<td></td>
<td>2. Ashok Leyland</td>
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<tr>
<td></td>
<td></td>
<td>3. Mahindra &amp; Mahindra</td>
</tr>
<tr>
<td></td>
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<td>4. VE CVs – Eicher</td>
</tr>
<tr>
<td>10 &lt; MM ≤ 12</td>
<td>Parcel &amp; courier, intercity logistics, agri-perishables</td>
<td>1. Tata Motors</td>
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<tr>
<td></td>
<td></td>
<td>2. Ashok Leyland</td>
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<tr>
<td></td>
<td></td>
<td>3. Mahindra &amp; Mahindra</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. VE CVs – Eicher</td>
</tr>
<tr>
<td>12 &lt; MM ≤ 16.2</td>
<td>Intra-city distribution, market load, construction</td>
<td>1. Tata Motors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Ashok Leyland</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Mahindra &amp; Mahindra</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. VE CVs – Eicher</td>
</tr>
<tr>
<td>16.2 &lt; MM ≤ 25</td>
<td>Market load, construction, bulkers, minerals, tankers, stones, marble, re-fuellers</td>
<td>1. Tata Motors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Ashok Leyland</td>
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<tr>
<td></td>
<td></td>
<td>3. Mahindra &amp; Mahindra</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. VE CVs – Eicher</td>
</tr>
<tr>
<td>25 &lt; MM</td>
<td>Auto carriers, market load, cement, tankers, parcel &amp; white goods,</td>
<td>1. Tata Motors</td>
</tr>
<tr>
<td></td>
<td>construction, bulkers, minerals, tankers</td>
<td>2. Ashok Leyland</td>
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<tr>
<td></td>
<td></td>
<td>3. Mahindra &amp; Mahindra</td>
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<tr>
<td></td>
<td></td>
<td>4. VE CVs – Eicher</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Daimler India Commercial Vehicles</td>
</tr>
</tbody>
</table>

\(^1\) Maximum Mass (MM) or Gross Vehicle Weight (GVW) is the vehicle rating based on the combined weight of the vehicle and its load.
3. Assessing the Environmental Impacts of Urban Goods Movement

The movement of goods from one point to another has a range of negative effects, primarily air pollution, noise, road accidents, road related traffic fatalities, land-encroachment and visual obstruction. This chapter provides an overview of each of these externalities and discusses how it impacts urban dwellers.

Broadly speaking, the negative externalities that get generated from goods movement can be classified into two types: first-order and second-order impacts. First-order impacts are those environmental impacts that get generated directly from the movement of freight transport, warehouse, and packaging and material handling operations. Second-order impacts arise indirectly from the freight operations.

For example, advances in logistics have facilitated the process of globalisation so that goods can now be sourced from places located thousand miles apart. To accommodate the subsequent growth of freight traffic in such areas, governments have expanded transport infrastructure and this has often encroached on sensitive environments. The increase in air-freight and other traffic resulting from global sourcing is a first-order effect, whereas the increase in infrastructure, such as road building in sensitive areas, is a second-order effect (Cullinane & Edwards, 2010).

The negative effects discussed in this chapter are limited to first-order impacts as they are the ones that are directly linked to the urban goods movement activity.

3.1 Environmental impacts

3.1.1 Atmospheric emissions

Emissions from freight transport largely depend on the type of fuel used. Due to the advancement of technology and production methods, various alternative fuels now exist. However, the main fuel used by goods vehicles continues to be diesel, with a relatively small amount of goods moved by petrol-engine vehicles.

Trucks (HCVs) and passenger vehicles (LCV) emit pollution mainly because the combustion process in their engines is incomplete. Diesel and petrol contain both hydrogen and carbon. If perfect combustion could be achieved, 100% of the hydrogen would be converted into water and all the carbon into CO₂. However, because combustion is not complete, tailpipe emissions of pollutants such as hydrocarbons, carbon monoxide and nitrogen oxides result (Holmen & Niemeier, 2003).

Apart from Mumbai and, to a certain extent, Chennai and Kolkata, negligible amounts of urban goods are moved by electrically powered road vehicles or on trains. Even in the cities mentioned above, the pollutants are not emitted inside the urban area but at the point where the electricity is generated. In a country like India, where electricity is still predominantly produced using fossil fuels, the carbon intensity of electrified rail freight services still remains relatively high. In contrast, countries like France and Switzerland, where only small proportion of electricity is produced using fossil fuels, have very low carbon intensity (IRU, 2002).

Likewise, diesel and petrol – the two dominant fossil fuels used in urban goods movement – have damaging yet different environment impact properties. Compared to petrol, diesel engines emit more CO₂ per unit of energy, but because they are more energy efficient, the overall impact of diesel engines on CO₂ emissions is less than that of an equivalent petrol engine (Schipper & Fulton, 2003). However, diesel engines emit much higher levels of particulate matter (PM₃₅) and nitrogen oxides (NOₓ) than an equivalent petrol-powered engine (Holmen & Niemeier, 2003).

In India, levels of particulate matter (PM₃₅) concentration—a deadly form of pollution—are five times the levels recorded in the U.S. According to a World Health Organization (WHO) report released in May 2014, Delhi’s particulates pollution was almost three times higher than Beijing’s between 2008 and 2013. Effectively regulated and managed freight transportation, could then potentially improve living conditions of hundreds of millions of Indians living in urban areas.
The pollutants emitted by transport vehicles can be divided into local, regional, and global effects (see Table 5). As the classification suggest, local pollutants remain close to the source of the emission, while regional effects can occur far away from the source of the emission (like in the previous example of electricity generation and distribution) and affect may have a wider geographical coverage, sometimes spanning several adjoining countries.

Greenhouse Gas (GHG) emissions, however, affect the global atmosphere. The same pollutants, such as sulphur dioxide or nitrogen dioxide, can have an adverse effect on the environment over differing distance ranges.

### 3.1.2 Global effects of atmospheric pollution

According to the United Nations Inter-Governmental Panel on Climate Change (UN IPCC, 2007), ‘greenhouse gases are the gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the Earth’s surface, the atmosphere itself, and by clouds’ (2007: 82). The greenhouse effect arises because some gaseous compounds in the atmosphere are capable of absorbing infrared radiation, thereby trapping and holding heat in the atmosphere. By increasing the amount of greenhouse gases emitted into the atmosphere, human are augmenting the natural greenhouse effect, thus ultimately causing global warming.

At a global level, the transport sector accounts for 23% of all energy related CO2 emissions in 2007. In India, transport accounted for 7.5% of the national overall GHG emissions in 2007. Another study of CO2 emissions carried out by a Delhi based organisation Centre for Science and Environment (CSE) has depicted that the emissions of CO2 on Indian roads is expected to reach a value of 1,212 million tonnes during 2035 from a value of 208 million tonnes during 2005 (CPCB, 2012).

### 3.1.3 Regional effects of atmospheric pollution

The two main examples of air pollution extending over extensive areas are (Cullinane & Edwards, 2010):

- **Acid rain** – In simple words, Acid Rain is acid mixed with rainwater. Some acidic gases mixed in air such as sulphur dioxide or oxides of nitrogen produce various acids from a prolonged reaction with oxygen and the moisture of air. When there is rain, these acids (along with some suspended particulate substances) come down on the earth dissolved in rainwater and may render the soil or water of surface water bodies acidic. The effects of acid rain on the public health are dangerous in nature. Acid rain contains two acids

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**Table 5: Geographical extent of pollutant effects**

<table>
<thead>
<tr>
<th>Effect</th>
<th>PM</th>
<th>HM</th>
<th>NH3</th>
<th>SO2</th>
<th>NOx</th>
<th>NMVOC</th>
<th>CO</th>
<th>CH4</th>
<th>CO2</th>
<th>N2O</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Global</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GHG – indirect</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>GHG – direct</td>
<td></td>
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<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Regional</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acidification</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Photochemical</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Local</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

PM = particulates, HM = heavy metals, NH3 = Ammonia, SO2 = sulphur dioxide
NOx = Oxides of nitrogen, NMVOC = non-metallic volatile organic compounds
CO = carbon monoxide, CH4 = Methane, CO2 = carbon dioxide, N2O = Nitrous Oxide

Source: qtd. in Cullinane & Edwards, 2010
– sulphuric acid and nitric acid – which are harmful to the lungs and the respiratory system; they may cause lung cancer, and damage the digestive and nervous systems. The road and rail sectors contribute a very small proportion to total acid rain, mainly, as a result of the adoption of low and ultra-low-sulphur diesel in the trucking sector and, to a lesser extent, by rail freight companies.

**Photochemical smog** – is a type of air pollution derived from vehicular emission from internal combustion engines and industrial fumes that react in the atmosphere with sunlight to form secondary pollutants that also combine with the primary emissions to form photochemical smog. Photochemical smog is a serious problem in many cities and continues to harm senior citizens, children, and people with heart and lung conditions such as emphysema, bronchitis and asthma.

### 3.1.4 Local effects of atmospheric pollution

These effects are experienced in the immediate vicinity of the pollution source, where concentration levels are high.

- **Nitrogen oxides** (**NOₓ**): Nitric oxide and nitrogen oxide result from combustion at high temperatures where nitrogen and oxygen combine. Short-term health effects are rarely noticed but long-term exposure to fairly low levels can increase susceptibility to infections, pulmonary diseases, impairment of lung function, and eye, nose and throat irritations.

- **Hydrocarbons** (**CHₓ**): Hydrocarbons result from the incomplete combustion of organic materials. Included within this category are volatile organic compounds (**VOCs**). Many hydrocarbons, such as benzene, are known to be carcinogenic.

- **Particulate matters**: Particulates come in various sizes and from a variety of sources. In the case of vehicles, the majority take the form of soot emitted by diesel engines, particularly those that are badly tuned. Fine particulate matter may be toxic itself or may carry toxic (including carcinogenic) trace substance, and can alter the immune system. Fine particulates penetrate deep into the respiratory system irritating lung tissue and causing long-term disorders.

- **Carbon monoxide (CO)**: Carbon monoxide results from the incomplete combustion of carbon-based fuels. It binds well with haemoglobin, which carries oxygen around the body and thus reduces the circulation of oxygen (HPA, 2009). At low levels of exposure, perception and thought are impaired, but at high levels it can cause death (HPA, 2009). It has effects on the cardiovascular system, exacerbating cardiovascular disease symptoms, particularly angina. It might also particularly affect foetuses, sick, anaemic and young children, and affect the nervous system,

**Figure 7: Street scene in Delhi, India. © Manfred Breithaupt**
impeirng physical coordination, vision and judg-
ments, creating nausea and headaches, reducing pro-
ductivity and increasing personal discomfort

- **Sulphur dioxide (SO₂):** Fossil fuels, particularly diesel, contain sulphur. When they are burned in the engine, the remaining sulphur is converted into sulphur dioxide, an acidic gas which is then emitted through the exhaust pipe. It has adverse effects on lung functioning.

3.1.5 Noise pollution

Traffic-related noise pollution accounts for nearly two-thirds of the total noise pollution in an Indian urban area. Traffic noise on existing urban roadways lowers the quality of life and property values for areas near urban corridors. Thus, studying road traffic noise in big cities is an important issue. Due to limited availability of land resources and finances, many highways and important roads are located in residential and commercial areas. Hence there are some adverse and environmental effects including psychological and physiological effects on those living in proximity to these corridors.

3.1.6 Accidents

Every year, India incurs a loss of 55,000 crore\(^\text{[7]}\) due to road accidents, and “every year 1.37 lakh\(^\text{[8]}\) people die, 3 lakh lose their limbs and 4 lakh people get injured in road accidents”. The majority of the 1.37 lakh deaths per year from road accidents are caused by trucks, followed by two-wheelers. Across the country, 17% of those killed in road accidents, or 24,081 people, have died in accidents involving trucks. This is partly because of the greater momentum of trucks, and partly due to the relatively high proportion of time that they are driven by unqual-
ified drivers on Indian roads (Transport and Research Wing, 2011).

3.2 Environmental standards

Environmental standards can be divided into two types; those that are mandatory and those that more environment-ally responsible companies meet voluntarily. The former type is mostly technical, while the latter one is often more management-orientated.

3.2.1 Mandatory standards

**Bharat stage emission standards**

Bharat stage emission standards are instituted by the Government of India to regulate the exhaust of air pollu-
tants from internal combustion engine equipment, including motor vehicles. The Central Pollution Control
Board (CPCB), the statutory organisation under the Ministry of Environment & Forest (MoEF) and Climate Change, sets the emission standards and the timeline for its implementation.

The standards are based on European regulations and were first introduced in 2000. Progressively stringent norms have been rolled out. All new vehicles manufactured after the implementation of the norms have to be compliant with the regulations. Since October 2010, Bharat stage III norms have been enforced across the country. BS-IV is being supplied in most big cities by April 2016 and will be made available all over the country from April 2017.

However, at the moment India has instituted this stand-
ard only to LCVs whereas it is necessary to make HCVs also compliant of such framework as well. This is because HCVs are major contributors to vehicle kilometres travelled (VKT) and also account over 50% of the CO₂ emis-
sions from the road transport sector.

In January 2016, in one of its boldest step so far, the Gov-
ernment of India decided to move directly from Bharat Stage IV norms for all petrol and diesel vehicle to Bharat VI standards by the year 2020.

3.2.2 Voluntary/management standards

**India Greenhouse Gas Program (India GHG Program)**

The WRI India, The Energy and Resources Institute (TERI) and Confederation of Indian Industry (CII)

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\(\text{[7]}\) A crore (abbreviated cr) is a unit in the Indian numbering system equal to ten million (10,000,000; in scientific notation: 10\(^7\)). It is widely used in India, Bangladesh, Pakistan, Sri Lanka and Nepal, and is written in these regions as 1,00,00,000.

\(\text{[8]}\) A lakh (abbreviated L; alternatively Lac or Lacs) is a unit in the Indian numbering system equal to one hundred thousand (100,000; scientific notation: 10\(^5\)). In the Indian convention of digit grouping, it is written as 1,00,000.
launched the India Greenhouse Gas Program (India GHG Program), a voluntary initiative to standardise measurement and management of GHG emissions in India. The program aims to make measurement and management of GHG emissions standard practice for Indian businesses seeking a more competitive, profitable and sustainable business environment. Founding member companies include Godrej & Boyce, HCC Limited, Ford Motor Company (India), Mahindra Sanyo Steel, Jet Airways, Tata Teleservices, Bayer Group, Infosys Technologies, Tata Chemicals, NTPC, ITC, Yes Bank, Cummins India, Forbes Marshall, JK Tyres, Shree Cements, United Technologies, Ambuja Cement and GAIL India Limited.

The GHG Program will help companies in India to monitor their progress towards voluntary goals in a consistent and credible manner. The program will provide companies with tools and technical assistance to build inventories, identify reduction opportunities, establish both annual and long-term reduction goals, and track their progress based on the GHG Protocol, the most widely used accounting and reporting standard in the world (Adhia, 2013).

3.2.3 Voluntary Commitment Program

The Green Freight India (GFI) Initiative

The vision of this program is “to increase the transparency on carbon emissions of logistics operations and the cost efficiency by establishing an industry platform that enables collaboration along the supply chain”.

The GFI initiative utilises a market-based, NGO-led collaboration framework to provide freight shippers, carriers, and logistics companies with tools to benchmark and improve fuel-efficiency, save money, and track progress for their achievements. Its principal elements include:

- Partnership programs – to assess, benchmark, and track emissions of private sector organisation like carriers, shippers, or logistics companies. Furthermore, the data will be used to identify the most economical interventions and strategies that could be utilised in order to increase fuel efficiency and thus reduce the carbon footprint of the partnering association. The program will assist in providing benchmarking and reporting tools to further optimise road fleets.

- Technology interventions – providing technological assessment and offering suitable technology interventions which could allow road fleets to achieve the desired performance in terms of fuel savings and emission reduction.

- Recognition, marketing and out-reach – “greener” measures and practices will be disseminated in the form of information and education (e.g. workshops, fact sheets, newsletters, website, workshops) and used as basis for future marketing (media campaigns and events).

In order to internalise the carbon emissions, the partners (GIZ-India, the European Business Technology Centre (EBTC) and Clean Air Asia (CAA)) have developed a toolkit for calculating emissions from the freight sector tailored specifically to India.

Figure 8: Street scene in Mumbai, India. © Chhavi Dingra
4. Reaching out to Different Stakeholders Involved in Urban Goods Movement

This chapter provides an overview of how an active dialogue between both the public and private sector stakeholders can address the problems and side effects of urban goods movement. It showcases how a lack of understanding of critical issues can inhibit better policy formulation and restricts an improvement of contemporary freight logistics practices. Additionally, the chapter will also cover various policy-related issues pertaining to the urban freight distribution movement.

4.1 The need to map out the stakeholders

As previously established, the efficiency of the goods movement is dependent upon a wide number of factors. The city demands its urban freight distribution system to be as dynamic as possible so that it is able to maintain its competitiveness within the market. At the same time, it also demands that the system does this without further deteriorating the already saturated urban road transport network in terms of road congestion, pollution, and the road safety aspects. These contrasting expectations create a multitude of existing stakeholders in the urban realm.

Therefore, before implementing any policy towards the urban goods movement, cities must reach out to all concerned stakeholders. A clear understanding of all objectives and interests not only has the potential to increase the efficiency of goods movement but also to influence stakeholder’s infrastructure investment strategies around the city.

As mentioned by Hensher and Puckett (2004), “Policies that do not take into account the complex interactions within the chain may yield suboptimal outcomes, based on inaccurate projections of the likely effects.” Stakeholder mapping or consultation exercises prior to implementing any urban goods movement can be helpful tools to help policy makers gain insight into the plausible behavioural strategies adopted by various stakeholders and to consequently develop comprehensive policies (Stathopoulos, Valeri, & Marcucci, 2010).

Figure 9 showcases the relationships between different stakeholders involved in the urban goods movement. The diagram clearly distinguishes between the private (shippers, freight carriers and consumers) and public

Figure 9: Relationship among stakeholders.
sector (planners and regulators) parties. While both the private and the public sector are inextricably linked, they still have competing interest and may not be fully aware of each other’s objectives. This lack of consideration is a critical issue, which can inhibit better policy formulation and can restrict efficient freight logistics practices.

4.2 What is the public sector’s role in freight transportation?

The overwhelming majority of problems in the nation’s freight network occur at the local level, and most costs are largely borne locally. Consequently, addressing congestion will likely create substantial local benefits, even if some benefits will spill over to adjacent jurisdictions or even the nation as a whole. Given the complicated nature of freight congestion and other problems in the supply chain system, as well as the major involvement of the private sector, it is naturally fair to ask: what responsibilities do the national/state and the local government have?

At present, freight problems seem to be among the least important issues for public sector stakeholders. Neither the government, nor the respective ministries are investing significant attention or funds in the issue of understanding and resolving freight problems. In the past, the government has indirectly dealt with the needs of the freight distribution network by steering construction of the Golden Quadrilateral (GA), along with subsequent phase-wise project implementation under the National Highways Development Project (NHDP). This has helped to connect many of the major industrial, agricultural and cultural centres of India. It has also contributed towards efficient movement of vehicular traffic. However, there is more that needs to be done, especially as the implemented schemes are not specifically designated for freight. Identifying and developing freight corridors is part of the government’s role of facilitating inter-state traffic and the spatial movement of goods.

While there is a wide debate over the various ways in which the public sector must get involved, the following list provides broad objectives, which the public sector should focus on (Wilbur Smith Associates and S.R. Kale Consulting LLC, 2009):

- Improve freight planning at every level of government by improving freight data, disseminating best practices and promising approaches, and increasing institutional capacity;
- Provide financial assistance to appropriate freight projects based on justifiable and sustainable revenue sources;
- Conditional public sector assistance to freight projects on specific and measurable performance criteria;
- Reform regulations that inhibit the competitiveness of various freight modes or inhibit the active involvement of the private sector in freight projects;
- Respond to market failures, such as the lack of cooperative efforts, and positive and negative externalities from freight projects.

4.3 Getting the private sector more involved in freight

Public agencies can better understand the need for goods and their transport in their area if they obtain input from private sector representatives who are moving freight. Better understanding the demand will enable agencies to develop effective transportation plans and improvement programs that address the needs of their customers. Private sector involvement in the public planning process can:

- Help to establish freight planning goals and objectives;
- Identify problems and issues affecting freight mobility;
- Result in opportunities for building a mutual understanding about planning processes and freight mobility needs;
- Generate political and public support for investments in transportation improvements;
- Build trust to facilitate gaining access to private sector data and information that planners can use to help identify needs and plan in order to meet these needs.

The public and private sector share interests in a number of transportation-related topics, including economic development, congestion and capacity, funding and financing, environmental issues, and security. Moreover, they have similar views in regards to the connection between economic development and an efficient multi-modal transportation system. In addition, the national and state economic development plans typically raise private sector issues and concerns, including the
importance of people and goods movement for economic well-being. Thus, economic development agencies and chambers of commerce are potential key allies when undertaking freight planning initiatives.

Currently, congestion and road network capacity are the most significant obstacles for moving goods, independently of the city or area of nation. In the past, several national studies have reviewed and analysed the issues of congestion and capacity, with various proposals having been advanced to identify potential solutions nationwide, for instance the NTPDC report “Moving India 2032”. Private sector input on freight transportation bottlenecks can help public sector planners and decision-makers to develop strategies and funding mechanisms in order to reduce congestion and improve capacity.

Inputs on environmental issues, security and safety from the public and the private sector can help to inform freight transportation planning activities. Private sector representatives often advocate streamlining the environmental process to speed up project development and implementation, which in turn could contribute to a quicker resolution of congestion, capacity, and other issues. Transportation planners are internalising security issues in plans and other documents. Private sector concerns about the cost and difficulty of implementing security requirements can help to inform the planning departments. Similarly, private sector concerns about safety issues, requirements, and solutions can help to refine the public planning process.

4.4 Who from the private sector should be involved?

Identifying specific groups or organisations for involvement depends on the specific task for which stakeholder input is desired. For example, representatives from port and waterway organisations would be among those whose input might be sought for a special study on development of coastal transportation system. In some situations, freight stakeholders may self-identify by inquiring about how to become involved with an agency’s freight-related activities.

Generally, when deciding with whom to engage, it may be useful to view freight transportation as part of a supply chain where goods are moved between origin and destination. Various entities are involved in the movements along these supply chains, for instance, shippers, carriers or transportation providers, and receivers (Figure 10).

State, regional, and local economic development organisations and chambers of commerce may have an interest in freight planning because transportation is an important factor that businesses consider when they are looking for new locations, considering expansion at existing locations, or deciding whether to stay in or move from an existing location. Port authorities often are involved with local and regional economic development as well as with intermodal transportation by water, highway, rail, air carrier, and/or pipelines. Representatives from colleges or universities with an interest in freight planning activities should also be involved.

Residents Welfare Associations (RWA) may also like to get involved in planning activities of goods movements near residential areas or where redevelopment of an industrial area to other land uses types is being contemplated or underway, or where real or perceived conflicts occur between goods movements and people movements.
4.5 Challenges

One of the biggest challenges is to convince private sector stakeholders why they should be involved in freight planning activities. Demonstrating the value of having a unified metropolitan transport authority (UMTA) and prioritised transport investment program can be a significant challenge, especially if the plan or program contains few provisions specifically addressing concerns of urban goods movement and the freight stakeholders.

Communicating goals, objectives, and benefits of plans and programs to the private sector requires an effective public involvement program and considerable skills on the part of the transportation agency personnel and their governing bodies. As public agencies stand to gain a lot from private sector input, they should develop activities that communicate what private agencies and their customers can gain from working together on freight planning activities, how they can provide input into the public planning and programming processes, and how public sector decision-makers consider private sector input in decision making processes about funding. That way, private sector stakeholders can be assured that their input was valuable even when the final decision may not be consistent with private sector recommendations or expectations (Wilbur Smith Associates and S.R. Kale Consulting LLC, 2009).

Another challenges is to identify private sector representatives who are willing to provide independent input for the existing or proposed freight planning activities (Wilbur Smith Associates and S.R. Kale Consulting LLC, 2009). Additionally, maintaining private sector interest over time provides a challenge. Many private sector stakeholders have limited time to serve in an advisory role to public agencies. Transportation agencies thus need to provide stakeholders with clearly articulated information about the purpose, duration, expectations, and anticipated outcomes of their involvement. The results of planning and programming activities furthermore need to show which difference the private sector involvement has in addressing freight problems and concerns (Wilbur Smith Associates and S.R. Kale Consulting LLC, 2009).

4.6 Current scenario in India – Institutional framework and current transport and logistics policies

4.6.1 Institutional framework at the national level

The work of Baindur (2011) provides an excellent starting point towards understanding the institutional framework in India. It highlights that the setup of the transport system in India is institutionally very complicated. Many of the transport sector activities are bifurcated between the state and the national government with other significant segments almost entirely controlled by the private sector. However, the government’s ongoing plans towards steadily deregulating the transport sector to achieve strong and sustained economic growth have allowed private investment and innovative practices in the transport sector.

Table 6 displays the relative importance of the state government, transport departments within the states, and the current structure in which elements like infrastructure, services and regulation are rationed.

The responsibility of regulating the transport sector lies largely at Central Government level:
- Ministry of Road and Highways Transport for inter-city roads, highways and express-ways;
- Ministry of Urban Development for transport infrastructure development within the cities;
- Ministry of Railways for the national and some commuter rail services;
- Ministry of Shipping for Major ports, inland waterways and shipping; and
- Civil Aviation Ministry for airlines and airport.

Based on their expertise, different sub-agencies or institutions within these ministries are directed to carry out infrastructure projects, policy-making, investment, design, construction, and regulation and enforcement.

The Indian railway system covers the provision and maintenance of the railway track network, the operation of freight and passenger services, as well as substantial production units for rolling stock (Raghuram, 2000). In India, railways have traditionally been the slowest to allow private investment and management of rail infrastructure and services. Lately however, the Public Private Partnership (PPP) cell in the ministry is undergoing a restructuring to make itself more result-oriented. The objective of this restructuring process is to create more jobs in the economy, and additionally augment capital.
Table 6: Transport sector – involvement of State and private sector

<table>
<thead>
<tr>
<th>Physical Basis/Assets</th>
<th>Ownership/Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Air</td>
</tr>
<tr>
<td>Regulator</td>
<td>(State controlled)</td>
</tr>
<tr>
<td></td>
<td>DGCA, AAI</td>
</tr>
<tr>
<td>Terminals</td>
<td>(Partially Controlled)</td>
</tr>
<tr>
<td></td>
<td>AAI, Defence, Private Sector</td>
</tr>
<tr>
<td>Rolling Stock</td>
<td>(Open to all) IA, AI, private airlines</td>
</tr>
<tr>
<td></td>
<td>IA, AI, other private airlines</td>
</tr>
<tr>
<td>Maintenance Services</td>
<td>Terminals</td>
</tr>
<tr>
<td></td>
<td>(Open to all) IA, AI, other private airlines</td>
</tr>
<tr>
<td></td>
<td>Rolling Stock/Equipment</td>
</tr>
<tr>
<td></td>
<td>IA, AI, other private airlines</td>
</tr>
<tr>
<td>Operations</td>
<td>Operations</td>
</tr>
<tr>
<td></td>
<td>(Partly open) DGCA, AAI, private cos.</td>
</tr>
<tr>
<td></td>
<td>(Open to all) IA, AI, other private airlines</td>
</tr>
<tr>
<td></td>
<td>(Open to all) IA, AI, other private airlines</td>
</tr>
<tr>
<td>Regulations</td>
<td>Licensing</td>
</tr>
<tr>
<td></td>
<td>Pricing</td>
</tr>
<tr>
<td></td>
<td>Service levels</td>
</tr>
</tbody>
</table>

*) GoI – Government of India

Source: Baindur, 2011
for improving the overall railway system. The ministry is also exploring means to forge partnerships with the private sector, so as to improve last-mile connectivity, expand the rail fleet of rolling stock and modernise rail station infrastructure.

In contrast, a large number of organisations are involved in road transport including the Central Government (for highways and express-ways), State Governments (for state highways and PMGSY), the Defence Ministry (for border roads) and large industries and contractors (for project roads). Very few city municipalities have organised truck terminals direct under supervision of their governance.

Infrastructure and terminal maintenance for road services is delegated to private concessionaires or else to national/state or local governments. Maintenance of the rolling stock and equipment is largely managed by a vast number of small-scale warehouses all over the country. The Ministry of Road Transport and Highways (MORTH), the Ministry of Urban Development (MoUD), the Railway Ministry, the Ministry of Shipping and the Civil Aviation Ministry all have independent transport development strategies and subsequently different areas of investment which are specific to cater the requirements of their transport sector.

In the urban context, the Ministry of Urban Development (MoUD) is responsible for formulating policies, supporting and monitoring programmes, and for coordinating the activities of various central ministries, state governments and other nodal authorities related to urban development. The mandate extends to the formulation of urban transport policy making as well.

4.6.2 National Urban Transport Policy (NUTP)

The Government of India announced the creation of a National Urban Transport Policy in April 2006. With its policy vision “moving people – not vehicles” it addresses issues of road safety, deteriorating urban air quality and rising energy demand for the national economy. Urban local bodies have demanded the policy measures to focus on:

- Improvements in public transport and facilities for the use of non-motorised modes;
- Greater participation of the private sector in developing transport infrastructure, and the provision of public transport services;
- Innovative financing mechanisms to enhance efficiency and reduce the impact on the public budget;
- Better integration of land use and transport planning to reduce travel demand;
- Encouraging the use of cleaner technologies;
- Building capacity of urban transport planning at institutional level; and
- Creating awareness and support for initiatives that require tough decision-making and compromises.

The NUTP acknowledges that freight traffic will grow substantially as cities, population and economic activities expand. Timely and smooth freight movements are crucial for the well-being of the people and economic viability of the city. Policy measures propose to further encourage:

- Using off peak passenger travel times to move freight;
- Earmarking late night hours for freight movements within the city and restricted entry of heavy vehicles into cities during day time;
- Developing public private partnerships to build bypasses for freight trucks to go around the city and not add to city traffic;
- All wholesale activities to be located at the periphery of the city along the major rail and/or highway rather than at the city centre, therefore developing dedicated truck terminals for parking facilities for freight trucks outside city limits through public private partnerships;
- Parking space to be provided at appropriate locations on street/off-street with proper management and use of ITS. Appropriate parking fees should be levied to manage the demand and reflect the cost of urban land used for the purpose;
- Planning of ring roads to relieve traffic congestion in the central area and also allow balanced urban development. Similarly, bypass roads to be planned and developments along such bypasses controlled to ensure that such bypasses do not become arterial city roads in the future. All new satellite townships/emerging activity centres (SEZs) planned for future are either developed along defined major transport corridors and/or integrated properly with mass transit systems in the Master Plan itself;
- Implementation of Auto Fuel Policy approved by the Government of India in 2003 that laid down the roadmap for tighter emission regulations up to 2010 for new vehicles. Vehicles produced before the first mass emission norms in 1991 would require to be replaced;
Adoption of alternate fuel vehicles as an important step to clean the environment by bringing industry into confidence and building a consensus.

4.6.3 Urban freight data collection in the country

Unlike passenger traffic, where data is of better quality and quantity, the data on urban good movements in Indian cities is almost non-existent. As stated by the Planning Commission Committee report for the eleventh Five Year Plan, there is no institutional body to carry out any form of freight transport data collection in order to measure urban or inter-urban transport flows. However, availability of good quality freight data is essential to ensure that transport and supply of urban goods are carried out optimally so that both the operational costs of transport and the negative externality on the urban society are minimised (Schoemaker, Allen, Huschebeck, & Monigl, 2006).

Municipalities require information on traffic and transport such as the number of trucks of a special size registered in a city or region or freight load (in tonnes) of single business fields. The former data can be obtained easily without much financial effort but its use is rather limited for urban freight transport planning. Data on the amount of freight transported are difficult to collect and often transport companies are reluctant to share their data for reasons of confidentiality (Schoemaker, Allen, Huschebeck, & Monigl, 2006). Nevertheless, the transport industry requires data to ensure cost efficiency for operations, more transparency in access-restrictions and harmonisation of restrictions throughout the city.

The availability of reliable statistical data alongside periodic updates is necessary in order to evaluate implemented policy measures (Stantchev & Whiteing, 2006). Results from such evaluations will help the Indian municipalities to conduct holistic planning and to assess the effectiveness of existing measures for urban goods transport. However, comparing the planning and organisation of goods transport and city logistics is currently extremely difficult due to two critical factors – firstly, goods transport data in India is non-existent and secondly, because of the lack of systematic and non-existent standard data collection methodologies and institutions (Sriraman, Venkatesh, Karne, & Mohite, 2006).

Information such as the number of trips by each vehicle in the transport company, vehicle occupancy factors, sizes of vehicles in different fleets, goods transports via different transport modes, and use of road space by trucks and lorries is usually missing in typical surveys (Sriraman, Venkatesh, Karne, & Mohite, 2006). To develop realistic urban freight transport models, data on transport chains, number of tours and number of stops and origin-destination matrices related to transport weights, consignment sizes, and vehicle types is essential (Huschebeck, 2001).

The main existing sources for urban freight movement data in India are the Permit System, vehicle registrations and Octroi charges (Sriraman, Venkatesh, Karne, & Mohite, 2006).

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Octroi is a local tax collected by the state government or the city municipality on articles brought into a town for local use. Levy of Octroi is based on the value, weight, length and number of articles and the basis of levy varies from the State to State or even between different local bodies within a State.
Permit system

Permits are issued by the State Transport Authorities to operators in the form of intra-state and national permits. Presently the method of data collection on goods transport is done by means of permits and licences issued to vehicles and operators as well as the revenues collected by the Regional Transport Offices under the Motor Vehicles Act, 1981. This is the Central Act applicable throughout the country. For goods carriage, Table 7 shows the different types of permits issued.

The database relating to these permits, however, is not updated on a systematic basis, and as a result the exact number of permits issued is unknown.

A new national permit system has been implemented in all States/Union Territories, effective from 8 May 2010, in order to facilitate inter-state movement of goods carriages. In accordance to this arrangement, national permits can be granted by the home State on payment of INR 1,000 as home State authorisation fee and INR 15,000 per annum per truck towards consolidated fee authorising the permit holder to operate throughout the country. The government has implemented the new national permit system. The consolidated fee collected by the Central Government through the State Bank of India is distributed among the States/Union Territories on a pro-rata basis (MoRTH, 2011).

The National permit is expected to save costs of up to INR 10,000 annually per truck, reduce operation hurdles and saves time for both commercial vehicles and the State Administration. The new unified permit will not affect shippers and forwards hugely, as the permit fee contributes less than 2% of the total operating cost.

Vehicle Registrations

Another source of data is the number of vehicles registered by the Regional Transport Offices in each State. Registration is based on the vehicle category (Sriraman, Venkatesh, Karne, & Mohite, 2006). Assuming an average loading capacity per vehicle type, the total capacity available for goods carriage can be estimated. However, this data does not give a break-up of fleet composition. Registered numbers often include vehicles that are not in use anymore.

Octroi Charges

Octroi is a local tax on goods, which was introduced into the districts. Heavy vehicles carrying goods have to pay the tax at the Octroi posts located at the borders of a city. The Octroi is collected based on the value of goods coming into the district by road or rail transport modes. Octroi constitutes a major source of revenue for Municipalities.

For example, only scarce urban freight transport data exists for Mumbai. Given that the freight transport industry has never been in the public domain and is fully deregulated, collection of freight transport data has always been a problem. A number of Working Committees set up by the Indian Government have emphasised

<table>
<thead>
<tr>
<th>Type of permit</th>
<th>Class of vehicles to which permit applies</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goods carriers</td>
<td>Goods trucks, delivery vans, trailers, etc.</td>
<td>Transportation of goods within Maharashtra State for hire or reward;</td>
</tr>
<tr>
<td>Temporary permit</td>
<td>All kinds of transport vehicles;</td>
<td>Use of transport vehicles on special occasions like fairs, religious gatherings, seasonal business, to meet a particular temporary need and in case of pending decisions on renewal of permit;</td>
</tr>
<tr>
<td>National permit of goods vehicles</td>
<td>Goods truck with sleeping berth to spare driver;</td>
<td>Transportation of goods all over India.</td>
</tr>
</tbody>
</table>

Source: Baindur, 2011
Table 8: Urban freight indicators by impact category

<table>
<thead>
<tr>
<th>Impact category</th>
<th>Indicator category</th>
<th>Indicator</th>
<th>Data collected in India (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Volumes and commodities</td>
<td>Transport Demand</td>
<td>Volumes transported into urban areas</td>
<td>No</td>
</tr>
<tr>
<td>in urban areas</td>
<td>Logistics</td>
<td>Goods receivers</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Logistics costs</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Share of urban transport costs compared to total supply chain</td>
<td>No</td>
</tr>
<tr>
<td>Population</td>
<td></td>
<td>Salaries in urban freight transport</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Population density and share of population in urbanized areas</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Household size</td>
<td>No</td>
</tr>
<tr>
<td>Urban Freight transport fleet</td>
<td>Freight Vehicles</td>
<td>Number of vehicles according to GVW and age</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proportion of goods vehicles in total traffic</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ownership of Vehicles</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vehicles operating in cities</td>
<td>No</td>
</tr>
<tr>
<td>Urban Traffic Flow</td>
<td>Number of vehicles entering cities</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Distribution of freight vehicles movement over day</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Services visits and waste</td>
<td>Service visits</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>collections</td>
<td>Waste Collections</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Performance</td>
<td>Freight vehicle kilometres</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Use of load capacity</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Urban Deliveries</td>
<td>General Delivery</td>
<td>Combined shipments</td>
<td>No</td>
</tr>
<tr>
<td>characteristics (operator)</td>
<td>Delivery days and times</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Regularity of trips</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Origin of delivery trips</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Number of stops per tour, per day</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Trip length</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Distance between stops</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Trip times</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Travel time to and within city centre</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>General Delivery</td>
<td>Deliveries at premises</td>
<td>No</td>
</tr>
<tr>
<td>characteristics (receivers)</td>
<td></td>
<td>Dwelling time in urban area/loading and unloading times</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Home delivery</td>
<td>Home delivery services offered by shops</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of km covered by inhabitant</td>
<td>No</td>
</tr>
<tr>
<td>Impact category</td>
<td>Indicator category</td>
<td>Indicator</td>
<td>Data collected in India (Yes/No)</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------</td>
<td>----------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Contribution to economy</td>
<td>Employment % in transport and logistics</td>
<td>Number of jobs in transport</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of transport related companies</td>
<td>Yes</td>
</tr>
<tr>
<td>Environment</td>
<td>Energy Use</td>
<td>Typical fuel consumption by vehicle type</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Energy consumption in urban freight transport</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consumption of non-renewal fuel resources</td>
<td>No</td>
</tr>
<tr>
<td>Exhaust emissions</td>
<td>Typical emission factors by vehicle type</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Share of urban freight in exhaust emissions</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Noise</td>
<td>Noise levels driving truck</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Noise levels loading/unloading truck</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>Accident and casualties in urban freight transport</td>
<td>Number of accidents</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of fatalities</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Involvement of freight vehicles in accidents</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Weekly distribution of accidents involving HCV’s</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Road User type</td>
<td>Cyclists</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pedestrians</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Car Drivers</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

Source: Huschebeck, 2001; Baindur, 2011.

the need to develop a systematic database, however no systematic time series data is available to this date.

The Table 8 lists the critical indicators for freight transport planning and policy purposes and highlights the severe gap in existing data collection from the Indian context.

### 4.7 Conclusion

In summary, mapping different stakeholders and striking a right balance between the objectives of each of these stakeholders is one of the biggest challenges when defining freight policy. It requires open discussions and a clear understanding of different motivations. In reality however, local policy-makers tend to neglect the diversified impacts that one single policy might have on different stakeholders and how these impacts can shape the successful implementation of those policies. Thus, stakeholder consultations, which include problem perception and policy proposals, should be a fundamental step to bring potential conflicts between stakeholders to the surface (Stathopoulos, Valeri, & Marcucci, 2010).
5. The Source of Demand for Urban Goods Movement and its Supply

In order to propose policy recommendations for urban freight, it is necessary to understand the nature of the freight transport industry. This chapter focuses on the sources of demand for urban freight movement and its supply through the main distribution practices in urban areas. For each sector, the existing processes and the most probable causes for inefficiency are reviewed and possible future market trends in urban freight transport are analysed.

The following urban freight transport market sectors are covered:
- Retail (including e-commerce)
- Courier and post
- Hotel/Restaurant/Café (HoReCa)
- Construction
- Waste

The freight transport industry in India, particularly the road freight transport sector that is most relevant for urban freight movement, is an extremely competitive sector in itself. Freight transport operators are highly cost-conscious and often dynamically respond to market signals (e.g., increases in petrol/diesel prices cause a knock-on price increase in vegetable prices). Any additional costs that are imposed by the public sector are eventually passed onto customers, as operators are not willing to absorb the cost themselves. While deliveries to and collections from urban areas are vital to the functioning of urban economies, inappropriate policy measures at a local level might have negative impacts on the efficiency and cost of urban freight movement, and, in turn, a detrimental impact on the local economy and/or environment.

Nevertheless, the highly competitive nature of the freight transport market also means that policy measures for urban freight should not, as a general rule, discriminate between different types of operators, as this creates market distortions. For example, deliveries of fresh products to markets or supermarkets and pharmaceuticals to pharmacies should not be treated different than the delivery of parcels to homes or the delivery of stationery to offices.

India’s retail sector is an evolving market. The sector will grow and develop over the next four to six decades, as consumers will earn more and those below the poverty line will cross over. The gains from economic growth will be felt more equally. As more retailers enter the market and expand operations, consumers’ buying patterns and shopping habits will also evolve. Retailers currently operating in the market, and those who plan to enter the market, now have the chance to understand local market dynamics, develop robust supply chains, establish formats and choose the right product assortment to meet the diverse needs of Indian consumers in the future.

5.1 Retail market sector

The Indian retail market

The retail industry constitutes of individuals or groups of companies engaged in the sale of finished products, such as food & beverages, personal care, hair care, skin care, consumer durables, and electronics to end-user consumers. Retailing is the last point in the supply chain before the products reach their final destination, i.e. the hands of the consumers.

In India, smaller family-run or locally targeted (chain) stores called kirana(s) dominate the retail business. In the past few years, medium to large retail group chains have entered the market. Figure 12 provides overview of India's retail sector and its market segmentation.

Retail constitutes the largest industry in India, accounting for over 10% of the country’s GDP and for around 8% of employment. The performance of the retail sector has a direct effect both upstream and downstream of the retail value chain. For example, in the upstream markets,
retailers often interact with other players such as wholesalers and suppliers, commercial property services, transport companies, advertising and marketing agencies, energy suppliers, and waste collection and recycling services. On the downstream side, the retail sector has a direct impact on the quality of life of citizens by providing access to basic household goods and groceries. Hence, it is of great importance that retail monitoring prior the adoption of any sustainable growth plans or policies for the movement of retail-related goods.

Economies of scale have transformed the business models of retailers. The small independent stores that dominated the urban areas until the late 1990s have been partially replaced by retail chain stores and supermarkets. The increase in the purchasing power of retailers has allowed chain stores to negotiate low prices from their suppliers. Greater competition has contributed towards making retail chains more efficient and has curbed the erosion of their margins. Increased efficiency in the supply chain of organised retailing sector had an impact on small independent shops, agricultural producers, and small/medium sized manufacturers with many shutting down or being forced to move to another business. The typical Indian retail shop is very small. Out of 14 million outlets operating in the country, only 4% of them are larger than 500 sq. ft (46 m²) in size. The majority of the unorganised retail shops in India employ family members and as such do not have the scale to procure or transport products at a high volume wholesale level, have limited or no quality control or fake-versus-authentic product screening technology, and have no training on safe and hygienic storage, packaging or logistics. The unorganised retail shops typically offer no after-sales support or service. Finally, most transactions at unorganised retail shops are done with cash, with all sales being final.

From the consumers’ point of view, large retail chains stand to lose their attraction as small independent stores start to diversify by offering value-added services and the use of modern technology. The ability of the small stores to provide personalised services, along with added
advantage of speaking the regional language also holds value from the customer’s perspective.

From the retailers’ point of view, smaller stores are still a very important and interactive interface. Smaller stores or kiranas are able to tailor the mix of goods and products on display to their consumers. This controlled mixed display of goods allows the manufacturers to understand their customers better, detect shopping behaviour and expectations, and consequently to change product offerings, the display of goods, the layout of the store, and to offer new services.

Overall it is clear that retailers could become a driving force in the adoption of sustainable growth paths due to their interaction with consumers.

Retail logistics and urban freight transport

Major retail chains

Transport, logistics and supply chain performance are increasingly considered to be key success factors for most major retailers. The supply chains of large retail groups have evolved over the last decade and are still undergoing big innovation and improvement processes.

Up to the early 2000s, the distribution channel of logistics remained under the control of suppliers and wholesalers. Direct store deliveries were made on an infrequent basis; the stores were usually able to hold stock in ‘godowns’ or ‘store rooms’. During the late 2000s, responsibility for shop deliveries shifted from manufacturers and wholesalers to the large retailers themselves. Retail groups invested heavily in distribution networks in order to take control of deliveries and increase overall supply chain efficiency, consolidating supplies upstream of the stores in centralised distribution centres. Most firms reduced the number of warehouses from which they serve the stores with the aim of exploiting economies of scale in warehousing and reducing inventory levels. These processes allowed the third-party services (3PL) to step into the picture and establish themselves as competitive players. Large retailers that progressively require more frequent but small quantity deliveries, shifted to a just-in-time (JIT) system. Since the 2000s, the collaboration among supply chain

Figure 13: Major demographic groups that are driving purchases across retail sector. © PwC, 2012
partners has increased and the focus has been more on overall supply chain efficiency.

As the major retail groups are important players for the distribution of goods in urban areas, the evolution of their supply chain has heavily influenced the urban freight movement. Shops increasingly deliver consolidated loads from the retailer-controlled distribution centres. At the same time, multiple-drop deliveries of manufacturers and wholesalers have declined which has promoted the consolidation of loads in larger vehicles. From the large retail chains’ point of view, this results in an increase in efficiency, making better use of each vehicle’s carrying capacity and increasing the fill-rate; it also results in relatively environmentally friendly behaviour, because it involves carrying out fewer deliveries per day. Such trends might cause several issues for the retailers, for instance when vehicle weight restrictions are imposed in urban areas. Retailers are unable to optimise the fill-rates for their vehicles, and, at the same time, the decentralisation of shops to the periphery of urban areas has reduced the need for goods carriers to penetrate urban centres. However, while the decentralisation of retail activity has decreased freight traffic in urban areas, it has increased the number of shopping and commuting trips made by private car thus augmenting urban and suburban road congestion and contributing to poor air quality.

**Independent retail – kirana’s**

Independent retailers differ significantly from the major retail chains in terms of transport organisation and relationships with other stakeholders. Firstly, they do not control deliveries as wholesalers or suppliers are being solely responsible for goods transport (using their own account or 3PL carriers). Secondly, the retailers do not pay for the transport directly and have no contact with the carrier except for the receipt of the delivery.

It is estimated that in India, independent stores and local convenience stores together easily represent more than 60% of all daily deliveries in an urban area. Freight movements to local stores contribute significantly to urban road congestion, with deliveries varying from three times a week to once or twice a day. Moreover, the deliveries can have diverse suppliers that all use their own vehicles with low vehicle fill rates.

**Challenges**

A lack of distribution channels makes it difficult to reach consumers or distribute products nationwide. India is a diverse market, with 28 different states and many languages. Companies accustomed to national distribution agreements will find those opportunities virtually non-existent. When selling fruits and vegetables, for example, a farmer might encounter five to six middlemen. This inefficiency and the lack of refrigerated distribution cause around 40% of perishable food torots before delivery.

**Limited physical infrastructure**

India has one of the largest road networks in the world, yet less than half of the roads are paved and less than 2,000 kilometres are express highways – a significant difference when compared to China’s 30,000 kilometres. Indian National highways along with the express highways account for less than 2% of the total Indian road network, yet they carry 40% of the traffic. One reason is the relatively low average speed of 40 km per hour, compared with the West’s 90 km per hour. The poor condition of roads also causes shorter vehicle lifespans, thereby increasing operating costs and reducing efficiency. Off the highways, firms can only run trucks smaller than 20 feet. All these restraints highlight the government’s lack of attention to invest in transport and infrastructure solutions.

**Disorganised trucking operations**

In India, two-thirds of fleets have less than five vehicles, making it difficult for shippers to manage the plethora of carriers required to handle shipment volumes. Freight consolidators and brokers take a commission to provide truck owners with consignments, and corruption is rampant. Additionally, inadequate infrastructure causes equipment maintenance costs to be extremely high. These increasing costs and dwindling profits leave little opportunity for small fleet owners to expand their business.

**Limited technology usage**

Firms don’t use technology to plan, execute or communicate logistics operations. Only an estimated 30,000
commercial vehicles have tracking systems, leaving the remaining companies that ship within the country without visibility or notification. Without notification, firms can’t replenish or collaborate with suppliers until manual reports are tallied.

Non-existent warehouse and warehouse standards

There is virtually no complex distribution centre set-up, no standards for suppliers, and little vendor compliance. Beyond that, firms will find there is little vacant distribution centre (DC) space available. Foreign firms who want to invest and run business will have to build this infrastructure, which includes supplying their own electricity, running water and road access.

E-commerce and Urban Freight Transport (UFT)

The growth in the use of the Internet in India has led to the rapid development of e-commerce, which currently appears to be one of the fastest growing marketing channels for different kinds of products and services. In 2013, India’s e-commerce market was worth about USD 12.6 billion of which the e-retail market stood worth USD 2.3 billion. About 70% of India’s e-commerce market is travel-related while the Electronics and Apparel segment is the biggest category in terms of e-retail sales. According to Forrester, the e-commerce market in India is set to grow the fastest within the Asia-Pacific Region at a CAGR of over 57% between 2012–2016. However, the market is still at the nascent stage compared to India’s (physical) retail market, which is expected to grow to USD 675 billion by 2016 and USD 850 billion by 2020.

In order to reach the predicted growth rates, Indian e-commerce companies have to overcome some serious obstacles. Among the largest of them is urban freight movement. While major multi-nationals like DHL and Fed-Ex operate in India, goods are normally shipped through smaller and much cheaper third party carriers. Different carriers are generally used for different regions of the country.

For orders sourced outside the major cities, individual couriers often have to be hired to make last mile deliveries from drop-off points by bicycle or motorcycle. The unreliability of the carriers has forced e-retailers like Flipkart or Amazon to develop their own logistic arms in order to deliver their packages. However, this decision carries enormous capital expenses in this emerging industry and hugely increases exposure.

Furthermore, the rising relevance of TIER 2 and TIER 3 cities for market capitalisation and increasing sales have necessitated companies to invest in their own logistics operations. It is estimated that TIER II and III cities will contribute to more than 350 million dollars of the e-retailing shipments by 2018, exceeding the demand from the traditional retailers. This is encouraging them to develop networks of branches and delivery points so as to service such high-growth cities. However, there is also a difficulty associated to the model adopted by the e-retailers in India — the Cash-on-Delivery (CoD) option. For Cash-on-Delivery, the consumer pays the courier once they have received the product. CoD is seriously harming e-commerce business due to the higher return rate of goods — sometimes up to 10%

Under the recommendation of the Sixth Central Pay Commission, the CCA classification was abolished in 2008. The earlier HRA classification of cities was changed from A-1 to X, A, B-1 and B-2 to Y and C and unclassified cities to Z. X, Y and Z are more commonly known as Tier-1, Tier-2 and Tier-3 cities respectively.
— by consumers who simply changed their mind about a product or could not be reached at home. These goods appear on the inventory after weeks, produce a high cost of restocking and re-listing, and sometimes have to be written off altogether.

Therefore, one of the biggest differentiators for any logistics service provider will be its ability to effectively manage cash flow and address challenges such as theft, the use of cash for working capital and reconciliation issues. This requires a fundamentally different system compared to those currently existing in the market.

Logistic service providers will need to develop fulfilment capabilities to gain access to the small, but growing market of offline retailers moving online. They will need to go beyond the traditional express delivery model to a higher level in the value-chain — managing inventory, handling invoicing, providing consumer insights and other value-added services.

Conclusion

This sub-section tried to highlight the many causes of under-utilisation of vehicle capacity, which, for most commercial operations, is not economically viable. Hence, the retail sector and organisations cannot afford to be complacent with how they utilise their vehicle capacity. In addition, rising economic and environmental pressures are forcing businesses to re-adjust their priorities so as to focus on efficient operational activities through better vehicle fills or moving away from the traditional constraints on load size and weight. This necessarily means optimising vehicle size and weight limits for sustainable distribution, and adopting mechanisms that incentivise efficient loading. It will also require an internal realignment to existing business objectives within companies as well as greater external collaboration along and between retail sectors supply chains. Advances in vehicle, materials handling and information technology can assist efforts to improve loading, as can investment in more storage space at critical points in the supply chain.

Figure 15: The restriction on medium and heavy Commercial Vehicles’ entrance into many of Indian metro cities has made it necessary for logistics companies to procure Small Commercial Vehicles and Light Commercial Vehicles for within-city delivery of goods, Mumbai. © Chhavi Dingra
Case Study – Flipkart

Founded in 2007 by two IIT Delhi graduates, Flipkart.com is now India’s largest online shopping website. The company was started with the objective of making books easily available to consumers with access to the Internet. Today, it offers a range of product categories including movies, music, games, mobiles, cameras, computers, healthcare and personal products, home appliances and electronics, stationery, perfumes, toys, and apparel amongst others.

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It has been cited as a success story in the domain of online retail — a sphere generally dubbed as impossible to succeed in in India. From the initial investment of INR 4 lakhs, Flipkart has grown exponentially in the last 5 years and touched revenues of 1,180 crore in 2012–2013. The company is now valued at approx. 9,900 crore (USD 1.6 billion) and plans to use the capital raised to improve its technology and supply chain capabilities, and to enhance its end user experience.

Logistics

Logistics is one of the most important facets of any successful e-commerce venture. Flipkart ships more than 100,000 items a day and bears the cost of the delivery itself thus making it a financially and managerial complex issue. In order to successfully manage these challenges, Flipkart uses its in-house logistics known as ‘eKart’ (EKL).

The e-commerce company created eKart as a separate brand in April 2013 in order to serve WS-Retail (the B2C side of Flipkart), and currently reaches consumers in about 150 cities. eKart offers services such as delivery logistics, reverse logistics and pay-on-delivery. It also offers customer support and technology integration for order tracking, customer notifications, reporting and analysis, billing, etc. In March 2014, Flipkart began to also deliver packages for its competitors and eKart Logistics continually opens services for other e-tail ventures.

eKart’s Distribution model

While more than 90% of the Cash on delivery (COD) shipments and about 60–70% of the overall shipments are delivered by the EKL, the rest of the shipments are catered by 3PL service providers. Moreover, if there are more than 100 deliveries for a particular destination then the company uses the services of EKL.

With EKL, the shipment is first transported to the mother hub and then to the delivery hub. Subsequently, the last mile delivery is done using suitable modes of transport, primarily two-wheelers, bicycles, or on foot. The company has a network with more than 15 courier companies as well as the Indian Post to deliver their products. To manage these 3PL providers efficiently the company allocates time slots to different logistics partners and they can pick up deliveries on specified time slots only.

Developing its own in-house logistics has helped Flipkart save commissions worth 2% that otherwise would have to be paid to courier firms. It also helps them to track the packages more accurately. And because labour costs are relatively low in India, its delivery cost is a modest INR 65 a package.

How items get delivered is decided based on the area where the item needs to be delivered to as well as product type and payment method. EKL is presently available in major TIER I cities, including metropolitan areas only. The company uses India Post only if the shipment location is not serviced by any of the 3PL as well as EKL primarily because of the higher delivery time. Moreover, India Post orders are of prepaid nature only. The delivery time varies between 3 days to 3 weeks depending on the location and availability of the product. Imported products, for instance, take about 3 weeks to get delivered to the customers whereas if a product is available in a local warehouse it gets delivered within 3 days.

The mode of transportation is also dependent on the location. Inter-city, trans-zone deliveries are made using air cargo whereas products are transported overnight by train or truck to satellite cities. In contrast, products are delivered using two-wheelers, bicycles, or on foot to local areas in proximity to the company warehouses.
5.2 Postal, courier, express delivery services

The postal and courier industry is one of the oldest industries in India. The advent of organised courier services and EDS in India can be traced back to the late 1970s and early 1980s. As trade and industry grew, the need for an organised courier service became more apparent. Foreign companies started entering the Indian market during that time, mainly through tie-ups with Indian companies. The liberalisation of the Indian economy in the 1990s then resulted in an increase in India’s trade – both in goods and services. India’s international trade has increased more than nine-fold since the 1990s. This has generated the need for supporting infrastructure, which in turn facilitated the fast growth of the EDS/courier industry.

The EDS/courier industry in India has undergone significant changes. Family-owned courier businesses have grown and developed into EDS companies providing integrated services. There have been a number of mergers, acquisitions and tie-ups. Nevertheless, the express/courier industry in India is still highly fragmented with a wide variety of companies offering different kinds of services. There are four main categories of express/courier companies in India, besides India Post. These include the global integrators, the large Indian companies, regional players and small courier companies.

All the four global integrators (UPS, FedEx, TNT and DHL) are present in India. They mostly focus on large corporate clients and carry high-value consignments and documents, mostly to and from international markets by offering regular and value-added services based on international standards. They do have tie-ups/partnerships with local Indian companies. Global Integrators have also acquired Indian companies who cater to the domestic market. For example, Blue Dart was acquired by DHL in 2004 and Prakash Air Freight Private Limited is owned by FedEx. These companies have well-developed logistics networks and infrastructure, including their own aircrafts, dedicated gateways for custom clearance (for example, DHL and FedEx in Delhi airport), and sophisticated globally owned networked IT and scanning systems.

The large Indian companies such as Desk to Desk Courier (DTDC), First Flight and Overnite Express focus on the domestic market and most of them have a good, countrywide network. Some of these companies also service selected international markets. In terms of their market segment, it can be said that these companies target the entire spectrum of the domestic market (including intracity delivery and mass mailing) along with the value segment of the international market. These companies also provide some of the value-added services offered by the multinational EDS providers.

The third category consists of regional Indian players. They may have a countrywide network but, generally speaking, they are more focused on certain regions of the country. Some of these companies are located in manufacturing hubs like Tirupur (knitted textile hub) in the south or Jalandhar (sports goods hub) in the north. These are medium-sized companies (for example, Shree Maruti Courier Service Private Limited which is extremely well organised in the western part of India) but they compete directly with the bigger Indian companies in the regions where they have a strong presence.

The fourth category consists of large numbers of small companies, which essentially provide local courier services. They have a much lower level of capital and investment and are mostly unorganised. These companies provide door-to-door courier service without any other value-added services. They mostly carry low-value items like documents, gifts and some mass mailing items, and their charges are also lower than those of the organised operators.

The India Post

The India Postal Service is the world’s biggest post office system with more than 155,333 post offices (China at second place has 57,000 post offices) employing more...
than 520,000 people. The Department of Posts is part of the Ministry of Communications and Information Technology of the Government of India and commonly known as ‘India Post’. Most of these postal services are provided at manually operated counters; however, counter operations are now being progressively computerised to provide a greater range of services to customers from a single window leading to services that are more responsive and error-free. With the infusion of new technology, India Post has enhanced its premium value-added services (such as Speed Post, Business Post, etc.). Almost the entire revenue of India Post is used up to meet operational costs. Thus the real challenge is to remain cost-effective (and systematically reduce costs) while simultaneously increasing competitiveness by offering valuable service to the customers. Currently, almost half of India Post’s revenue comes from financial services including Postal Savings Bank and savings certificates. It is important to note that the revenue generated from savings banks and other financial services are not invested to obtain higher returns or for further capital generation for the postal sector.

India Post ramps up operations to handle e-commerce services

India Post is re-inventing itself to cater to the burgeoning e-commerce services industry in the country by setting up data centres, arming postmen with hand-held devices and implementing software for facilities like cash on delivery (CoD). The modernisation project is being supervised by an Inter-Ministerial Steering Committee, which includes officials from the Ministry of Finance, the Department of Electronics and Information Technology and other stakeholders.

The aim is to cash in on the growing demand for delivery and logistics in the e-commerce space. India Post, by virtue of its huge network and experience in handling mail and parcels, is well placed to provide better service across pan-India delivery service. According to market analysts, India’s e-tailing space is estimated to be worth over USD 6 billion with delivery and logistics comprising around 10–12%. The reinvention project is also looking at providing standard web-based integration systems and an end-to-end tracking service for the e-commerce firms. This will enable the Department to undertake large consignments of goods and services.

As part of this pilot project, India Post will also provide hand-held devices to all postmen across India. The solar power handheld devices, which would be connected with the national data centres will allow core banking solutions to reach the rural areas.

The completion of this procurement is expected by 2016. Additionally, software is being created for real time delivery data updates, and money remittance systems for Cash on Delivery (CoD)/electronic generation and settlement of bills and interface (with tracking systems of railways and airlines). India Post will also have multiple access channels like POS, portal, a mobile site and call centres for information, complaint management and article booking. To roll out these services, the modernisation project would additionally open data and recovery centres, and develop software for money remittances services. A primary data centre has already been operationalised in Mumbai and the building of a data recovery centre is underway.

Communications and IT minister Ravi Shankar Prasad had said India Post with its rural, urban and semi-urban reach was best-suited to offer delivery services to e-commerce players. According to India Post, its parcel revenue which registered a 2% decline in 2013–14, had clocked 37% growth in 2014–15 and further grew by 117% during the first half of 2015–16 (India Post, 2016). It has already setup an e-Commerce Parcel Processing Centre in Mumbai which is a fully mechanised and computerised system equipped with conveyor belts, scanners, computers and electronic weighing scales. The centre is equipped with a dedicated transport facility to dispatch parcel bags to Mumbai Airport. Currently, the centre processes around 7,000 e-Commerce parcels per day and has an installed capacity to handle 30,000 e-Commerce parcels in a day in three shifts. The quick delivery of e-Commerce parcels is done through four dedicated mechanised nodal delivery centres which cover 21 delivery post offices in Mumbai.

Source: PTI, 2014
Challenges

Postal administration in India is grappling with the challenge posed by growing volume of mail, the need to deliver services faster to the customers, increasing competition from private courier industry, administered prices and poor technology. These issues are discussed in detail below.

Structural issues

(Jain, Morris, & Raghuram, 2001)

Historically the post in India has acted as a carrier of written communication between individuals and established a network to and in-between inaccessible areas – it had a public service role and character. During the last decade, not only has the share of the Post in the communication market declined, but more significantly, the share of private communication between individuals in the postal traffic has declined due to the growing share of business-to-business (B2B), business-to-individual (B2I) and individual-to-business (I2B) communication. As a result, the post in India is acquiring a business character and faces competition. It needs to remove the governmental controls and vest it with the operational and financial flexibility of a corporation. The so-called social service character — a cheap postal service with state subsidy for the benefit of the common man — can be still retained in terms of well-defined universal service obligations.

Expenditure revenue gap and tariff control

(Jain, Morris, & Raghuram, 2001)

The government should not determine postal tariffs, and deciding power should be transferred from legislative to executive control. There has been an irrational expansion of the network and manpower without correspondingly increasing user charges. The dependence on manpower instead of technology has resulted in growing costs due to periodic pay rises effected by central pay commissions and the in-built system of payment of dearness allowance in line with the increase of the consumer price index. While expenditure has steadily increased, postal tariffs have not been correspondingly increased to reflect costs.

Technological leap frogging

(Jain, Morris, & Raghuram, 2001)

India post continues to own and operate a large number of ancillary logistic services even though outsourcing or simply abandoning these services would be the cheaper alternative. In the age of digital communication, physical transmission of written message is getting outdated and hence the department adopts new technologies. Technology has changed the way business is conducted, especially in the communication sector. Physical exchange of data and messages is quickly being replaced by electronic exchange through the worldwide web. This relieves end-service providers like the Department of Posts of its reliance on physical carriers such as railways and airlines. The Post now has to make a choice to become an e-mail operator instead of a snail-mail operator to survive competition.

Figure 17: At wholesale market in Delhi, India.
© Manfred Breithaupt
Amazon Pilots Cash On Delivery (COD) model with India Post

India Post is one of the prime carriers of the Amazon India, an Indian subsidiary of the global online shopping giant Amazon.com. All of its “Amazon Fulfilled” orders are now shipped through India Post. Amazon India uses India Post’s delivery channel of over 19,000 pin-codes spread through 155,000 post-offices, which includes a majority of outlets in rural areas across all 35 states and union territories in India.

Source: Prabhudesai, 2013

The decision was influenced by the extreme difficulty in reaching inner Indian regions. According to Amazon, while it is relatively easy to cover the metros and TIER I cities, expanding their logistics coverage to smaller towns and villages is expensive and challenging. In order to overcome this issue, Amazon has started a pilot with India Post three years back. Under this agreement, India post personnel will not only deliver the package, but also collect payment on Amazon’s behalf.

Currently, Amazon is the largest business partner in e-Commerce. For the year 2015–16, it is estimated that India Post has collected INR 1,000 Crore Cash on Delivery (CoD) orders on Amazon India’s behalf.

Source: http://yourstory.com/2016/06/amazon-india-my-stamp-india-post

5.3 Indian courier and express sector

Since the introduction of organised services in the early 1980s, the Indian express industry has evolved rapidly and has increasingly added various services and user segments in the ambit of express deliveries. The size of the Indian express industry was estimated at INR 10,870 crores (USD 2.2 billion) in the financial year 2011–2012 and is considered one of the fastest growing sectors in India. The industry contributes to about 3% of the Indian logistics industry and is comparable to other segments of the logistics industry like coastal shipping, cold chain and container freight station and inland container depot.

The express industry includes both the courier and logistics industries. There is no authentic database for the courier industry in India and hence it is difficult to get more information about the market. The Indian courier industry consists of national, local and regional players. Integrators primarily concentrate on international operations though of late, a few are venturing into the Indian domestic market. The national players mainly operate across pan-India, while regional players operate regionally. Local players are quite unorganized and they are the key players in narrowly defined local markets. India Post is also a major player in the express delivery industry.

The share of organised players is estimated at 65%, while EMS (Indian Postal Department) holds a 10% share, and the unorganised segment holds 25%. The heterogeneity of the Indian express industry can be gauged from the fact that although there are more than 2,000 players operating in the country, only 20–25 players operate at a national level.

The express services providers use a hub and spoke network model. The branches form the spokes in this network. The larger player owns and operates more than 3,000 branches and service points whereas smaller players have an average of 35 branches. The branches for larger players are distributed over multiple regions, while branches of smaller players are largely concentrated in one region. Express service providers operate through a mix of owned and franchise branch networks. Most of the large players prefer to handle the consignments using their owned networks distribution, but are open to tie-ups with other players in order to extend their geographical reach. These tie-ups are largely on a non-exclusive basis in order to manage their operational costs. The smaller players have a higher dependence on tie-ups to extend their reach.
Regarding urban freight transport, parcel and express transport services are one of the fastest growing transport businesses in cities. Within the domestic market, intra-city and the top four metros form the top two segments which together account for almost two thirds of the markets by volumes while metros and large cities make up more than half. Such statistics are also an indication that the express services market is still dominated by the large urban locations and that there is lower penetration of express services in the smaller cities. However, this trend might change as economic activity shifts from the metropolis towards TIER 2 and 3 cities.

In general, the industry uses small to medium sized trucks and is based on consolidated delivery tours departing from cross-dock terminals located in close proximity to suburban areas. Express transport can make 70–90 deliveries in one delivery tour, while a traditional parcel delivery tour only serves about twenty receivers because the express courier network and planning enable operators to optimise times and transport costs.

**Challenges**

**Investments in the supply chain**

Both the courier and express service players have to maintain a network for collection, transportation and distribution of parcels. Sizeable investments need to be made towards developing the branch and hub network for any operation spread across multiple cities. However, the upfront investment required for a small operation is relatively low. As a result, the entry barrier for the industry is low but scaling up operations is a challenge as it involves significant investment as well as strong systems. The investment has to be supported with transport infrastructure and IT system infrastructure to offer acceptable service quality. The operations of express delivery services are labour intensive and therefore involve high manpower costs. A large number of these costs are fixed in nature thus requiring high volumes to break even.

By forming alliances, the Indian courier and express service players have found innovative ways of keeping their fixed cost low. Alliances between regional and local players, especially in the small package (less than 500 grams) market, have allowed smaller players to survive and become cost effective and more flexible than the large national players. Such arrangements take advantage of organising the large workforce of inter-city couriers into a network that shares transport infrastructure (and even consolidates sub-packages from various small couriers in a single large courier bag to be transported by air cargo or road transport rather than these sub-packages being carried by several manual couriers on the train). This way the courier firms are improving the efficiency of their services and are sharing fixed costs.

**Fragmented regulatory framework**

Express couriers work very efficiently in city centres, but their efficiency is threatened by the ever-increasing regulatory changes to access city centres. As a general rule, every municipality sets access restrictions based on its own needs, so that express couriers have to operate in a fragmented regulatory context. The two main operational features are time pressure and standardisation of procedures, so ideally they need to be able to collect and deliver in all

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Figure 19: Distribution of domestic shipments.© CRISIL, 2012
the cities they serve in the same time window and move freely to and from and within urban areas.

5.4 Infrastructure and construction sectors

Indian infrastructure and construction market overview

The liberalisation efforts of the past two and a half decades have sparked the interest of the international community towards opportunities in the country. The Indian Government identified Infrastructure as one of the key drivers of economic development. Investment in Infrastructure has increased from about 5% of GDP in the 10th Five Year Plan period to 9% in the 11th Five-year Plan Period.

The planning commission has projected an investment of USD 1 trillion for the infrastructure sector during the 12th Five Year Plan. About 40% of the funds for such investments are expected to come from the private sector. At the minimum, 45% investment in infrastructure is spent on construction and 20% on the modernisation of the construction industry. In order to attract such investment, the Indian government has eased foreign direct investment (FDI) norms for a number of infrastructure-development sectors (Planning Commission of India, 2014).

The Construction sector in India is considered to be the second largest employer and contributor to economic activity, after agriculture. It is estimated to be worth more than USD 126 billion. Construction also accounts for the second highest inflow of FDI and employs more than 35 million people in the country. Half the demand for construction activities in India arises from the infrastructure sector, while the rest is accounted for by industrial activities, residential and commercial development, etc.

The Indian Infrastructure and Construction sectors have moved out of its nascent stage. For the past few decades, both government as well as private developers have targeted the “low hanging fruits”, i.e. projects which were easy to execute and provided the maximum economic benefit, but are now willing to undertake complex and complicated projects like the extremely ambitious plans to develop 100 smart cities as satellite towns of larger cities and by modernising the existing mid-sized ones.

Urban infrastructure

Only 30% of the Indian population lives in urban areas (Planning Commission of India, 2014). The government expects urbanisation to grow at an astonishing rate of 38%. Furthermore, it is estimated that USD 650 billion investments are required in urban infrastructure over next 20 years; of this, almost 45% is required for development of urban roads and services.

To boost urban infrastructure across the country, the government has initiated numerous measures and has allocated almost USD 2 billion under JnNURM. The government also launched the Urban Infrastructure Development Scheme worth USD 1 billion to address infrastructure needs for small and medium-sized towns. Additionally, there is a renewed push towards PPPs in this sector. The Delhi-Mumbai Industrial Corridor (DMIC) is an ambitious infrastructure programme conceptualised together with the Japanese government, which aims to develop new “Smart Cities” and converge next generation technologies across infrastructure sectors.

Such ambitious infrastructure targets require an uninterrupted supply and delivery of raw materials to the construction sites that could be located anywhere, from the middle the most congested corridor of an area, to historical/ecological sensitive areas (e.g. religious shrines, heritage sites or reserved forests/coastal area). Logistic chains for construction materials are often not optimised mainly due to the fragmented nature of the industry itself and also the project-to-project based approach adopted by contractors. This then leads to relatively higher proportion of empty or half-loaded trucks trips or long queue of trucks waiting to gain access to construction sites. Their significant number and frequency of operation contribute to the overall congestion especially within urban areas.

The industry has recognised the problem and has introduced various measures at the project design and planning level towards consolidating both in-bound and out-bound logistical movements. This will reduce costs and also reduce negative transport externalities involved in construction related activity.
Challenges
(Antink, Garrigan, Bonetti, & Westaway, 2014)

The conceptualisation, design, and construction stages of urban elements like commercial buildings, residential blocks, roads, bridges are determined by a diverse and complex supply chain, both upstream and downstream of the construction site. On the upstream side, the building and construction sector is characterised by a proliferation of relatively small and local actors (by international business standards) with a high degree of fragmentation within, and non-integration between its many elements. Even the largest construction projects rely, to a large extent, on a myriad of small and medium enterprises (SMEs) as suppliers and subcontractors, contributing to aspects of the design, providing and transporting materials and offering specialist skills on site. The complexity of interaction among these participants is perhaps one of the greatest barriers towards greening the construction supply chain. Downstream of the construction site, the building market is equally fragmented, with many small landlords, corporate property owners and public housing authorities managing multiple buildings typically in local or regional markets.

Coordination among all the stakeholders in the building and construction sector is uncommon. As a result, decisions taken during the conceptualisation, design and construction phases – which have a major influence on the overall environmental impact of a building during its use – tend to be made without consideration of lifetime impacts or costs since these are often not seen as the responsibility of the developer (UNEP-SBCI, 2009). Similarly, the supply of materials is often done in isolation, with little or no incentive to pursue product development or alternative options, as many of the benefits of such actions are not realised by those directly involved in the process.

5.5 Municipal solid waste

Overview of municipal solid waste in Indian cities

Municipal solid waste refers to the refuse, the solid and semi-solid waste matters of a community apart from night soil. Solid waste contains both organic and inorganic matters. Municipal Solid waste management (MSWM) includes the entire process of dealing with solid waste, starting from the collection from the primary source to ultimately disposing off it hygienically. Stages of waste management process include management at waste generation level, storage at the source of generation, primary collection, street cleansing, temporary storage at locality level, regular and periodic transportation of this temporarily collected waste to disposing sites and treatment plants.

Process of transportation of waste

MSWM is one of the most essential basic services provided by municipal authorities in the country. However, it is also among the most poorly rendered services in the urban areas — the systems applied are unscientific, outdated and inefficient. Population coverage is low and as a result the urban poor are marginalised.

The transportation of waste from the waste storage depots to the disposal site is done with a variety of vehicles such as bullock carts, three-wheelers, tractors, and trucks. Only few cities use modern hydraulic vehicles. Most of the transport vehicles are old and open. They are usually loaded manually. The fleet is generally inadequate and utilisation suboptimal. Inefficient workshop facilities do not do much to support the old and rumbling squad of squalid vehicles. The traditional transportation system does not synchronise with the system of primary collection and secondary waste storage facilities and multiple manual handling of waste results. As a result, waste is generally seen lying in heaps or scattered around at the unscientifically designed temporary waste storage points presenting an unsightly appearance and causing nuisance and unhygienic conditions.

Challenges

Inadequate transportation vehicles result in delayed clearance of waste, lack of trip monitoring or vehicle movement. Additionally, there is no knowledge of the weight of waste being transported, and the lack of planning and poor supervision results in high percentages of vehicles remaining off roads due to a lack of planning and poor supervision. Open trucks and overloading of vehicles results in littering of waste during transportation and workshop facilities are inadequate for maintaining vehicles and other machines. For an augmentation of the municipal transport fleet, the corporation must purchase modern garbage handling machinery and
Housing and Urban development has to provide funds, so that some of the machinery and equipment required for collection and transportation of solid waste is purchased and the solid waste management system is improved (Khan, 2014).

5.6 HORECA

The Indian Hotel/Restaurant/Café (HoReCa) sector

HoReCa (short for Hotel/Restaurant/Café) is the sector of the food industry, which prepares and serves food and beverages (food service). The HoReCa sector in urban areas predominantly serves hotels and other short-stay accommodation (with and without restaurants), bars and restaurants, canteens and catering.

Recent tourism statistics reveal that both domestic and foreign tourism are on a robust growth path. This growth needs to be serviced by a substantial increase in infrastructure, including air-road, rail connectivity as well as hotels and restaurants.

Within this sector, the food service market is one of the fastest transforming and growing sectors in India. According to Reuters, today India represents the second-highest priority market for food service industry. The sector has witnessed double digit growth across formats in the organised sector, particularly in quick service retail (QSR) dominated by international chains, coffee chains dominated by Indian & international majors, and casual & fine dining driven by Indian and private equity majors.

Changing demographics and lifestyles see consumers seeking more convenience and choice. Rising disposable incomes and government initiatives such as open market and liberalisation policies are additionally infusing this sector with huge opportunities for new and existing players. As a result, more international food service chains are opening their branches in various cities of the country either directly, through franchisees or in partnership with local majors.

The size of the total market (organised and unorganised) was INR 247,680 crore (USD 48 billion) in 2013 and is projected to grow to INR 408,040 crore (USD 78 billion) by 2018 at a CAGR of 11%. The projected growth of the restaurant industry (organised – chain and licensed standalone outlets) was estimated at INR 67,995 crore (USD 13 billion) in 2013 and is projected to grow, at a CAGR of 16%, to reach INR 145,770 crore (USD 28 billion) by 2018 (N.P, Rajan, & Lodha, 2012).

However, the picture is not all positive. Nearly 90% of food processing units in India are small-scale and operate with limited use of technology. Additionally, the lack of integrated supply chains and poor transportation infrastructure (in terms of transit time and transaction costs) cause India’s farms to lose between 20–25% of their fruit and vegetable output – worth an estimated USD 10 billion (INR 52,000 crore) – due to spoilage at various stages every year. An Exim container of foodstuffs, for instance, will take 12–13 days to process in India, compared with just 3–5 days in France or Denmark (N.P, Rajan, & Lodha, 2012).

The HoReCa distribution channel

India is a heterogeneous market representing varying consumer attitudes, preferences and behaviours across regions. New consumer segments keep evolving as consumer needs and aspirations undergo changes. For example, health-conscious consumers have recently emerged as a major consumption class. With the increasing incidence of lifestyle diseases, sedentary lifestyle, and the desire to stay healthy and look fit, consumers are on the search for healthy meals. They are also willing to pay a premium for ‘healthier’ products, thus presenting a lucrative opportunity for food services players who can cater to different consumer choices such as fresh and nutritious, oil-free, low calorie food.

In summary, the evidence suggests that the Indian HoReCa distribution channels are characterised by unpredictability. Businesses maintain significant stocks but also often require just-in-time supplies. Orders are generally very small and deliveries are often arranged on a JIT basis, which leads to frequent (and inefficient) deliveries. The fragmented supply chain and disorganised back-end processes present a challenge towards offering these services whilst ensuring consistency and quality.

The Indian F&B sector has understood these limitations and they are trying out innovative ways to secure their presence in the market. Many players have begun investing in commissaries, and are expanding their cold chain and logistics network. Furthermore, new raw material suppliers are being added, enhancing the sector’s growth across segments. A few examples include:
**Café Coffee Day (CCD):** The brand has invested in technology to regulate most of its supply chain operations. Two well-equipped roasting facilities in Karnataka with state-of-art packing machinery increase not only the packing capabilities but also the shelf life of roasted coffee beans. The brand procures from multiple vendors, and uses technology to link its supply chain to those of the vendors.

Brands like *Lite Bite Foods, Devyani International, Pan Foods,* and *Azure Hospitality* have made substantial investments towards setting up large-scale commissaries to not only fulfill internal demand but also cater to external demand and thus increase revenues.

In the frozen dessert/ice-cream space, *Gelato Vinto* and *Natural* have made significant investments in front- and back-end operations to strengthen the supply chain, including transport and logistics.

Overall, the Indian HoReCa services market is trying to stabilise using various back-end demand and supply side factors. The increasing affluence and exposure of consumers and their drive to experiment, alongside the emergence of several domestic and international brands, will ensure sustained growth of current trends. It is however imperative that existing players continue to innovate and customise their offerings to suit the changing tastes of consumers.

### 5.7 Conclusion

A strong commonality exists across different supply chains. Overall the objective of any supply chain model is to fulfill the end-users needs, with the least amount of investment and inventory across the complete value chain. However, there are exceptions specific to the respective sector. For instance, department stores or vegetable markets often designate a constrained time window for deliveries. Even the supply chain for waste removal is sensitive to the dual service requirements of timely and thorough collection of all waste materials within a given geographic area. Many companies also maintain similar statistics, to which both inbound and outbound goods operators must adhere.

Although service sensitivity is a constant, there is more built-in flexibility for longer distance transport. If a disruption occurs during a longer distance stage, such as the transportation of aggregates material to a ready-mix concrete plant, then it is easier to make up for lost time and still deliver the materials when needed. However, during a shorter haul stage, such as the delivery of highly perishable goods like vegetables or ready-mix concrete to a construction site, there is less buffer time for handling hurdles like traffic jams. As a result, it is much more challenging to meet stage service requirements during shorter distance, especially in the dense urban areas that are infamous for fluctuating traffic conditions.

Not surprisingly, congestion is one of the most common obstacles to supply chain performance. Given that service deadlines are often geared around customer time-of-day preferences; shipment windows tend to fall during peak travel times when the urban road transport system is most congested. Delivery trucks may fall far behind their schedule and run the risk of returning undelivered items to the central warehouse. This is a costly outcome that drivers try avoid by rescheduling same-day delivery.

In addition to compromising service performance, congestion also affects the overall productivity of the supply chain. Not only are trucks at a greater risk of not making all their deliveries on time, they are also at risk of supplying fewer customers. Taking into account customer preference, performance metrics and driver incentives, fleet schedules are designed to complete as many deliveries in a workday as possible. Maintaining high per-truck productivity should also be of particular interest to public planners trying to reduce overall numbers of truck trips. When a single truck can efficiently serve a multi-stop territory, companies are not forced to assign multiple trucks for performance assurance on the route.

A further challenge to both supply chain service and productivity performance is urban access. Without adequate and reliable parking facilities and loading space, urban delivery trips are bound to remain significantly less efficient. Facility access can even be a challenge for supply chains that control their own retail networks if stores are in dense urban districts. Access issues can also arise from efforts to navigate large delivery trucks, such as petroleum truck tankers, into older petrol stations or smaller streets, particularly when they compete for space with the passenger vehicles. Such difficulties can be partially mitigated by night-time or early morning deliveries. Transport regulations, especially those that are inconsistent across jurisdictions, are potential barriers to optimal urban delivery performance; weight limits being a typical example of this.
6. Review of Best Practises in Urban Goods Movement

6.1 Measures implemented in Mumbai

Measures to alleviate traffic congestion in Mumbai compromise a mixture of land use policy measures, the development of new urban transport infrastructure and the expansion of the existing urban transport infrastructure network. These measures are categorised according to type and are briefly reviewed below.

Development of truck terminals, truck parking lots

Planning for the expansion and new locations of truck terminals forms an important objective in transport planning in Mumbai under the Comprehensive Transportation Study (CTS) report. Based on the detailed analysis of goods vehicle movements, new truck terminals have been proposed. Approximately 44 major truck terminals have been identified in the study area. Five major truck terminals and 10 mini truck terminals are proposed to be developed by 2031 taking into consideration the expected Dedicated Rail Freight Corridor (DRFC), which is expected to reduce delays.

The Wadala Truck Terminal is being developed on 115 hectares of land by MMRDA, with the aim to move the existing freight distribution centre away from the Masjid Bunder area. The basic objective of developing the Truck Terminal is to de-congest south Mumbai by shifting the existing transport companies’ offices, which are today concentrated in B&C Wards in South Mumbai. It will also help to rationalise the movement of truck traffic onto city roads. The terminal is designed to hold a capacity of 3,000 trucks at a time and offers all infrastructure facilities such as offices, loading/unloading facilities, parking and idle trucks, banks, restaurants, dormitories, etc. The truck terminal will have free access to the Eastern Express Highway and Anik-Panjarpol link, which forms the part of East Island Freeway. As economic activities gradually move north of the city, the potential advantage of Wadala Truck Terminal lies in its location, which will improve efficiency of freight distribution.

Shifting of wholesale markets

In the 1990s, a number of wholesale markets moved from the South Mumbai to the New Mumbai area in order to relieve the traffic from the congested south part of the city. To encourage relocation, the MMRDA extended loan facilities for construction of new markets, internal roads in the market yards, and the construction of central facilities. A move of the wholesale textile markets from South Mumbai to Bandra-Kurla Complex is also under consideration.

Restrictions on freight vehicles

Time and route restrictions on freight vehicles have been the preferred policy measures to relieve congestion on city roads in India. In the case of Mumbai city, the traffic police regulate restrictions on hourly and weekly periods of vehicle movements. The Traffic Control Branch regularly issues notifications to denote no parking areas on heavy vehicular movement, animal driven vehicles, handcarts and other.

Improvement of existing public transportation, network and fleet

Mumbai’s suburban railway system is used for passenger as well as intra-urban freight transport. At least three rakes on each suburban train are dedicated for goods transport. To improve the suburban rail system the Mumbai Urban Transport Project (MUTP I & II) was recommended by the Comprehensive Transportation Study and covers road and rail components. The idea is to improve the suburban rail systems by adding rail capacity along western and central lines and completing two key east-west road links.

Development of all north-south & east-west arterial roads and missing links

The following list highlights the major road infrastructure projects that are underway to install arterial roads and thus reduce detours of freight and passenger movements in the Mumbai Metropolitan Region:
1. The Mumbai Urban Infrastructure Project (MUIP) sanctioned in 2003 and the Extended Mumbai Urban Infrastructure Project sanctioned in 2007, aim to upgrade transport infrastructure facilities and thus allow local industries to prosper and create newer opportunities within the Metropolitan Region;

2. The Mumbai Trans-Harbour Sea Link Project (Sewree to Nhava) to improve connectivity between the island city and mainland by building a 22 km long six lane bridge to facilitate economic development in the Mumbai Metropolitan region;

3. Connecting Mumbai and its hinterland with freeways to reduce congestion on the western corridor between Bandra and Nariman Point. The Western Freeway (Worli – Nariman Point) will be constructed via a 13.75 km sealink upto Priyadarshini Park combined with a tunnel under the Malabar Hill.

All these infrastructure projects are formulated by the Mumbai Metropolitan Region Development Authority (MMRDA) to bring about improvement in the urban traffic and transport situation in the Mumbai metropolitan region.

6.2 Mumbai dabbawalas

In a study on Mumbai’s lunch box delivery system, Baindur (2011) highlights the capability of the informal sector to develop a precise, reliable and affordable logistics system in the urban realm. The “dabbawallah’s” or the ‘lunch box delivery people’ of Mumbai pickup and deliver lunch boxes from homes or restaurants and deliver it to the customer’s office — all within a specified time frame — and then deliver the empty box back to the place of pickup.

The Nutan Mumbai Tiffin Box Charity Trust of Mumbai was established in 1891 to provide pick-up and delivery of lunch for British workers in Mumbai. Since then it has become the leading lunch delivery cooperative in the city. It picks up and delivers 200,000 lunch boxes in a standard container every day and returns the same to the place of pickup. The firm has an annual turnover of about USD 12 million and employs 5,000 people for pickup and delivery – almost all of them are uneducated. However, only less than 10 boxes are wrongly delivered or not picked up each month.
The high performing and error-proof operations of the group have attracted global attention and won them many awards. They represent a growing group of service providers that exist as an element of the logistics network, providing niche service and generating value in return for the customer.

The operations of the trust are hierarchically organised – pick-up teams, consolidation teams, and delivery teams. Typically, each lunch box passes through more than four pairs of hands and may be transported up to 60 km each way. Pickup is done between 7:30–9:00, delivery between 12:00 and 13:00 and return between 14:00–17:00. In these tight time-windows, teams of 20–25 members (supervised by a team leader) pick-up lunch boxes from homes — about 30 pick-ups per person. The boxes are carried on a bicycle to the nearest train station where they are organised by destination. A consolidation team performs this task and carries the boxes, which need to travel to the same geographic destination onto the train. Often lunch boxes are unloaded at intermediate train stations, re-consolidated with boxes coming from other locations, and carried onto a third train to their final destination station. At the destination station, the lunch boxes are once again organised according to the building they need to be delivered to. Finally, a delivery team picks up the boxes, carries them on their bicycles and deliver them to the office where the owner of the lunch box works. Later in the afternoon, the same person picks-up the empty box and pursues the reverse logistics so that the box is ultimately delivered to its point of origin – either a home or a restaurant.

The reason for the high efficiency of the process has many factors. Contextually, the delivery team members see their role as very important — they are responsible for delivering food to their customers — and this enhances their commitment to their task and establishes a critical customer-service provider link. The operation is simplified by breaking down all tasks. The designed process is simple and easy to understand for each operator. More importantly, each operator has a limited yet clearly defined role. Each pickup operator does not pick-up more than 25–30 boxes, as that is the number of addresses that he can remember accurately without making mistakes. The lunch boxes are enclosed in a standard container with a unique code for the destination station, the building where the box is to be delivered to and the floor number in that building where the office of the customer is located. Each operator recognises a
limited set of codes that are relevant to him instead of learning the entire coding scheme. Finally, the continual repetition of the task helps the delivery team to avoid errors. The linear geography of Mumbai, the punctuality of trains, a relatively stable demand and strong inter-dependence between operators further facilitates the operation. The case study presents an example of how a manual logistics system can be organised to effectively deliver value to the customer.

6.3 Delhi – The Azadpur Mandi in Delhi – The Mandi that never sleeps!

Constructed in 1977 by the DDA, the New Sabzi Mandi (NSM) at Azadpur Mandi is the largest wholesale products market in all of Asia. Covering 43 acres in North Delhi, it not only supplies Delhi and its surrounding communities with fresh products but also serves as a hub for the rest of India. The Azadpur Mandi is the biggest distribution centre of fruit and vegetables in the world and thus has been declared to be of national importance as a National Distribution Centre (see Figures 22–27).

The market is governed and operated by the Agricultural Product Marketing Committee (APMC), which was formed under the Delhi Agricultural Produce Marketing (Regulation) Act, 1976. The purpose of regulation is to safeguard the interests of both producers/sellers & consumers by providing qualitative and quantitative economic, legal and infrastructural conditions for competitive marketing.

Transport of fruits and vegetables

Trucks transporting vegetables arrive from UP, Rajasthan, Himachal Pradesh and Punjab. Middlemen buy the goods from the farmers and bring them to Azadpur. The larger traders and ‘arhtiyas’[11] buy vegetables by the bori (sack) and often sell them through auctions. The traders usually sell directly to the arhtiyas because they are the only ones who can afford to buy goods in bulk. The arhtiyas then sell the vegetables by the dhadi (5 kg) to the smaller traders within the mandi or other large buyers.

6.4 ITC e-choupal

The e-choupal project was launched by ITC (a large diversified company with strong FMCG presence) in 2000 in the central Indian State of Madhya Pradesh (MP) to re-organise the distribution of soybeans in rural markets. Today 5,200 internet-enabled kiosks help e-choupal to reach out to more than 3.5 million farmers in 31,000 villages and thus cover a variety of agri-business products. E-choupal is a unique venture with the aim to eliminate the middlemen from the agricultural commodity supply chain and reduce information asymmetry for the farmers. It is an extremely profitable rural distribution system with unique design features.

Traditionally, farmers used to sell their products through government mandated markets called “mandis”. Commission agents who bought and sold the produce conducted mandi trading. Farmers would only find out the market price upon arrival at the mandi, where the product was auctioned. When enough purchases had been made at the mandi and demand was low, the auction prices fell dramatically. At the same time, the farmers were unaware of the auction status at other mandis where there could have been shortages. The decision regarding the quality of the product was also dependent on the trader. Similarly, distortions in price and quality affected agro-business trading firms like ITC who were, by government law, required to purchase from the mandi and through these traders and not directly from farmers.

Under the e-choupal model, kiosks were setup in villages to provide farmers with information on agricultural inputs, best practices in farming, market price realisation at various mandi auctions and weather conditions, all in their local language. Nevertheless, it enabled ITC to purchase products directly from farmers (through a change in the law), thus enhancing the quality of products and significantly reducing costs (i.e. USD 5.40 per tonne on soybean). The e-choupal model now has just two service providers in its procurement chain — the sanchalak, a person between the kiosks and the farmers who inspects the product and based on his quality assessment determines the price of the commodity (with a 0.5% commission on the volume sold) and the samyojak, who manages the ITC warehouses (receiving a 1% commission on

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[11] Arhtiyas — Arhtiyas are non-institutional agencies or commission agents which finance the credit needs of the farmers. Arhtiyas usually advance loan without keeping anything as a security for they know their clients (farmers) and their credit worthiness. At the same time, they make it sure that sale deeds are carried out through them ensuring that their economic interest remains intact.
Figures 22–27: The Mandi market in Delhi, always busy, always moving.
© Manfred Breithaupt
transactions). Samyojaks also handle much of the logistics at the procurement hub like storage management and transportation from the hub to processing factories.

ITC was able to overcome the hurdles posed by infrastructure inadequacies in villages. It uses solar energy to power the batteries of the computer kiosks and has shifted from dialup connection to satellite based technology (VSAT). Farmers are now able to better understand the market, make informed decisions and thus have a higher productivity. Various seed and fertiliser companies are now able to reach a wider market with lower transaction costs. E-choupal has provided a market for more than 64 companies (amongst them Monsanto and Nagarjuna Fertilisers). The innovative direct procurement channel is a win-win mechanism for all involved parties. Subsequently, ITC is building a rural retail infrastructure based on the idea of the e-choupal network, thereby changing the rural distribution landscape.

6.5 GATI

Established in 1989 when firms in India hardly outsourced their logistics requirements, GATI has transformed itself from a cargo movement company to one of the leading end-to-end logistics and supply chain solutions providers in India. Continuous innovation and high-end technological investments to improve service quality, speed and efficiency have led to GATI’s success in connecting with mass retail markets in several cities through 1,500 Customer Convenient Centres. GATI is also the first Indian company to operate in the far-east market with its own subsidiary in Hong Kong. GATI has been a pioneer on the service front, by providing a money back guarantee on cargo services, cash-on-delivery and a toll-free number for convenience of customers.

GATI operates one of the largest networks linking 594 out of a total of 602 districts in India with a turnover of USD 104 million in 2005-2006. It covers 3.2 lakh (320,000 km) every day with a fleet size of 2,000 trucks. Its automated shipment tracking ability has brought it closer to the customers through email confirmations and continuous updates on the status of delivery.

With its modern web-based warehouse management system (WMS), GATI has transformed the warehouse management practices in India. WMS is a web based warehouse management system that provides both functionality and flexibility to customers in managing their warehouse operations. It enables GATI and its customers to track inventory status in real time. Along with its transportation related capabilities, this has allowed GATI to manage the entire outbound logistics (i.e. warehousing, transport and dealer/retailer replenishment) of Blue Star for his home air-conditioning division. As a consequence, order processing times and shipping errors have fallen and customer service levels have improved. Currently, GATI operates 10 warehouses and plans to setup another 25 over the next three years at an investment of USD 100 million. These new warehouses will be designed with mechatronic systems that could lead a paradigm shift in warehouse management in India by implementing CRM and ERP systems.

6.6 AMUL

The Kaira District Milk Cooperative Union, better known as AMUL, was established in 1946 in Anand in the western State of Gujarat. Its aim was to remove the intermediaries in the milk procurement and distribution process and thereby increase the return to milk farmers. At that time, milk farmers were generally marginalised members of the society, and most of them barely poured a few litres of milk each day. As subsistence farmers, however, their existence depended on their business and any money lost to the middleman or environmental uncertainties posed a direct threat to their livelihood. Thus, AMUL (the Hindi word for “invaluable”) was founded; it is an extraordinary story how networks can be utilised to benefit the poor. From being a net importer of milk in 1947 when it became independent, India has now emerged as the largest milk producer in the world. AMUL played a significant role in this transition.

The AMUL network is coordinated by the Gujarat Cooperative Milk Marketing Federation (or GCMMF), which markets milk and milk products. There are 12 milk unions (each having several factories), one in each of the twelve districts of Gujarat. Each Union collects milk from farmers through cooperative Village Societies, a model, which is now replicated in the majority of states of India. In 2005–2006, GCMMF had a sales turnover of USD 860 million from its 15 different categories of milk and milk products.

The 12 Unions collect about 6.3 million litres of milk every day from 2.5 million farmers in 11,962 Village Societies. This amounts to 2.28 billion litres annually...
(in 2005/06). Each village may have 100 to 1,000 farmers who pour milk twice a day. Twice every day, about 500 trucks collect milk from these villages and transport it to one of the five cooling centres or processing plants. The Unions then process the milk into various types of liquid or powdered milk products. These products are distributed to consumers through a channel of 4,000 distributors and 500,000 retailers. Due to the complexity of such an operation, the network realised the need for a unique model to deliver value to customers while ensuring high return for the producers.

This section will briefly illustrate the unique mechanisms used by the AMUL network to coordinate the complex supply chain with the help of a number of third party service providers (distributors, retailers, logistics service providers and IT support groups). An extensive network of information, including IT kiosks at the milk pickup locations, complements frequent deliveries and low inventory levels in the chain. Payment to farmers for RM procurement is instantaneous – during the same or in the next shift. Milk is carried to the plants either twice daily in cans by trucks or once a day in chilling trucks. The routes of the trucks are well established and the arrival timetables accurate, thus reducing delays. The improved availability of products and quick delivery times allow the network to operate a zero stock out policy. Careful planning to reduce variability at each stage helps to maintain punctuality and time management. GCMMF coordinates the production plan between the twelve Unions and ensures matching the geographic markets with supplies. Total Quality Management (TQM) and Hoshin Kanri\(^{(12)}\) are the key tools used to plan and implement daily production and change programmes – these have facilitated a six-sigma performance throughout the network and have led to a doubling of sales revenue in the last ten years. Interestingly, AMUL has the largest market share in every product category that it competes in – its competitors being both large MNCs and larger and smaller Indian firms.

AMUL illustrates how good managerial practices can help bridge the gap between providing profits for the supplier as well as ensuring the provision of low cost,

\(^{(12)}\) Hoshin Kanri is the means by which the overall control system and Total Quality Management (TQM) are deployed.
high quality products for consumers – all through efficient coordination of logistics operations across an extensive network. AMUL operates one umbrella brand for products from all member Unions – a testimony to the strong quality and cost coordination across all Unions and Village Societies. In addition, it has been singularly responsible for pulling out several million of its members from poverty, ill health and illiteracy through its business model (called Anand Pattern) and social programmes. A more detailed account of the story and success of AMUL is provided by Chandra and Tirpuati (Chandra & Tirpuati, Managing Complex Networks in Emerging Markets – The Story of AMUL, 2003).

6.7 Sustainable sourcing and procurement practices at Max Hypermarket (PwC, RAI, 2012)

In 2004, Max Hypermarket entered into an agreement with SPAR to retail food and non-food merchandise in India. This section focuses on Max’s sustainable business practices of working with local farmers and communities to procure fresh fruits, vegetables, meat and fish for consumers. These sustainable sourcing and procurement practices ensure that:

- Suppliers receive a fair market price, are paid regularly and on time, and are also educated on best practices in farming and business management;
- Max receives well-priced and high quality products that can be sold to consumers;
- Consumers receive price benefits from Max and also consume fresh and hygienic food that meets Max’s high standards of quality.

Fruits and vegetables

Max maintains agreements with local farmers which are located between one and two hours away from the processing units. 70% of the fresh products in Max’s hypermarkets and large format supermarkets are sourced from local farmers. The vegetables and fruits are processed in temperature-controlled processing units. With a mandated 24-hour fresh delivery policy, Max ensures freshness of their product.

Lamb

Max buyers have deep and personalised relationships with suppliers, which have been developed over years.

As lamb farms are based in and around Karnataka, Max buyers are required to visit farms and check the antecedents of livestock. After animals are sent to government-approved slaughterhouses, the carcasses are transported to Max within two hours of slaughter. Buyers are in continuous contact with lamb farms and slaughterhouses to ensure quality control and transparency.

Poultry

The farms and processing units are checked before any cooperation to ensure that they meet Max’s stringent quality and hygiene standards. Birds of a certain weight and size are sent to processing units where they are culled and processed according to Max standards. Spot checks and surprise visits are typically made by buyers to ensure that quality and quantity benchmarks that were set are being meticulously followed. Timing, packing, transportation and delivery processes have been streamlined and payment procedures have also been put into place.

Fish

Due to previous issues with non-payment and pricing problems, fishermen were initially hesitant to supply to a large modern trade retailer like Max. Furthermore, Max initially faced issues regarding the quality and quantity of fish as suppliers were not present at the time when shipments arrived at the Max store. Payment was found to be another issue since fishermen did not have bank accounts. Max taught fishermen how to open bank accounts in order to streamline the process of payments. In addition, grading and quality parameters have been universally enforced which has resulted in a rejection rate of nil. Max buyers have travelled the Indian coastline to locate vendors that can supply the product quality that the company demands. 80% of fish is sourced directly from the landing centres and fish farms. Relationships with sellers have been built up over several years and have involved buyers living and fishing with the fishermen on the trawlers. The introduction of a classification scheme has furthermore helped to better source and price fish, to merchandise, and manage inventory and promotional activities.
7. Strategies for Sustainable Urban Goods Movement

7.1 Introduction

Approximately 33% of India’s population lives in an urban environment. Rapid growth is expected as the Government of India undertakes big economic reforms. The surging growth and employment opportunities in cities will act as a powerful magnet to attract another 300 million people to the existing 300 million people who are already living in the Indian towns and cities. For the government this means it cannot only focus on the development of large household infrastructure projects but also need to invest in building commercial centres to supply large quantities of goods and services both for commercial and domestic usage. The growth in infrastructure will result in an increasing demand for freight transport services (European Commission, 2007). Strategies for sustainable city logistics thus become vital in order to manage the demand for infrastructure and goods effectively and efficiently. A few key concepts (Allen & Browne, Sustainability strategies for city logistics, 2010) are discussed in this chapter.

7.2 Urban freight research and policy making

Urban transport is highly relevant to the urban economic viability and the urban environment, and should receive more attention both from researchers and the government at the national, state and local municipality level. Unfortunately little attention has been paid to urban freight in India until very recently.

Most of the research into the urban goods movement took place during the early 1990s when the Indian economy was about to be liberalised. Back then, research was concerned with the safety of heavy goods vehicles in urban areas, and resulted in the development of transport centres at the outskirts of the urban agglomerations and vehicle entry restrictions. Moreover much of the research was conducted for big metropolitan areas like Delhi, Calcutta, Mumbai, and Chennai and has no relevance for smaller cities.

Even though cities grew at an unprecedented rate, urban freight research further diminished as both researchers and policymakers gave little or negligible attention to the cause of existing or future logistical issues facing urban areas. The only solution which was advocated up until a few years ago was to either construct a new bypass road so as to restrict the number of vehicles entering the city or to construct, expand and relocate existing transport consolidation centres/transport villages to outer edges of the cities’ urban limits.

However, in recent years there has been a growing interest by the government, environmentalists and private companies to understand the intra- and inter-city movement of goods. This renewed interest in the urban good movements among policy makers was complemented by the constitution of National Transport Development Policy Committee (NTDPC), which has formulated a long-term transport policy for India. The committee devotes their time to study and present coherent long-term transport strategies up to 2032. However, the focus of the committee’s efforts has primarily been interstate movement of freight and its integration with other transport modes. Nevertheless, many parallels could be drawn about the implementation strategy for the urban good movements.

Despite of the adoption of NUTPs vision of encouraging urban local bodies (ULBs) to focus greater attention on the movement of people and goods, it has failed to formulate any coherent freight transport policies. In contrast, most of the ULBs have developed mature passenger based transport policies.

Thus, at the immediate stage, the national, state, and local governments have to encourage research in the field of urban goods movement. Attempts should be made to understand the importance of the research and to offer recommendations on designing urban goods movement schemes. Investment in understanding the use of ITS for the urban freight transport, investigating the role of multi-modal transport for the urban goods distribution, and the development of innovative models that tackle the needs of next generation urban distribution and supply chain would also be highly beneficial.

For instance, BEST Urban Freight Solution (BESTUFS) is one of the most active networks established to encourage the cooperation between domain experts, research
institutions, urban transport operators and city administrations. It aims to identify and disseminate the Urban Freight Solutions (UFS), which are considered best practice within Europe. Furthermore, BESTUFS acts as a platform for knowledge exchange for urban freight experts, user groups/associations, ongoing projects, the relevant European Commission Directorates and representatives of national, regional and local transport administrations and transport operators.

Similarly, the Institute for City Logistics (ICL) established in Kyoto, Japan in 1999 is a centre of excellence for research and development in city logistics and urban freight transport in Asia. It brings together academics and practitioners to exchange knowledge, experience and information through conferences and short courses (Institute for City Logistics, 2008).

In the Americas, the METRANS Transportation Centre has been organising and hosting the Annual National Urban Freight Conference in North America which brings together North American researchers and practitioners (METRANS, 2008).

Similar networks in India are very much in need.

7.3 Understanding efficiency issues in the urban goods movement

The negative social and environmental impacts of urban goods movement (i.e. fossil fuels consumption, greenhouse gas emissions, and air and noise pollution) are widely known to the larger audience. However, fewer attempts have been made to understand difficulties faced by the operator towards moving urban goods. The issues may be related to policy, operational or financial limitations, for example:

- Traffic congestion issues caused by traffic levels, traffic incidents, inadequate road infrastructure, narrow street layouts and poor driver behaviour;
- Transport policy-related problems, including neglect of freight transport issues in traffic studies and transport planning. Other policy issues include vehicle access restrictions based on time and/or size/weight of vehicle and (unintended) dedicated width of bus lanes;
- Parking and loading/unloading problems, including regulations, fines, lack of unloading space and handling problems;
- Customer/receiver-related problems, including queuing to make deliveries and collections, difficulty in
finding the receiver, and collection and delivery times requested by customers and receivers. Hence there is a need to document the expectations and limitations of the two distinct groups within the urban goods movement ecosystem, namely:

- Policy makers in charge of making operations of urban good movements within the city as efficient as possible through the introduction of suitable policies; and
- Logistic companies that introduce initiatives to reduce the impact of their freight operations.

Inefficiencies in the urban goods movement can be the result or combination of existing road design, layout or traffic levels in the area. They can be a result of the negative effects of non-freight transport policy measures in the region, e.g. the introduction of bus lanes without proper kerb side measure for freight vehicles. Additionally, inefficiency can occur due to the variations in urban freight transport policy measures adopted across different suburban authorities within a single urban area. For example, different access or loading time restrictions requirements within different parts of a city can be problematic for companies serving these locations with a single vehicle. Such inefficiencies can have both financial and environmental impacts and are therefore best avoided from the perspective both of freight operators and the society in general. In order to avoid these inefficiencies arising, improved collaboration and communication between policy makers and transport operators is needed. This could be done by establishing a broader consensus with the help of routine discussions between policy makers, planners and transport operators.

7.4 Establishing integrated urban freight data collection framework

Establishing a framework for collecting time series data of the local level freight movement needs to be developed and maintained. It will allow decision makers to better understand the process of goods movements and its performance with the existing road infrastructure and freight solutions. The post-processing and analysis of such continuous time-series data will direct decision makers towards improving the economic, social and environmental sustainability of the urban freight and freight industry in general.

At present, much of the freight data is being collected by the national government and is reported at a national scale which does not distinguish between urban and non-urban freight. Extracting urban freight data from these national surveys though possible, is not desirable, as the extracted data will not truly represent local conditions under which the goods move.

Therefore, cities need to focus on developing a data collection framework which is coherent, scalable and which can holistically collect all freight data (production, logistics, and transport). It is worth noting that there exists a great variation in scale, scope (coverage) and purpose of surveys that could be conducted. Moreover, adopting a single type of survey may not usually be sufficient to understand the urban goods movement. Hence, cities need to undertake a combination of surveys to capture a wider range of data rather than adopt the most “efficient” way which may be expensive, utilising significant manpower and material resources (Allen, et al., 2014). To survey relevant (various) freight agents, cities must leverage state-of-the-art sensing technologies and approaches to obtain urban freight data.

7.5 Urban freight transport initiatives

Numerous measures exist that could be implemented to increase the sustainability of urban goods movements. These include either one or combination of economic, environmental or social aspects, implemented without negatively affecting the remaining aspects. Broadly speaking, efficient urban freight transport initiatives can be classified according to their focus areas, namely

- achieving transport efficiency through improved operation models,
- the utilisation of environmentally friendly modes of transport for goods movements,
- the reorganisation of land-use patterns or supply chain organisation,
- regulations influencing urban transport behaviour and patterns through the implementation of transport policies, and
- the use of technological focused methods in vehicles routing operations and warehousing facilities.

Urban goods movement operators tend to be inclined towards adopting operational and market initiatives, while public authorities including the government should restrict themselves towards introducing
regulations, including those concerned with traffic movement, spatial land use and vehicle technologies.

In last decade or so, various types of urban freight initiatives and experiments have been implemented around the world, including India. The most prominent include:

- **Environmental zones**: often aimed at goods vehicles, these schemes aim to encourage the use of less polluting engine technologies in urban areas. Schemes have existed for several years in some Swedish cities and have been introduced in many other European cities.
- **Urban consolidation centres**: these schemes can be either voluntary or compulsory and aim to reduce the number of goods delivery vehicles in urban areas by consolidating vehicle loads at centres located in or near towns or cities. There are several examples of such centres in the India such as the Azadpur Vegetable Market, Sabzi Mandi in Delhi.
- **Vehicle access weight/size/time restrictions**: these are among the most common types of regulations imposed by policy makers, and include loading and unloading restrictions at the kerbside. Innovations in the field include automated vehicle access control systems to identify vehicles that are permitted to serve a particular area, the multi-use of road space by time of day in Barcelona, and the Nearby Delivery Area (ELP) scheme in Bordeaux, which sees town staff assist with making deliveries.
- **Out-of-hours deliveries and reduced noise from operations**: the PIEK programme in the Netherlands has researched quiet technologies for urban delivery that could help in reducing the noise associated with night deliveries. A night deliveries scheme operates in Barcelona that makes use of quiet technologies, while the Lorry Control Scheme in London aims to reduce goods vehicle activity and hence noise in residential areas at night.
- **Use of non-road modes**: the use of tram systems for freight movements like the City Cargo scheme in Amsterdam and the Cargotram scheme in Zurich, as well as the use of water-based modes, for instance the transport of waste by barge in Liege.
- **Lorry-routeing schemes**: voluntary or compulsory schemes to provide suitable road networks and routes for heavy goods vehicles.
- **Use/design of environmentally friendly goods vehicles**: the use of environmentally friendly road vehicles such as bicycles, cycle-rickshaws, bullock-carts, and donkeys. Such arrangements are very visible in Indian cities with a lack of sufficient road width.
- **Road pricing systems**: initiatives which tend to be aimed at all road users, such as the road pricing schemes in London and Norwegian cities, but do also affect the road freight industry.

The following sections focus on two initiatives, which have the potential to be readily accepted within the context of Indian cities.

### 7.5.1 Urban Consolidation Centres

Broadly speaking, the key objective of Urban Consolidation Centres (UCCs) is to diminish the need for goods vehicles to deliver part loads into urban areas (a city centre, an entire town or a specific site such as a shopping centre). In order to achieve this objective, UCCs provide facilities in or close to the urban area where deliveries can be consolidated for subsequent delivery into the target area. This way a high level of load utilisation can be achieved. The UCC furthermore provides a range of other value-added logistics and retail services.

Many of the existing transport centres within Indian cities were constructed as UCCs. As the initiative has both advantages and disadvantages, care needs to be drawn when assessing the potential economic, environmental benefits of UCCs against the potential costs associated with consolidation, including

- capital and operating costs of UCCs,
- an additional handling stage in the supply chain, and
- issues related to security, liability and customer services.

Because much of urban freight is executed at the intra-company level or between freight operators and the end user, the benefits of trying to channel urban goods flows through a consolidation centre may be limited. Another issues revolve around the financial viability of UCCs and the ultimate ownership of UCCs. Indian cities have resolved such issues through the formation of trust bodies under agricultural acts. However, efficiencies of governing bodies and their reliance over public money are often questioned.
7.5.2 Environmental zones

Several terms are often used interchangeably when referring to the concept, including ‘environmental zones’ (EZs), ‘low emissions zones’ (LEZs), ‘Umweltzonen’, ‘Milieuzones’, ‘Lavutslippssone’, ‘Miljøzone’ and ‘Miljözon’.

An ‘environmental zone’ (EZ) is a defined geographical area that can only be entered by vehicles meeting certain emissions criteria. The purpose of an EZ is to either restrict or charge the most polluting vehicles if they enter the EZ. By capitalising on recent legislation for road vehicles, which are progressively set to impose tighter emission limits on new vehicles manufactured over the past decade, EZs can improve air quality. Where EZs are implemented in locations in which air pollution has reached levels that are dangerous to public health, the government can improve air quality as well reduce the negative health problems associated with it.

Because only vehicles that meet specific emission criteria can enter an environmental zone (EZ), the EZ differs from the following types of access restrictions that can be placed on goods vehicles in urban areas:

- Weight restrictions;
- Length restrictions;
- Restrictions based on utilisation of loading capacity;
- Time restrictions;
- Permanent street closures and pedestrianisation schemes;
- Road user charging.

The above-mentioned types of access restrictions can be implemented in addition to an EZ. EZ schemes can take many forms based on their objectives, the geographical area they cover, the times at which the EZ is in force, the vehicle emissions standards required for vehicles to enter the zone, the types of vehicles that need to comply with the EZ, and the implementation and enforcement approaches used. EZs are seen as effective options for helping to improve urban air quality.

7.6 Conclusion

There are no standard, easily applicable solutions to the problems caused and experienced by freight transport in urban areas. However, the goal ought to be to identify policy measures and initiatives that ensure safe vehicle operation, promote economic vitality and lead to environmental improvement.

Policy makers will need to adopt a range of policy approaches in order to address the issues related to urban freight transport and sustainable development. In some cases, it will be necessary to impose restrictions on certain aspects of goods vehicle operation and to enforce these restrictions so as to meet safety and environmental objectives, through LEZs for instance. In other cases, working closely with the private sector might result in more progress to improve operational efficiency and to reduce the negative impacts of urban freight.

Public and private sector strategies to increase load consolidation and/or less frequent deliveries, for instance the use of urban consolidation centres, fiscal measures to encourage improved lading factors, and company-led innovations in their supply chains have the potential to reduce the number of goods vehicle deliveries considerably. Achieving increased levels of load consolidation often requires policies which avoid the unnecessary use of weight and time restrictions on goods vehicle operations generally, whilst still ensuring that such restrictions are imposed in specific local situations as required.
8. Role of Government in Promoting Green Logistics

8.1 Introduction

A number of examples from around the world show different ways to minimise the environmental impacts of the urban goods movement. These examples suggest that urban goods operators are willing to adopt greener technologies in their portfolio. However, reducing carbon emissions of the freight and other energy-intensive sectors requires concentrated efforts from the government, companies and the general public.

The government has a strong interest in reducing its dependency on fossil fuels, which, in turn, would help them provide a cleaner environment for all citizens of India, as promised under Article 21 of the Constitution of India. Nevertheless, India has been quite equivocal about its contribution to the United Nations Framework Convention on Climate Change (UNFCCC), agreeing to reduce emissions by “a broadly indicative number” (REUTERS, 2009).

While India has made good progress in the last 25 years since vehicular emission norms were first introduced and tightened regulations progressively since 1996 in order to reduce exhaust emissions, cut vehicle noise levels and upgrade the safety measures of freight vehicles, there is still a considerable improvement potential to attain higher environment standards.

Based on the work of McKinnon (2010), the following sections discuss the role of the government in promoting green logistics.

8.2 Define robust objectives

The objectives of the government should be simple, and yet very comprehensive in nature. Broadly speaking, the aim should be to

- improve the efficiency of goods distribution (supply chain),
- minimise congestion on urban roads,
- promote better utilisation of transport infrastructure facilities,
- minimise pollution and reduce greenhouse gas emissions (GHG), and
- reduce the number of road accidents, injuries and cases of ill-health associated to the goods movement.

8.3 Policy measures

The government can deploy a range of policy-level instruments to reduce the environmental impact of goods transport/logistics.

- Taxation instruments: fuel taxes, excise duty and road-user (toll) charges;
- Financial incentives: tax-rebates that can support capital investments for new equipment or infrastructure, or subsidise the use of greener freight modes or urban consolidation depots;
- Regulation: vehicle design and operation, the status of the freight operators, the tariffs they charge and even the capacity of the freight sector (e.g. Auto Fuel Policy 2025);
- Liberalisation and privatisation of freight markets;
- Infrastructure and spatial land-use planning: the construction and management of network infrastructure and terminals, controls on vehicle access to infrastructure and the zoning of land uses for logistics related activity;
- Advisory body: governments identifying and promoting best environmental practice in freight transport through close work with different trade associations.

With numerous potential measures, it depends on the government to prioritise and decide how it expects to change the behaviour of urban goods movement organisations. There is no “one size fits all” policy to achieve the desired results and therefore policy makers need to skilfully choose measures that can help to meet the defined target objectives. A package of measures should always consider geographic constraints of the country, the existing freight market conditions, infrastructure and industrial growth and strategies already adopted by various ministries. At the same time, policies have to meet the expectations of the general public along satisfy political interests.

When designing a package of sustainable logistics measures, policy makers must also take possible
“second-order effects” into account. There is always a risk that the implementation of a green measure in one area of logistics will have a cascading effect somewhere else. For example, increasing vehicle fuel efficiency can reduce the cost of transporting goods (per tonne-km). However, it can also cause the local operators to readjust their logistics strategy, including the sourcing of raw material from farther distances, and building larger consolidation centres further away that could actually generate more freight movement. In such cases, parallel measures, for instance taxes and regulations to suppress such roll-over effects are necessary.

The five objectives of policy making can be translated into five sustainable logistics strategies. These include improving freight transport intensity, freight modal split, vehicle utilisation, energy efficiency, and the level of externalities and are discussed in more detail below.

8.4 Reducing freight transport intensity

As stated in the NTPDC report “Moving India 2032”, cities need to de-couple their relationship between urban mobility and GDP. According to the vision for 2032, the Government of India is still hesitant to introduce more drastic measures, as those are seen as a potential threat to increasing the amount of freight movement and, in the broader sense, economic growth. As a result, the inaction jeopardises the implementation of a sustainable freight strategy.

From an environmental perspective, recent trends in road freight in India are headed in an adverse direction (NTPDC, 2014). The road freight transport intensity has been increasing, generating more tonne-km per billion rupees of output. Furthermore, the total transport system study (TTSS) carried out by RITES for the Planning Commission in 2007–08 observed a modal change, as rail share of total inter-regional freight traffic decreased from 89% in 1951 to 30% in 2007–08. The decreased use of rail is consistent and unchecked, which resulted in an estimated cost of about INR 385 billion (16% of total transport cost) in the year 2007–08 (NTPDC, 2014).

The NTPDC study further estimates changes in the modal share ratio of rail and road for total freight traffic, from 35:65 in the 12th Plan to 50:50 in the 15th Plan. With an elasticity of 1.2, total freight traffic is expected to grow at 9.7% rate per annum and reach over 13,000 btkm in 2031–32, compared to 2,000 btkm in 2011–12. As a result of increased freight transport intensity, India’s environmental footprint will further grow. Hence, it is necessary for the government to introduce explicit policies that curb the growth of tonne-km.

As identified, there are numerous ways to downsize emissions to more sustainable levels. These approaches will require changes to supply chains, including geographical changes in production and distribution.
systems that are key drivers of regional freight traffic growth. Promoting a return to more localised sourcing, greater vertical integration of production and decentralised warehousing could reduce freight transport intensity, but would require a reversal of well-established business trends.

One possibility is to increase taxation on freight operations. However, due to the relatively low price elasticity of freight transport, tax levels would need to be raised steeply to achieve a significant traffic reduction. Oil prices also play a big role, due to the dependency of freight transport on fuel. If oil prices rise sharply in the medium to long term, market forces may relieve governments of the need to raise transport taxes (Fiorella, et al., 2008).

A simpler and less controversial measure is to introduce initiatives that encourage companies to reduce the amount of freight movement based on their existing logistical systems and trading links. Examples include the introduction and implementation of vehicle routing systems with the support of computerised vehicle routing and scheduling (CVRS) or establishing swap arrangements between producers such as open and independent freight trading (exchange) platforms. In the UK, companies were given advice on the use of CVRS as part of the government’s Freight Best Practice programme (DfT, 2007). Similarly, in the Netherlands, the government operated a ‘transport prevention’ programme that gave companies guidance on ways of reducing their demand for freight movement through rationalising logistical operations.

8.5 Shifting freight to greener transport modes

Traditionally, policy makers and politicians have viewed the move of freight from the road onto the rail network and waterways as the most promising way of lessening the environmental and congestion problems associated with goods movement.

However, the current state of the logistics sector in India is unsophisticated and badly organised. There is a shortage of skills alongside high investments in the highway network. The discriminatory pricing of rail freight versus passenger transport will furthermore have dramatic effects that will make it difficult to stop or reverse freight trends in the foreseeable future.

Neverthelesss, there are ways for implementing a progressive shift in order to achieve the envisioned modal shift. Measures include making rail and water-borne transport more attractive or penalising organisations from using environmentally damaging modes. A combination of both can exert pull and push pressures on companies’ modal split decisions.

Taxation

In India, the pricing of fuel varies by state, though central taxes are part of the pump price of petrol. The central government taxes account for 24–26% of the pump price of petrol. The state’s taxes vary, but on average end up making about 20–25% of the final cost. As a result, approximately half of the pump cost of petrol goes to the government in the form of different taxes.

Furthermore, additional charges such as the ‘Green Surcharge’ exist which currently do not extend to diesel consuming vehicles. At the moment, the Green Surcharge of INR 2 is applied only on petrol sold across the country – in order to curb the use of individual motorised travel. The introduction of such user charging for trucks can also favour a switch to rail and water. For example the German government estimated that the LKW-Maut[13] would encourage a 6% shift in long-distance freight tonne-km to alternative modes (McKinnon, 2006).

The recommendations of the NTPDC report justify additional taxation, by specifying that “the pricing for transport services and for associated inputs like fuels should be depoliticised and set by market or by independent regulatory authorities. Where independent authorities set prices, they should be responsive to changing economic fundamentals in a timely fashion to minimise adjustment costs. Subsidies should be limited to those areas where their retention on societal considerations is overwhelmingly justified. Wherever subsidies are retained, they must be made as explicit as possible so that they are clearly identifiable to ensure transparency.” (NTPDC, 2014)

[13] Lastkraftwagen-Maut — Germany’s LKW-Maut is a toll for goods vehicles based on the distance driven in kilometres, the number of axles and the emission category of the vehicle.
Financial incentives

The nature of governmental financial support for greener transport operations varies widely, thus reflecting the differences in service and infrastructure ownership, the nature of the freight market, competition policy and rules governing the awarding of state aid. Support can typically consist of capital grants for rolling stock/vessels and terminal development, discounted infrastructure access payments or operating subsidies/revenue support grants. Such financial aid should be made conditional to only those freight operator and/or client that demonstrate adequate environmental benefit (supported by year-to-year auditing mechanism) from the use of the alternative mode.

Regulation

Focus here should be put on liberalising the rail freight sector so that railways can compete more effectively with roads. The Ministry of Railways’ announcement to introduce FDI in the rail sector to help the modernisation and expansion of railway projects is a welcome first step towards the establishment of commercial conditions.

The present government has approved FDI in segments like suburban corridor projects through public private partnership (PPP), dedicated freight lines, rolling stock including train sets, locomotives/coaches manufacturing and maintenance facilities, railway electrification, signalling systems, freight terminals, passenger terminals and infrastructure in industrial parks like railway line/sidings. As a result, the investment allows the rail sector to exploit the advantages of long-distance freight transport among pan-India more effectively.

Infrastructural measures

In the recent rail budget 2015, the government announced investment in rail infrastructure. In order to de-congest the Indian Railways network, the
government is committed to prioritise traffic-generating projects, which encompasses the fast tracking of sanctioned works on 7,000 kilometres of double/third/fourth lines and the commissioning of 1,200 kilometres in 2015. 1,300 km out of the total of 7,000 kilometres of system contracts in 2015–16 are expected to be Dedicated Freight Corridor (DFC).

Furthermore, the Transport Logistics Corporation of India (TRANSLOC) aims to make rail-freight more attractive through Public Private Partnerships. TRANSLOC supports the development of common user facilities through the provision of end-to-end logistics solutions at select railway terminals.

8.6 Improving vehicle utilisation

To exploit the full potential of freight movement, policies must improve the utilisation of road freight capacity. This can be done by carefully raising the vehicle load factors which are directly associated with reduction of driven kilometres, transportation costs, congestion levels, fuel consumption and emissions. Similar to the shift to greener transport, the measures to improve vehicle utilisation encompass taxation, financial incentives and consultation schemes, including strategies to increase the back haul ratio. In India back haul utilisation is extremely low, compared to other countries. The concept of Freight Exchange Platforms needs to be promoted and applied.

Taxation

The introduction of higher taxes on the ownership and/or operation of trucks will indirectly pressurise transport operators to become more efficient. For example, the Swiss Heavy Vehicle Fee (HFV) is reckoned to have significantly improved truck loading, particularly on backhauls. It is claimed that, ‘the main reason for the more powerful effect of the HVF was its incentive for fully exploiting the logistic potential to optimise utilisation of the vehicle fleet and especially avoiding empty runs’ (Swiss Federal Office for Spatial Development, 2004: 22).

Financial incentives

If the government would subsidise the development of urban consolidation centres (UCC), this would allow more efficient movement of goods between the cities and incentivise operators to maximise their profits. The work of Browne et al., (2005) reviews a range of urban consolidation initiatives around the world that have benefited from public support and created systems within which companies delivering and collecting goods in urban areas can combine loads and thereby improve vehicle fill.

Advice or accreditation schemes

The Government of India should run advisory, benchmarking and promotional schemes to encourage goods movement companies, among other things, to improve the utilisation of their vehicles. Those schemes should target both freight shippers and carriers and disseminate the best operational practices and technology available in an effort to accelerate their uptake.

8.7 Increasing fuel efficiency

The growing dependence on import of crude oil in the country has raised concerns about energy security. India’s estimated requirement of diesel is likely to increase to 86.76 MMt by 2017–18. The major consumption of diesel is accounted for by Heavy Duty Vehicles. Therefore, it is imperative to define Fuel Economy Norms for Heavy Duty Vehicles in India. Such norms should be made part of ‘carrots and sticks’ phenomena where government provides advisory service and financial incentives so as to accelerate energy-saving technology within the freight operations along with a “stick” in the form of high fuel efficiency so as to cut total energy costs and reduce dependence on imported fossil fuels, so as to fulfil its environmental commitments. Following are broad policy measures that could be deployed.

Raising fuel (excise) duty

Raising the fuel tax will ensure that operators buy more fuel-efficient trucks — which in turn would curtail India’s dependency on oil and reduce the greenhouse-gas emissions. However, the rise in fuel duty should be supported by schemes like fuel economy labelling. This is because the vehicle fuel economy labelling can influence
vehicle purchaser behaviour and can also be a motivational tool for manufacturers to improve vehicle fuel efficiency beyond fuel economy standard target values.

**Promoting/subsidising driver-training schemes**

Promoting/subsidising driver-training schemes offer a relatively cost-effective means of improving the fuel efficiency of trucks and vans and usually yield supplementary benefits in reduced accident involvement and lower insurance costs. The Petroleum Conservation Research Association (PCRA) under aegis of Ministry of Petroleum and Natural Gas, Government of India programme on ‘Eco Driving’ should also be extended to HCV drivers. Case studies of companies using this programme indicate average fuel savings ranging from 2.6 to 12% (DfT, 2006). Such training programmes should be introduced with incentive schemes that would help organisations to ensure that improvements in driving behaviour are maintained. Use of truck simulators should also be encouraged for this purpose, though their relatively high capital and operating costs generally make them less cost effective.

**Enforcing speed limits**

A study conducted by Southwest Research Institute in 2008 indicates that for heavy goods vehicles, every one mph reduction in speed saves approximately 0.8% of fuel. Thus simply enforcing existing speed limits can significantly cut fuel consumption and emissions. The government should make it mandatory for HCVs to install speed governors to ensure that truck drivers adhere to speed limits, as is currently the case in the EU.

**Incentivising replacing older vehicles**

Evidence from Canada suggests that the average fuel efficiency of heavy trucks more than 10 years old is around 24% lower than that of the average heavy truck (Transport Canada, 2005). Retiring elderly vehicles and replacing them with newer models can, therefore, affect substantial fuel savings. The government could also envisage something similar to its existing scheme called ‘JnNURM Bus Funding’. Through the JnNURM scheme, Government of India funded almost 10,000 buses. This allowed cities and states across the country to upgrade/implement bus based public transport systems. Obviously the funding should be restricted to government compliant ‘truck specifications’. This would ensure, that specification is not based on manufactures availability of product but rather it’s purely based on the vision, drawn by the Government for future freight sector. This would promote manufactures to bring necessary design and technological improvements.

8.8 Government-sponsored advisory and accreditation programmes

Governments in several countries have established programmes that promote the adoption of good environmental practice in the logistics sector. Good examples of such programmes can be found in the UK and United States.

**UK Freight Best Practice (FBP) programme**

The Freight Best Practice programme[^14] provides companies with advice on a broad range of measures that improve the efficiency and reduce the environmental impact of freight transport operations. Alongside numerous reports and brochures, the programme runs workshops and has established online tools for monitoring and benchmarking energy efficiency. Until recently, the programme was concerned solely with the movement of freight by lorries. It has been extended and now covers van traffic and promote the use of alternative, more environmentally friendly transport modes. Recent market research has established that companies obtaining advice from the FBP showed a significantly greater propensity to implement a range of fuel savings measures (Lawson, Michaelis and Waldron, 2007). It also suggested that the FBP provides a cost-effective way of promoting the decarbonisation of freight transport operations (at approximately GBP 8 of public funds per tonne of CO₂ saved).

**US SmartWay programme**

The SmartWay programme was set up by the US Environmental Protection Agency (EPA) in 2004 to help shippers to ‘reduce their transportation footprint’.

[^14]: Available online: http://www.freightbestpractice.co.uk; last accessed on 1 June 2016
It provides companies with advice and management tools, and approves emission-reducing products and services that transport companies can use. Furthermore, SmartWay offers financial support for green technologies such as anti-idling devices for trucks and helps companies obtain loans from private sources for other ‘green’ investments. Around 1,000 shippers and carriers have joined the SmartWay Transport Partnership and the membership ‘helps companies to build supply chain management strategies that integrate energy efficiency, air quality and climate change directly into the transportation decision-making processes’. Carriers that meet specified environmental criteria can gain differing levels of accreditation. An increasing number of US shippers, such as Wal-Mart, are insisting that their carriers are SmartWay accredited. The EPA also advertises the SmartWay brand, thus helping participating companies to derive a marketing advantage from greening their freight transport operations.

Green Freight India initiative (GFI)

The concept of ‘Green Freight’ has gained worldwide attention due to market and societal pressure to improve efficiency and reduce emissions from freight movement. According to the McKinsey report — Building India — Transforming the Nation’s Logistics (2010), freight transport in India is projected to reach 3,450 billion tonne-km (btkm) by the year 2020 from 1,325 btkm in 2007 – a 2.5-fold increase. At the same time, there was a loss of USD 45 billion due to inefficiency in logistics, which includes modal costs, low speeds, inefficient handling, long distances, and theft amongst others. Not addressed, these inefficiencies will cause a loss as high as USD 140 billion by 2020. Fundamentally, measuring the GHG emissions from transport is based on measuring or estimating fuel use, and as such is aligned with good logistics and fuel management – and all the cost savings this can bring.

The GFI initiative aims to create a carbon conscious society that understands the impact of fuel consumption in transportation and leverages knowledge, technologies and policies for a green environment and sustainable economic growth.

The project is segregated into three phases that are mutually interdependent. Broadly speaking the three phases will be:

- **Phase 1:** Developing a Methodology — This phase will focus on identifying the key areas that should be tested for when calculating CO₂ emissions. It will involve identifying the necessary processes for calculating the emissions and developing a protocol that is in sync with international standards.

- **Phase 2:** Conducting a Pilot Test — This phase will focus on testing the developed methodology in collaboration with volunteer organisations. It will include collecting baseline data, analysing the data, recommending/testing interventions to reduce the emissions and improve fuel efficiency.

- **Phase 3:** Dissemination of the final methodology — This phase will focus on disseminating outputs from Phase 2 and promote the findings (along with the policy recommendations) to the participating government agencies.

8.9 Conclusion

Government policy can greatly influence the performance and efficiency of the freight transport sector. Given the complexities and effectiveness of the range of measures, the government should introduce measures based on its environmental, economic and long-term sustainability vision. Looking at policy examples from countries, which have just introduced policies or those that have mature policies for implementing sustainable logistic strategies in place, can provide India with valuable learning opportunities. As a result, the Indian freight sector can grow and support the country sustainably.
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