



The Logistics Sector in India: Overview and Challenges

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Abstract

The logistics industry in India is evolving rapidly and it is the interplay of infrastructure, technology and new types of service providers that will define whether the industry is able to help its customers reduce their logistics costs and provide effective services (which are also growing). Changing government policies on taxation and regulation of service providers are going to play an important role in this process. Coordination across various government agencies requires approval from multiple ministries and is a road block for multi modal transport in India. At the firm level, the logistics focus is moving towards reducing cycle times in order to add value to their customers. Consequently, better tools and strategies are being sought by firms in order to enhance their decision making. In this paper, we provide a perspective on these issues, outline some of the key challenges with the help of secondary information, and describe some interesting initiatives that some firms & industries are taking to compete through excellence in managing their logistics.

1 Introduction

The Indian economy has been growing at an average rate of more than 8 per cent over the last four years (Srinivas, 2006) putting enormous demands on its productive infrastructure. Whether it is the physical infrastructure of road, ports, water, power etc. or the digital infrastructure of broadband networks, telecommunication etc. or the service infrastructure of logistics – all are being stretched to perform beyond their capabilities. Interestingly, this is leading to an emergence of innovative practices to allow business and public service to operate at a higher growth rate in an environment where the support systems are getting augmented concurrently. In this paper, we present the status of the evolving logistics sector in India, innovations therein through interesting business models and the challenges that it faces in years to come.

Broadly speaking, the Indian logistics sector, as elsewhere, comprises the entire inbound and outbound segments of the manufacturing and service supply chains. Of late, the logistics infrastructure has received lot of attention both from business and industry as well as policy makers. However, the role of managing this infrastructure (or the logistics management regimen) to effectively compete has been slightly under-emphasized. Inadequate logistics infrastructure has an effect of creating bottlenecks in the growth of an economy, the logistics management regimen has the capability of overcoming the disadvantages of the infrastructure in the short run while providing cutting edge competitiveness in the long term. It is here that exist several challenges as well as opportunities for the Indian economy. There are several models that seem to be emerging based on the critical needs of the Indian economy that can stand as viable models for other global economies as well.

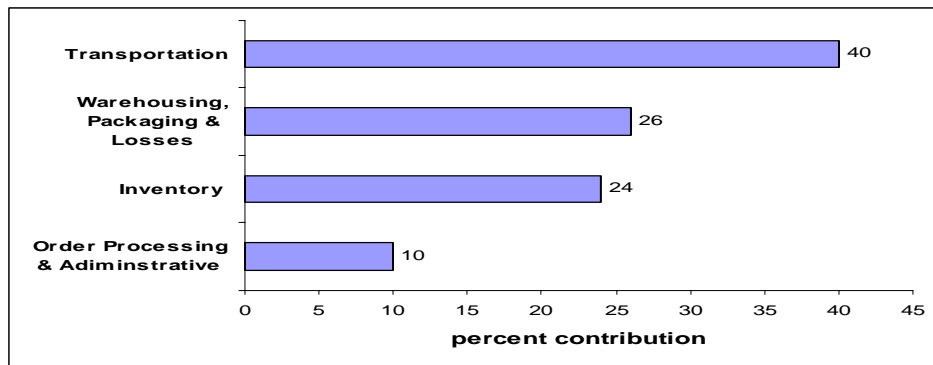
Chandra and Sastry (2004) have pointed towards two key areas that require attention in managing the logistics chains across the Indian business sectors – cost and reliable value add services. Logistics costs (i.e., inventory holding, transportation, warehousing, packaging, losses and related administration costs) have been estimated at 13-14 per cent of Indian GDP which is higher than the 8 per cent of USA's and lower than the 21 per cent of China's GDP (Sanyal, 2006a). Service reliability of the logistics industry in emerging markets, like India, has been referred to as slow and requiring high engagement time of the customers, thereby, incurring high indirect variable costs (Dobberstein et. al,

2005). However, the Indian logistics story is one with islands of excellence though there has been a general improvement on almost all parameters. It is this aspect that we explore further in this paper. The paper is organized as follows: the next section gives a brief introduction of some of the peculiarities of the Indian logistics sector. In section 3 we discuss the determinants of growth in this industry. In section 4 we provide some interesting initiatives that point towards a renewal of the sector. The challenges facing the sector are discussed in the last section.

2 Some Peculiarities of the Indian Supply Chains

The Indian logistics sector has typically been driven by the objective of reducing transportation costs that were (and often continue to be) inordinately high due to regional concentration of manufacturing and geographically diversified distribution activities as well as inefficiencies in infrastructure and accompanying technology. Freight movement has slowly been shifting from rail to road with implications on quality of transfer, timeliness of delivery and consequently costs except for commodities which over long distances, predominantly, move through the extensive rail network. More on the infrastructure issues later.

Figure 1 shows the relative value of transportation costs vis-à-vis other elements of the logistics costs in India. The transportation industry is fragmented and largely unorganized – a large number of independent players with regional or national permits that carry freight, often with small fleet size of one or two single-axle trucks. This segment carries a large percent of the national load and almost all of the regional load. This fragmented segment comprises owners and employees with inadequate skills, perspectives or abilities to organize or manage their operations effectively. Low cost has been traditionally achieved by employing low level of technology, low wages (due to lower education levels), poor maintenance of equipment, overloading of the truck beyond capacity, and price competition amongst a large number of service providers in the industry. Often, one finds transportation cartels that regulate supply of trucks and transport costs. However, the long run average cost of transport operations across the entire supply chain may not turn out to be low.

Figure 1: Elements of Logistics Cost in India

Source: Sanyal (2006a)

Table 1 gives a breakup of the logistics cost across different sectors of the Indian industry and the changes therein over the last five years. It shows how the logistics spend is increasing, sometimes dramatically, across various industrial sectors. Steel, pharmaceuticals, food & agro-business, and auto have also been the sectors that are growing most rapidly in the national economy – it is no surprise that their logistics costs have been increasing at a faster rate. A few observations are in order here. The low change in order processing & administrative costs in the cement sector could possibly be due to the use of call centers by various producers for order processing and dispatch planning. Steel and pharmaceutical sectors have seen maximum changes in component costs. The distribution practice of pushing goods down the channel might be responsible for high increase in the inventory and warehousing costs in the pharmaceutical industry. Investments in new cold chains and losses might be the causes of high change in the warehousing, packaging & losses related costs.

Warehousing, has also been typically dominated by small players with small capacities and poor deployment of handling, stacking and monitoring technologies. While it has had detrimental effect on almost all sectors, the food sector has been the one that has suffered the most due to low investment in cold chains and allied machinery. Erratic power outages have also meant low dependence on technology and a more manual operation. Another fact that has affected both the location as well cost of operating a

warehouse has been the “octroi tax¹.” Firms have been locating warehouses outside city limits.

Table 1: Distribution of Logistics Costs across Some Sectors (2000-2005)

Sector	Logistics Cost Components (in US \$ mn)	Transportation	Inventory holding	Warehousing, packaging & losses	Order processing & administrative	Total Logistics cost
Auto	2000-01	285.0	171.0	185.3	71.3	712.6
	2005-06	406.5	243.9	264.3	101.6	1016.4
	Avg. Change	20.3	12.2	13.2	5.1	50.6
Cement	2000-01	50.6	30.4	32.9	12.7	126.5
	2005-06	55.4	33.3	36.0	13.8	138.5
	Avg. Change	4.8	2.9	3.1	1.2	12.0
Consumer Durables	2000-01	331.9	199.1	215.7	83.0	829.6
	2005-06	398.9	239.3	259.3	99.7	997.3
	Avg. Change	11.2	6.7	7.3	2.8	27.9
FMCG	2000-01	201.5	120.9	131.0	50.4	503.8
	2005-06	280.7	168.4	182.5	70.2	701.8
	Avg. Change	13.2	7.9	8.6	3.3	33.0
Food	2000-01	398.7	239.3	259.2	99.7	996.8
	2005-06	524.5	314.7	340.9	131.1	1311.2
	Avg. Change	21.0	12.6	13.6	5.2	52.4
Garment	2000-01	337.3	202.4	219.2	84.3	843.2
	2005-06	454.4	272.6	295.3	113.6	1135.9
	Avg. Change	19.5	11.7	12.7	4.9	48.8
Pharmaceutical	2000-01	174.0	104.4	113.1	43.5	434.9
	2005-06	310.0	186.0	201.5	77.5	775.0
	Avg. Change	22.7	13.6	14.7	5.7	56.7
Steel	2000-01	438.3	263.0	284.9	109.6	1095.7
	2005-06	693.6	416.1	450.8	173.4	1734.0
	Avg. Change	42.5	25.5	27.7	10.6	106.4

Source: IAEIS

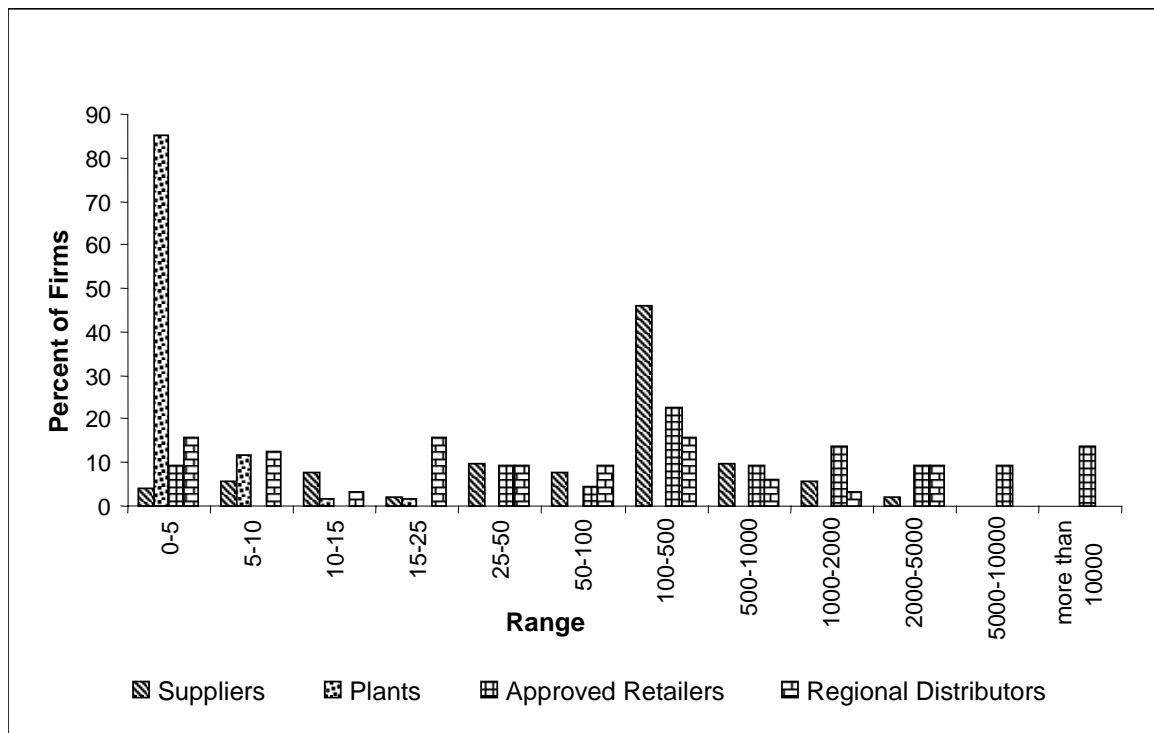
They delay moving goods into retail network as late as possible. It has also led to the development of a unholy business-government nexus to avoid the tax and extract rents. Use of technology is quite limited – both IT and engineering equipments in order to increase productivity and service. An in-appropriate evaluation of the diverse benefits of technology has led to higher usage of manual labour across the logistics industry whether

¹ An entry tax on goods coming into a city. The tax is a major source of revenue for city municipal corporations.

it is in the distribution activities or within plants. Many firms try to compete through the factor advantage of low wages which have necessitated hiring low or no skill personnel thereby sacrificing productivity related gains in the long run.

Understanding the linkage between inventory and transport planning is a key to reducing operational cost of distribution. Chandra and Sastry (2004) identify transport & dispatch planning as an area of concern in a survey of manufacturing firms in India. Ninety eight per cent of sample firms in that survey have a contract with trucking companies for making dispatches and only 11 per cent own their own fleet of trucks. While 36 per cent of these firms use third party logistics (3PL) service providers for making dispatches, about 30 per cent use 3PL service providers for procuring their material from their suppliers. Somehow, transport planning has remained a unglamorous area within Operations despite the fact that about 10 per cent of the cost of sales comes through physical distribution (Sanjeevi, 2003). Transport planning (e.g., optimal dispatch quantities & frequency of dispatch, vehicle routing, loading pattern in the trucks etc.) does not appear to have received the required attention. For example, in the same survey, only 21 per cent of sample firms report the use of some software for scheduling dispatches.

It is worth understanding the structure of the Indian supply chains, in aggregate, to get a better appreciation of many of the issues raised earlier. In Figure 2 Chandra and Sastry (2004) present the structure of the supply chain of a sample of firms. It can be seen that about 4 per cent of firms have less than five suppliers, about 85 per cent of firms have less than five plants, about 14 per cent of firms have less than five regional distributors, and about 9 per cent of firms have less than five retailers. A similar statistics is obtained for other ranges of suppliers, plants, distributors, and retailers. What is worth noting is that 63 per cent of firms have more than 100 suppliers, about 39 per cent of firms have more than hundred distributors, and 77 per cent of firms have more than hundred retailers. In addition, about 17 per cent of firms claim to have more than 500 suppliers. The same for distributors and retailers is 22 and 54 per cent respectively. This is perhaps where difficulties in managing logistics in India lie - larger the number of suppliers or distributors, higher is the cost of coordination.

Figure 2 : Structure of the Supply Chain of Sample Firms

Source: Chandra and Sastry (2004)

When we look at the spatial distribution of both plants and suppliers, the above statement becomes even stronger. Of the sample firms that operate more than one plant, 48 per cent of these plants are located more than 100 kilometers away from each other, 33 per cent of these plants are located more than 500 kilometers away from each other and 18 per cent of these plants are located more than 1000 kilometers from each other. Similarly, on an average, only 4 per cent of suppliers are located within 5 kilometers of the manufacturing plant, about 13 per cent are located within 5-25 kilometers of the plant, 16 per cent are located within 25-100 kilometers of the plant and about 67 per cent of suppliers have facilities that are more than 100 kilometers away from the plants. Location policies of the past may have forced some firms to locate plants away from each other. However, this may be coming to haunt today as the cost of coordination increases and the ability to provide quick response to customer requirements might reduce. This problem gets exacerbated with suppliers. Manufacturers have to either develop suppliers separately for each location (thereby increasing the number and affecting consistency in quality, price & delivery times) else material has to travel longer distances if there is a common supplier to all plants.

The logistics challenge in such an environment is immense – build the infrastructure, manage the requirements of a changing structure of various sectoral supply chain, change industrial policies to facilitate efficient production and movement of goods and services, deploy effective managerial practices and technology to enhance the competitiveness through better management of logistics networks, and develop new models for new sectors especially in the service sectors as well as traditional areas like agri-business etc. It must be mentioned that the logistics industry in India is transforming itself very interestingly despite its peculiarities by developing innovative business models and by chipping away at the such structural and policy based rigidities. In a later section, we discuss some of these innovative initiatives that are leading the renewal of the logistics industry in India.

3 The Changing Logistics Infrastructure

With rising consumer demand and the resulting growth in global trade, the role of infrastructure support in terms of rails, roads, ports & warehouses hold the key to the success of the economy. In this section we provide a quick overview of the status of the logistics infrastructure in India and the current initiatives, both private and public, in that area.

Goods are transported predominantly by road and rail in India. Whereas road transport is controlled by private players, rail transport is handled by the central government. With the second largest network in the world, road contributes to 65 per cent of the freight transport (Rastogi, 2006). Road is preferred because of its cost effectiveness and flexibility. Rail, on the other hand, is preferred because of containerization facility and ease in transporting ship-containers and wooden crates. Sea is another complementary mode of transport. Ninety five per cent of India's foreign trade happens through sea (Deccan Herald, 2006). India has 12 major ports, six each on the West and East coasts and 185 minor ports. Table 2 maps the various modes on different performance indicators, clearly indicating the vitality and importance of road transport in Indian economy. There is also evidence of an, across the board, increase in freight traffic for all modes indicating an increased logistics activity. For instance, the per cent change in road, rail, air and sea cargo traffic has increased, between 2001 and 2005, from 5 to 14 per cent, 4 to 7.5 per cent, 6 to 20 per cent and 3.5 to 11 per cent respectively (CMIE Database, 2006).

Table 2: Comparison Chart for Various modes

	Rail	Road	Sea
Number (wagons, trucks, ships)	214760	3487538*	806
Freight Capacity(mn ton)	10.66	5.12*	7.9
Route Length (mn km) /Number of major ports	0.11	3.34	12
Freight Revenue (US \$ bn)	7.00	38.64	4304
Major Products	coal, steel, petroleum, primary metals	automobile, electronic items, garments etc.	iron ore, coal, petroleum (and industrial and consumer products on the outbound export)

Source: IAEIS, 2005-2006, Financial Express, 2006a

*This figure is for 2002-03

1 US\$ = Rs 44

In keeping with the increasing demand for road transportation, the National Highway Authority of Indian (NHAI) has been strengthening and widening national highways in multiple phases. As part of the National Highways Development Project, the work on the development of golden quadrilateral (connecting Delhi, Mumbai, Chennai and Kolkata) and the North-South and East-West links were started in 1998. It will build 13000 km expressways that would connect the nation (Surabhi, 2006). NHAI is investing about \$650mn towards the development of an Intelligent Transportation System (ITS) which will make transport services on the highways (like reducing congestion, advance signaling, medical assistance, accident management, etc.) efficient and automating many processes like toll collection etc. (Sanjai, 2007).

Because of the growing opportunity and potential for high revenue, the Ministry of Railways has been taking measures to expand the rail connectivity and recapture the market share of freight business. By focusing on improving wagon utilization, the Railways have managed to reduce the freight cost from 61 paise² per net tonne km (ntkm) in 2001 to 56 paise per ntkm in 2005 (Rastogi, 2006). At present, goods train run on same

² 100 paise = 1 Rupee

railway tracks as passenger trains at an average speed of around 25 kmph (Gill, 2006). With the proposed dedicated west and east freight corridors, the goods trains are expected to run at 100kmph. The West and East rail corridor of 1469-km and 1232-km will be built with an investment of \$2.60 bn and \$2.40 bn respectively and will be equipped with the latest centralized traffic control systems (Acharya, 2006a). Indian Railways has also decided to collaborate with bulk users of freight transport to build the rail network in a Public Private Partnership (PPP) mode. The first project on this line comprises nine public and private sector companies that are building a 82-km rail line between Haridarpur and Paradip at a cost of \$ 120mn (Telegraph, 2006). Recently several steel companies have also shown interest in linking iron and coal mines in Orissa with a 98-km rail line (Business Standard, 2006).

Multi-modal transport in India was a monopoly of the Container Corporation of India till 2005. With licenses being given to 13 new private players (Acharya, 2006b), rail trade should improve considerably. In order to encourage trade by small scale industries, Indian Railways has started a “road-railer” system where container vehicles are capable of running both on highways hauled by trucks and on rail (Guha and Sinha, 2006). In 1998-99, the Konkan Railway (one of the railway zones in South-Western India) pioneered the 'roll-on, roll-off' ('RO-RO') concept between Mumbai (Kolad) and Goa (Verna). Privately owned trucks are loaded with their goods which are driven on to a rake of flat cars and are carried (trucks and their cargo) to the destination.

In 2005-06, the ports handled 456.20 million tonnes of cargo traffic. This is expected to increase to 700 million tonnes by 2011-12. In keeping pace with the growing demand, the government plans to increase port capacities to around 1 billion tonnes per annum in the next six years (Raja, 2006). Under the National Maritime Development Programme (NMDP), the government is encouraging public-private partnership to build and maintain ports. This scheme will cover 276 port related projects at an investment of \$12.40 bn (Raja, 2006). With rising congestion levels at major ports and with high average turnaround time, the government has decided to develop minor ports in seven states to ease the traffic of major ports (Financial Express, 2006b). Tables 3 the operational performance of various ports in India – while there is an improvement in performance, the pace is slow. The estimated cost of this development is expected to be around \$350 mn. Further, private sector is likely to invest \$ 7.67 billion over the next six years.

Table 3: Average Turnaround Time At Ports (in Days)

Port	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	CAGR
Chennai	6.40	5.80	5.30	3.70	4.60	3.80	(9.90)
Cochin	3.23	3.10	2.37	2.19	2.22	2.33	(6.32)
Haldia	5.21	3.96	4.01	3.02	2.87	3.00	(10.45)
Jawaharlal Nehru	1.72	2.48	2.34	2.28	2.04	1.84	1.36
Kandla	6.15	4.72	6.55	5.94	5.06	4.62	(5.56)
Kolkata	6.59	5.50	4.71	4.47	4.29	4.17	(8.75)
Marmugao	4.30	4.25	2.04	3.86	4.47	4.35	0.23
Mumbai	5.60	5.20	5.47	5.06	4.10	4.21	(5.55)
New Mangalore	3.80	2.89	2.73	1.90	2.35	2.96	(4.87)
Paradip	3.89	4.16	3.99	3.37	3.42	3.41	(2.60)
Tuticorin	6.39	4.10	4.11	3.59	2.59	2.66	(16.08)
Vishakhapatnam	4.75	3.71	3.51	3.72	3.33	3.20	(7.60)
Average	4.84	4.16	3.93	3.59	3.45	3.38	(6.92)

Source: IAEIS

Currently, fifteen private sector projects are operational at various major ports and four more projects are under implementation (Raja, 2006). One of them aims to build the deepest port in the world at an investment of \$ 1bn (Financial Express, 2006c). This project is handled by a three-firm Chinese consortium with a Mumbai-based partner, Zoom Developers. Interestingly, firms like Ambuja Cement have been using barges for transport of clinkers from their factories to crushing and packaging plants all over the coast, thereby, reducing transport costs considerably. It can be seen that there is a fury of activity in enhancing the infrastructure capacities in the country.

4 Determinants of Logistics Growth in India

The Indian logistics business is valued at US\$ 14bn and has been growing at a CAGR of 7-8 per cent. As mentioned earlier, the logistics cost represents 13-14 per cent of the country's GDP. The market is fragmented with thousands of players offering partial services in logistics; it is estimated that there are about 400 firms capable of providing some level of integrated service (Mahalaksmi, 2006). The economy is expected to grow around ten per cent over the next ten years and sectors like chemicals, petrochemicals (especially distribution), pharmaceuticals, metals and metal processing, FMCG, textile, retail and automobile are projected to grow the fastest. New business models are emerging as new firms, both domestic and foreign, enter the market. As a result of the ensuing competition, linkages with global supply chains and domestic market growth

promise to change the face of logistics industry beyond recognition. In this section, we discuss how these are going to determine the growth of the sector.

The scale of operations in manufacturing is changing and so are their markets and sourcing geographies. Growth in manufacturing in India has happened across clusters that are located in different parts of the country, e.g., Ludhiana, NCR, Baddi and Dehradun in North, Rajkot, Jamnagar, Pune and Mumbai in West (along with Ankleshwar, Vapi, Aurangabad, and Kolhapur and most recently Kutch), and Coimbatore, Vishakhapatnam, Bangalore, Hosur, Chennai, Pudduchery and Sriperumbudur in the South. Assembly plants at these locations are being fed with raw materials and intermediate products from all over the country and abroad (as well as these locations). Moreover, distribution networks with emerging hubs in Indore and Nagpur (i.e., Central India) supply all over the country and abroad. This is going to increase the nature and extent of movement of goods and services across the country. This has been accompanied by the expansion of domestic production capacity (e.g., ORPAT in Morbi has added capacity to produce 40,000 units of quartz clocks and time pieces at a single location) as well as a big MNC entry into the Indian manufacturing scene (e.g., NOKIA's new factory at Sriperumbudur produces 1 million mobile phones per month). As the volume of production grows, so will the extent of movement of goods either to the ports for export or to the rest of the country. Some of the large players to enter (or expand significantly) the Indian market recently have been Reliance Retail, Big Bazaar Hypermart, Pantaloon and RPG in Retail; Nokia, LG, Samsung, Motorola, Sony, Blue Star in Consumer Electronics; Bajaj, Hero Honda, Maruti, Honda, Toyota, Audi, Volkswagen, Renault, Volvo in the Automotive sectors; Holcim in Cement; etc. It can be expected that their operations will drive the growth of logistics industry.

The liberalizing Indian economy is experiencing entry of large domestic and global firms in new businesses as well as enlargement of distribution network of many regional Indian firms. The announcement of large retail projects by Reliance and Bharti (in collaboration with Wal-Mart) will bring new technology, add additional warehouse capacity and will require fast and reliable movement of goods across the country. Reliance is thinking of establishing large warehouses in Thailand to take advantage of low cost sourcing from South-East Asia once the Free Trade Agreement with Thailand (as well as ASEAN) gets finalized. Similarly, regional food & grocery retail leaders like

Subhiksha who are present very extensively in the South Indian market are now entering the rest of the country with more than 600 new retail stores in 2007. Their logistics strategy and needs are transforming very significantly with this nationwide expansion. New retail chains are entering the non-metro towns and non-State capitals. It may be mentioned that the growth of the courier industry post-liberalization has helped change the parameters of service evaluation in the industry from cost alone to cost, time, and reliability. This sector has also seen a number alliances between regional and local players especially in the small package (less than 500 grams) market thereby creating networks of small players who are not only cost effective but also more flexible than the large national players. This segment of the industry has taken advantage of the large manpower and is gradually moving away from “Angadiyas” or manual inter-city couriers to a more organized 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; the courier firms are gaining on service and are sharing fixed costs).

The entry of large third party logistics (3PL) carriers like Federal Express and DHL and the expansion of domestic networks of Indian firms like Gati and Shreyas Shipping is also transforming the nature of services and the business practices across the sector. Table 4 gives an idea of the investment plans announced by the various firms for the coming financial year and gives a sense of their increasing activity. Another trend driving growth in this sector has been the consolidation amongst the logistics player. Mergers & Acquisitions amongst Indian and MNC logistics firms is starting to increase the reach of MNC 3PLs in the domestic

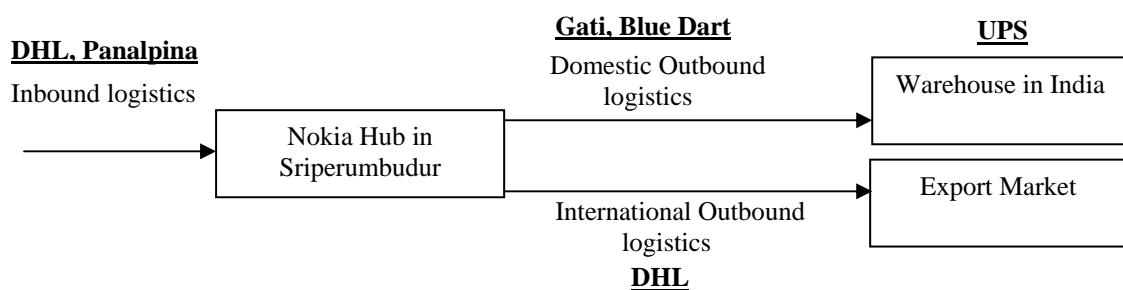
Table 4: Investment Plans of Major 3PL Service Providers

Firms	Investment Details/ Plans (2007-08) (in US \$ mn)
DHL	260
TNT	115
Gati	200
*Shreyas Shipping and Logistics	350

Source: Baxi (2006), Sanjai (2006a)

market while consolidating the business (e.g., DHL acquired Blue Dart, TNT acquired Spedage Express Cargo Service, Fedex bought over Pafex etc.). Consolidation is expected to be beneficial to both the service providers as well as the consumers. Initially MNC 3PL firms were providing only custom clearance and freight forwarding facility to their international clients. With the logistics market growing we should see a shift in this trend. The complexity of managing the supply chain in the pre-consolidation era is illustrated through the following scenario at Nokia (Figure 3) . Logistics activity for Nokia's India Hub was maintained by a large number of

Figure 3: Typical Logistics Supply Chain of Nokia



Source: Mishra et al. (2006)

service providers. Coordination and handover was a problem at times. With DHL acquiring Blue Dart, it is now able to provide seamless end-to-end integrated supply chain solutions. Downstream distribution channels have also seen some consolidation. Manufacturing firms, particularly, in the FMCG sector have started to reduce the number of wholesalers (and at times, distributors) so as to increase the reach and consequently the returns to each wholesaler. This also induces them to invest in new productivity enhancing technology and effective managerial practices. Technology in the logistics chain is being upgraded bringing better visibility on customer off-takes (though an absence of cash registers and the accompanying regulatory discipline to avoid tax evasion stand in the way of automated data updation). Introduction of more efficient transport technology and mobile communication has the potential of changing the logistics practices in the industry. Increasing competition and the low penetration of IT also implies that the scope for change is immense and imminent. The agri-business sector's supply chain, for example, has changed significantly with increasing investment in cold-chains across the country. With this, fruits and vegetables are being transported long distances (often more than 1500 kms) and milk grid is able to pickup and deliver liquid

milk from and to remote areas more frequently. Here the role of cooperatives like AMUL has been exemplary both in increasing the size of the distribution network and also in re-organizing the supply network very efficiently along with enormous buildup of social capital – a pre-requisite for growth in emerging economies (Chandra and Tirupati, 2003). Low penetration of hand held technologies for order processing and tracking, product tracking and material handling accessories, as well as IT for improved decision making can be seen as opportunities for growth. Mobile technologies also hold the potential for rapidly using information for real time decision making as well as for coordinating both the inbound and outbound logistics. Indian customers exhibit strong value and variety seeking behaviour hence developing capabilities in the process of product and service delivery will induce loyalty (i.e., process loyalty).

Government policies have been another driver of change in the logistics industry. The trend towards a higher road cargo traffic as compared to rail is going to require better logistics control and coordination. The golden quadrilateral road project and the east & west rail corridors are expected to change the reactivity of Indian firms through shorter lead times as well as lower maintenance costs on the transport equipment. They also have the potential of reducing the procedural delays on highways by reducing the number of checks and related stoppages of vehicles. Its impact on perishable good will be most significant. Thirteen States and three UTs have already amended the State laws allowing private sector participation in direct purchases of farm produce from farmers (Ahya, 2006) which is making procurement more efficient and is bringing better technology as well as products in the rural production and distribution network (e.g., see ITC echoupal in the next section). Banks have developed venture capital funds for logistics players. Small Industries Development Bank of India or SIDBI, for instance, has invested \$ 2.3 mn in the Mumbai based firm Direct Logistics (Baxi, 2006). The unbundling of the logistics supply chain (both the physical pickup, storage and movement of goods as well as allied services like invoicing, order management, freight forwarding, customs clearance, octroi tax management etc.) will lead to business opportunities and add value to the customers. An interesting example is that of Reliance Connect Service Centres that have been established on Indian highways by Reliance industry along with petrol stations. The Connect Centres provide a place for truckers to relax (sometimes with overnight stay facilities), send information (including data) to parent firms on their location, completed transactions etc., receive material/instructions from the firm, remit money to parent firm,

etc. It has become a one-stop shop for truckers and their companies to keep in touch. Similarly, once VAT is introduced, it will simplify the process of goods servicing and will lead to rationalizing of many operational decisions.

The implication of the emergence of a strong service industry on logistics performance is not well understood. Perhaps, a new business segment will emerge that is technology driven and will help coordinate activities across business channels. For example, there is a need to integrate the flow of information, goods and services between a medical physician, a diagnostics center, hospitals & nursing homes, and retail medical outlets – all of which are un-coordinated independent entities at the moment. This could range from digital transmission of MRI scans from a diagnostics center to a physician's computer to blood collection and delivery from various city centers to nursing homes/blood banks or directly to dispersed operation theatres. The role of a coordinating agency becomes, organizationally, valuable in such an environment. The need is to link physical logistics processes with communication technologies –building on the strengths of the IT and mobile communication industries.

5 The Renewal of the Sector: Some Innovative Experiences

There have been several instances of firms undertaking innovative re-design of their logistics systems or deployment of interesting business models to enhance the effectiveness of their networks in order to deliver value to their customers. Sometimes it was done to overcome an inherent disadvantage that may exist in the supply chain. In this section, we present a few such experiences both at the firm level and at the industry level, through brief caselets highlighting their innovative contribution. They also represent the renewal process that is transforming the logistics sector and the distribution strategy of firms.

***GATI*³**

Established at a time (in 1989) when firms in India hardly outsourced their logistics requirements, Gati has transformed itself from a cargo movement company to become one of the leading end-to-end logistics and supply chain solutions provider in India. Continuous innovation and high end technological investments to improve service

³ Source: www.gati.com, Sharma and Thakur (2006), Prowess (2006), Reddy (2007)

quality, speed and efficiency can be ascribed as the reasons behind their success. It is starting to connect with mass retail market in several cities through 1500 Customer Convenient Centres. It is also the first Indian company to operate in the far-east market with its own subsidiary in Hong Kong. On the service front, there have been several firsts in India by Gati – 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 road networks linking 594 districts out of a total of 602 districts in India at a turnover of \$104mn in 2005-2006. It covers 3.2 lakh⁴-km every day with a fleet size of 2000 trucks. Its automated shipment tracking ability has brought it closer to the customers – for example, the SMS based tracking system has allowed the customers to continuously get an update on the status of their consignment. Another feature also enables customers to get email based conformation of any delivery.

Gati has also transformed the warehouse management practices in India with its modern system, WMS - a web based warehouse management system that provides both functionality and flexibility to customers in managing their warehouse operations. WMS 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. Order processing times and shipping errors have decreased and customer service levels have improved, as a consequence. Currently, Gati operates with 10 warehouses and plans to setup another 25 over the next three years at an investment of \$100mn. It is designing these new warehouses with mechatronic systems that could lead to a paradigm shift in warehouse management in India. It has implemented CRM and ERP systems, using IT to full advantage delivering value to the customers.

AMUL⁵

The Kaira District Milk Cooperative Union or better known as AMUL was established in 1946 in Anand in the western State of Gujarat with an aim to remove the intermediaries in the milk procurement and distribution process and thereby increase return to milk farmers. The milk farmers were mostly marginalized members of the society and most of

⁴ 1 lakh = 100,000

⁵ www.amul.org; Chandra and Tirupati (2003)

them barely poured a few litres of milk each day. They, however, depended on this for their livelihood and any money lost to the middleman or to uncertainty in the environment meant a threat to their existence. Thus was born AMUL (which means invaluable in Hindi)! The Story of AMUL is an extraordinary story of vision, effort and power of networks for the benefit of the poor. From being a net importer of milk in 1947 when India became independent, India has now emerged as the largest milk producer in the world. This remarkable story has been scripted by a network of cooperatives called AMUL.

The AMUL network is coordinated by the Gujarat Cooperative Milk Marketing Federation (or GCMMF) which markets milk and milk products that are produced by 12 Milk Unions (each having several factories) one of which is AMUL at Anand. The Unions are spread in twelve districts of Gujarat. Each Union collects milk from farmers through cooperative Village Societies. (This structure is now replicated in almost all the States of India.) In 2005-2006, GCMMF had a sales turnover of \$860mn through milk and milk products (its Unions or plants produce 15 categories of milk products with several products in each category).

The 12 Unions collect about 6.3million litres of milk every day from 2.5 million farmers through 11,962 Village Societies. (with an annual collection of 2.28 bn litres in 2005-2006). Each village society may have 100 to 1000 member farmers who pour milk twice a day. Twice daily, about 500 trucks collect milk from these Village Societies and bring them to either of the five chilling centers or the processing plants (or Unions). The Unions process the liquid milk – produce milk of various types for consumption, convert some to powder as inventory and use both powder and liquid milk for producing milk products. These products are distributed to consumers through a channel comprising 4000 stockists (or distributors) and 5,00,000 retailers. It is not difficult to imagine the complexity of coordinating such a network of perishable products with an explicit social objective, in addition to a commercial one. The network realized the need for a unique model to deliver value to customers and through that serve the key objective of setting up of the cooperative – making a producer out of a poor consumer and helping her get better returns.

Briefly, we will illustrate the unique mechanisms used by this network to coordinate the complex supply chain through the intervention of a number of third party service providers (distributors, retailers, logistics service providers and IT support groups). The network practices frequent delivery and works with low inventory levels in the chain, supported by extensive information network and IT kiosks at the milk pickup locations that provide a variety of services. Payment to farmers for RM procurement is instantaneous (well, almost!) – during the same or in the next pouring shift by the Village Society staff. Milk is carried in cans by trucks (twice daily) or in chilling trucks, once in a day, to the plants. The routes of the trucks are well established and the arrival timetables at each Society well known and rarely is there any delay. This helps provide visibility to every member of the chain and improves the return on investment in the channel. The network operates with a zero stock out through improved availability of products and quick delivery. Disciplined planning to reduce variability at each stage helps in maintaining timeliness in the channel. GCMMF coordinates the production plan between the twelve Unions and ensures matching of geographic markets with supplies. TQM and Hoshin Kanri 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 has led to a doubling of sales revenue in the last ten years. Most interestingly, AMUL has the largest market share in every product category that it competes in – its competitors are both large MNCs and large & small Indian firms.

AMUL illustrates how good managerial practices can help bridge the gap between profits for the supplier and low cost, high quality products for consumers – all through exceptional coordination of logistics operations across an extensive network. AMUL operates with one umbrella brand for products from all its member Unions – a testimony to 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. For details on this case study see Chandra and Tirupati (2003).

The DABBAWALLAHs of MUMBAI⁶

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. It is an example of how processes can play an important role in coordinating logistics of an important service industry in India. The Nutan Mumbai Tiffin Box Charity Trust of Mumbai was established in 1891 to provide pick-up and delivery of lunch for Britishers working 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 \$12 mn and employs 5000 people for pickup and delivery – almost all of them are uneducated. However, there are less than 10 boxes mis-delivered or un-picked in a month! We discuss, briefly, the processes that help make this logistics network error-proof and deliver such an astonishing performance. The operations of the group has 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, provide niche service and generate value in return for the customer.

The Trust which is organized as a cooperative is operationally organized in hierarchical teams – pick-up teams, consolidation teams, delivery teams (and then the reverse logistics for empty boxes with reversing of the functions for the teams). Typically, each dabba or the lunch box passes through more than four pair of hands and may be transported up to 60 km each way. Pickup is done between 7.30am-9.00am, delivery between 12.00 and 1.00pm and return between 2.00-5.00pm. These represent tight time-windows where a team of 20-25 members (and supervised by a team leader who also fills in as a pickup person in case of any absence) pick-up lunch boxes from homes – about 30 per pick-ups person. The boxes are carried in a specialized fixture on a bicycle to the nearest train station where the boxes are consolidated by destination. A consolidation team performs this task and carries the boxes (which may have been picked by members of different teams but need to travel to the same destination geography) into the train. Often tiffin or lunch boxes are un-loaded at intermediate train stations – re-consolidated with boxes coming from other locations (i.e, cross-docked) and carried on a third train to its

⁶ Lecture of Mr Megde, President of the Nutan Mumbai Tiffin Box Suppliers Charity Trust at IIM Ahmedabad, 2003; Chandra (2004)

destination station. At the destination station, the lunch boxes coming from various origins/cross-docking destinations, are once again segregated by the building where the delivery is made. Finally, a delivery team picks up their boxes, i.e., boxes that they will deliver to specific owners in specific buildings, carry them on their bicycles and deliver them in the office of the owner of the box. Later in the afternoon, the same person picks-up the empty box and pursues the reverse logistics and the box is ultimately delivered at its point of origin – either a home or a restaurant. With this as the complexity, what may be plausible reasons for such low errors?

Contextually, the group members see their role as very important - they are responsible for delivering food to their customers – socially, it enhances their commitment to their task and establishes a critical customer-service provider link. Operationally, the handoff is done successfully through simplification or breaking down of tasks, codification and repetition. The designed process is simple and easy to understand for each operator. More important, each operator has a limited yet definite role. This role is one of pickup, consolidation & transfer and delivery (and the similarly for reverse logistics). Each pickup operator does not pickup more than 25-30 boxes as that is the number of addresses etc. that he can remember accurately which helps in avoiding mistakes. The lunch box is enclosed in a standard container which carries a unique code for the destination station, the building where the box is to be delivered and the floor number in that building where the office of the customer is located. Each operator recognizes a limited set of codes that are relevant to him (and does not have to learn the entire coding scheme). And finally, repetition of the task (i.e., same pickup location, same place for cross docking, same delivery location etc.) helps in making the task foolproof. Of course, what helps is the linear geography of Mumbai, the punctuality of trains, relatively stable demand and strong inter-dependence between operators. It is an example of how manual logistics systems can be organized to effectively deliver value to the customer.

*ITC e-choupal*⁷

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-organize the distribution of soyabean in rural markets. Today e-choupal reaches out to

⁷ Source: www.echoupal.com, Talk by the eChoupal CEO S Sivakumar at IIMA, 2003, Mitra (2004), MBS CS (2006)

more than 3.5 million farmers in 31,000 villages through 5,200 internet enabled kiosks and now covers a variety of agri-business products. The e-choupal was a unique venture which aimed 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 its unique design features.

The e-choupal was started with an objective to re-organize the soybean trade which was operating in an inefficient manner. Farmers used to sell their produce through government mandated markets called “mandis.” Mandi trading was conducted by commission agents who bought and sold the produce. As the produce was sold through auction by these traders, farmers would find out the market price only upon arrival at a mandi. If the buyers had purchased enough for the day at this mandi then either the auction prices fell dramatically or the farmers had to wait for the next day’s auction. While all this may have been happening at one mandi, the farmers were unaware of the auction status at other mandis where there could have been shortages. The decision regarding the quality of the produce was also dependent on the trader. Similarly, distortions in price and quality effected 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 providing farmers information in local language on agricultural inputs, best practices in farming, market price realized at various mandi auctions, weather details etc. Nevertheless, it enabled ITC to purchase products directly from farmers (through a change in the law), enhancing quality of products and significant cost reduction (e.g., it saved \$5.40 per tonne on soyabean). The e-choupal now has just two service providers in its procurement chain - the *sanchalak*, a person between the kiosks and the farmers who inspects the produce and based on his assessment of the quality, the price of the commodity is decided (he gets 0.5 per cent commission on the volume sold) and *samyojak*, a person who manages the ITC warehouses (he gets 1 per cent commission on 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 inadequacy 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 make informed decisions as they understand the market better leading to higher productivity. Various seed and fertilizer companies are now able to reach wider market with lesser transaction cost. The e-choupal has provided a market for more than 64 companies (to name a few, Monsanto and Nagarjuna Fertilizers). This innovative direct procurement channel is a win-win mechanism for all the involved parties. ITC is now building a rural retail infrastructure on the foundation of the e-choupal network thereby changing the rural distribution landscape.

Transforming the Auto-Component Replacement Supply Chain

With changing government policies and consumer preferences, the distribution supply chain of Indian companies has been effected significantly. This poses new challenges for various channel partners. We illustrate this transformation process through the lens of the auto component replacement market supply chain and discuss its implications. We surveyed 21 manufacturers and 22 channel members (distributors, wholesalers and retailers) spread equally in Northern and Western clusters of auto component Industry in India for this purpose.

The auto component industry produced parts worth \$6.7 billion (2004-05) with 57 per cent of the demand coming from the replacement market (ACMA, 2005). Low entry barriers have led to a large number of players in the replacement market. There are about 400 firms in the organized sector and more than 5000 in the unorganized sector. Another feature of this sub-sector is the long duration of ownership of vehicles in India which leads to high requirement of parts. It is also found, anecdotally, that willingness to pay for parts decreases with the length of ownership. This has led to an intense segmentation of the parts market by price.

Pre-1991, this industry was still in a nascent stage. It was characterized by few manufacturers and low demand. Consequently, the distribution network was flat (Figure 4a). Availability of spare parts was a key issue with long delivery lead-times and manufacturers sought large order sizes. This also led to the growth of un-branded parts or parts branded by regional producers (often supplied by small firms) in the replacement market. The product was sold chiefly on personal relationship with the buyer; quality, brand and price were not the selling propositions. Maruti Udyog Limited had created a

network of suppliers of quality parts for its vehicles. Hero Honda had done the same for its motorcycles.

Post-1991, the liberalization of the automotive industry led to an entry of many foreign auto players. Because of the impending automobile industry boom and high margins for distributors, the demand for spare auto-parts was expected to grow. The distribution channel was modified with the entry of two more channel members, i.e., wholesalers and semi-wholesalers (Figure 4b). The latter were smaller versions of the former and locally oriented.

The period 1994-2007 saw a major transformation of the distribution structure (Figure 4c). OEMs started to operate in the replacement market through a parallel supply chain selling parts through their service stations. Additionally, the entry of large number of channel members caused semi-wholesalers to move out of the supply chain - they either moved up the chain to become wholesalers or moved down to become retailers. To strengthen the coordination of this extended supply chain and to buffer against the differential tax structure across states, companies started to operate with Carry and Forwarding Agents (C&FA). Transportation related activities are carried out by all the members of the supply chain. Manufacturers use services of 3PL for transferring their stock to C&FA and distributor locations. But thereafter, the transportation activity is solely managed by channel members themselves.

An analysis of the available IT infrastructure and its usage pattern for all the channel members in our sample survey indicates that there is a high deviation in the usage of IT in the replacement market supply chain. Eighty seven per cent of the sampled firms use an ERP package – most of which is customized and developed locally. The main impediment in the use of a branded packages is the high cost of purchase and implementation. These packages are used to generate sales report, order from suppliers, account for the financial transactions and track the level of inventory at plant and C&FA. Manufacturers order the stock from suppliers mostly through emails. In order to track inventory in the channel, firms also made IT investments both at C&FA and within the firm. Linking the C&FA to the company website enabled firms to check stock status at the C&FA and reduce the order processing and customer response times. Larger firms are also providing a similar setup to their distributors. Since the C&FA is mostly owned

and managed by the firms, manufacturers are also able to check the inventory status, dispatching status and customer records. Distributors have invested primarily in computers for keeping track of the inventory and updating accounting details. On the other hand, rest of the channel partners (wholesalers and retailers) don't even own computers. Parts are ordered primarily on the phone. Interestingly, most distributors were found to be following periodic review policy while the rest of the channel members were following continuous review policy because of their low sales volume.

Post 2007, with the implementation of a uniform tax structure across all states, there will be some changes in the way firms operate. The C&FA will, perhaps, become redundant as most manufacturers will prefer to deal directly with distributors. The concept of an exclusive distributor is expected to vanish. It is expected that with the increase in variety of components, distributors might become wholesalers and will stock multiple brands for the same product. Two parallel distribution channels are expected to be in operation – the OEM chain and the non-OEM chain (Figure 4d). OEM network will primarily handle the passenger car replacement parts and the non-OEM distribution network will sell parts for Light Commercial Vehicles, Heavy Commercial Vehicles, 2-wheelers and 3-wheelers as the car customer is becoming more brand conscious even while replacing parts which comes along with superior service. Further, we perceive that the more advanced automobiles, Free Trade Agreement with other Asian countries and VAT are going to change the way the replacement market operates. There will be a rationalization of this market in terms of number of firms competing thereby leading to an improvement in quality, delivery time and availability of parts. The size of the firms is expected to increase with an emergence of large national players (in addition to OEMs). This may reduce the number of producers exclusively focusing on the local markets.

Figure 4a

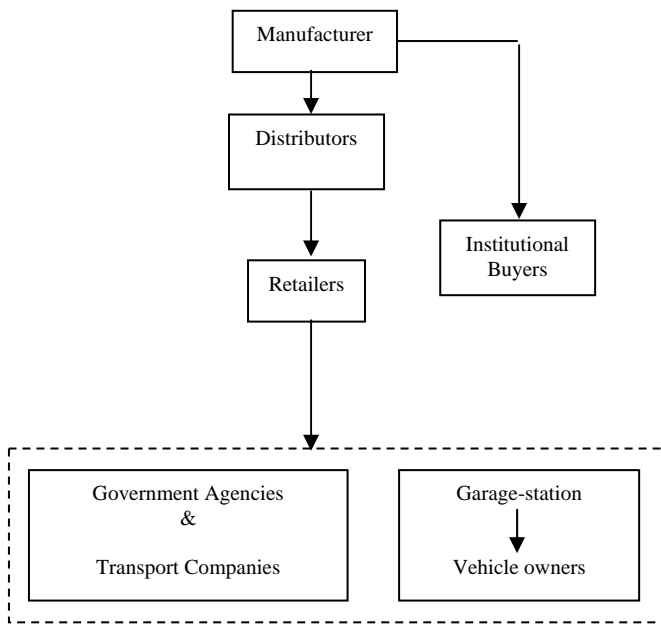


Figure 4b

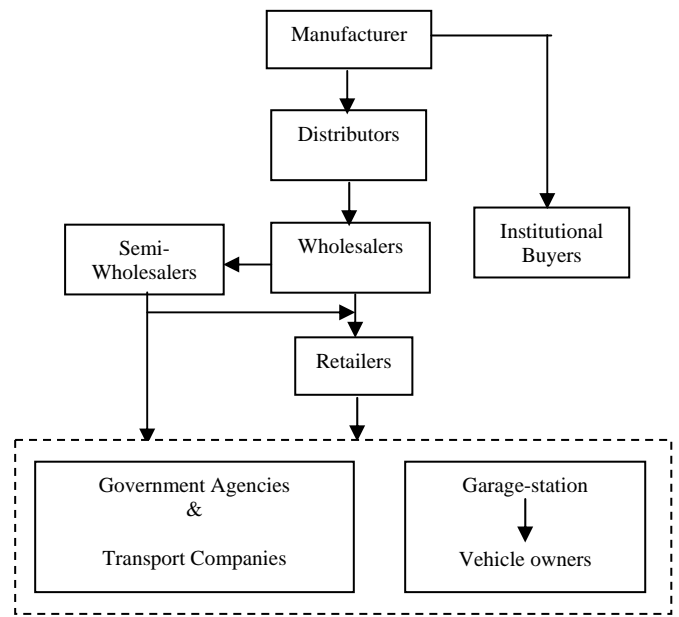


Figure 4c

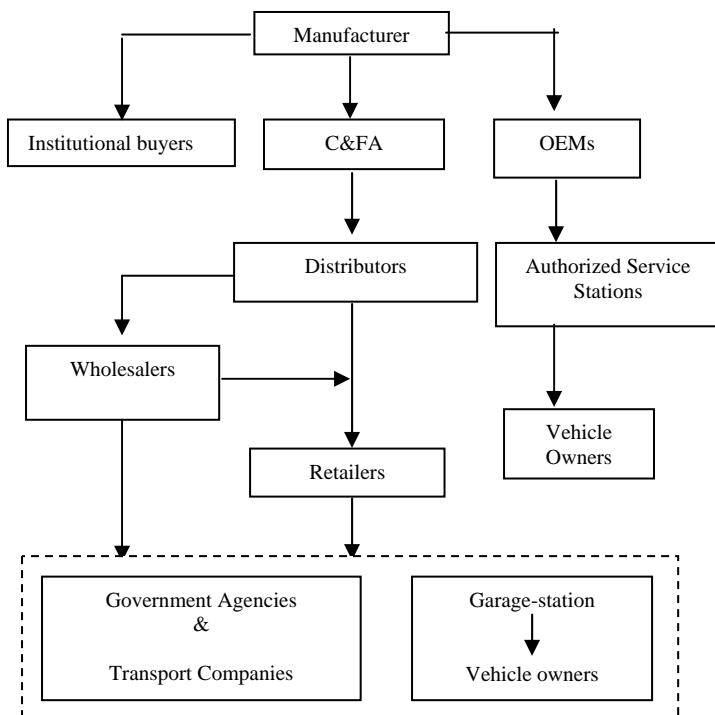
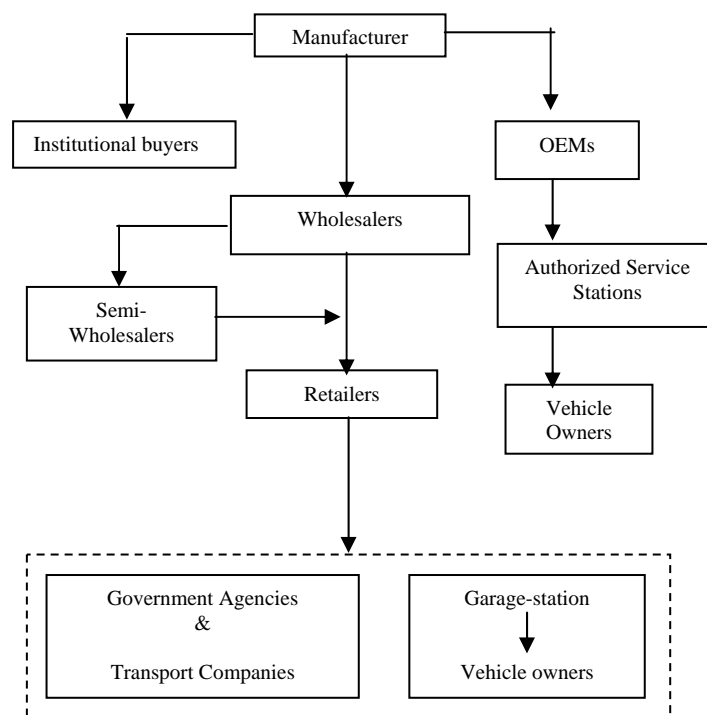


Figure 4d



7 Challenges Ahead

Several challenges remain before the Indian logistics sector and its future success will depend on the ability of the industry to overcome these hurdles. Some of these impediments are at the firm level while others are at the policy level.

At the policy level, the issues of infrastructure and integration of the nation's logistics network remain the two most critical areas that require attention. The growth of infrastructure, since 1991, has been quite extensive (covering a wide geographical area) as well as strategic – linking the key industrial, consumption and transshipment centers. However, some imminent weaknesses need be addressed. Movement beyond the golden quadrilateral is required to bring goods from upcountry production sources to main shipment centers. The rate of growth of expressway has to increase. Poor road conditions increase the vehicle turnover, pushing the operating cost and reducing efficiency. National highways are being upgraded but they account for a meager 2 per cent of the total road network. (Sanyal, 2006a). More importantly, due to non-contiguous development of expressways, truck traffic has to frequently move from the expressway on to old national highways and vice-versa. This is inconvenient and is restricting the utilization of the excellent road network that is being developed. The pricing of the toll on these expressways especially for cargo traffic has also been a deterrent to its usage – perhaps, one needs to understand the price elasticity of this demand and develop appropriate price packages for heavy and frequent users. Here, the role of transport technology needs to be mentioned as well. Once the cost of manufacturing multi-axle trucks comes down, it will see higher penetration and consequently lower per unit cost of transportation. Volvo is trying to develop this market but the volumes of high capacity truck continues to be low (about 7 per cent of the total truck production, IAESI, 2006-2007). The East & West bulk rail transport corridor will divert some traffic from road provided the secondary movement (i.e., from the nearest station to the plant/warehouse) can be minimized and the issue of security of the goods is addressed adequately. Similarly, river navigation in the North and North-Eastern India can pose useful options for cargo movement in hinterland where road congestion is high.

Goods vehicle run only 250-300 km a day in India as compared to 800-1000 km in developed countries (Sanyal, 2006b). Inter-state check posts, surprise checks and unauthorized hold ups on highways (some due to security reasons while others are to

establish the authenticity of the cargo as declared) create bottlenecks. Entry taxes into cities for goods also create procedural bottlenecks. The Motor Vehicles Act and the Motor Transport Workers Act that regulate driver licensing, loading norms etc. and duty hours of drivers respectively require modification to address the quality of services in this sector (Raghuram and Shah, 2003). Similarly, while the regional permits that allow a truck to ply between certain states come at a lower cost (as compared to a national permit), it limits the flexibility of truckers to convert opportunities. Indian logistics market remains fragmented on these counts and the national market (as well as service) does not appear as one integrated entity. Harmonization of taxes, procedures and policies across States is required to facilitate a seamless flow of goods and services. For instance, if there was a nation-wide broadband logistics IT-network then a trucker starting in Chennai (in the southern Indian State of Tamilnadu) could file all the papers in Chennai, get all inspections done there and move without interruptions to say, Jammu (in the northern Indian State of Jammu & Kashmir). Each state entry point could have access to those papers and they could flag the truck through their check-post as it reached there with no stoppages or delays. Today, it could take anywhere from half hour to few hours to get papers and goods inspected at each check post. The later could be taken care of by having sealed container carriers. Changes in process technology are needed to increase the effectiveness and responsiveness of the transport network.

In privatizing the operations of container traffic through rails, new entrants are expected to face serious problems. Because of limited manufacturing capacity for producing wagons, these firms will have to import wagons at high cost. Huge investments in storage capacities near railway stations will also add to their cost (Bhatt, 2006). All these factors will increase the entry barriers for the private operators. Moreover, the tariff structure and revenue sharing is still a hindrance for public-private partnership projects to succeed in infrastructure development.

While the use of IT for logistics management is increasing, it is largely limited to large size firms. This represents an opportunity to further improve the decision making abilities across the supply chain and reduce costs further. For instance, order processing and delivery status are two areas that reflect a certain weakness in servicing (Chandra & Sastry, 2004). With the growth of the IT sector in India, these are clearly areas that can

gain from the IT sector's engagement. For example, manufacturing firms can collaborate with the extensive network of call centers for managing order processing and actual integration of order servicing with the physical supply chain. Similarly, there is a role for emergence of a segment (e.g., a service provider) in the logistics chain that manages dispatch information and performs delivery tracking across manufacturers for their customers. Similarly, only a few thousand vehicles out of a total of several millions have tracking system (Sanyal, 2006a). Truck manufacturers could integrate the tracking technology in its products and IT servicing firms could provide information service on highways tracking movement of vehicles. This would provide information to distribution firms and help track both the consignment as well as the truck better. As of now, the best service is the one provided by Reliance Connect at their petrol pumps on the highways where truckers stop by and call their firms to inform them of their whereabouts. Such service providers become very valuable to tiny and small trucking companies that proliferate the logistics industry and who do not have the wherewithal to either install or operate their own IT systems. As the concentration in the industry increases, the need to manage larger number of trucks, routes, warehouses and customers will require decision support systems that perform dynamic planning & scheduling. As observed by Chandra and Sastry (2004), the IT base is indeed low and firms need to compete on the basis of real logistics costs instead of clever accounting practices before the sector will see increased IT penetration. As the need to have visibility in the supply chain increases, better technology applications will also appear.

Another area that will see tremendous growth is outsourcing of logistics service. While logistics outsourcing has been in existence for several decades, it was limited to transportation and warehousing. Post-liberalization, the country has seen outsourcing of value add services like freight forwarding, fleet management, import/export and customs clearance, order fulfillment, consulting services like distribution network planning etc. These are early years for the 3PL service providers and a recent survey cites lack of trust and awareness as the key hurdles to its growth (Mitra, 2005). Service tax on outsourced cost and the requirement to establish multiple warehousing facilities in order to avoid double taxation (and thereby lose the advantage of scale economies with fewer warehouses) were also found to undermine the 3PL business (Mitra, 2005). According to this survey, most of the 3PL service providers offer limited services. In future, their role as coordinators will require that they offer a wider menu of value add services. They also

have the potential of integrating SME channels through a variety of logistics services and technology across a network of small producers.

The logistics industry is evolving rapidly and it is the interplay of infrastructure, technology and new types of service providers that will define whether the industry is able to help its customers reduce their logistics costs and provide effective service. Changing government policies on taxation and regulation of service providers will also play an important role in this process. Coordination across various government agencies require approval from multiple ministries and is a road block for multi modal transport in India (e.g., ports, roads, railways, container freight operations etc. are all managed by different ministries in the Government of India (Sanjai, 2006b)). At the firm level, the logistics focus will have to move towards reducing cycle times in order to add value to their customers. These are few of the issues one need to take account before the logistics industry can boom significantly in India.

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