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Republic of India

Manufacturing Plan Implementation

Supply Chain Delays and Uncertainty in India: The hidden constraint on manufacturing growth

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GTCDR

SOUTH ASIA

Contents

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EXECUTIVE SUMMARY

The performance of India's freight industry, through the delays and uncertainty it creates in supply chains, is a constraint on the growth of its manufacturing sector, possibly a binding one, and regulations make as much difference as do the thousands of Crores being invested in highways.[1] In fact, the large investments being made in transport infrastructure are unlikely to yield more than a fraction of their full potential in economic returns unless and until those regulatory barriers are addressed.

This matters enormously, because logistics are a higher share of costs for manufacturing firms in India than either electricity or labour. Its effects are less obvious, because more indirect, and therefore it does not attract as much attention as it should, except under the broad rubric of 'infrastructure', which is in itself misleading.

These are the findings of a review of existing literature and data on the freight and logistics industry in India, combined with a new survey of almost 70 manufacturing firms across four industries. It considers both domestic road freight and international trade, focusing on regulatory barriers that may cause delays and uncertainty in domestic road freight and imports and exports and the consequent impact on manufacturing competitiveness.

The primary survey results are presented in Annex A; the results of statistical analysis and modeling on them in Annex B; and this report provides a narrative of the conclusions drawn from both, as well as a review of prior studies. Key results are:

- Less than half of the average domestic freight journey is spent 'on the road', the remainder being split between rests and regulatory stoppages.
- Unpredictability in freight requires manufacturers to hedge against possible delays by carrying higher levels of inventory than they would otherwise need, or face the even costlier risk of lost sales, interrupted manufacturing production runs, or a proliferation of pricey, avoidable emergency shipments.[2]
- Including indirect effects on inventories and sales, logistics is 10-14 percent of the operating costs of manufacturing firms, by far the largest cost difference between them and services firms.

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[1] According to the Government's 12th Fifth Year Plan, an estimated one trillion dollars investment will be needed in the infrastructure sector. For the road sector, "against an outlay of Rs.192428 crore in the Eleventh Plan for the road sector, the anticipated expenditure was Rs.158077 crore (at current prices)." (p. 215) "The Twelfth Plan budgetary support for Central Sector Roads is Rs.144769 crore. In addition, the sector is expected to generate IEBR amounting to Rs.64834 crore and private-sector investment of Rs.214186 crore during this period. The Twelfth Plan budgetary support for Rural Roads (PMGSY) is Rs.126491 crore." (p. 226).

[2] As documented in detail for Vietnam in: Luis C. Blancas et al., *Efficient Logistics: A Key to Vietnam's Competitiveness* (Washington, DC: The World Bank, 2014).

- Domestic freight performance is explained almost entirely by distance and state border-crossings, and adding two border crossings can add a week of uncertainty in shipments.
- Average times and delays in customs show some variance with firm characteristics, with young and small companies having the greatest difficulty (especially versus large firms).
- These effects are likely to have inhibited convergence in incomes between low- and high-income states, and are spatially rearranging even successful industries such as autos.

These findings not only prioritize even more the long-delayed introduction of a national Goods and Services Tax (GST), they motivate a sustained period of follow-up action to dismantle check points and fully implement systems for risk-based compliance monitoring for customs and domestic inspections. This, along with the more thorough implementation of already-announced initiatives and sustained human capital and capability building in the trucking industry, could do as much or more than vast highway and port investments to unlock growth in the medium-term.

Undertaking this in practice will require sustained engagement among States, not only in passing the GST but in follow-up actions to reduce barriers in practice. At the more tactical level, sustained mechanisms for feedback on the real status of reforms are needed, to raise the flag when a notified policy is not having ground-level impact.

In the absence of this strengthening of the policy and implementation process, and without needed reforms implemented through and alongside them, the manufacturing sector is unlikely to reach the targets set by the Government of India, remaining fragmented and stunted instead of connected and expanding. The largest gains in economy-wide total factor productivity (TFP) in economic history have come through the modernization of freight, more so than electrification, and it is these gains that current regulations constrain.

This report is structured as follows: Section 1 provides the context of the freight and logistics industry in India; Section 2 describes the headline impacts of its performance on manufacturing firms; Section 3 then explores variations in this impact and causes thereof; and Section 4 concludes with a more detailed look at the reform agenda this motivates.

1. CONTEXT: FREIGHT AND LOGISTICS OVERVIEW

Definitions, scope and stylized facts

For the purposes of this study, freight refers to the movement of goods from a buyer to a seller,[3] whether by one or more intermediaries, or by the buyer or seller themselves. 'Domestic' freight refers to instances where both buyer and seller are located in India; 'international' where at least

[3] Here 'buyer' and 'seller' do not refer to distinct firms, but to distinct plants or service locations, i.e., it covers shipments from one unit of a larger firm to another (within-firm shipments as well as between-firm).

one is located abroad. The 'freight industry' is used to refer to the firms that take part in one or more aspects of this movement, though primarily the physical movement, as well as the internal departments of firms that undertake freight themselves.

These definitions are broad in theory, but are narrowed somewhat in practice. Only one out of eight surveyed firms own the equipment for moving goods. Moreover, although goods can be moved by road, rail, or air, road so predominates in India that it will be the primary focus. Road traffic accounted for about 60 percent of freight traffic.[4] While there are strong arguments for increasing rail's share, not only will doing so require decades of investment and difficult policy decisions, the Government is already moving ahead with dedicated freight corridors.[5] Studies focused on going further than this tend to be both overly grand and overly simple.[6]

Hence, for domestic freight, this study concentrates on the business environment for *road* transport. The estimated needed investment in road infrastructure in general as well as in specific connecting infrastructure for dedicated national investment and manufacturing zones (NIMZs) are thus not covered.[7] Similarly, for imports and exports, estimates of the enormous sums required for investment in ports and airports were considered out of scope. Instead, *the study considers the regulatory barriers that may cause delays and uncertainty in domestic road freight and imports and exports*, no matter the size or quality of theoretical expansions.

According to a 2011 study of the trucking industry, the third-party industry is dominated by small truckers: in a sample of over 1,200 goods transport units, about two-thirds were individual proprietorships, and the same proportion had 15 or fewer employees. Of the units classified as vehicle owners, about 83 percent had five or fewer trucks.[8] At the high end some modern freight forwarders are present, both multinational corporations (MNCs) and domestic firms such as TVS

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[4] Government of India, Ministry of Road Transport and Highways, "Annual report 2011-2012," p. 6.
[5] India's Twelfth Five Year Plan emphasizes the need for a better modal mix, especially the opportunities of rail to serve a larger share of the overall freight traffic through prioritized investments in dedicated freight corridors.
[6] McKinsey&Company, "Building India," report, August 2009, is perhaps typical of the genre.
[7] At the time of the 2014-2015 Union Interim Budget speech, February 17, 2014, "The investment in eight National Investment and Manufacturing Zones (NIMZ) has been announced along the Delhi-Mumbai Industrial Corridor (DMIC) and nine projects have been approved by the DMIC Trust. Five NIMZs outside DMIC have also been given in-principle approval. Three more corridors connecting Chennai and Bengaluru, Bengaluru and Mumbai, and Amritsar and Kolkata are under different stages of preparatory work." NIMZs were introduced as part of the Ministry of Commerce and Industry, Government of India, "National Manufacturing Policy," November 4, 2011. As noted in a just in time note on *Manufacturing Policy Implementation and the Concept of a 'Backbone Organization'* (June 2012, Annex 3 – Learning from SEZs) and documented elsewhere, "the new approach embodied by NIMZs and the NMP [National Manufacturing Policy] is promising in many regards, and seems to incorporate important lessons from both India's and other countries' experiences with SEZs [Special Economic Zones]." However, as mentioned in the same note, challenges remain and include embracing non-contiguity and getting the necessary infrastructure in place both within and outside the zones, notably necessary roads to ports and airports.
[8] JPS Associates, "Study on Economics of Trucking Industry," Final report submitted to the Ministry of Shipping, Road Transport and Highways, October 2011, pp. E-V, 47.

Freight Forwarding, but most of the companies in our sample used small firms on a fluctuating day-to-day rate.

A range of estimates have the average distance traveled by a truck in India as 250-300 kilometers (km) per day, compared to 450km in Brazil and 800km in the US (Figure 2). The average speed per hour on a highway is reported to be 20-40km per hour, but with some lack of clarity on whether this is averaged over stoppage times and over what quality of highway. Both can make substantial differences to such estimates, in particular the former.

This study is based on the findings of a review of existing literature and data on the freight and logistics industry in India, combined with a new survey of almost 70 manufacturing firms across four industries, auto-components, textiles, electronics, and heavy-engineering (Figure 1).

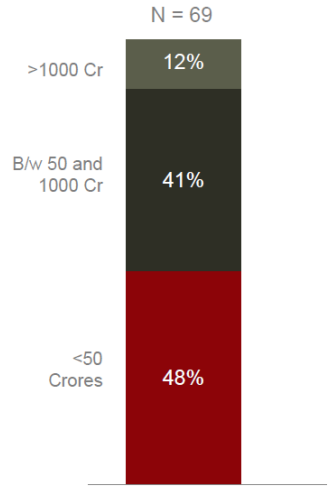
In our sample, firms reported an average of 2.7 days for inbound freight, and 3.7 days for outbound freight, and corresponding large standard deviations of respectively 2.2 days and 2.6 days. For international freight, firms reported that the average import shipment (from shipment by supplier to delivery at the firm's doorstep) required 4.5 weeks to arrive, and exports on average 4.1 weeks. The average time to clear customs was just over 4 days, though with a median of 3.5 days this was skewed towards higher times. There was also substantial reported variance among ports: some clearing in under a day, others requiring a week or more. We will return to these various causes of variance below. First, we turn to breakdowns of journey time.

Figure 1[9]

The survey covered 69 companies across auto-components, textile, electronics and heavy engineering sector

# of Companies

By Size (Annual Turnover in INR Crores)



By Industry

INDUSTRY	TOTAL # of SURVEYED COMPANIES	COS. EXPORTING FG	COS. IMPORTING RM
Auto components	18	44%	67%
Textile	18	61%	17%
Electronics	17	71%	88%
Heavy Engineering	16	81%	63%
TOTAL	69	64%	58%

Infrastructure is only part of the story

Although there is a widespread preoccupation with road infrastructure (Figure 3), perhaps the most significant fact about freight in India is that only a minority of a journey's time is spent on the road. This accords with general trends observed in other developing countries. Studies of logistics performance (in terms of cost, time and reliability) across the developing world find that infrastructure is only one of three factors influencing logistics performance. In fact, in most countries high logistics costs mainly depend upon the market structure and organization of the trucking sector and regulatory and policy implementation challenges that increase uncertainty.[10]

In India, as noted above, the trucking industry tends to be relatively small and informal. To the authors' knowledge there is little evidence that the trucking industry is very different from others in India in this respect. From size thresholds for schemes to the ability to evade monitoring, the factors that tend to promote small and informal firms are therefore likely to hold in common with other industries. Since these are treated elsewhere, they will not be considered here.[11]

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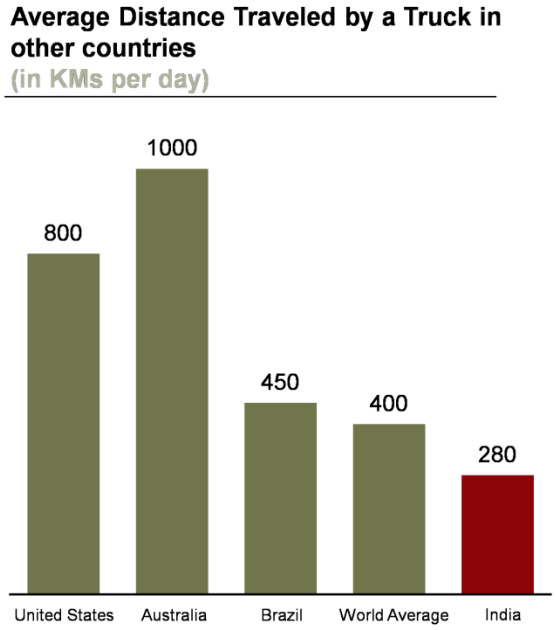
[9] Annex A, p. 4.

[10] Jean-François Arvis, Gaël Raballand, and Jean-François Marteau, *The Cost of Being Landlocked: Logistics Costs and Supply Chain Reliability* (Washington, DC: The World Bank, 2010).

[11] See Deepak Bhatassali, Neeti Katoch and Luke Simon Jordan, "Regulations Restricting the Growth of Non-Farm Enterprises," draft 2013; Luke Simon Jordan, Bertine Kamphuis, and S.P. Setia, "A New Agenda: Improving the

Figure 2[12]

Indian trucks travel a third of the distance per day compared to developed countries and still lag behind their developing contemporaries.



The regulatory impediments, though, are substantial. A range of studies in the last few years has analyzed the time composition of truck journeys, with most finding that only around 40 percent of journey time is spent driving. This implies that even if road infrastructure improved to such an extent that average speeds while driving doubled, journey times would only decrease by 20 percent.[13] Approximately 15-20 percent of the total journey time is made up of rest and meals; another around 15 percent at toll plazas; and the balance, roughly a quarter of the journey time, is spent at check posts, state borders, city entrances, and other regulatory stoppages.[14]

Competitiveness of the Textiles and Apparel Value Chain in India," March 2014; and Dieter Ernst, "Fast Tracking India's Electronics Manufacturing Industry: Business Environment and Industrial Policy," March 2014.

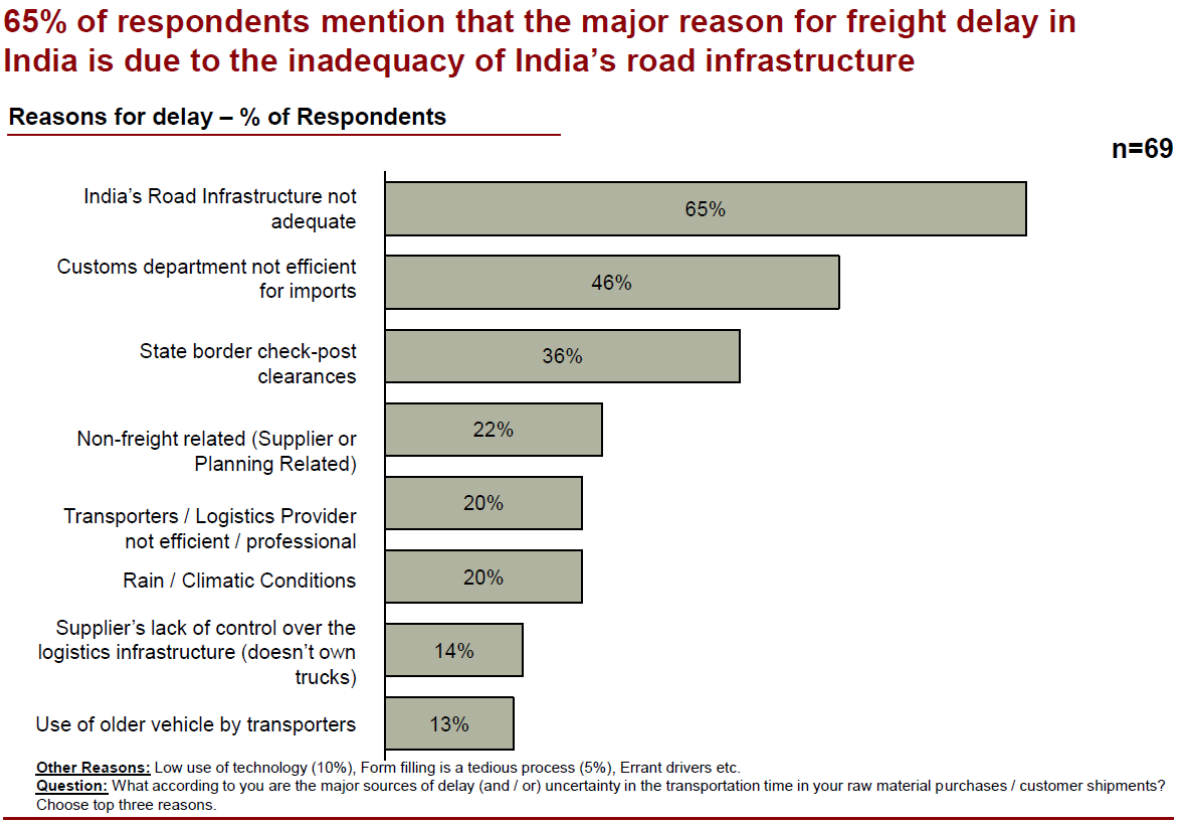
[12] Prepared by RedSeer, based on, for the Unites States, American Trucking Associations, 2010; for Australia, Centre for Environmental Management, "Calculating, Reporting and Reducing Greenhouse Emissions in the Australian Trucking Industry," September 2010; for Brazil, World Bank, "Brazil Green Freight Transport Report," 2010; for World, National Transport Development Policy Committee, "Integrated Logistics Strategy," 2011; for India, JPS Associates, "Study on Economic Cost of Inter-State Barriers in Goods Traffic," October 2011.

[13] "The percentage of actual moving time to the total trip time was about 69%, 54% and 38% for Mumbai-Delhi, Delhi-Kolkata and Kolkata-Chennai routes respectively," according to the survey by Rajiv Ghandhi Institute for Contemporary Studies, cited in: Ministry of Road Transport and Highways, Government of India, "Report of the Sub-group on Policy Issues," September 2011, p. 33. Another study suggested that out of total trip time, actual moving times accounted for only 33% for trips of less than 500km, 36% for 500-999km trips, and 43% for longer distances. JPS Associates, "Study on Economics of Trucking Industry," p. E-VIII.

[14] Ibid., p. 82; JPS Associates, "Study on Economic Cost of Inter-State Barriers in Goods Traffic."

Moreover, these regulatory stoppages account at least as much for *variation*. Indeed, besides from road quality, the next most cited causes for shipment delays are inefficient custom departments and state border check-post clearances. Except for the largest trucking companies, with established (mostly informal) links to regulatory authorities across their routes, most of the trucking companies and firms that use them have little way to predict how long their trucks will be stopped. This has a cascading effect on transport time, for instance, when the unpredictability of arrival times at city entrances hinders effective planning and adds further delays there, when trucks have to wait at city entrances.

Figure 3[15]



In fact, a large proportion of uncertainty and variance in the supply chain is explained solely by distance and by the number of state borders which freight must cross. Specifically, state borders explain two thirds of the variance in transit time, such that adding two state borders between origin and destination can add as much as a week to the uncertainty in delivery schedules (Annex B). Likewise, distance explains a similar proportion – two thirds – of variance.[16] Revealingly, the explanatory power of distance drops to only 35 percent when restricting the analysis to

[15] Annex A, p. 8.
[16] This explanation enters logarithmically, i.e. log distance explains two thirds of the variance of the log transit time. See Annex B.

companies that source their primary raw material within the same state, while distance does not provide any significant explanation of variance for companies sourcing from more than two states away.

Similarly, for domestic sales transit time between the manufacturing firm and the customers' warehouse increased with both distance (as expected) and state borders crossed. For every order of magnitude increase in the average distance between the origin and the destination, the average total transit time goes up by one day. However, their effect on uncertainty and variance is less strong, except in the auto sector. Overall, the regulatory difficulties in crossing state borders are having as much of an impact on freight performance as the quality of long-distance roads.

Regulatory specifics: taxes, checkpoints, and customs

These effects are not surprising once one considers the number and range of checkpoints and other stoppages which can affect freight journeys. One that has been much discussed of late is toll booths, whose manual processes can lead to delays of hours. The Planning Commission's working group on logistics suggested that such delays have largely negated the time saved from better condition National Highways Authority of India (NHAI) highways. Since some studies estimate waiting tolling at 12.5 percent of journey time, or a third of the time driving on the highways, this may be plausible.[17] The Government is actively addressing the issue, with a high-level committee formed in 2010 to recommend the most suitable technology for the implementation of national electronic toll collection. The committee presented its recommendations to the Ministry of Road and transport and Highways the same year. India Highways Management Company Limited (HMCL) was established in 2012 to implement the electronic tolling system on National Highways using passive RFID (radio frequency identification device) technology, allowing automatic vehicle identification at a fraction of the costs for the vehicle owner compared to alternatives. The technology has been rolled out on a pilot basis. However, full implementation in 2014, as originally announced, is unlikely in the context of a slowdown in financial closure and execution in the road sector and attacks against toll gates.[18]

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[17] Government of India's Planning Commission, "Report of the Working Group on Logistics," 2007, p. 64; and Transparency International India, "Corruption in Trucking Operations," p. 21.

[18] Transport Company India (TCI) and the Indian Institute of Management (Calcutta), "Operational Efficiency of Freight Transportation by Road in India," Second edition, 2012. Recommendations of Committee chaired by Nandan Nilekani to examine all technologies available for Electronic Toll Collection (ETC) and recommend the most suitable one for implementation throughout India, June 28, 2010, http://ihmcl.com/wp-content/uploads/2013/12/ETC-report_Nandan-Nilekani.pdf. A subsequent Apex Committee for ETC Implementation was tasked in 2011 with suggesting the operational methodology for implementation and operation of ETC, "Electronic Toll Collection, Report by Apex Committee for ETC Implementation," Government of India, September 2011. Manu Balachandran, "NHAI to partner banks for e-payment of toll: Roll out of e-tolling will happen soon," *Business Standard*, February 15, 2014.

Turning to regulations, the best known are the various sales and entry taxes which can create check-points and barriers at State crossings. However, these are not the only sources of checkpoints. Another is the regional transport offices (RTOs), which register vehicles and provide driving licenses. They are also the primary body for obtaining permits and for collecting motor vehicle taxes for using state roads. Others include checkpoints for commercial taxes and VAT, excise taxes, and forestry clearances. There are about 330 RTO checkpoints across India, and these are only half the total number, with (in order of frequency) commercial and VAT checkpoints, excise tax checkpoints, and forestry checkpoints making up the remainder.[19]

The delays related to commercial, excise and VAT results in particular from reconciling the sales taxes in one state with those in the other, such as the imposition of the additional 2 percent in Central Sales Tax (CST).[20] This affects not only domestic freight but can also effect international freight: a garment exporter in Tamil Nadu reported diverting his shipment by several hundred kilometers, not using the high-quality and nearby Cochin port, simply to avoid the Tamil Nadu-Kerala border crossing.

The other checkpoints are principally to check permits are in order, as well as to impose taxes on or prohibit the movement of specific types of goods, such as alcoholic products (for state excise taxes), mineral products (for royalties) and forestry products. Many are located only in the relevant areas, such as mining districts. All can lead to delays if on a main trade route and inspecting most vehicles 'in case' they are carrying the relevant products.

As will be described below, there is substantial variation between States in the number of checkpoints and the time spent at each. Haryana, for example, has managed to eliminate domestic checkpoints, replacing them with widespread mobile squads; in contrast, Uttar Pradesh (UP) is reported to have over 100 commercial/VAT checkpoints. Karnataka and other states have implemented e-permits that have dramatically cut the time spent at checkpoints; Gujarat has moved to a fully electronic inter-state check-post system.[21]

Most intriguingly, some States seem to have almost seamless borders: Andhra Pradesh (AP), for example, has attracted a substantial amount of investment near to Tamil Nadu, as firms report

[19] JPS Associates, "Economic Cost of Inter-State Barriers in Goods Traffic," p. 37.
[20] It is the commercial, excise and VAT checkpoints that tend to absorb the most time in delays according to a 2003 study by Arindam Das-Gupta, "Internal Trade Barriers in India: Fiscal Check-posts," paper, August 2003. A more recent study suggests that "VAT/Commercial check-posts are the most common on-road check-posts and involve the most cumbersome and costly procedures than other check-posts barriers," JPS 2011, "Inter-State Barriers," p. 10. However, this same study shows that RTO check posts are more prevalent, and that check post halting time is primarily accounted for by RTO posts. At the same time, the incidence of defaults is much higher for commercial tax and VAT, resulting in substantial additional hours of delay.
[21] JPS Associates, "Economic Cost of Inter-State Barriers in Goods Traffic," pp. 10, 37-38; and Annex A, p. 35.

they can use Chennai port with no delays crossing the border while availing the lower cost land in AP. The contrast between this border and that between Tamil Nadu and Kerala is stark.

Overall, it is important to keep in mind that the checkpoints serve a clear fiscal purpose. Careful studies have shown that attempting to simply eliminate checkpoints, or move too rapidly to overly sophisticated information-based solutions could result in substantial fiscal damage to the States.[22] This will be discussed further in Section 4 below.

Finally, on international freight, the key regulatory constraints are related to disputes and dispute resolution over the classification of goods. As documented in studies on both the textiles/apparel and electronics sector, the Government of India has in principle notified a 'risk management system' (RMS) for imports several years ago, and earlier this year notified its extension to exports. However, its implementation has lagged, and varies substantially between customs offices in different ports.[23]

2. THE IMPACT ON MANUFACTURING FIRMS

Hidden freight costs add substantially to total freight costs

The impact of logistics performance on manufacturing firms goes well beyond direct freight charges. To them must be added the cost of capital of inventories, which expand with the time taken to receive supplies and reach customers, as well as the cost of packaging for transport and of lost sales due to customers for whom the firm is uncompetitive due to logistics, rather than cost or quality.

This applies in particular for uncertainty and variation in delivery times. Over and above direct transportation and other logistical costs, uncertainty increases what are called 'delayed hedging costs', which includes the capital cost of additional inventory on the roads, uncertainty induced inventory and warehousing costs, and – when time is almost priceless – the costs of shifting to a faster, more expensive, mode of transportation.[24]

Concretely, in India uncertainty pushes up total logistics costs substantially:

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[22] Das-Gupta, "Internal Trade Barriers in India."
[23] Jordan, Kamphuis & Setia, "A New Agenda," and Ernst, "Fast Tracking India's Electronics Manufacturing."
[24] Arvis et al., *The Cost of Being Landlocked*, p. 33. A detailed study in Vietnam reveals that "the root cause for costly logistics is the incidence of unpredictability that permeates supply chains. This unpredictability requires manufacturers to self-insure against uncertain freight itineraries by carrying higher levels of inventory than they would otherwise need to manage their daily operations, or face the even costlier risk of lost sales, interrupted manufacturing production runs, or a proliferation of pricey, avoidable emergency shipments." World Bank, "Taming Unpredictability as Source of Growth: What More Competitive Freight Logistics Can Do in Vietnam," summary note, 2014, p. 2; and Luis C. Blancas et al., *Efficient Logistics: A Key to Vietnam's Competitiveness* (Washington, DC: The World Bank, 2014).

- It hinders efficient asset utilization planning, increasing costs and prices. Companies, for instance, might need to switch to premium freight providers to meet order deadlines or to meet the needs of high priority customers. For freight providers themselves, a truck which is unexpectedly late on one delivery may miss the next scheduled collection, leading to low asset utilization. More commonly, freight providers may simply refuse to offer specific collection or delivery times, in turn preventing such detailed planning by their customers, the manufacturing firms themselves.

- It creates lost sales, as firms miss customers' delivery requirements, and so are cut out of repeat orders or have to provide substantial discounts. While this effect may be limited domestically, given widespread expectations of uncertain delivery times, it leads to a substantial loss of competitiveness in global value chains, which are increasingly structured around rapid, 'just-in-time' production, even in such industries as textiles.[25]

- It increases the size of buffer stocks that firms must hold, sometimes almost doubling inventory holding periods. Out of about 70 firms surveyed in India, on average, 43 days of inventory was found to be maintained across the four industries represented (auto components, textiles, electronics, and heavy engineering), of which approximately 27 percent (11.6 days) of this inventory is buffer stock.

While it is difficult to estimate the impact of the first factor, the deep-dives with three companies indicate that the second and third together can account for at least 14 percent, and as much as 23 percent, of the total logistics costs.[26]

These are though liable to be substantially under-estimated, since they exclude systemic effects. For example, when asked how much their sales would increase with more efficient freight, most firms responded that since such logistics would be a public good, all their competitors would benefit equally. As a result, the estimates of lost sales do not include the lost *aggregate* demand that results from high logistics costs and the fragmentation it generates.

Similarly, the estimates of buffer stocks reported by firms are liable to be under-estimated, since the use of lean techniques has simply been infeasible and thus many firms are unlikely to have systematically tried to reduce inventories. For example, in the one industry where such techniques are widespread – automotive components – inventories are *half* those of textiles. Utilizing a higher estimate of buffer stocks increases the 'regulatory share' of logistics costs to at least a quarter.

Finally, we have not quantified the reductions in *direct* freight costs that could result from a reduction in uncertainty, and resulting increase in small truckers' ability to plan and utilize assets (doing so would require a fresh survey into the economics of those informal firms). However,

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[25] Jordan, Kamphuis & Setia, "A New Agenda," and Ernst, "Fast Tracking India's Electronics Manufacturing."
[26] Annex A, p. 34.

such efficiencies might be very large: as will be discussed below, improved efficiencies in asset utilization in logistics caused some of the largest historical increases in total factor productivity.

Logistics can matter more than the 'usual suspects' (i.e. electricity and labor)

Indian firms, particularly intermediary firms, which purchase from and sell to other firms, thus not only incur high inbound freight charges for supplies and outbound freight charges for deliveries, but also face additional carrying costs for inventory, lost sales from missed deliveries or orders not taken, and additional packaging costs to avoid loss and damage during transit.

Adding these together, we estimate that total logistics costs can range from 10.4 percent of net sales for automotive to 14.1 percent for electronics (Figure 4). Even for companies that have structured their supply chain to source nearby (within one day's transit), total logistics costs remain at least 4.5 percent of net sales.[27]

These total logistics costs make as much difference to the cost structure of manufacturing firms as do much-discussed electricity or labour costs, and in some cases is more important. For comparison, the total wage bill in these industries ranges from 6.2 percent of net sales to 11.8 percent. With many companies having to rely upon alternative and more expensive power sources as electricity is in short and erratic supply. Power, fuel and water costs range from a mere 1.1 percent to 6.8 percent of costs, and as these are reported financial numbers they include the cost of self-generation. Only electricity costs in textiles, and personnel costs in electronics, come close to matching the cost impact of logistics (Figure 5).

It should be cautioned of course that these cost estimates depend on several assumptions, whose values were derived from phone interviews with a sample of firms, and thus are vulnerable to a range of errors. As such, they should be considered order-of-magnitude estimates, but the differences above are substantial enough to give confidence in the results.

[27] Based on a survey of almost 70 companies in the auto-components, textiles, electronics and engineering sectors; in-depth, repeated examination of the logistics patterns of three SMEs; and analysis of the Prowess Dataset for FY2011-12, which contains financial data on twenty-seven thousand companies.

Figure 4[28]

The estimated total logistics costs[1] vary between 10.4% of net sales to 14.1% of net sales

	Source: Prowess and Quantitative Surveys (all figures in %)[1]			
INDUSTRY	**Auto-components**	**Textiles**	**Electronics**	**Heavy Engineering[4]**
Inward Freight	3.1	3.9	4.0	3.5
Outward Freight	3.8	3.4	3.1	4.1
Average Inventory as % of sales[3]	13	26	30	19
Cost of carrying inventory (at 15% cost of capital) as % of sales[3]	1.95	3.9	4.5	2.85
Packaging Cost as % of sales	0.2	0.9	0.7	0.4
Lost sales as % of current revenues[2]	6.1	5.0	8.5	5.6
PBDITA Margin[2]	12.8	13.6	15.7	16.0
Damages in transit	0.5	0.5	0.5	0.5
TOTAL LOGISTICS COST	10.4	13.3	14.1	12.2

Note: 1) Formula used for calculating the total logistics costs = Inward Freight + Outward Freight + Cost of Carrying Inventory (Total) + Packaging Cost + Damages + EBITDA due to lost sales
2) EBITDA due to lost sales is calculated by multiplying the lost sales as % of current revenues (from Survey) with PBDITA margin. (from Prowess).
3) Inventory carrying cost is calculated based on total inventory. Since the value of transit inventory and buffer inventories are not available separately, the total value of inventory (from Prowess) is used. The total value of inventory is going to slightly overestimate the inventory carrying cost for the in-transit and buffer inventory
4) Heavy Engineering data corresponds to machinery sector (manufacturing of all electrical and non-electrical machines including electronic equipments)

Figure 5[29]

The total logistics cost as % of net sales is higher than the industry's employee costs as well as the power and fuel costs

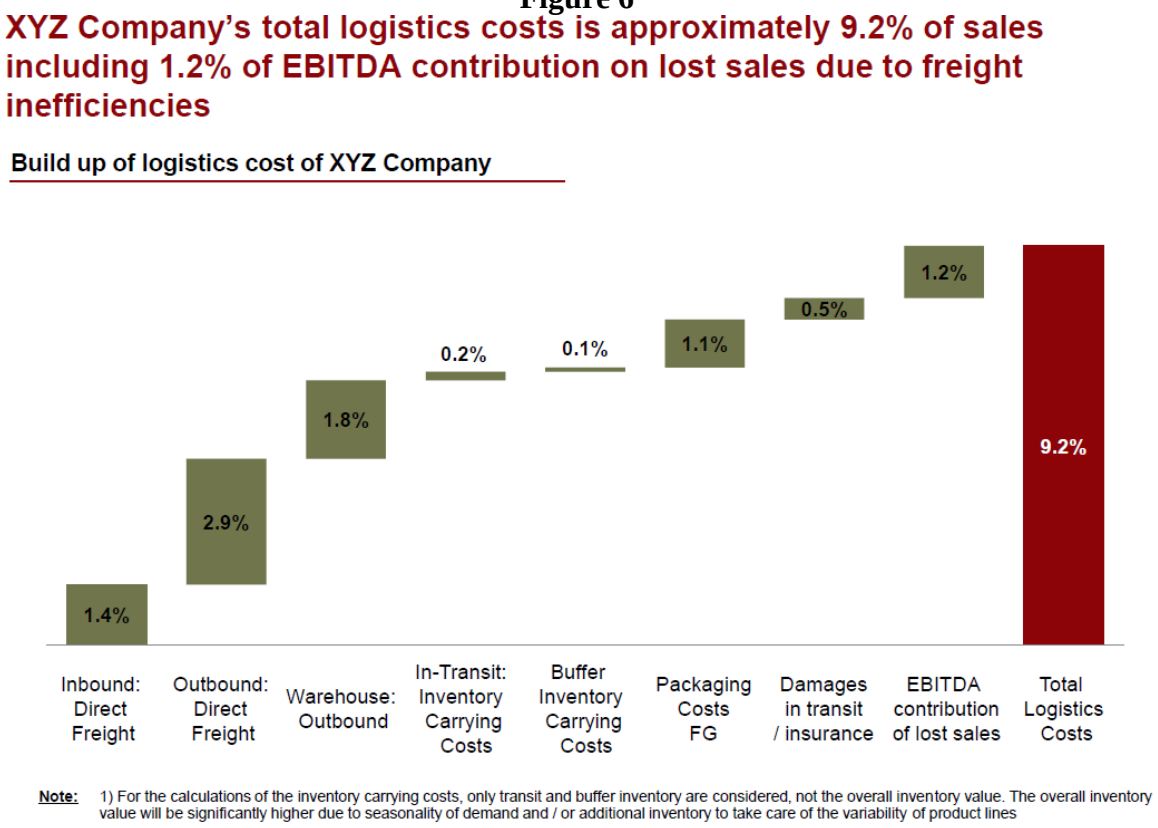
	Source: Prowess and Estimations (all figures in %) FY2011-12			
Manufacturing – Cost Heads	**Auto-components**	**Textiles**	**Electronics**	**Heavy Engineering[1]**
Employee Cost as % of Net Sales (FY11-12)	7.1	6.2	11.8	8.6
Power, Fuel and Water Cost as % of Net Sales (FY11-12)	3.7	6.8	1.8	1.1
Research and Development Costs (capital & current account) as % of Net Sales (FY11-12)	0.5	2.4	0.1	1.1
Logistics Costs as % of Net Sales (as estimated)	10.4	13.3	14.1	12.2

Note: 1) Heavy Engineering data corresponds to machinery sector (manufacturing of all electrical and non-electrical machines including electronic equipments)

[28] Annex A, p. 20, citing RedSeer Freight Survey, 2013; Prowess Data for FY2011-12.
[29] Annex A, p. 21, citing Prowess and Estimations (all figures in %) FY2011-12.

Moreover, they were tested through repeated, in-depth interviews and primary evidence at three SMEs, manufacturing in Himachal Pradesh, Bangalore and Uttarakhand.[30] All three manufacture high-value, low-volume products (alcohol products, high-end batteries, and transformers). One, whose suppliers are almost all based within its State – many in the same sector – does have very low total costs, at 4.4 percent of sales, and another, which sources only one major input from outside the State, has costs of 6 percent of sales. The third, though, with a somewhat more typical profile – multiple suppliers outside the State – has logistics costs of 9.2 percent of sales, with a particularly high amount of lost sales (Figure 6). The low cost of firms sourcing in-state may be taken as an indication of the substantial effects on competitiveness from cross-state sourcing.

Figure 6[31]



Comparison to services

Moreover, total logistics costs might explain the unfulfilled promise of India's manufacturing, contributing only 16 percent of India's GDP, in contrast to comparator countries. Using the logic of Hausmann, Rodrik and Velasco (2005) in conducting a 'growth diagnostics', it is

[30] As a condition of access, these firms were guaranteed confidentiality.
[31] Annex A, p. 28, citing RedSeer Freight Survey, 2013.

revealing that an avoidance of logistics costs is the principal difference between manufacturing and the faster-growing service sector.

Total logistics costs do not exceed 1 percent of net sales for information technology (IT), hotels and tourism and communications. By contrast, power, water and fuel account for approximately 7 percent and 9 percent of net sales for the latter two industries; the IT industry has little to no dependence on logistics or power, with 45 percent of its cost in the wage bill (Figure 7). Overall, the most substantial difference between the operating cost structure of manufacturing and services in India is not reliance on labor or power, but on logistics.[32]

Last, the manufacturing industry that has posted the strongest performance in recent decades – automotive – is the industry that has been most aggressive in decreasing its dependence on logistics. As will be discussed below, there is evidence that the industry is changing its spatial structure in response to logistics costs, with potentially significant damage to its long-run competitiveness.

Figure 7[33]

Related data from services sector[1] shows that logistics costs are much higher for manufacturing sector

	Source: Prowess and Estimations (all figures in %) FY2011-12		
Services – Key Cost Heads[1]	**Information Technology**	**Hotels & Tourism**	**Communication**
Employee Cost as % of Net Sales (FY11-12)	45.4	24.6	14.3
Power, Fuel and Water Cost as % of Net Sales (FY11-12)	0.9	6.9	8.8
Distribution Expenses as % of Net Sales (FY11-12)	0.1	0.1	0.0
Average Capital value of inventory as % of Net Sales (FY11-12)	1.2	5.1	3.0
Inventory carrying cost as % of Net Sales (FY11-12)	0.2	0.8	0.4
Total Logistics cost as % of Net Sales (FY11-12)[1]	0.3	0.9	0.4

Note: 1) Logistics cost data for services is indicative and only includes the inventory carrying costs and the distribution expenses as percent of net sales
2) Distribution expenses as % of net sales might by understated as some companies do not report distribution separate from sales expenses

[32] A similar analysis has not been done for *capital* costs, but there it might be expected that the principal difference would be the larger land footprint of manufacturing.
[33] Annex A, p. 22, citing Prowess and Estimations (all figures in %) FY2011-12.

3. VARIATIONS AND AGGREGATE EFFECTS

It might be posited that logistics, like some other aspects of cost, is amenable to improvements by firms themselves. In that case, high logistics costs would motivate improving supply chain management capabilities, as much or more than regulatory changes.[34] At the same time, it might be argued that the effect of logistics on average firms might cancel itself out.

Domestic delays and uncertainty afflict all firms without prejudice

When it comes to the ability of manufacturing firms to influence domestic freight performance, we find that few to no characteristics help firms manage delays and delivery times. Statistical analysis finds that a firm's sector, its size in terms of revenue and profitability, and the composition of its principal raw material are not significant in explaining variance in delivery times for domestic shipments.

This implies that domestic freight performance is an almost purely environmental constraint on firm performance. If management capabilities were important, one would expect profitability (as an imperfect proxy for capabilities) to have a significant impact on variance. From a similar logic, specific regulations on certain kinds of material are not a root cause. Finally, we also note that the number of freight providers a company uses is also not significant in explaining transit time, i.e., whether a company uses many small companies or few large ones has an insignificant effect on transit times versus distance and state borders.

At a descriptive level, there appear to be some differences between sectors, with auto-components facing the smallest delays and electronics the largest (Figure 8). However, sector differences are not statistically significant when controlling for other factors. This may be accounted for by the ongoing spatial re-arrangement of the auto sector (discussed in more detail below).

Young and small companies have the most difficulty in customs

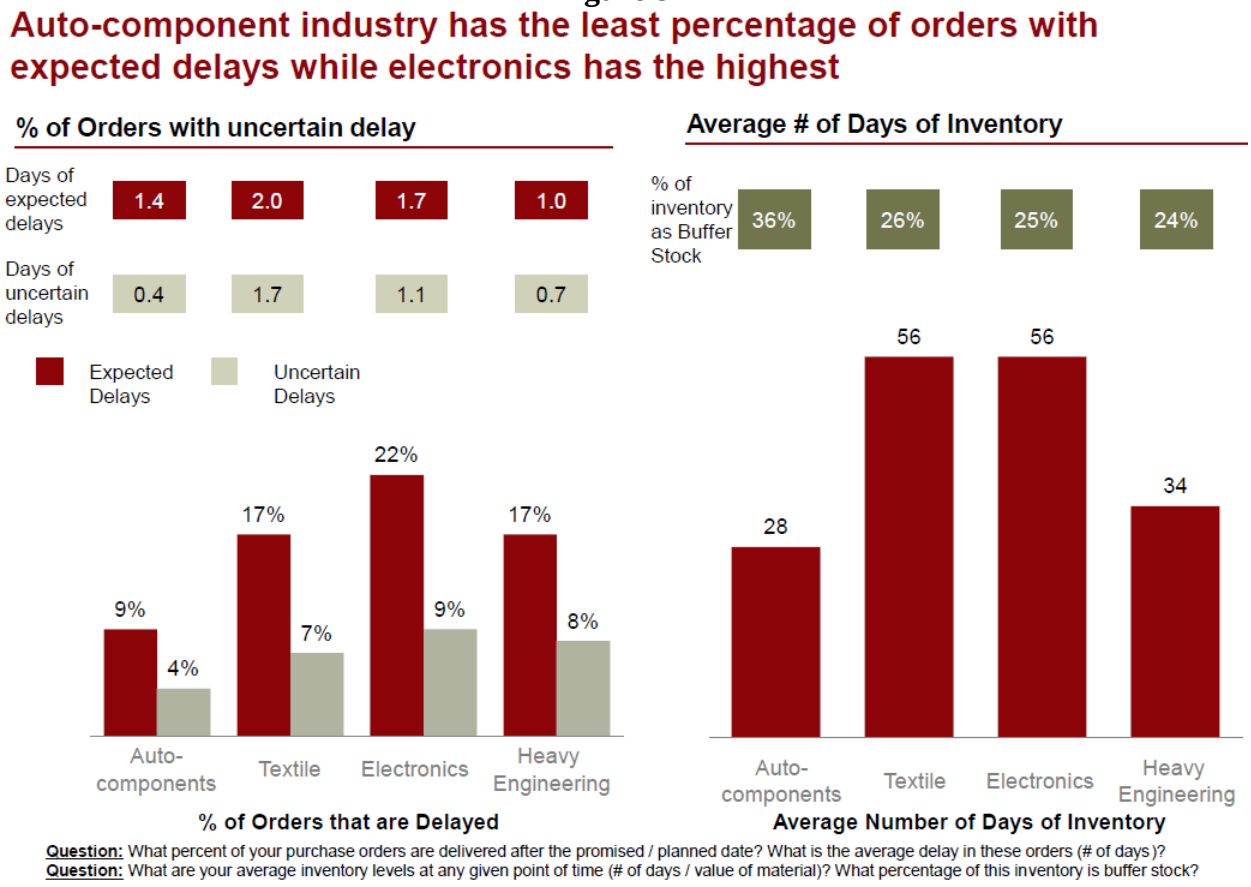
Turning to international freight, the survey did find greater influence of firm characteristics on delays.[35] However, this influence seems to stem from size, rather than capabilities.

The larger the company, the lower number of its orders is delayed at customs, though the magnitude of this difference is not large. Statistically, an increase in company revenue by approximately 100 crore (everything else being equal) implies a reduction of 0.03 percent in the

[34] Or viewing those regulatory impediments in the light of their effect on capabilities, as is appropriate for the textiles value chain. Jordan, Kamphuis & Setia, "A New Agenda."
[35] Annex B. This analysis is based on the 40 companies in the sample that import products, and the 43 that export.

number of orders delayed.[36] This aligns with anecdotal reporting from firms interviewed in more depth, who report that 'green channels' at customs, intended to allow faster clearance for firms that have a clean track-record, in fact just privilege larger companies.

Figure 8[37]



One counter-intuitive finding is that uncertainty in import processes tends to be higher for more profitable companies, in terms of margins. A difference of 1 percent in profit margins is associated with an increase of 0.4-percentage points in delays in imports. When combined with the findings above, this indicates that smaller, highly profitable companies will be particularly disadvantaged by delays in customs in clearing imports. There is one exception, however, and that is the auto-components sector, where more profitable and higher revenue companies were found to have significantly lower transit time.

There could be a range of explanations for this phenomenon, for example that high-end export products with higher prices and margins create more room for disputes in the implementation of

[36] The magnitude of impact here could be underestimated, given that few very large companies were interviewed, and anecdotal evidence suggests that these face the smoothest customs processes.
[37] Annex A, p. 11, citing RedSeer Freight Survey.

regulations, causing delays – as has been the experience of some smaller, high-end garments exporters interviewed. Another is that more profitable companies may be importing from lower-cost destinations which face increased scrutiny. These and other competing explanations may be an avenue for future research.

In – only partial – support of one of those, we do find systematic variation by the country of origin. Importing from China, Taiwan and Japan increases the number of days spent in transit. In particular, importing from China adds a full day in customs, all else being equal. However, it is not clear from the data whether there are other, unobserved causes of this variation.

Finally, there are some non-linear effects in dealing with customs processes. Firms that are near to ports tend to face far fewer delays at the port than those far away, likely indicating a premium to personal interaction with customs officials. Strangely, firms that export a moderate amount tend to face greater obstacles than those that either export very little – having just once-off shipments – or those that rely on exports for a substantial portion of their sales. This may indicate that firms which export only a little may entrust orders to aggregators, while those that do so a lot are practiced at complying with requirements. The intermediate firms, which are starting to export in large volumes, then face the greatest difficulties.

Overall, as is discussed at length in both of the companion studies, on textiles and electronics, the principal issue in customs is not the letter of regulations, but their implementation. A process of concerted implementation of reforms will be necessary before manufacturing firms in India can sustainably link into global value chains, which in turn is necessary if they are to compete in ever more globalized industries. This is discussed further in the final section.

Freight difficulties are rearranging the locations and structure of industries

In theory, the cost burden imposed on individual firms by logistics might not have a large aggregate effect, if firms individually adopted coping strategies (e.g. using premium freight providers) that led to widespread mitigation of the effects. On the other hand, such coping strategies might do the opposite, and lead to effects that were even more constraining than at the firm level.

Further research would be required to answer this question conclusively. Our survey results do show that firms have developed a range of coping strategies to deal with unpredictable freight, but that these raise costs rather than mitigate them. More than half of the firms surveyed stated that they used premium freight providers for high priority orders, with the highest proportion (82 percent) among electronics firms.

Roughly 45 percent of firms also indicated a willingness to pay a premium for on-time delivery. Even in low margin businesses, such as textiles and apparel, firms anecdotally reported that for the most time sensitive deliveries, such as samples, they would resort to air cargo, or to sending staff on long-distance train rides carrying the goods personally.

The most extreme coping strategy has been witnessed in the automotive industry. There, the physical distribution of activities and the reaping of scale and other economies has been almost entirely subordinated to overcoming logistical difficulties.

Here, the case of Maruti Suzuki is illustrative. In 2001, its total logistics costs were substantially higher than its wage bill (perhaps up to four times as high),[38] but in 2013 those costs had been slashed, by *requiring* almost all suppliers to build, warehouse or locate within a few hours radius of the plant.[39] Specifically, in the early 2000s Maruti Suzuki relied on some 400 major suppliers, located across India, with some being almost 2,500km distant from their main plant in Haryana. At the time, this meant it had to carry large buffer stocks and deal with substantial freight costs.

Today, the situation has been transformed. Over the last decade the company has required its suppliers to locate close to it. Approximately 80 percent of its suppliers are now located within a 100km radius of the plant.[40] The company reports that its buffer stocks are now down to zero, and it is running lean production processes. It has been able to force this change because of the enormous scale of its operations, which make its business alone valuable enough to its suppliers to motivate them relocating.

More generally, the auto-industry, with its enormous economies of scale in plants producing hundreds of thousands if not millions of cars per year,[41] may be uniquely able to impose such a structure, so that auto-component firms have the lowest outbound distances of any industry by a factor of a third (Figure 9). Even so, component producers have complained of their own decreasing economies of scale and loss of localization economies. Given the land price dynamics at work in India today, this risks diverting substantial amounts of investment from plant upgrading and building human capital into the acquisition of land.[42]

As such this is unlikely to be an optimal or replicable strategy for manufacturing growth. It runs the risk of creating an auto-component industry that foregoes the advantages of having individual

[38] Sumila Gulyani, "Effects of Poor Transportation on Lean Production and Industrial Clustering: Evidence from the Indian Auto Industry," *World Development 29*, no. 7 (2001), pp. 1157-1177.
[39] Alternative explanations for this change over time have not been explored, and external factors thus might have played a role as well.
[40] Interview with Maruti Suzuki representatives, September 20, 2013.
[41] "The Indian automobile industry produced a total 1.69 million vehicles including passenger vehicles, commercial vehicles, three wheelers and two wheelers in August 2013 as against 1.56 million in August 2012, registering a growth of 8.18 percent over the same month last year," http://www.ibef.org/industry/automobile-industry-in-india-snapshot.
[42] An auto component producer setting up in the NCR today is likely to pay a large multiple for its land as it would if it set up in the southern United States, let alone Michigan. Building on Sanjoy Chakravorty, "A New Price Regime: Land Markets in Urban and Rural India," *Economic and Political Weekly XLVIII*, no. 17 (2013), pp. 45-54.

parts of the supply chain co-locating, with consequent knowledge spill-overs among suppliers of the same part, and economies of scale in component production.[43]

In sum, the performance of domestic freight in India may be imposing an unpalatable choice on the auto and auto-components industries: either have a final assembly industry that can deliver effectively to the domestic market, organized in clusters of dissimilar producers around large original equipment manufacturers (OEMs); *or* have a world-class auto-components industry, organized in clusters of similar parts producers, distributing goods to OEMs around the country, forced to maintain high buffer stocks and forego just-in-time production. Industry bodies have therefore begun to clamor for public land acquisition and subsidies for parts producers, in order to mitigate this difficulty, but this would only solve part of the dilemma, if at all.

Though these effects are most noticeable in automotive, they is by no means restricted to it. For example, apparel and textiles producers in many parts of the country complain that they simply do not have a domestic supply chain – despite many of the products they need being available in the country. So they do not bid for large or rapid orders and both they and firms elsewhere forego sales, depressing capacity utilization and hence investment.[44]

International comparisons

Finally, it might be argued that logistics is not as serious a constraint to global competitiveness as it seems, if India's performance is no different to its competitors. Unfortunately, it is difficult to find the like-to-like comparisons of performance, as analyzed in this study, that would be needed to answer this conclusively.[45]

Overall, though, the picture is that India's relative performance on domestic logistics is worse than its relative performance on international logistics. This accords with the anecdote widely

[43] This concern was voiced explicitly at the conference on regulatory barriers to firm growth organized in June 2013 at the initiative of then Chief Economic Adviser Raghuram Rajan, where the Automotive Component Manufacturers Association of India (ACMA) highlighted the requirements from OEMs for suppliers to move next to their factories as a major problem facing the component industry.

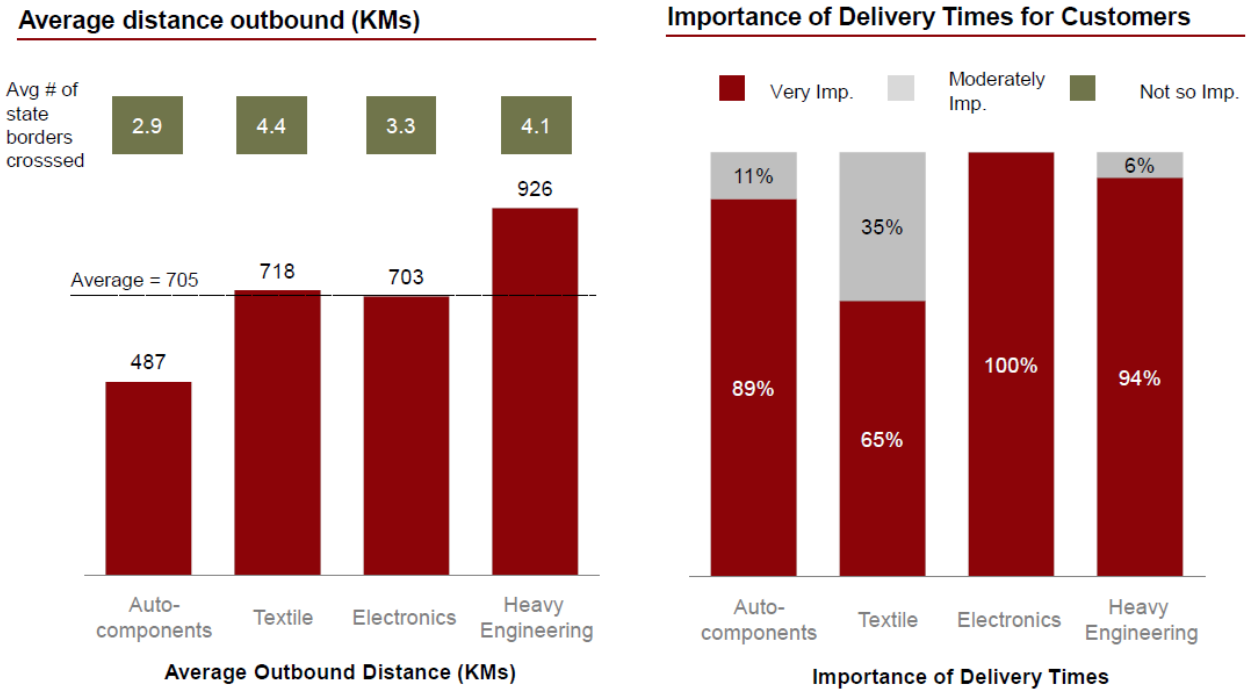
[44] See "A New Agenda" for a more detailed analysis of the other factors that cause this.

[45] The World Bank's Logistics Performance Index (LPI), the most used basis of international comparisons, places India in the middle of the pack internationally – it ranks 46th in the 2012 Logistics Performance Index. However, this ranking is based upon a survey of global freight forwarders and express carriers, providing feedback on the logistics 'friendliness' of the countries in which they operate and those with which they trade. Data collected in the domestic part of the same survey on the logistical constraints within countries perceived by logistical experts working in those countries does not inform this ranking. A comparison with other lower middle income countries on the domestic LPI gives a more mixed picture of India's performance. Being based on surveys of agents inside countries, this ranking is vulnerable to perception bias, i.e., what is 'low' performance to respondents in one country may be 'high' in another. Moreover, this ranking is also oriented towards exports, primarily considering distances and lead times to reach ports.

quoted in these reports, that shipments from China take as much time and cost to reach major ports in India as domestic shipments from elsewhere in the country.

Figure 9[46]

Heavy engineering has the largest outbound distance while auto-components has the least



Question: What is the average distance of your products from your factory to where they are consumed? (in KMs)
Question: How important are delivery times for your domestic customers? What value of orders (as %age of annual revenues) is lost due to inefficient delivery times?

Moreover, domestic logistics performance will matter more for India than for almost any other lower middle-income country. One of India's largest potential strengths, as one of the only continental economies, is its size and diversity. These potential strengths are particularly of benefit to manufacturing, with its large economies of scale. As such, domestic logistics that is substantially worse – in relative terms – than international logistics will nullify exactly what should be India's core strengths. On this front, India substantially lags behind the few other continental economies (e.g., its trucks travel half the distance per day as those in Brazil).

In this light, there is perhaps a more pertinent comparison, drawing on the economic history of another continental economy. Perhaps one indication of the foregone economic gains imposed by these freight deficiencies comes from the economic history of another continental economy. The single largest gains in TFP growth in US economic history occurred in the 1930s, during the

[46] Annex A, p. 13, citing RedSeer Freight Survey, 2013.

Great Depression.[47] In that period, when US income was still just around $5,000 per capita, TFP grew more than in any other peak-to-peak cycle since the 1880s, and including the electrification of manufacturing in the 1920s and the IT boom of the 1990s and 2000s. The source of that TFP growth was the reconfiguration of the US logistics industry to take advantage of the potential of rail and road freight. At present, therefore, the regulatory burdens on its freight system imply India is missing out on the single largest boost to living standards in economic history, one greater than either electrification or the 'IT revolution'.

4. REFORM PRIORITIES

Carrying through a few major reforms could make as much difference as massive investment

The good news is that major steps forward in unlocking the freight industry are possible even without the massive investments routinely called for in consulting reports. As a priority, the almost 60 percent of journey time spent without driving could be significantly reduced through a reform agenda such as:

1. Implement the national GST;
2. Follow it up with a national campaign to make the roads close to check-post free;
3. As an initial step, enable and encourage states that have not yet adopted an 'e-permit' system to do so, and ensure coherence between them;
4. Fully implement a true 'risk management system' (RMS) for customs, to create a 'green channel' that makes customs hassle-free for young, small firms with clean records;
5. Implement Government's desired intent to introduce e-tolling on national highways, and promote its extension to all state highways, to eliminate waiting at tolls.[48]

One other non-regulatory action, but one that might also be highly cost effective, would be to devise and implement programs to improve the human capital of the trucking industry. In other words, this would involve a concerted effort to improve the health and education levels of truckers themselves.[49] Doing so would substantially reduce time lost to illness, disputes from misunderstood forms, and so forth.

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[47] AJ Field, *A Great Leap Forward: 1930s Depression and US Economic Growth* (Yale University Press, 2011).
[48] The key challenges to meeting effective implementation of e-tolling on national highways was not reviewed further as part of this study.
[49] Maruti Suzuki is in fact doing this already on its own initiative. It reduced the number of accidental damages per lakh dispatches from 59 in financial year 2007-2008 to 28 in 2012-13, thanks to a joint initiative of Maruti Suzuki and its logistics partners on training of drivers combined with health camps and better monitoring of the fleet condition. The introduction of GPS systems alone resulted in a reduction of 3% in delays in the last two years. Interview with Maruti Suzuki representatives, September 20, 2013.

This is not to say that investments in transport infrastructure and reforms of the freight sector are not needed. Further improvements in unlocking transport and logistics will be needed, and have been identified elsewhere.[50] The principal focus of this concluding section, however, will be the list of actions described above. The common theme in this list is that all of the needed measures have already been identified by Government. Unfortunately, many have been implemented partially, or not at all, so that their impact has languished. The more deep-seated problem is then the lack of feedback mechanisms: policymakers may believe the problem has been solved when the notification has been issued, while the systems do not take root.

More generally, these are reforms that will impose short-term costs – economic and political – on some sets of stakeholders, in exchange for large long-term gains. The distribution of those costs and benefits is therefore a difficult issue, one that is resistant to purely technical issues, and hence requiring a careful, long-term process of consensus building.

The principal argument of this section – and this study – is that there can be few higher priorities demanding the attention of policymakers and stakeholders than that process, given what is at stake. This is nowhere more true than with the national GST.

Implementing GST

The GST has been long-delayed, with recent estimates suggesting a date sometime in 2015.[51] Some firms described waiting for it as akin to 'Waiting for Godot'. The changes it will cause are summarized in Figure 10: although the entities involved, and flow of funds seem similar, the variety of different – and cascading – taxes, locally administered, will be replaced by a unified administration, avoiding the need for reconciliation when crossing every state border.

[50] See, for instance, the strategy proposed in the 12th Five Year Plan to improve the transport sector in a comprehensive manner. Specifically on ports, see: World Bank, "Reforming the Indian Port Sector," June 2013; and on the trucking industry, see, for instance: JPS Associates, "Study on Economics of Trucking Industry."

[51] The Government of India had introduced the Constitution 115th Amendment Bill (GST) in 2011 in the Lok Sabha to provide for the introduction of a GST. The Bill envisages a harmonization of the indirect tax regime by subsuming a variety of taxes levied by the Centre and the States (such as service tax, state VAT, etcetera), contributing to the creation of a single market. On 7 August 2013, the Parliamentary Standing Committee on Finance, to which the Bill had been referred, submitted its report with observations and recommendations. Several of the recommendations relate to the need to have broad consensus among States with respect to the implementation of the GST, and address the concern of states regarding loss of revenue. At the time of the presentation of the Union Interim Budget 2014-2015, it was announced that the Bill would be deferred till after the general elections in April-May 2014. Parliamentary Standing Committee on Finance, "73rd Report on The Constitution (115th Amendment) Bill, 2011," presented to Lok Sabha; laid in Rajya Sabna on 7 August, 2013; Institute for Policy Research Studies, "Standing Committee Report Summary: The Constitution 115th Amendment Bill, 2011 (GST)," PRS Legislative Research, August 26, 2013; and "Union Interim Budget 2014-2015 Speech of P. Chidambaram, Minister of Finance," February 17, 2014.

Given the importance of this reform to the freight system, hence to manufacturing competitiveness, and so to the target of 100 million jobs, it must continue to be a high priority.[52] The process of implementation requires not only the resolution of a number of issues on fiscal transfers and compensation, between Center and State, but putting in place large and sophisticated systems to efficiently handle transactions once it is done.

As well as a continued search for imaginative solutions to the fiscal issues, and sustained pressure from all stakeholders, this would motivate investing in advance in the necessary systems. As an example, though on a much smaller scale, in Malaysia a national GST reform has taken many years to pass through the political process. As part of the 'One Malaysia' plan, it was decided to build – in advance – the systems and capabilities needed in the Ministry of Finance and the provinces. The result was that when, the Prime Minister announced a decision to implement the reform, the time taken to implement it in practice had been brought down, by some estimates, from three years to one.[53]

Moreover, even after GST comes into force, a careful program of graduated efficiency improvement and subsequent removal of checkpoints will need to be undertaken to ensure its full benefits are reaped. A side-effect of the intense dialogue around the reform is that institutional channels have been created among participants, particularly among the States and between them and the Centre. It would be a waste for those institutional capabilities to dissipate once the initial disputes are settled. As such, there should be a strong case for *retaining* the working groups, committees and forums created even after GST comes into effect, and orienting them to the goal of 'seamless State crossings' by a certain date. This could also be supported by a system of monitoring and feedback in ways that could also strengthen long-term capabilities for revising and implementing policies for domestic market integration.[54]

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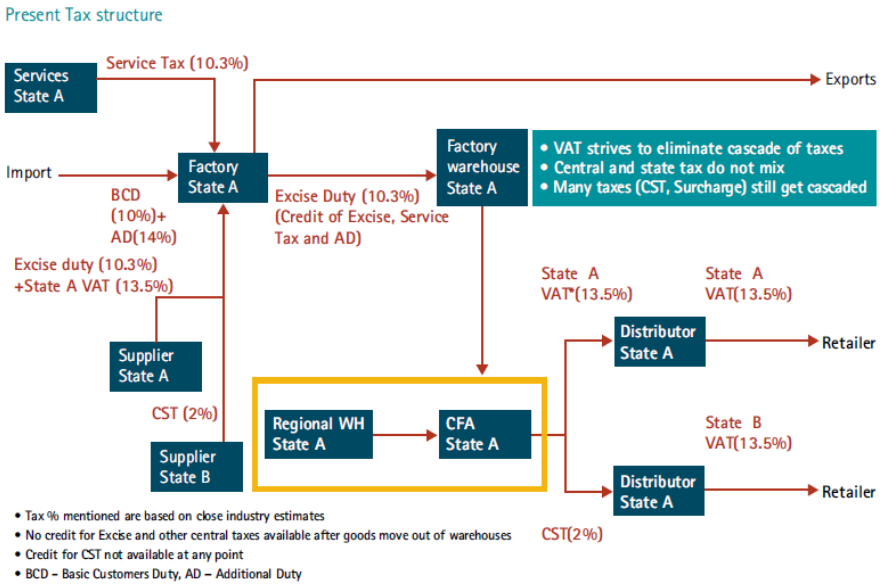
[52] "Implementation of a comprehensive GST across goods and services is expected, ceteris paribus, to provide gains to India's GDP somewhere within a range of 0.9 to 1.7 per cent," according to NCAER, "Moving to Goods and Services Tax in India: Impact on India's Growth and International Trade," Final report prepared for the Thirteenth Finance Commission, Government of India, December, 2009.

[53] The Government of Malaysia, though, still decided to delay the final coming-into-effect until 2015, to provide time for expectations to adjust.

[54] For examples of how feedback mechanisms could be included in policy processes and implementation, see the just in time note on *Manufacturing Policy Implementation and the Concept of a "Backbone Organization"*; and as the India Backbone Implementation Network (IbIn) aims to catalyze in practice.

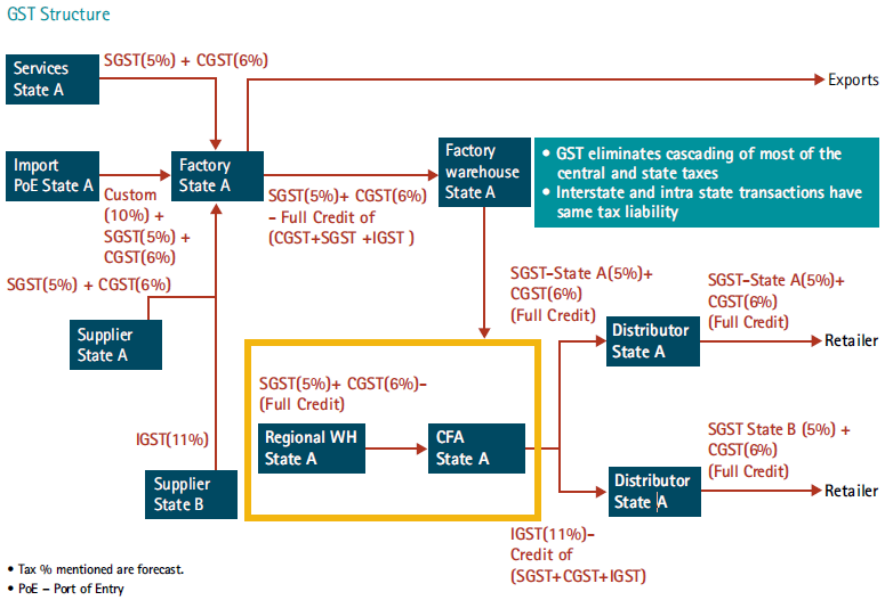
Figure 10

Comparison of the present and proposed tax structure under GST – (1/2)



Source: Accenture Goods & Services Tax (Transforming Supply Chain Performance in India)

Comparison of the present and proposed tax structure under GST – (2/2)



Source: Accenture Goods & Services Tax (Transforming Supply Chain Performance in India)

State-level actions

Change does not need to wait for GST, and GST will not solve all problems. Many can be tackled already by States, and some will have to be tackled by them.

As described in Section 1, many check posts exist within State borders as well and will not be removed simply by GST. Many of these impose delays as documents are checked and informal arrangements made, even where regulatory changes have introduced All-India Permits or other such measures. Many of these can be addressed even in advance of GST, and should be the object of continuing reform even once it is in place. One example often mentioned is that Haryana has entirely shifted to a mobile squad based system of monitoring and enforcement. On the other hand, such squads are expensive: even Maharahstra only had 38 squads, for the entire state, in 2003. Moreover, such squads require careful organizational set up and iterative design, to avoid monitoring and other issues. Needless to say, these issues will be particularly acute in low-income states.

Some States have also taken a lead already in reducing time barriers at their borders. For example, many firms have located in Andhra Pradesh that use the Chennai port, or that tap into the skills pool of Bangalore, since its borders are considered seamless.

Another promising reform that has already been undertaken is the introduction of 'e-road permits'. These allow firms to print out permits in advance for their shipments, which allow for the rapid clearing of state border and other check-posts. Awareness of this system was fairly widespread among the companies interviewed, all of whom reported positive results from it. Those who did use it most had among the lowest total logistics costs. However, implementation has been sporadic, both between and within States, and it requires continuing impetus.

This extends beyond the headline reforms, to matters as operational as opening hours. Several customs offices at ports are said not to operate on weekends. This issue recently seems to have been addressed.[55] This not only causes days of delay for shipments arriving at the end of the week, it means the following week starts with a backlog. The costs thereby incurred are then said to be charged to the firms. The Government has stated the desire to move to 365 day operation, but, again, implementation has lagged intent.

The principal obstacles to carrying through these reforms seem to be distrust between stakeholders. At a micro-level, firms report the feeling of institutional distrust by the customs office, in which every exporter or importer is treated as suspect, except, of course, for those that are breaking the law through informal arrangements. A large number of informal arrangements

[55] Focus group discussion with garments exporters, August 13, 2013. Recently, a 24X7 customs clearance (launched as a pilot in 2012) was extended to include other ports as well. Ministry of Finance, "CBEC Extends 24X7 Customs Facility for Export Cargo from 1st July, 2013," Press release, June 25, 2013.

would also be threatened by such reforms, informal gains that would not be compensated by system-wide gains in growth, creating stiff opposition among some powerful stakeholders.

At a macro-level, promises to States that they will gain in the long-term despite short-term costs from freer domestic trade can run up against short time-horizons among political leaders. The costs will come this electoral cycle, the gains the next. There is, as well, an (often deserved) distrust of external analyses, particularly when it is conducted or presented by stakeholders who would gain from the reform.

However, in terms of the various challenges facing reform in India, these would seem to be those facing the least insurmountable barriers. Certainly the costs of these reforms, and the political questions involved, would seem much smaller than, for example, labor laws, the distribution of costs among electricity consumers or the allocation of national resources.

The gains would be enormous, especially for inclusion and low-income states

Not only does the contention here seem more surmountable, but the potential gains are among the highest on offer in any policy area.

Simply halving the delays due to road blocks, tolls and other stoppages could cut freight times by some 20-30 percent, and logistics costs by even more, as much as 30-40 percent.[56] This would be tantamount to a gain in competitiveness of some 3-4 percent of net sales for key manufacturing sectors. This is a large multiple of the amounts these firms spend on research and development, and approaches the entire wage bill in some sectors.

At little direct cost, it could have an impact on freight times that would be equivalent to doubling the quality of the national road network. If it spurred the kind of rationalization of production locations and reaping of scale economies seen in other continental economies. So the rationale would seem compelling for a high-priority national campaign, to finally create an integrated national market in goods, through a concentrated effort to fully implement the reforms needed to dismantle regulatory barriers to movement.

Not only the direct effects, but the side benefits of such an initiative would be substantial. Most notably, the Government of India has made it a goal to reduce the enormous disparities in income between some of the States. Drawing again on economic history, in the US in the late 19th and early 20th centuries differentials between the states reached similar levels to those in India today. The single most effective means of convergence was again the true integration of the national market in goods: this meant that firms nationally moved to lower priced locations,

[56] See earlier calculation.

from which they were easily able to supply the markets of high-income areas.[57] This naturally created a convergence in incomes as investment flowed from the richer to the poorer states. This leveraged huge flows of private investment to address the inclusion challenge.

Without an integrated market in India, therefore, it is unlikely that private investment will flow to take advantage of lower costs in the low-income states. Instead, it is likely to continue to locate in second-tier cities and peri-urban areas in the more advanced states,[58] within close distance of the markets of the first tier cities and wealthy states.

On the other hand, it should be noted as a caveat that such a campaign, and the reforms and processes composing it, will be necessary though not sufficient to overcome the fragmentation of manufacturing in India. As noted in the studies on textiles and electronics, to achieve full connection will require a suite of complex, complementary policies – and, more than that, a strengthened learning, coordination and policy *process*.[59]

Other measures, such as subsidy schemes, are unlikely to have much impact

Various alternative measures have at times been proposed to overcome these difficulties. These have often revolved around subsidies, such as the requests from the auto-component industry mentioned above. Another has been various Freight Subsidy Schemes to subsidize freight in backward or remote areas.

The analyses conducted for these studies indicate that such measures are unlikely to have much effect, and may instead be counter-productive. This is because direct freight costs are only a portion, as little as half, of total logistics costs. Beyond those, any location specific freight subsidies are likely to just distort locations, breaking down the cluster effects and economies of scale that true reform would unleash. As such, they are liable to work against precisely the benefits which are sought. Similar arguments hold against 'logistics zones', and the recent proliferation of 'logistics' or 'industrial' corridors. Instead, thorough reform to the regulations inhibiting a healthy freight system will allow a natural evolution of the distribution of economic activities, at more limited fiscal costs, with greater long-term TFP growth and inclusion.

The urgency and potential for reform is enormous

In conclusion, there is no substitute for the thorough implementation of an integrated reform agenda for the freight industry. This is a necessary step if India is to reach the ambitious goals of the National Manufacturing Plan. It is as urgent, likely more so, than addressing the oft-cited trinity of power, land and labour regulations. It is politically less contentious, and most of the

[57] Robert J. Barro and Xavier Sala-i-Martin, "Economic growth and convergence across the United States," *National Bureau of Economic Research Working Paper*, 1990, No. w3419.
[58] Klaus Desmet et al. "The Spatial Development of India," Policy Research Working Paper 6060, May 2012.
[59] As IbIn aims to catalyze nationally.

needed reforms have been agreed in principle. As such, a firm and consistent push towards implementation could reap gains for decades to come. However, with every passing year the structure of activity remains sub-scale, sub-optimal location decisions are entrenched, and Indian firms are locked out of both global and domestic supply chains. There is thus no time to waste.

Freight Inefficiencies in India

Key Findings: Quantitative Survey and Repeater Interviews

World Bank

September 2013

Contents

Executive summary – 1/2

1. This survey was done telephonically reaching out to 69 companies in understanding their supply chain to assess the impact of inefficient freight to the industry. While industry specific data is not statistically significant, but it does provide a directional indicator towards the direct / indirect costs borne by different industries

2. Companies on average spend about 3.7% of their sales into both inbound and outbound freight. 65% of the companies bear the inbound freight themselves while 48% bear the cost for outbound

3. Outsourcing the transportation requirement is the major model for freight. Only 12% of the interviewed companies owned any transport infrastructure. More than 60% of the companies have contracts with less than 5 carriers, however a significant chunk of companies negotiate freight rates on a daily basis

4. Major reasons for delays and / or uncertainty mentioned by companies are: Road Infrastructure (Rank 1), Custom Clearance Delays (Rank 2), State border check post clearances (Rank 3)

5. Average number of domestic suppliers per company range from 50 to 70, while the average inbound distance is around 450 km

6. Average inbound transit time for inbound freight is around 2.7 days while that for outbound is around 3.7 days;

7. On an average, 16% of incoming orders are delayed due to unexpected delays while 7% orders are delayed due to uncertain delays. Average delay due to expected reasons is around 1.5 days while that due to unpredictable reasons is 1.1 days

Source: World Bank – RedSeer Freight Survey, 2013

Executive summary – 2/2

8. Auto-component industry is the leanest of the four industries analyzed with an average inventory of 28 days, while Textile and Electronics have the highest average inventory of about 2 months (56 days). On average, 43 days of inventory was found to be maintained across industries, approximately 27% of the above inventory is buffer stock (i.e. 11.6 days)

9. Even though 55% of the companies interviewed use a premium freight provider for high priority orders, majority companies are not willing to pay more that 2% of raw material cost as a premium to faster suppliers

10. Average outbound distance is ~700 km, auto-component (487 km) has the least while heavy engineering (926 km) has the highest; average number of state borders crossed on the way to customers is ~3.7

11. While all interviewed companies realize the importance of delivery time for their customers, majority say that the revenue growth would be limited to 10% if both the delays and uncertainty in domestic freight improve by 25%

12. For international purchases, the total transit time is 4.5 weeks; on average 4 days are spent in customs clearance with 44% companies reporting non-zero damages during customs clearance

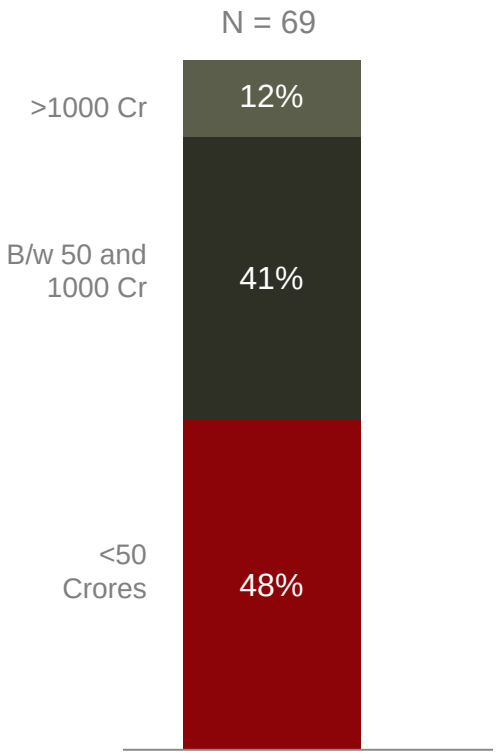
13. Exports delivery takes on average 4 weeks in transit with major geographies spread across the world; Electronics take the least transit time while auto-components the highest

Source: World Bank – RedSeer Freight Survey, 2013

The survey covered 69 companies across auto-components, textile, electronics and heavy engineering sector

of Companies

By Size (Annual Turnover in INR Crores)



By Industry

INDUSTRY	TOTAL # of SURVEYED COMPANIES	COS. EXPORTING FG	COS. IMPORTING RM
Auto components	18	44%	67%
Textile	18	61%	17%
Electronics	17	71%	88%
Heavy Engineering	16	81%	63%
TOTAL	69	64%	58%

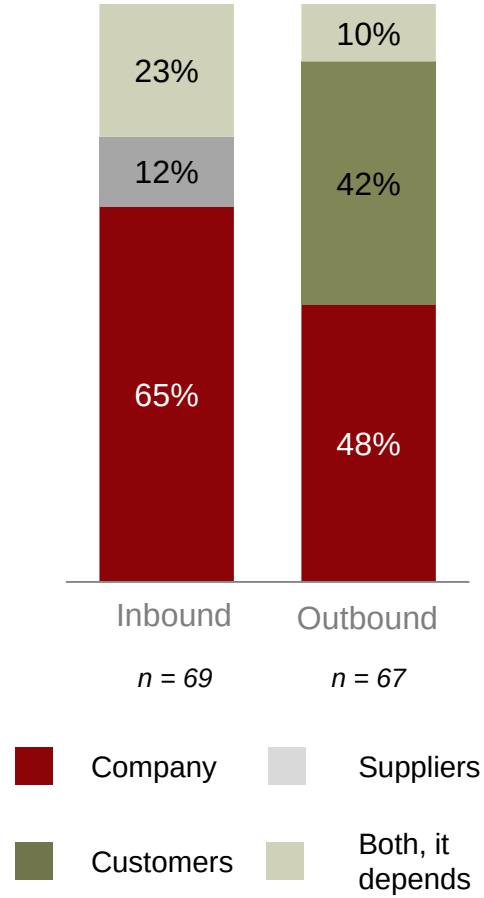
Source: World Bank – RedSeer Freight Survey, 2013

Median inbound and outbound freight are approximately 3.0% of sales. Lesser variation in the inbound freight charges compared with outbound

Freight Cost as % of Sales

	Inbound			Outbound		
INDUSTRY	Avg.	Med	SD	Avg.	Med	SD
Auto components	3.1	2.5	2.5	3.8	3.0	3.1
Textile	3.9	3.7	2.4	3.4	3.0	2.7
Electronics	4.0	3.0	3.3	3.1	3.0	1.4
Heavy Engineering	3.5	1.6	4.3	4.1	3.0	3.8
TOTAL	3.7	3.0	3.1	3.6	3.0	2.8

Freight Cost Borne By

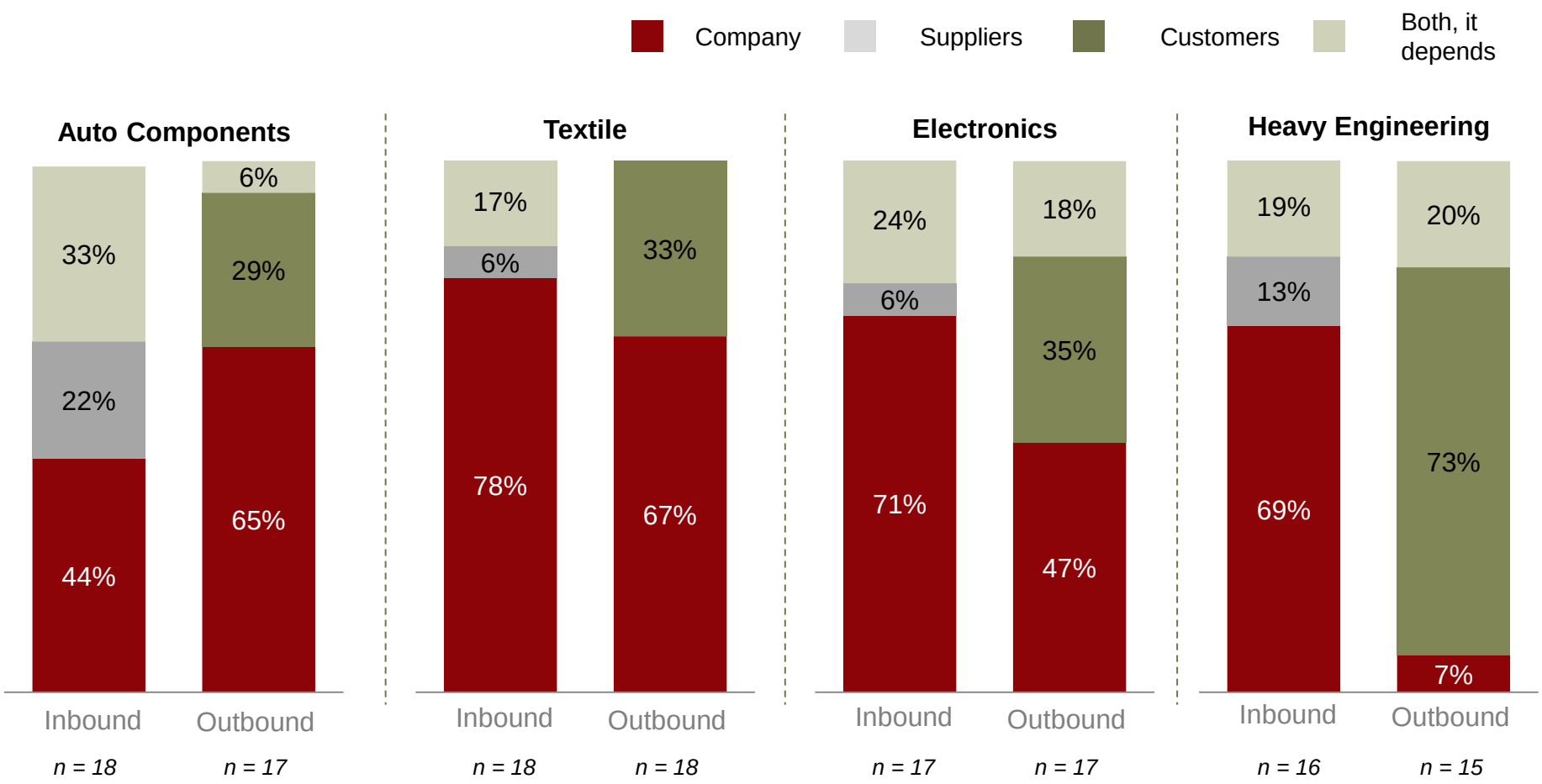


Question: What would be the % of revenues that you or your supplier/customer spend on logistics?

Source: World Bank – RedSeer Freight Survey, 2013

Freight costs for inbound raw materials is mainly borne by the consuming manufacturer

Who Bears the Freight Cost



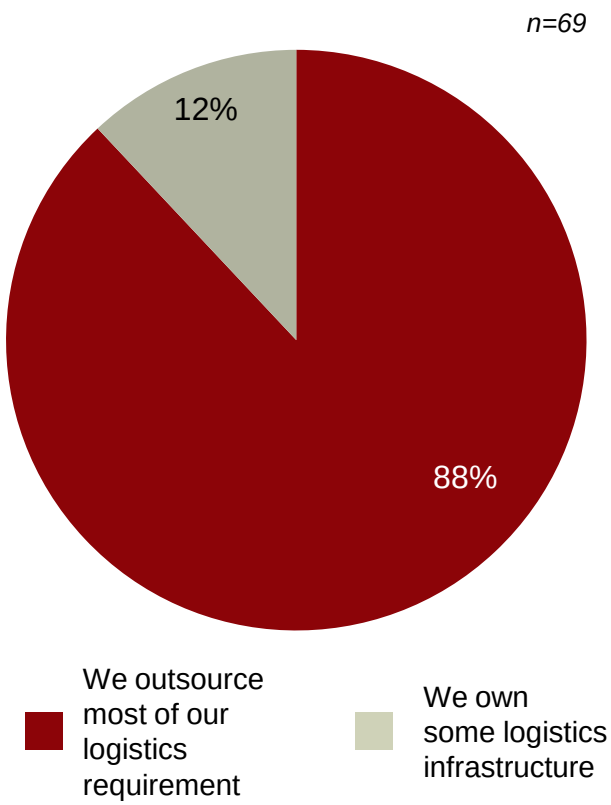
Question: Who bears the freight charges for your suppliers (inbound) / deliveries (outbound)?

Source: World Bank – RedSeer Freight Survey, 2013

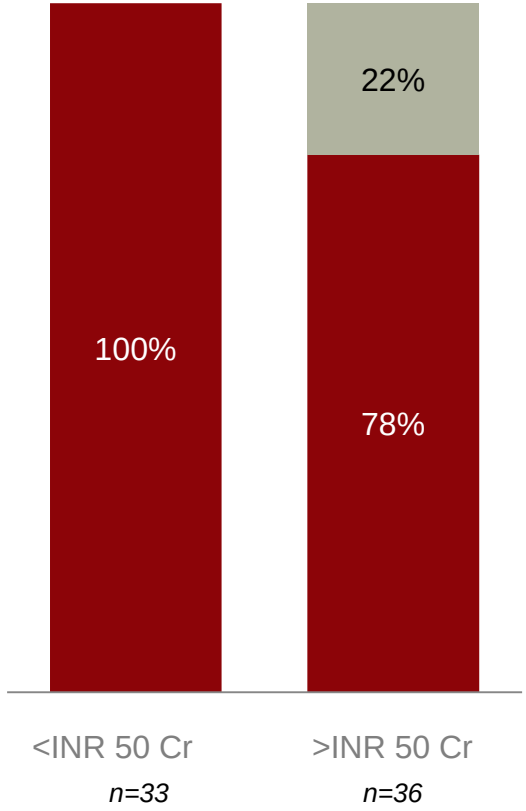
Only 12% of the surveyed companies own relevant transport infrastructure

Infrastructure Owned by Companies

Overall



By Size Annual Turnover



Number of Transporters

- 64% of companies use less than 5 transporters for outbound
- 62% respondents use less than 5 transporters for buying raw material
- However, many respondents were found to be negotiating the freight charges on daily basis rather than having annual contracts with transporters

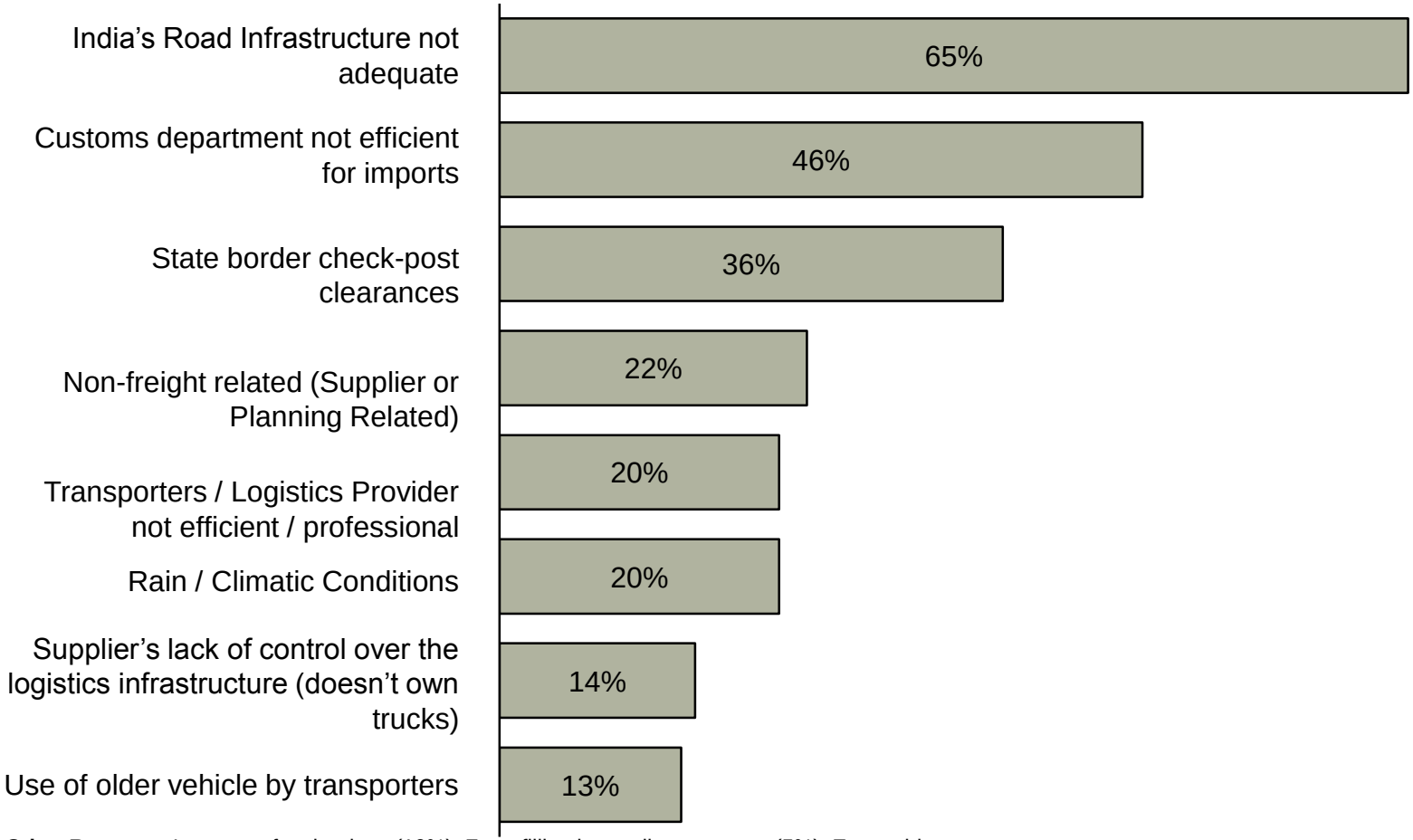
Question: Do you own logistics infrastructure for material handling and transportation? (for example: trucks, cranes etc.)?

Source: World Bank – RedSeer Freight Survey, 2013

65% of respondents mention that the major reason for freight delay in India is due to the inadequacy of India's road infrastructure

Reasons for delay – % of Respondents

n=69

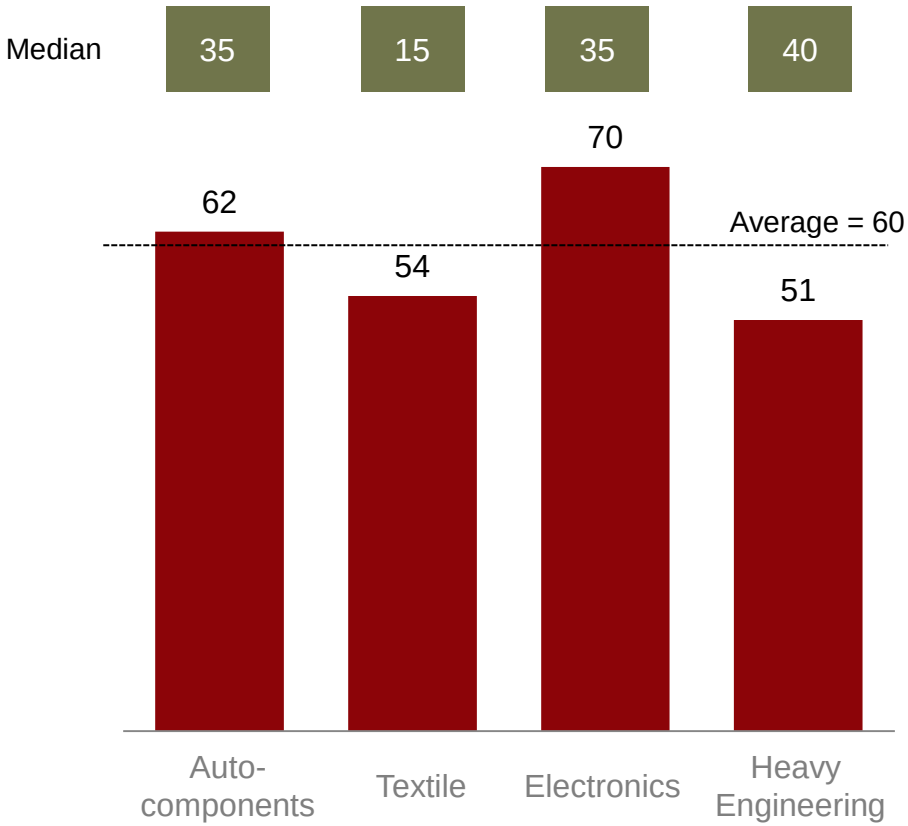


Other Reasons: Low use of technology (10%), Form filling is a tedious process (5%), Errant drivers etc.
Question: What according to you are the major sources of delay (and / or) uncertainty in the transportation time in your raw material purchases / customer shipments? Choose top three reasons.

Source: World Bank – RedSeer Freight Survey, 2013

Number of average active domestic suppliers range from 50 to 70, while the average inbound distance is ~450 kms

Average # of suppliers



Average # of Active Suppliers

Distance of Inbound Supplies (in KMs)

	Inbound Distance (kms)		
INDUSTRY	**Avg.**	**Med**	**SD**
Auto components	393	225	427
Textile	661	300	603
Electronics	369	200	380
Heavy Engineering	391	225	425
TOTAL	**456**	**250**	**474**

Question: What is the total # of active suppliers (from which you have procured during the last 1 year): Domestic only?
Question: What is average distance of inbound supplies: Domestic only (KMs)? (including co-located suppliers)

Source: World Bank – RedSeer Freight Survey, 2013

Average inbound transit time is around 2.7 days while outbound is around 3.7 days

Average transit time by industry (in days)

	Inbound			Outbound		
INDUSTRY	Avg.	Med	SD	Avg.	Med	SD
Auto components	2.5	2.0	2.5	2.9	3.5	2.2
Textile	3.3	3.0	2.4	4.2	4.0	2.9
Electronics	2.1	1.0	1.5	2.7	2.0	1.8
Heavy Engineering	2.3	1.3	2.2	5.2	5.3	2.9
TOTAL	**2.6**	**2.0**	**2.2**	**3.7**	**3.0**	**2.6**

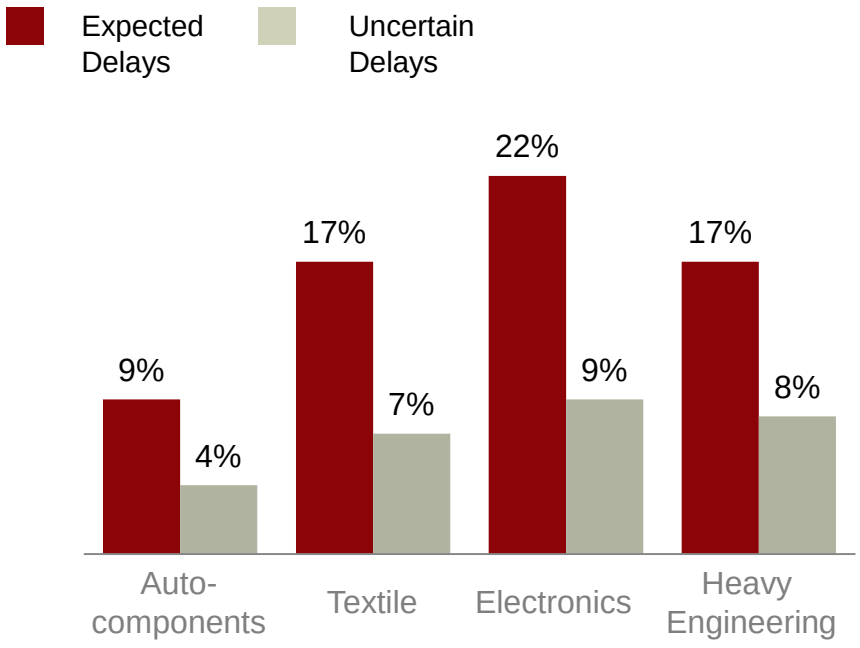
Question Inbound: What is the average time to deliver from supplier warehouse (largest suppliers of top-3 raw materials)? The data is averaged out over all three top raw materials. The standard deviation and median is calculated on these average transit times.
Question Outbound: What is the average time to deliver to your major customers (in days) after leaving your factory / warehouse?

Source: World Bank – RedSeer Freight Survey, 2013

Auto-component industry has the least percentage of orders with expected delays while electronics has the highest

% of Orders with uncertain delay

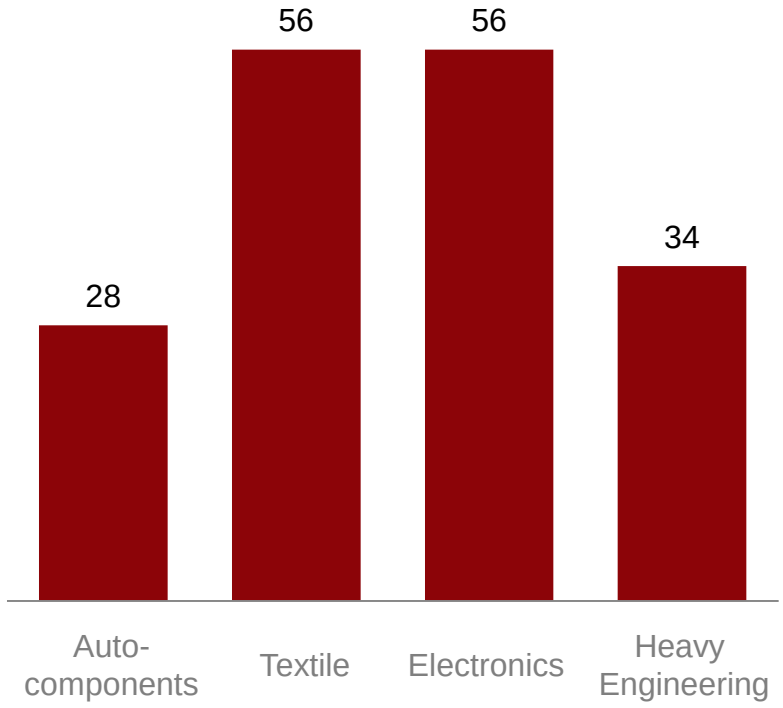
	Auto-components	Textile	Electronics	Heavy Engineering
Days of expected delays	1.4	2.0	1.7	1.0
Days of uncertain delays	0.4	1.7	1.1	0.7



% of Orders that are Delayed

Average # of Days of Inventory

	Auto-components	Textile	Electronics	Heavy Engineering
% of inventory as Buffer Stock	36%	26%	25%	24%



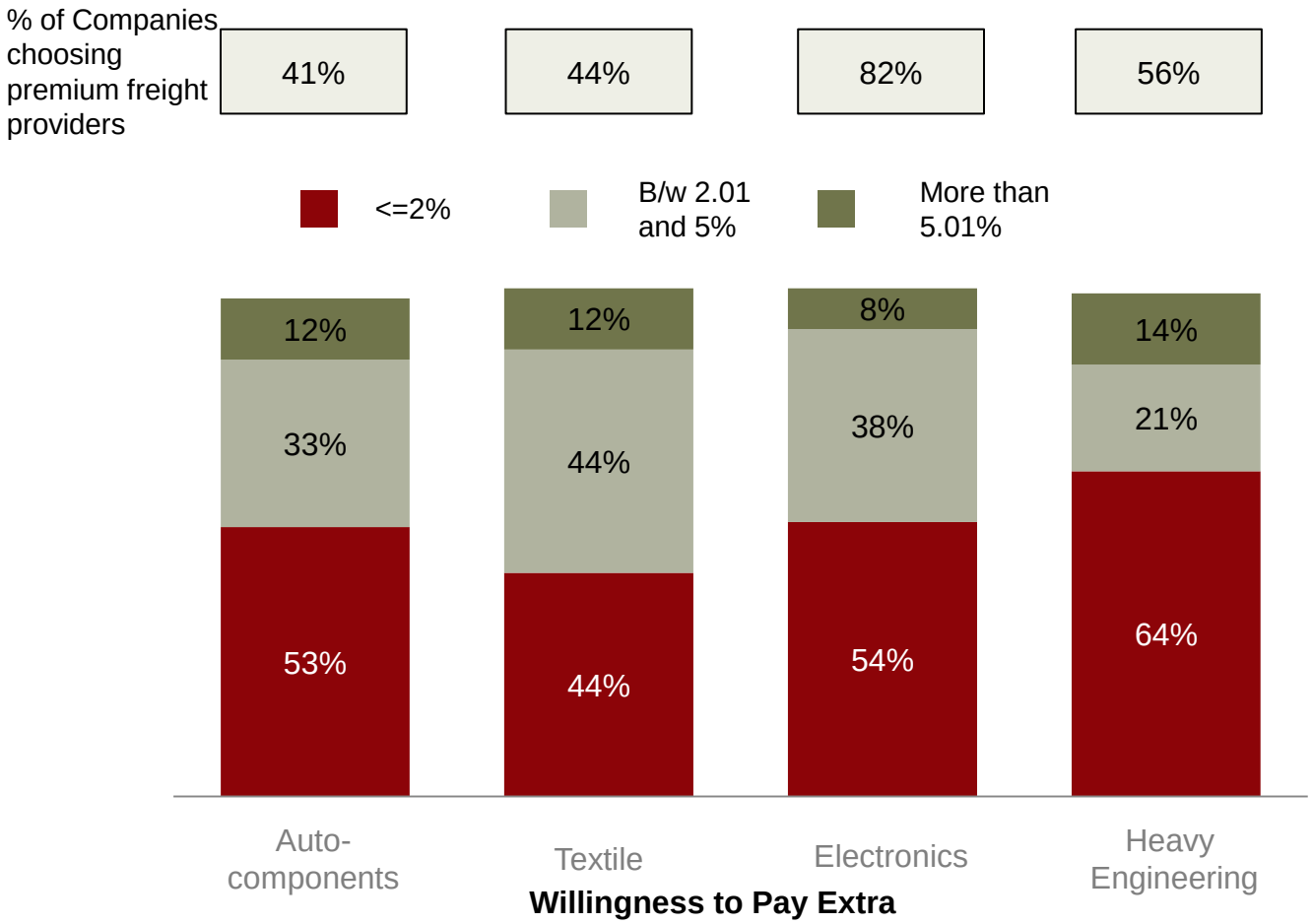
Average Number of Days of Inventory

Question: What percent of your purchase orders are delivered after the promised / planned date? What is the average delay in these orders (# of days)?
Question: What are your average inventory levels at any given point of time (# of days / value of material)? What percentage of this inventory is buffer stock?

Source: World Bank – RedSeer Freight Survey, 2013

55% of the companies use premium freight providers for high priority orders

Companies willingness to pay extra to deliver on time



Important Aspects

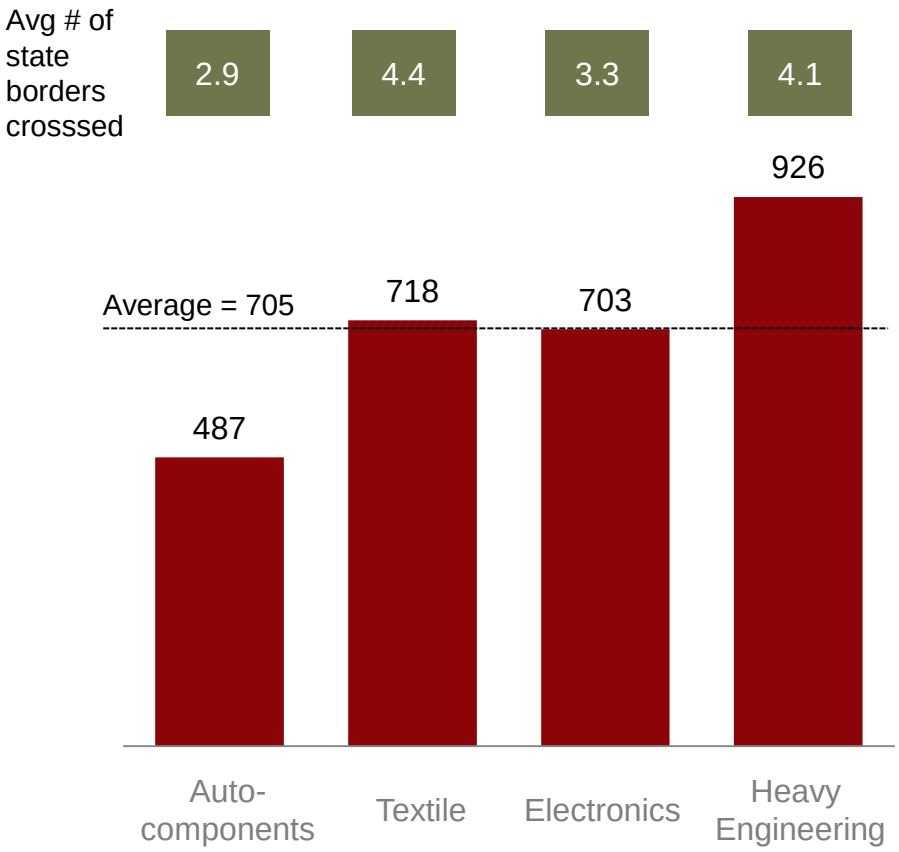
- 52% of respondents cited speed of delivery as a key aspect for their business
- 45% cited reliability of suppliers on promised delivery time as key
- 25% were concerned about damages to the goods in transit

Question: Do you use a higher price freight company for a high priority order?
Question: How much % extra are you willing to pay for suppliers who deliver on time?

Source: World Bank – RedSeer Freight Survey, 2013

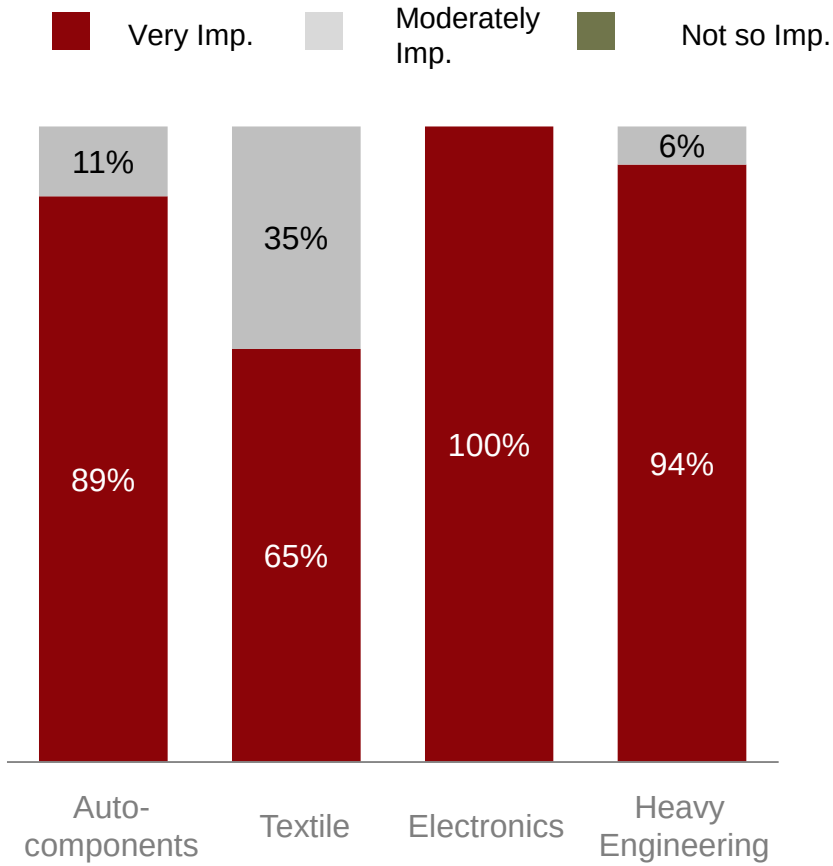
Heavy engineering has the largest outbound distance while auto-components has the least

Average distance outbound (KMs)



Average Outbound Distance (KMs)

Importance of Delivery Times for Customers



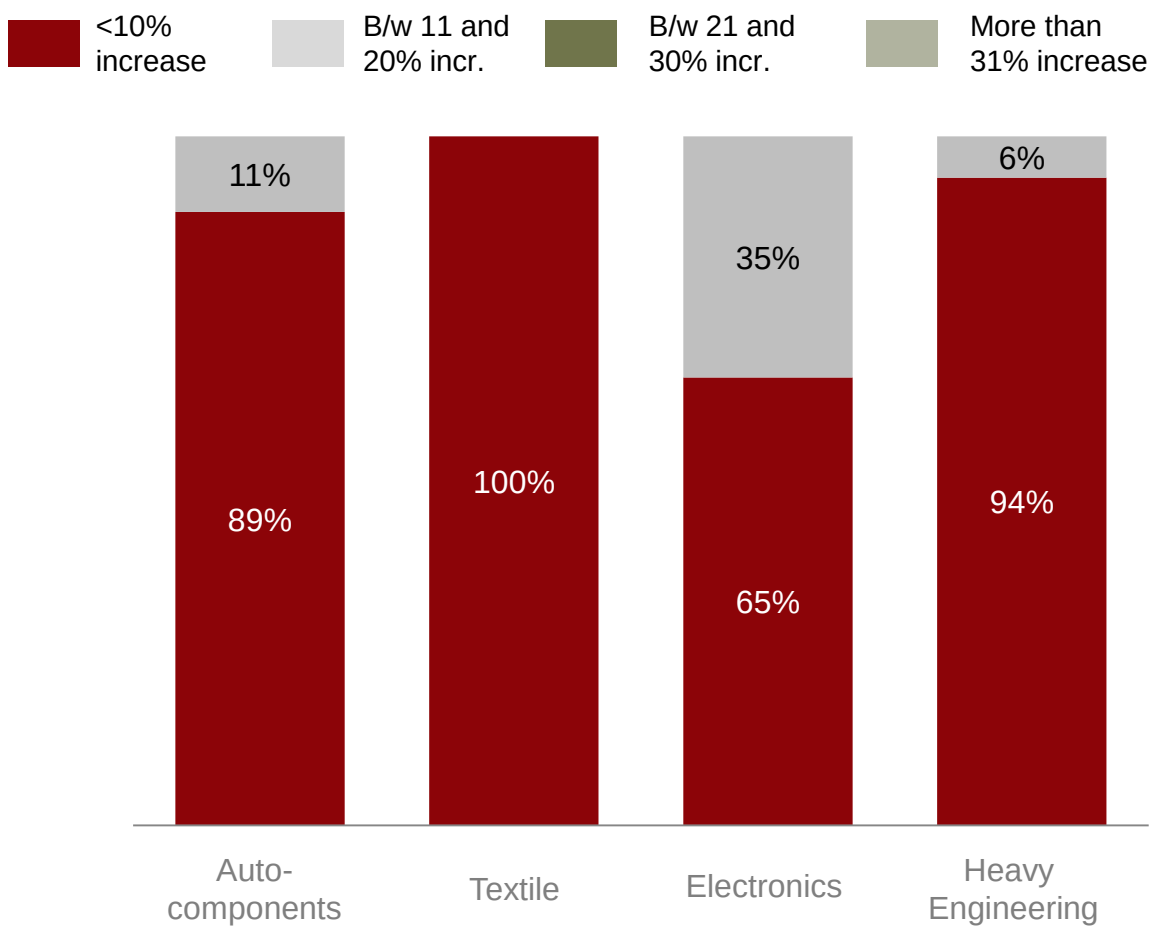
Importance of Delivery Times

Question: What is the average distance of your products from your factory to where they are consumed? (in KMs)
Question: How important are delivery times for your domestic customers? What value of orders (as %age of annual revenues) is lost due to inefficient delivery times?

Source: World Bank – RedSeer Freight Survey, 2013

87% companies predict less than 10% increase in their revenues if both delay and uncertainty is reduced by 25%

% increase in revenues with improvement in freight efficiency



Important Aspects

- Overall, 87% companies said that the revenue increase is likely to be less than 10% given an increase in domestic freight efficiency
- When asked to quantify the potential of specific increase, many were not able to quantify showing the lack of information planning in managing freight
- Also, respondents were quick to point out that any particular improvement would also impact their competitors in the same way and thus would not yield significant additional revenue

Question: What %age of annual revenues would increase if there is an increase in efficiency of domestic shipments? Or in other words if both delay and uncertainty in your domestic shipments is reduced by 25%, what would be the impact on your revenue?

Source: World Bank – RedSeer Freight Survey, 2013

Imports take on average of 4.5 weeks to arrive while 4 days are spent in customs clearance

Average Lead time for Imports and Customs

	Total Imports Transit Time (Weeks)			Customs Clearance Time (Days)			% Cos reporting damages at customs
INDUSTRY	Avg.	Med	SD	Avg.	Med	SD	
Auto components (n = 12)	5.4	5.0	1.6	4.3	4.0	2.5	27%
Textile (n = 4)	3.9	4.0	0.6	3.1	3.5	1.2	25%
Electronics (n=15)	3.8	3.0	3.1	4.3	3.5	2.3	40%
Heavy Engineering (n=9)	4.9	5.0	2.7	4.4	3.5	2.7	77%
TOTAL	**4.5**	**4.1**	**2.5**	**4.2**	**3.5**	**2.3**	**44%**

44% companies reported non-zero damages of the imported goods at customs, while the average damages was ~1% of the value of goods imported

Question: What is the average time taken from shipment by supplier to delivery at your doorstep (in weeks)? What is Average # of days in which material gets cleared by customs (from time of arrival to time of customs clearance in Days or hours)? Approximately, what % value of the total purchase value of imports is lost or damaged in customs?

Source: World Bank – RedSeer Freight Survey, 2013

Exports on average take a transit time of 4.1 weeks

Average transit time for exports

	Exports Transit Time (Weeks)		
INDUSTRY	Avg.	Med	SD
Auto components (n= 7)	7.2	6.0	1.6
Textile (n=12)	3.6	3.0	1.0
Electronics (n=12)	1.9	1.4	1.2
Heavy Engineering (n=12)	5.5	4.0	3.2
TOTAL	**4.1**	**3.0**	**2.6**

Electronics goods (being lighter in weight) are sometimes exported by air freight thus making the transit time significantly lower.

Top Export Destinations (# of mentions)

Auto Components
N=34
- Germany (15%)
- France (12%)
- USA (9%)
- Japan & Middle East (6%)

Textile
N=52
- Bangladesh (12%)
- China & Turkey (10%)
- USA (8%)
- UK & Vietnam (6%)

Electronics
N=39
- USA (21%)
- Brazil (5%)
- Germany (5%)
- Europe (5%)

Heavy Engineering
N=42
- China, USA (10%)
- Germany / Europe (7%)
- Australia, Thailand & Saudi Arabia (5%)

Question: What is the average time taken for shipment to reach export customers (in weeks)? Which countries are you export to?

Source: World Bank – RedSeer Freight Survey, 2013

Some insights from research

Use of Tech Savvy Methods: "Efficiency of Freight forwarders and understanding the various competences that exist/missing which are important has to be elaborated. For example most Couriers have 'online tracking' of parcels – but trucking companies and shippers do not. Similarly other tech savvy methods need to be surveyed in detail."*Mrs. Shobhana Prakash, MD*

Green Channel: "For regular or recognized importer there should be a green channel where the material can be cleared directly and later on the formalities regarding the paper can be done." – *Mr. Subhash Goyal, MD*

Online Custom Clearance "Government should provide the facility of Self online custom clearance.– *Mr. Vivek Kaushal, GM-Marketing*

Bring GST: With GST the entire structure of taxation will be simplified."– *Mr. Vinod Ahuja, Chairman*

Check Post Hindrance: "Check post delays are especially a major issue when our materials are shipped to Karnataka and Kochi. Then there is the problem of paying 2% CST against C-form else we have to pay 5%. Also, there is an Octroi issue with Maharashtra Government . If GST is introduced this will reduce the waiting period at the check post/ interstate borders enabling us to give faster delivery. "– *Mr. Sanjay Mehta, MD*

Unfunctional Software: "Custom Delays due to software of CBEC not working for uploading duty (paying online). Also excise regulation regarding consignment stock is a major problem as we are not allowed to keep consignment stock. "– *Mr. Nirmal Sharma, Senior Manager- Logistics*

Road Infrastructure: Poor road infrastructure needs an immediate action."– *Mr. Aditya, CFO*

Congestion at ports: "Delay at ICD/Sea Port are causing too much congestion for the inland freight. Sea ports should be well equipped to handle high traffic"– *Mr. Mayur Gupta, Joint Managing Director*

Route Plan: "Route plans for the suppliers should be very well planned as it will smoothen the movement of the goods"– *Mr. Amit Bhargava, MD*

Dedicated Freight Corridor: "Introduction of dedicated freight corridor will make the transportation hassle free– *Mr. Vipin Kumar, Director*

Logistics Train: "Introduction of special logistic trains should be there for carrying goods – *Mr. Amin Almel, Director*

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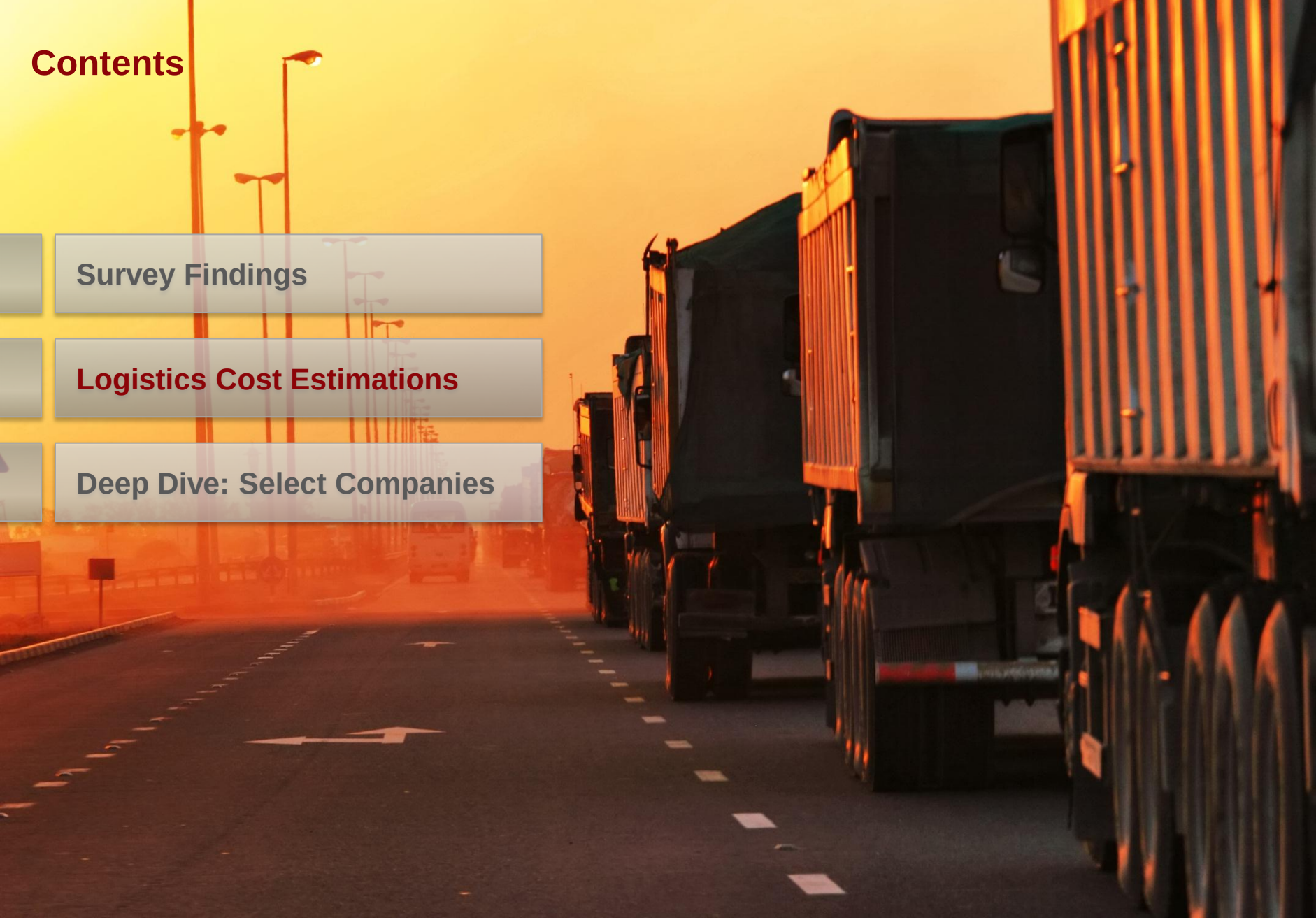


The logistics costs for a manufacturer are estimated using the following assumptions

Components of Logistics Cost
Assumptions and Sources

	Exports Transit Time (Weeks)		
Component	**Sub Component**	**Unit of Measure**	**Source/ Methodology**
Direct Freight	Inward	As % of Net Sales	From Survey
	Outward	As % of Net Sales	From Survey
Inventory Cost of Capital	Only capital cost not rent / warehousing costs	As % of Net Sales Sales	From Prowess: Average capital value of inventory for FY11-12
Cost of Capital	15% Assumed, multiplied with inventory cost of capital to obtain carrying cost of inventory		
Packaging Costs		As % of Net Sales	From Prowess: FY2011-12 reported packaging costs by industry
Lost Sales		As % of Gross Revenues	From Survey: Average value taken by industry <10 (5%), 11-20 (15%).
EBITDA contribution from Lost Sales			From Prowess: FY2011-12 industry level PBDITA margin as % of net sales
Damages in transit	Assumed 0.5% (more than the insurance premium that needs to be paid for freight)		

Source: World Bank – RedSeer Freight Survey, 2013

The estimated total logistics costs[1] vary between 10.4% of net sales to 14.1% of net sales

	Source: Prowess and Quantitative Surveys (all figures in %)[1]			
INDUSTRY	Auto-components	Textiles	Electronics	Heavy Engineering[4]
Inward Freight	3.1	3.9	4.0	3.5
Outward Freight	3.8	3.4	3.1	4.1
Average Inventory as % of sales[3]	13	26	30	19
Cost of carrying inventory (at 15% cost of capital) as % of sales[3]	1.95	3.9	4.5	2.85
Packaging Cost as % of sales	0.2	0.9	0.7	0.4
Lost sales as % of current revenues[2]	6.1	5.0	8.5	5.6
PBDITA Margin[2]	12.8	13.6	15.7	16.0
Damages in transit	0.5	0.5	0.5	0.5
TOTAL LOGISTICS COST	10.4	13.3	14.1	12.2

Note: 1) Formula used for calculating the total logistics costs = Inward Freight + Outward Freight + Cost of Carrying Inventory (Total) + Packaging Cost + Damages + EBITDA due to lost sales
2) EBITDA due to lost sales is calculated by multiplying the lost sales as % of current revenues (from Survey) with PBDITA margin. (from Prowess).
3) Inventory carrying cost is calculated based on total inventory. Since the value of transit inventory and buffer inventories are not available separately, the total value of inventory (from Prowess) is used. The total value of inventory is going to slightly overestimate the inventory carrying cost for the in-transit and buffer inventory
4) Heavy Engineering data corresponds to machinery sector (manufacturing of all electrical and non-electrical machines including electronic equipments)

Source: World Bank – RedSeer Freight Survey, 2013, Prowess Data for FY2011-12

The total logistics cost as % of net sales is higher than the industry's employee costs as well as the power and fuel costs

	Source: Prowess and Estimations (all figures in %) FY2011-12			
Manufacturing – Cost Heads	**Auto-components**	**Textiles**	**Electronics**	**Heavy Engineering[1]**
Employee Cost as % of Net Sales (FY11-12)	**7.1**	**6.2**	**11.8**	**8.6**
Power, Fuel and Water Cost as % of Net Sales (FY11-12)	**3.7**	**6.8**	**1.8**	**1.1**
Research and Development Costs (capital & current account) as % of Net Sales (FY11-12)	**0.5**	**2.4**	**0.1**	**1.1**
Logistics Costs as % of Net Sales (as estimated)	**10.4**	**13.3**	**14.1**	**12.2**

Note: 1) Heavy Engineering data corresponds to machinery sector (manufacturing of all electrical and non-electrical machines including electronic equipments)

Source: Prowess and Estimations (all figures in %) FY2011-12

Related data from services sector[1] shows that logistics costs are much higher for manufacturing sector

	Source: Prowess and Estimations (all figures in %) FY2011-12		
Services – Key Cost Heads[1]	**Information Technology**	**Hotels & Tourism**	**Communication**
Employee Cost as % of Net Sales (FY11-12)	**45.4**	**24.6**	**14.3**
Power, Fuel and Water Cost as % of Net Sales (FY11-12)	**0.9**	**6.9**	**8.8**
Distribution Expenses as % of Net Sales (FY11-12)	**0.1**	**0.1**	**0.0**
Average Capital value of inventory as % of Net Sales (FY11-12)	**1.2**	**5.1**	**3.0**
Inventory carrying cost as % of Net Sales (FY11-12)	**0.2**	**0.8**	**0.4**
Total Logistics cost as % of Net Sales (FY11-12)[1]	**0.3**	**0.9**	**0.4**

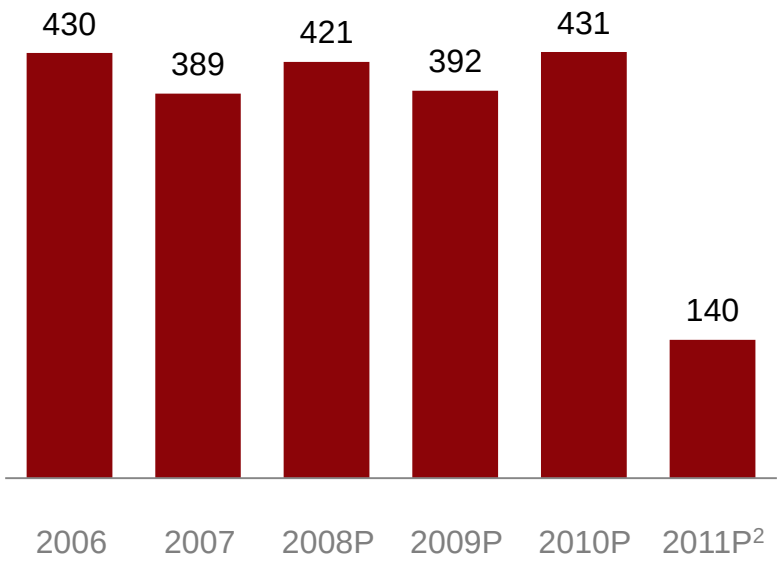
Note: 1) Logistics cost data for services is indicative and only includes the inventory carrying costs and the distribution expenses as percent of net sales
2) Distribution expenses as % of net sales might by understated as some companies do not report distribution separate from sales expenses

Source: Prowess and Estimations (all figures in %) FY2011-12

On an average, a strike or shutdown causes a loss of 14 days over the course of a year

Labor Unrest[1]

of Disputes (including strikes and lockouts)



Average Outbound Distance (KMs)

Labor Unrest[1]

Yearly # of Days Lost, Average over 2006 to 2011

Avg # of disputes per year	367
Avg # of workers involved per dispute	3202
Avg Total # of mandays lost (in million)	16.7
Avg # of days lost per worker involved	14.2

Considering an average industrial calendar of 300 working days, about 4.7% (=14.2/300) of potential production is lost due to labor unrest. However, only a few companies face the situation of strike or lockouts during one year. Therefore the actual average cost would be lower than 3.9%

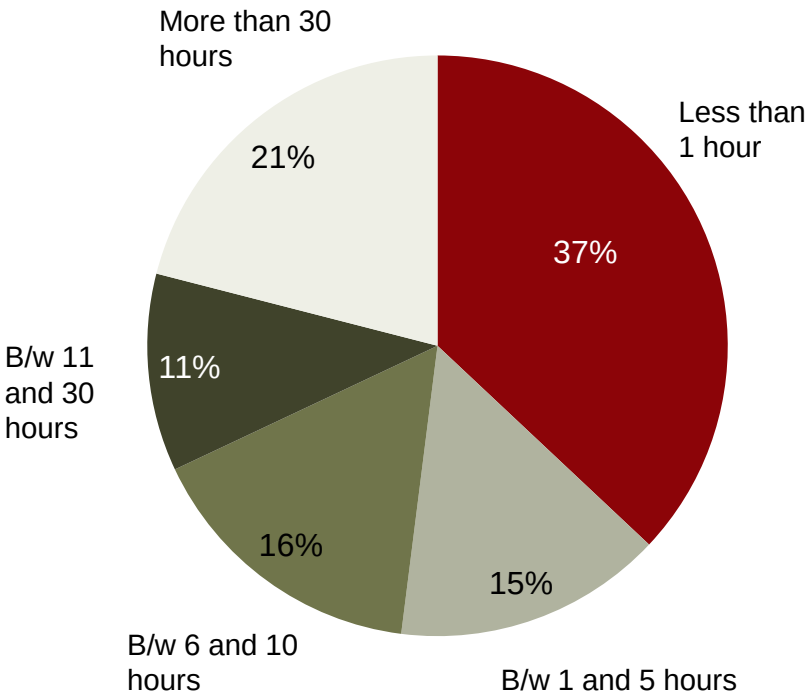
Note: 1) Data only pertains to the stoppages which are on account of industrial disputes and which involves 10 or more workers, whether directly and /or indirectly
2) Data for 2008 to 2011 is provisional. Data for 2011 is only upto Nov 2011

Source: FICCI http://www.ficci.com/spdocument/20188/Industrial-unrest.pdf;
Labour Bureau http://labourbureau.gov.in/idtab.htm

Due to the use of captive power plants (i.e. generators, backups etc.), companies also incur an additional cost of electricity

Power Outages

of Hours per week of Power Outage



Shortfall in Production

% of Production Lost (if no power backup available)

Production Lost Notional	% of Companies with the loss in production of ..			
Sector	<2%	2-5%	6-10%	>10%
Textile	56	11	15	18
Automobile and Components	23	10	0	67
Electronics and Equipment	9	9	9	73
Total (across all verticals)	12	13	12	61

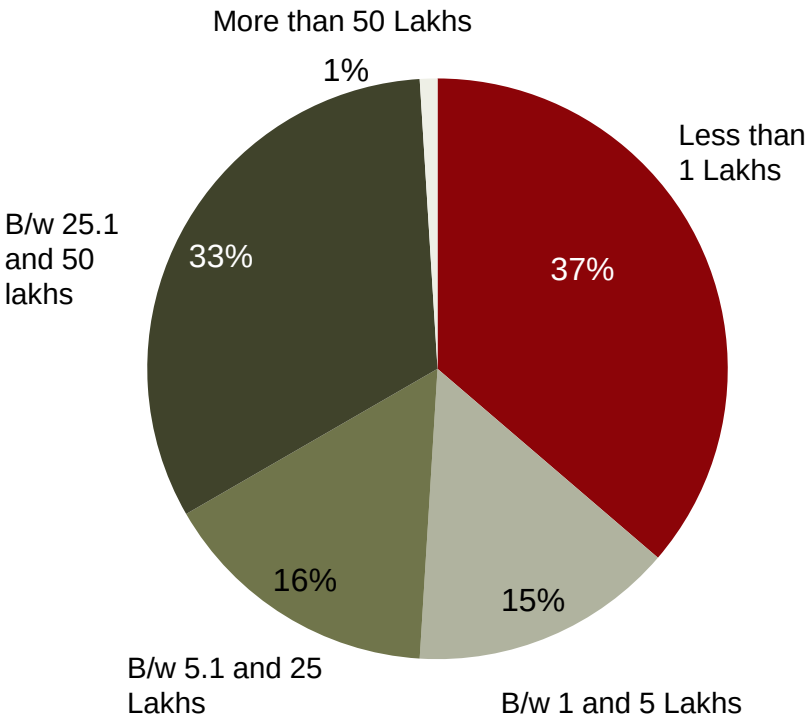
Even though most companies use their captive power plants and generators to tackle power outages, the cost per unit of captive power plants is around INR. 12-16 per KWH of electricity, while that for government supplied power is INR 5.2 to INR 8.5 per KWH. This additional cost is already included in the power, fuel and water charges mentioned. However the cost of generator and maintenance is not included.

Source: FICCI- Lack of Affordable and Quality Power http://www.ficci.com/Sedocument/20218/Power-Report2013.pdf

Median price of a generator is about INR 5 lakhs with an additional maintenance cost of INR 75000

Price of Captive Generator

% of Respondents, INR Lakhs



Additional Cost of Captive Power Plants

- **Backup:** Some companies own multiple generators to ensure that the backup has a backup
- **Maintenance:** Median maintenance cost of generators is ~ INR 75000
- **Running Expenses:** Generator fuel expenses are already included in the power, fuel and water expenses
- **Inventory Expenses:** An average firm holds a fuel inventory of INR 10-25k
- **Stabilizers Expenses:** For stabilizing the voltage fluctuations.

Source: FICCI- Lack of Affordable and Quality Power http://www.ficci.com/Sedocument/20218/Power-Report2013.pdf

Contents

XYZ Company is a major battery manufacturer

Company background

- Company Name : XYZ Company
- Year of establishment : 1987
- Promoter : Not disclosed
- Location (HQ) : Not disclosed
- Manufacturing : In Himachal Pradesh
- Net Sales (Latest) : INR 300 Crores

Overview

XYZ company is one of the fastest growing Lead acid battery manufacturing companies in the country. The company makes batteries from 2.5Ah to 200Ah for a varied range from two-wheelers, automotive, inverter, generator, UPS & solar etc.

Supply Chain

- Manufacturing in HP
- Central Warehouse (finished goods) in Ambala
- Regional depots in 27 locations across India
- Contract with 6-10 carriers for outbound from Ambala to various depots
- Separate supply chain department with 8 people
- Planning to implement SAP

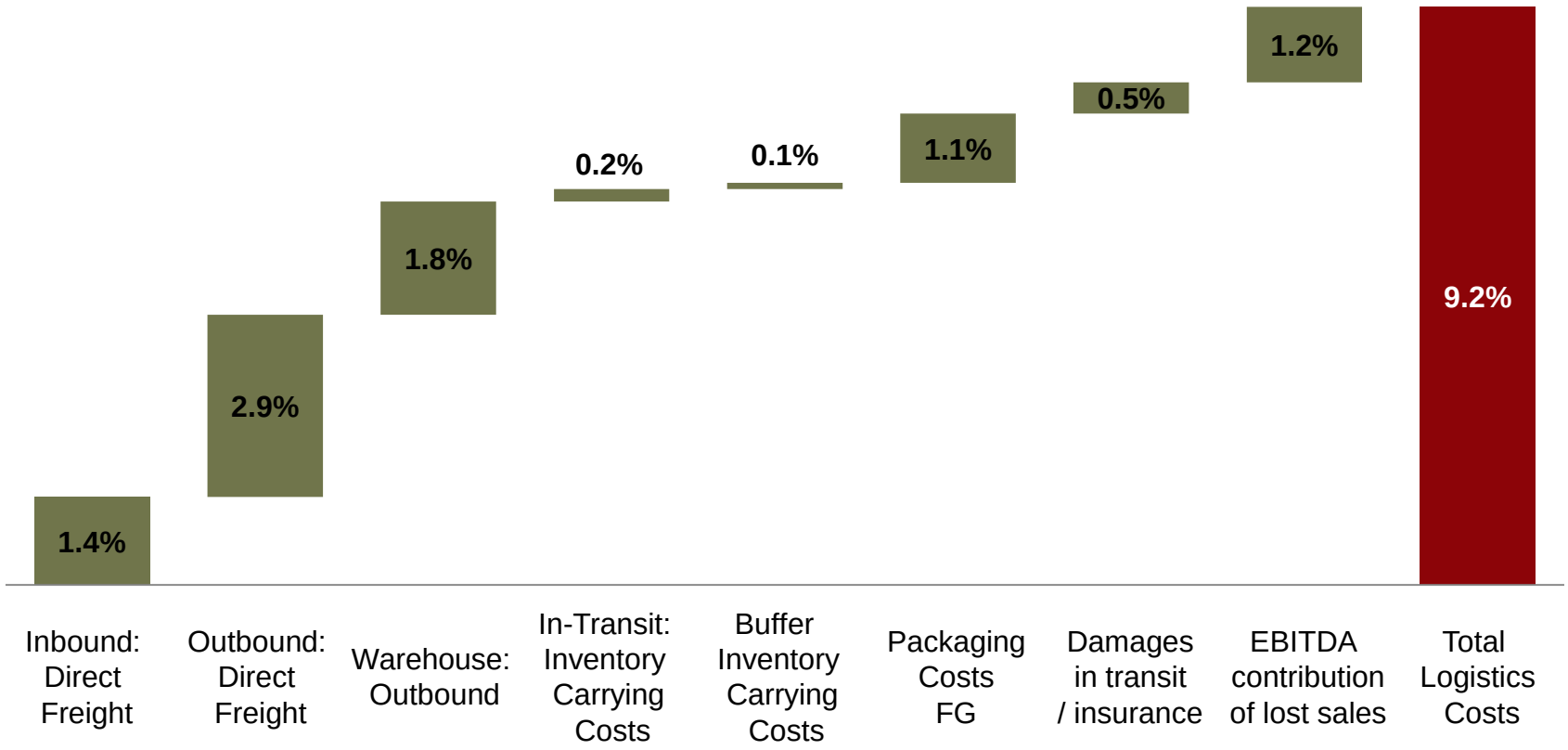
Key Financial Indicators

- Latest Turnover: INR 300 Crores
- EBTIDA Margin: 12%
- COGS: 75%
- Exports: <5% (Mainly Nepal)
- Imports: 0% (only tooling etc.)

Source: World Bank – RedSeer Freight Survey, 2013

XYZ Company's total logistics costs is approximately 9.2% of sales including 1.2% of EBITDA contribution on lost sales due to freight inefficiencies

Build up of logistics cost of XYZ Company



Note: 1) For the calculations of the inventory carrying costs, only transit and buffer inventory are considered, not the overall inventory value. The overall inventory value will be significantly higher due to seasonality of demand and / or additional inventory to take care of the variability of product lines

Source: World Bank – RedSeer Freight Survey, 2013

Amrut distilleries is a alcoholic beverage maker and distributor

Company background

- Company Name : Amrut Distilleries
- Year of establishment : 1987
- Promoter : NR Jagdale
- Location (HQ) : Bangalore
- Manufacturing : Bangalore / Kerala
- Turnover (Gross) : INR 500 Crores

Overview

Amrut Distilleries is into the business of distilling, bottling and distributing alcoholic beverages in India and abroad. The major products include Whisky, Brandy, Rum, Vodka and Gin. Amrut's single malt whisky is exported to the UK.

Supply Chain

- Two bottling plants (one each in Kerala and Karnataka). Bangalore plant is the largest
- Domestic sales only in respective states
- Yearly contract with transporter to supply to various state depots in Karnataka
- Separate transport department with 4 people
- Home grown inventory management system

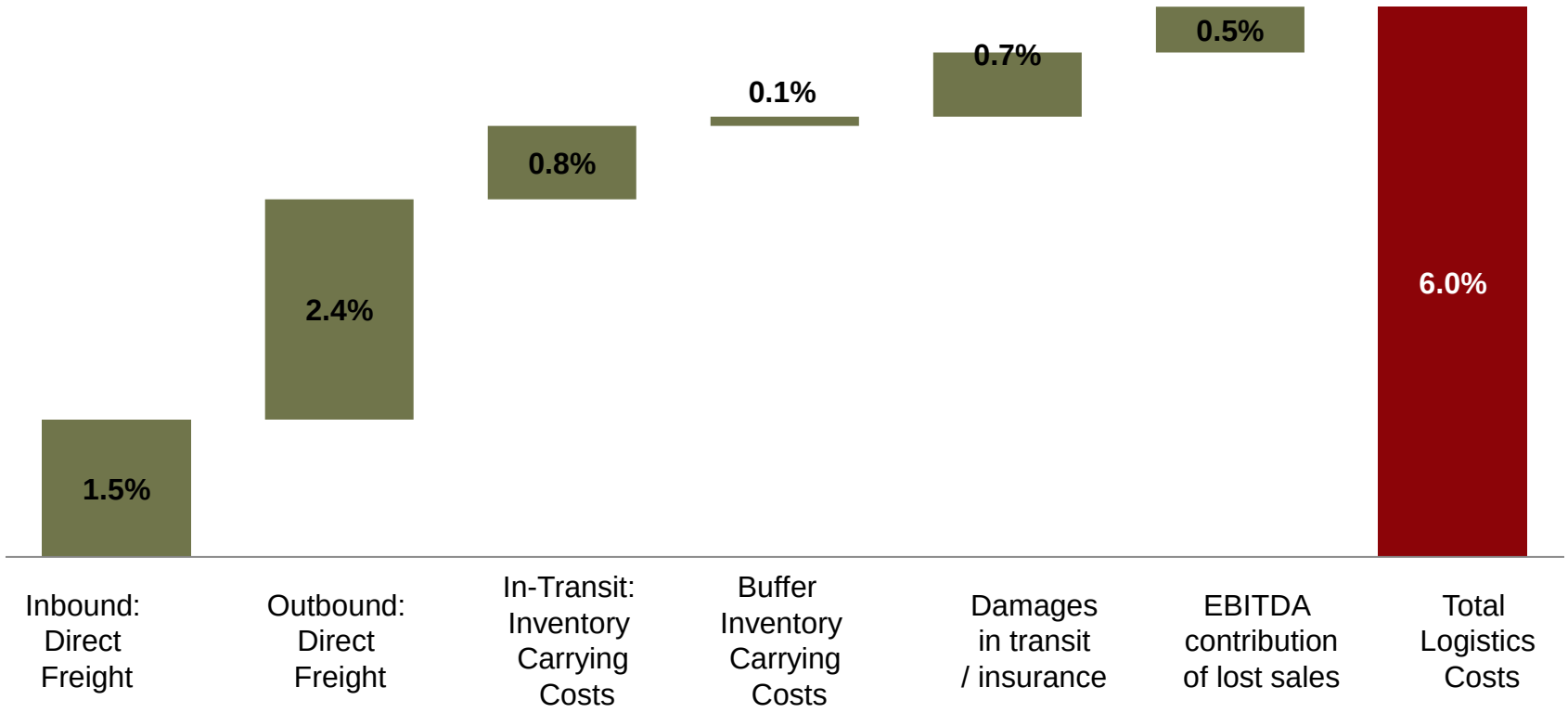
Key Financial Indicators

- Net sales: INR 200 Crores
- EBTIDA Margin: 9.6%
- COGS: 67%
- Exports: 5% (UK)
- Imports: 2-3% (UK packing material for Malt Whisky)

Source: World Bank – RedSeer Freight Survey, 2013

Amrut Distilleries' total logistics costs is approximately 6.0% of sales

Build up of logistics cost of Amrut Distilleries



Note: 1) For the calculations of the inventory carrying costs, only transit and buffer inventory are considered, not the overall inventory value. The overall inventory value will be significantly higher due to seasonality of demand and / or additional inventory to take care of the variability of product lines

Source: World Bank – RedSeer Freight Survey, 2013

Universal power transformer is a make-to-order transformer manufacturer

Company background

- Company Name : Universal Power transformers
- Year of establishment : 1978
- Promoter : Dhruva Talwalkar
- Location (HQ) : Bangalore
- Manufacturing : Bangalore / Haridwar

Overview

UPT is into the business of manufacturing and selling make-to-order power transformers for residential, commercial and real estate use. Other products include distribution transformers, compact substations and dry type transformers

Supply Chain

- Two manufacturing plants (Bangalore and Haridwar)
- Majority raw materials purchase on cash and carry
- Major sales in Bangalore, Chennai, Hyderabad and Mumbai from Bangalore unit
- Selects transporters based on requirements
- 2 people in production planning, 4 in purchasing
- Tally ERP (but no reorder point calculation)

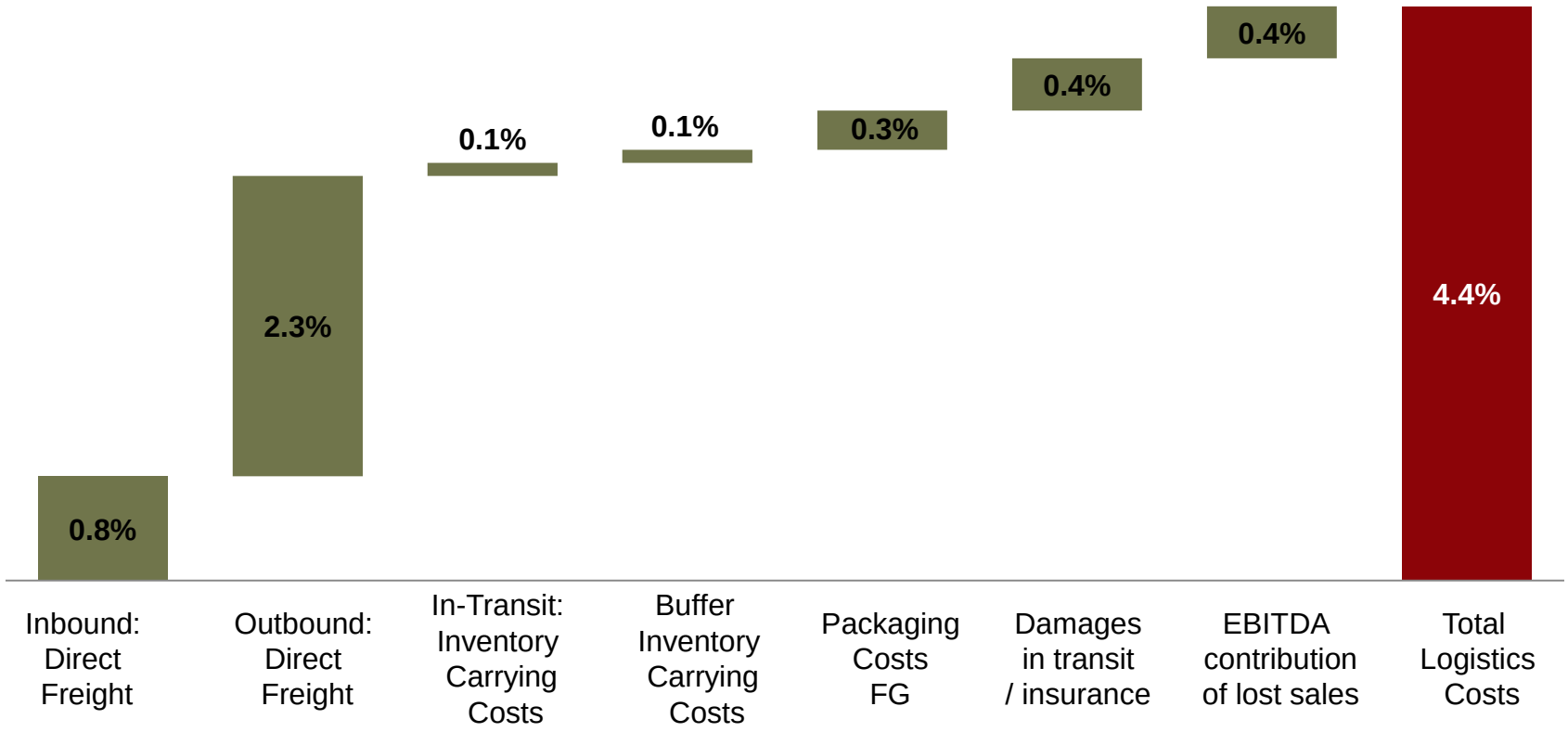
Key Financial Indicators

- Net sales: INR 100 Crores
- EBTIDA Margin: 4%
- COGS: 75%
- Exports: <5% (Canada, UK, Nigeria)
- Imports: 0%

Source: World Bank – RedSeer Freight Survey, 2013

Universal Power Transformer's total logistics costs is approximately 4.4% of sales

Build up of logistics cost of Universal Power Transformers



Note: 1) For the calculations of the inventory carrying costs, only transit and buffer inventory are considered, not the overall inventory value. The overall inventory value will be significantly higher due to seasonality of demand and / or additional inventory to take care of the variability of product lines

Source: World Bank – RedSeer Freight Survey, 2013

Comparison of logistics costs across different companies

Logistics Cost Comparison

	Logistics Cost	Industry KPIs
XYZ Company	**9.2%** of Net Sales	**Storage Battery Industry (FY2011-12)** ▪ Capital value of inventory = 18% of Net Sales ▪ Distribution Expenses = 2.7% of Net Sales ▪ PBDITA = 15% of Net Sales ▪ Raw Material Turnover = 8.4
Amrut Distilleries	**6.0%** of Net Sales	**Beer & Alcohol Industry (FY2011-12)** ▪ Capital value of inventory = 16% of Net Sales ▪ Distribution Expenses = 4.2% of Net Sales ▪ PBDITA = 14% of Net Sales ▪ Raw Material Turnover = 8.0
Universal Power Transformers	**4.4%** of Net Sales	**Generators, Transformers & Switchgear (FY2011-12)** ▪ Capital value of inventory = 15% of Net Sales ▪ Distribution Expenses = 1.4% of Net Sales ▪ PBDITA = 12% of Net Sales ▪ Raw Material Turnover = 10.4

Source: World Bank – RedSeer Freight Survey, 2013; Prowess Data for FY2011-12

Comparison of key parameters across the three companies

	All figures in % of Net Sales (unless otherwise stated)		
INDUSTRY	**XYZ Company**	**Amrut**	**UPT**
Total Logistics cost as % of Net Sales	9.2%	6.0%	4.4%
Employee costs as % of Net Sales[1]	1.9%	6.7%	10.8%
Power and Fuel Costs as % of Net Sales[1]	0.5%	0.3%	0.6%
Cost of Inward Freight as % of Net Sales	1.4%	1.5%	0.8%
Cost Outward Freight (including warehousing) as % of Net Sales	4.7%	2.4%	2.3%
Average Inbound Distance of Raw Material (KMs – weighted by raw material value)[2]	470	700	410
Average Outbound Distance (in KMs only domestic sales)[3]	1350	250	500
Inventory Carrying Costs (Only for Buffer and Transit Inventory) as % of Net Sales	0.3%	0.9%	0.2%
EBITDA lost due to inefficient freight as % of Net Sales	1.2%	0.5%	0.4%

Note: 1) XYZ Company data for FY2009-10 (Prowess), Amrut Data for FY2010-11 (Prowess), UPT Data for FY2011-12 (Company Annual Report)
2) Average inbound raw material distance is estimated from the top-3 raw materials largest supplier weighted by the value of raw material
3) Average outbound distance has been estimated from the manufacturing plant to the major destinations

Source: World Bank – RedSeer Freight Survey, 2013

Other insights from repeater interviews

Online Road Permit: "The harassment at the check-posts has been reduced quite a lot by using online-road permit. For example: If I have to buy goods from Maharashtra, I will generate a e-sugam form and send it to my supplier. At the Karnataka border checkpost, the official will check the validity of the goods and will release the consignment to reach our factory.In fact, we do not even have to carry the printout, we just need to SMS the e-sugam number to the driver." - Purchase Head at UPT

Online Road Permit: "Most of the states now have the online road permit that is issued for clearance at the border checkposts. Only Rajasthan and HP (in my knowledge) still have offline road permit that need to be issued by the buyer in these states. - Purchase Head at UPT

Online Road Permit: "Earlier (1.5 years back), the truck drivers used to ask for Rs 100 per checkpost as a bribe to be paid at the state checkpost but now the drivers don't ask for this since we have the e-sugam. The queues at state border checkpost have also been reduced drastically"

- Purchase Head at UPT

Excise Delays in Alcoholic Beverage: "There are huge inefficiencies in inter-state movement of alcoholic spirits (our raw material and also finished goods). It takes 25 days of approval to transport spirits from one state to the other. Every distillery in India is supposed to have an excise department. Government officials sitting on the production premises. The buyer has to send a request letter to the selling company. Selling company has to send the consent letter back, after which, the buying distillery's excise department creates a import permit .This import permit is first approved by the excise office at distillery then by the Deputy commissioner of excise and then the joint commissioner excise, followed by the commissioner of excise. All these approvals have to happen in hard copy and have to be sent via post to the selling company. Similar process needs to repeat for the selling company."

"Government should computerize the whole excise procedure. It is not just the duty that is killing us but also the delays in obtaining the approvals. Every distillery should be given a code and they should transact these permits online. " - ED at Amrut Distilleries

Reasons for Delay: "The state of road infrastructure is not upto the global standards. All transporters use second hand trucks. However, both Tata and Leyland have launched newer trucks which are not only fuel efficient but also have powerful engines"

- ED at Amrut Distilleries

Reasons for Delays: "Major reasons of delays are due to transshipments, errant behavior by the driver (driver stopping to rest / attend a party / visit hometown in between etc.). However there are also breakdowns in approximately 1-2% of the consignments.

- Logistics Manager at XYZ Company

Thank You !

“The government doesn’t realize that an improvement in freight infrastructure can save us 5-10% of the logistics cost and thus valuable foreign exchange by reducing oil spent on vehicles in traffic jams”

Vikas Zutshi, Gati

Effect of Freight System on Indian Manufacturing Industry

Presented to The World Bank

Lita Das

Table of Contents

1.Introduction

This document presents recommendations for further research and the supporting analyses to inform The World Bank of the sources of variation in transportation time performance for Indian manufacturing industries. This variability is seen both in the average values of transportation time and in its standard deviation. For the purposes of this document, the standard deviation (or extent of dispersion from the expected value) is denoted as the *measure of uncertainty*.

The analyses are performed across two broad parts of freight transportation associated with the industry. They are domestic and international shipments. Each of the two parts is further analyzed as sales and purchases segments.

A number of predictor variables were used to explain uncertainty and average transit time performance for all the 72 companies that were surveyed. Regression was used to understand the effect of the various predictor variables on the parameters of interest. The best regression models were chosen based on the adjusted R^2 value that gives us an idea of the explanatory power of the variables for the variability in the dependent variables[1]. The analysis discussed in this document sheds light on a few interesting ones.

For instance, analysis revealed that size of the company (measured as the amount of revenues generated and the profitability) is never significant in explaining variability in the transit time. Therefore, large revenue generating or profitable companies are susceptible to the same factors as the smaller companies when it comes to explaining uncertainty of transit time in case of all kinds of shipments (domestic or international (. It could probably mean that there are some inherent factors in the freight system that are not under the control of individual companies but perhaps should be addressed by the government. (E.g. regulations or infrastructure)

Effectiveness of port operations and the origin locations are found to affect delay in transit time. Specifically, it was observed that requiring a special screening process[2], goods originating from specific country or owning infrastructure equipment that are used for freight handling and transportation[3] impact variability in transit time.

This finding raises questions about the level of automation; congestion management (like optimizing berths at the ports) and administrative regulations exercised on freight movement and hence need to be investigated. For instance, for imports it was observed that requiring a special screening process could add 2.3 days to the average number of

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[1] A decision about retaining an insignificant variable in the model was based on running the model with and without the variable. It was accepted in the model if the adjusted R^2 increases by a fairly reasonable amount relative to when it is not included in the model.

[2] Special screening process is a binary variable factor and is a Yes/No response collected in the survey

[3] Owning infrastructure equipment for a company is described as is one of the three options as defined in the survey namely a) No logistics handling equipment is owned. Material handling and transportation is completely outsourced b) The company holds excellent infrastructure or c) The company owns only a few trucks and cranes

days spent in customs (ANDC). This value is about 55% of the average of the ANDC across all companies, which is 4.2 days. Therefore it is worthwhile to investigate questions like (i) what is the level of automation of equipment used at the ports for customs process? (ii) Are goods that are imported from specific countries subject to a more aggressive screening process as compared to others, which could add to the amount of time spent at the customs? If yes, how can we reduce it? Is it a matter of low number of personnel or a result of inefficient management of the customs process?

It was also surprising to see how sectors have variable effects on the uncertainty of transportation time values. The international exports are the only segment that sees an effect of sectors. However, in the rest of the segments while certain parameters (distance, state borders) explain variability in transit time to a fair extent, they are not enough for other sectors. For instance, while distance and the number of state borders explain the variability in the Auto sector, they fail to explain the same in the others for domestic sales.

The rest of the report is structured as follows. The whole report is divided into two broad parts – domestic and international shipments. Each part discusses the corresponding sales and purchase sections. After this introduction, the report discusses domestic shipments in section 2. This includes description of the raw data available along with the transformed data created from the raw survey responses, which are the basis for this analysis.

This is followed by brief discussion of the simulation results of the transportation time values to indicate the range of means and standard deviations. The section then concludes with inferences from the regression models, which are tabulated in Appendix I. Section 3 follows the same pattern but discusses the international shipments in detail.

Finally, section 4 lays out a few recommendations for future work that could be adopted to increase the predictive power of the models used to explain transportation time performance levels.

2.Domestic Shipments

Description of the data

(a) Raw data information

The data available with us that are pertinent to the regression models used for analysis include the following.

a) Name and Sector of the Company
b) Transit time information for the largest supplier/customer both domestic sales and purchases. This includes the longest, average and the shortest total transit time
c) Number of state borders crossed
d) Revenues & Profitability
e) If the company being interviewed own their own logistics infrastructure [4]

[4] Please refer to footnote one for definition of "Owning logistics infrastructure"

f) Average distance between the origin and the destination locations
g) Percentage of the total value of raw material that the largest raw material comprises in case of domestic purchases

(i) Domestic Purchases

57 out of 72 companies interviewed, procure their materials domestically. These companies provided information about the top raw material, which is defined based on the percentage of total revenues that it comprises. The division of the companies categorized across the 4 sectors is tabulated below: -

Sector	Number of Responses
Auto	18
Electronics	8
Engineering	18
Textile	13
Total	57

(ii) Domestic Sales

71 out of 72 companies that were interviewed provided information about the domestic sales that they transact. The division of the companies across the 4 sectors is tabulated below: -

Sector	Number of Responses
Auto	20
Electronics	18
Engineering	17
Textile	16
Total	71

(b) Transforming raw data to desired variables which are used in the models

Mean and standard deviation of the largest import supplier and largest export customer: The total transit time for the largest domestic supplier and domestic customer is modeled as a truncated normal distribution (truncated within the specific bounds of shortest and longest transit times for each). There are 2 main reasons why a normal distribution was used to model the transit time distributions.

- There is no information available for the distribution of transit time. Under these circumstances, the standard procedure followed is to assume normal distribution of transit time.

- My past research experience suggests that freight transported over oceans are frequently normally distributed in their transit time. As an example, examining imports into US for a leading manufacturing firm revealed that 88% of trade lanes (defined as unique origin-destination pairs) are normally distributed.

The simulation used to create normal distribution gives us the standard deviation of the transit time distribution. This is equivalent to a measure of *uncertainty* in transit time.

For domestic purchases, the simulation could be used to model transit time distributions for 45 out of 57 companies. The other 11 (out of remaining 12) companies reported the average and the minimum transit time to be equal and hence could not be simulated as a truncated normal distribution using the setup followed for the rest. One out of the 12 companies reported to have an invalid response for their longest time value.

For domestic sales, simulation could be used to model transit time distributions for 62 out of 71 companies. The other 9 companies reported the average and the maximum transit time to be equal and hence could not be simulated as a truncated normal distribution using the setup followed for the rest.

Some basic statistics for the transit time distributions are shown in Appendix II.

Inferences from the regression models

(a) About Domestic Purchases

1. **Logarithm of distance provides better predictive power in explaining uncertainty in transit time distribution as well as the average value of transit time for domestic purchases as compared to distance itself.** Specifically, every 1km increase of logarithm of distance increases the uncertainty of transit time in form of standard deviation by 0.4 days. The corresponding increase in the mean value of transit time is 2.9 days. This predictor variable by itself explains 64% of variability in uncertainty of transit time. On the other hand it explains 79% of variability in mean value of transit time values.

   Let us consider a response from the survey to illustrate the effect of distance on uncertainty in the distribution and the mean value of transit time. The distance between the origin and the destination for an auto manufacturer is 100 kms and the transit time distribution has a mean of 2 days and an uncertainty is 0.3 days for domestic purchases. Adding 1km to logarithm of distance (log (100)+1 = 2+1 =3) gives us a new value of 1000 kms. The model suggests that this increase of average distance between the supplier and the manufacturer (from 100 to 1000 kms) corresponds to an increase of 0.4 days in its uncertainty (from 0.3 to 0.7 days in this specific example). Although this increase might seem low in absolute terms, comparing it to the corresponding mean value of transit time puts the effect into perspective. The mean value goes 2 to 4.9 days. In other words, the largest value of transit time at an instant could be 5.6 days (4.9+0.7) as compared to 2.3 days.

2. **As expected, uncertainty in total transit time for the largest supplier of the top raw material increases with increase in the number of state borders. The**

mean value of transit time also increases with the number of state borders. Adding one new state border between the origin and the destination location increases uncertainty in transit time for the largest supplier by 0.2 days and the mean value in transit time by 1.2 days. State borders explain 64% of variability in uncertainty associated with transit time for the top domestic raw material. On the other hand, it explains 87% of variability in the mean value of transit time.

3. **Sectors and the size of the companies (in terms of revenues, profitability and cost of goods sold) have insignificant effects on the uncertainty in total domestic purchase transit time.**

4. **Composition (or the percentage of purchase value comprising from the largest domestic supplier) of the top raw material does not have an effect on the uncertainty in total transit time for the domestic purchases.**

5. **Looking into companies that procure their largest raw material within a domestic state or across a single domestic state border, the model suggests that the logarithm of distance explains only 35% of variability in uncertainty in transportation time.** However adding sectors to the above predictor variable increases the predictive power to 43%. Revenues, COGS, profitability and the composition of the top raw material as a percentage of the total cost are still insignificant variables and addition of these factors does not improve the adjusted R^2 of the model.

6. **However, the uncertainty factor for a company procuring the top raw material from a supplier that is situated at least 2 state borders away, is not well explained by the logarithm of distance.** Specifically, this predictor variable only explains 10% of the variability in uncertainty of transit time for domestic purchases.

   Similar to the above cases, revenues, COGS, profitability and the composition of the top raw material as a percentage of the total cost continue to be insignificant variables. This suggests that there are some other latent factors explaining the uncertainty parameter in transit time for these companies as compared to those who use one or 0 state borders for domestic purchases.

(b) About Domestic Sales

1. **The average total transit time between the respondent's manufacturing facility (origin) and the customer's warehouse (destination) increases with the average distance between the origin and destination.** However, distance is able to explain only 9% of variability in the average total transit time for domestic sales across all sectors. Specifically, for every 100 kms increase in the average distance between the origin and the destination, the average total transit time goes up by 1 day.

2. **The number of domestic state borders crossed added to the average distance between the origin and the destination can explain 12% of transit time variability.** However, the number of state borders alone does not explain any variability. But it was surprising to see that the average transit time decreases while increasing the number of state borders crossed (and keeping the average distance between the origin and the destination locations constant) in the case of domestic sales.

3. **In the Auto sector, the numbers of state borders along with the logarithm of average origin to destination distance are good predictor variables in transit time uncertainty.** Specifically, these variables individually explain 37% and 57% of variability in uncertainty of transit time respectively. Unlike the results for the effect of state borders observed on the uncertainty in transit time, it was found that **increasing the number of state borders increases the uncertainty in transit time for the major customers in the Auto sector**.

4. On the other hand, **the number of state borders and average distance between the origin and the destination explains very little or no variability in the uncertainty of transit time for the 3 other sectors (Textile, Engineering and Electronics).**

5. **Size of the company with respect to its revenue and profitability do not (significantly) affect the average total transit time or uncertainty in transportation time for major customers.**

6. **The number of carriers or transporters used by the respondent as a supplier or whether they own infrastructure used during freight transportation operations have no effect on the average total transit time or uncertainty in transit time associated with domestic sales.**

3.International Shipments

Description of the data

(a) Raw data information

The data available with us that are pertinent to the regression models used for analysis include the following.

a) Name and Sector of the Company
b) Transit time information –
   (i) For Imports
   - Average, Shortest and Longest total transit time values for the largest value import supplier
   - Average total transit time (Including all the segments of ocean transit i.e. Supplier origin to Origin port; Origin port dwell or waiting period; Port to port transit; Destination port waiting and customs; Destination port to

Final destination (the respondent's factory or manufacturing facility) for all imports
- Average delay in the import orders
- Average destination port dwell or waiting time (In the Indian ports)
- Average amount of time that the shipment goes through customs at the destination port
- Average amount of time taken from the destination port to destination (either by trucks or trains)

(ii) For Exports

- Average, and Longest total transit time values for the largest value export supplier and the corresponding percentage of revenues that it comprises.
- Average total transit time (Including all the segments of ocean transit i.e. Supplier origin to Origin port; Origin port dwell or waiting period; Port to port transit; Destination port waiting and customs; Destination port to Final destination for all exports
- Average amount of time between the origin and the origin port
- Average amount of time spent at the origin port waiting (origin port dwell) and time through customs

c) Import and export countries:
   - All the countries that the respondent imports or exports from
   - Country for the largest import supplier and largest export customer
d) Revenues & Profitability
e) If the freight that is transported requires a special screening process (Yes/No)
f) If the company being interviewed own their own logistics infrastructure (Yes/No)
g) The amount of revenues comprised by imports as a percentage of total revenues of the company and the equivalent numbers for exports
h) Number of sea ports used and the average distance of ports (import and export) from the manufacturing facility (often the destination of the freight)
i) Percentage of freight lost or stolen during customs for both imports and exports

(i) Imports

40 out of 72 companies that were interviewed import their products internationally. The division of these across the four sectors is as follows: -

Sector	Number of Responses
Auto	12
Electronics	15
Engineering	9
Textile	4
Total	40

It is important to note that engineering and textile sectors form a very low population amongst all the sectors. Hence, the analysis does not discuss any results related to these sectors.

(ii) Exports

43 out of 72 companies that were interviewed export their products internationally. The division of these across the four sectors is as follows: -

Sector	Number of Responses
Auto	7
Electronics	12
Engineering	12
Textile	12
Total	43

(b) Transforming raw data to desired variables which are used in the models

Import/Export Countries: There were a total 23 unique countries that the companies import from. It was observed that there was fair amount of repetition of specific locations across the 43 respondents. However, there were also a few countries that are unique origin for a given company. Hence it was not reasonable to see the effect of these countries, that occur only once amongst the 40 companies, as individual entities.

A new categorization criterion was therefore used to reasonably group the import countries. The countries that are import locations of at least 10 different companies were accumulated as one group for each unique country. However for the case when the frequency was less than 10, the countries were accumulated into Americas (North and South), Europe and Rest of Asia groups. Each location group is denoted as an independent variable corresponding to every respondent.

Similarly, there were a total 46 unique locations that all the 43 companies export to. However, in contrast to import country locations, majority of companies ship to unique countries (or in other words a given country is specific to only one company). Therefore, these 46 locations are categorized into just four exports location groups (Asia (and Australia); Europe; Americas and Africa).

Each location group is denoted as a binary variable for a given company. The value for the location group is 1 if the company transacts (imports/exports) from the specific group otherwise it is 0. The estimates of the regression model pertaining to each group is understood as an effect of adding a country from this group to the current list of import/export countries, on the average total transit time.

For instance let us assume that a company exports from 3 out of 4 above-mentioned groups and not from Africa. If the estimate for Africa in the model is +x days, it implies that starting to export from a country in Africa increases the average transit time of

exporting from the 4 groups together increases by x days than just exporting from the initial 3.

The groupings and the corresponding frequencies for both import and export are tabulated in Appendix III.

Transit time segments: For imports, the total transit time between arrival at destination port and arrival at the final destination is defined as the sum of 3 transit times:

- Destination port dwell time period
- Time through the customs process
- Landside travel between the port and the manufacturing facility or factory

For exports, the transit time information mentioned under raw data information is used for the models. The mean of all the average total transit time across the 4 sectors is tabulated below.

Mean of the average total transit time		
Sector	**Imports (in weeks)**	**Exports (in weeks)**
Auto	5.4	6.5
Electronics	6.6	1.9
Textiles	3.9	3.6
Engineering/Fabrication	4.9	5.5

Mean and standard deviation of the largest import supplier and largest export customer: The total transit time for the largest import supplier and export customer is modeled as a truncated normal distribution (truncated within the specific bounds of shortest and longest transit times for each). The simulation gives us the standard deviation of the transit time distribution. This again is equivalent to a measure of *uncertainty* in transit time.

For imports, simulation was used to model transit time distributions for 31 out of 40 companies. The other 9 companies reported the average and the minimum transit time to be equal and hence could not be simulated as a truncated normal distribution using the setup followed for the rest.

For exports, simulation was used to model transit time distributions for 38 out of 43 companies. The other 5 companies reported the average and the maximum transit time to be equal and hence could not be simulated as a truncated normal distribution using the setup followed for the rest. Because of unavailability of data, the shortest time for exports is assumed to be 0 units.

Some basic statistics related to the distribution of transit time are shown in Appendix II.

Inferences from the regression models

(a) About Imports

1. Findings regarding revenues and profitability margins of company

a) **Higher revenue companies have lower number of percentage of delayed orders.** For every 100 crore INR revenue difference (higher) between the companies (while assuming everything else like sector, geographic location etc. to be exactly similar.) implies 0.03% lower in delayed orders.

b) Surprisingly, **higher profitable companies were found to have a higher percentage of orders delayed.** A difference of 1% in the profitability margin of two companies would imply a 0.4 percentage increase in the orders delayed for the higher profitable company.

c) **Revenue and profitability of companies do not have a significant effect on the number of days spent at customs.**

d) **Revenue and profitability of companies explain almost no variability in the average transit time of freight.**

e) **More profitable and higher revenue companies have a lower total average transit time only in the Auto sector**. The model with only revenues is able to explain 13% of variability in the average total transit time for imports in the auto sector. On the other hand profitability explains 20% of variability in the average transit time.

The model suggests that smaller revenue companies have larger average total transit time. Specifically, a company that has revenue of 100 crore INR less than that of another similar one implies that the average total transit time for import freight increases by a unit day. On the other hand, increasing the profitability of a company by 1% decreases the average transit time by 0.1 days.

2) Point of origin finding

a) **Starting to import from China, Germany, Japan and the Americas to the current import countries for a company increases the average number of days spent at the customs. On the other hand, starting to import from Europe (outside of Germany), Singapore, Japan, Taiwan and the rest of Asia decreases the average number of days spent at customs for a company.**

Deciding to import from America, adds 1.4 days to the average number of days spent in the customs process. Future investigation might therefore

include investigating what kinds of goods are imported from these countries as compared to the others or trade laws between India and the above-mentioned countries.

b) Revenues and country groups give the best model that explains the variability in average total transit time. **This model explains about 15% of variability in the average total transit time. Starting to import from China, Germany, Taiwan and Japan to the current set of countries for a given company increases the average total transportation time. On the other hand, starting to import from Europe (outside of Germany), Singapore, Americas, Taiwan and the rest of Asia decreases the average total transit time.**

3) Destination port and final destination findings

a) Again, revenue and profitability of companies have no effect on transit time between the destination port and the final destination.

b) The best model in terms of the error term (adjusted R^2) is explained by deciding to add Europe, Singapore and Taiwan to the current list of import countries of a company. Starting to import from these countries reduces the average amount of time spent between destination port and final destination.

4) Other findings

a) Revenues and profitability explain a fair amount of variability in the average transit time in the auto sector (13% and 20%). They are however dramatically less useful when explaining variability in the electronics sector. This would mean that there are some missing predictor variables that explain variability in the electronics sector.

b) Requiring special screening process for freight increases the average number of days spent at customs by about 2 days.

c) As of now**, revenues, average distance of the seaport from the final destination and waiting time at the ports best explain percentage of orders delayed.** Specifically, the above factors explain about 25% of variability in the percentage of orders delayed.

d) Longer the average distance between the seaport and the final destination, larger is the percentage of orders delayed. Specifically, for every 100 kms increase in the average distance between the seaports and the final destination implies a 4% increase in the orders delayed.

e) **Increasing the waiting time at the destination ports increases the percentage of orders delayed.** Every increase of waiting time at the Indian ports by 1 day increases the percentage of orders delayed by 2%.

f) **Uncertainty in transit time for the largest import supplier is found to be dependent on profitability (P) and the percentage of imports purchased from this supplier (V).** This combination of variables explains 23% of variability of transit time by the largest import supplier. A nonlinear relationship was observed between uncertainty and the two predictor variables. Standard deviation (σ) is best explained as:

$$\sigma = -1.1 + 0.14P + 0.07V - 0.004PV$$

(b) About Exports

1. **The total average transit time is affected by the sector of the companies.** The sectors alone explain about 38% of variability in the average transit time. The auto sector is observed to be the slowest in terms of the transit time of exports. Compared to the auto sector, electronics, textile and the engineering/fabrication sector are about 5,3 and 1 week faster respectively. While auto is the slowest sector, electronics appears to be the fastest.

2. **The percentages of total revenues that are comprised by exports help explain variability in the average transit time for exports. This percentage along with the sectors helps explain about 41% of variability in the average total transit time in exports.** As compared to exports comprising of a low percentage of total revenues (less than or equal to 10%), higher percentages (values greater than 10 and less than 50%) imply slower transportation of freight.

   Specifically, a company which exports goods worth greater than 20 and less than 50 % of the total value, takes about 2 weeks more than that of low percentage composition. However, very large composition (exports form greater than 50 % of the total revenues) companies tend to be faster than that of a low percentage of the total revenue. Companies with very high proportion of exports (as compared to its total revenue) are about 3 days faster.

3. **Owning logistics infrastructure equipment makes the exports faster in terms of the average of the total transportation time as compared to not owning.** However, (as per the survey definitions) owning excellent infrastructure and owning a moderate level of infrastructure (a few trucks/ or cranes) has about the same effect on the average total transit time as compared to not owning any.

4. **Average total transit time can vary depending on the combination of export countries for a company.** Specifically, adding a new export country to the current list from the Asia and Australia group as compared to when not exporting

to a country in this group adds about 0.1 weeks to the average total freight transit time. The equivalent numbers for Americas, Europe and Africa are 0.9, 0.2 and 0.04 weeks respectively.

5. **Revenues and profitability of a company do not have any significant effect on the total average transit time for the exports. The age of the company denoted as a binary variable** (Establishment year <2000 then the age factor of the company is assigned as 0 else it takes a value of 1) **is also found to explain no amount of variability in average total transit time.**

6. **When compared to contracting with low number of carriers/transporters** (less than 5)**, having a moderate number** (between 6 and 10) **makes the amount of time spent in customs and at the port longer (**about 2 days more**). However on the other hand, contracting with much larger number of carriers/transporters (**more than 10**), surprisingly, suggests a faster (**about 0.8 days faster**) process through customs.**

7. **Exporting to countries in Asia (and Australia) and Americas adds about 0.2 days for both at the port and through customs as compared to not exporting to those groups. On the other hand, the equivalent numbers for Europe and Africa groups are about 2 days less.**

8. **Exports to Africa location group of the largest export market have the largest uncertainty in transit time.** As compared to exports into Africa, exports into Americas, Asia and Europe groups have 0.1, 1 and 0.4 weeks of less uncertainty. In other words, exports to other countries in Asia from India appear to be the least uncertain when compared to exports to Africa.

4.Future Work

In short, there are ample opportunities to improve the predictive power of the models that are used to explain the effect of freight system on the Indian manufacturing industry. The models and the inferences provided here offer a foundation for the following future work.

1. **Obtain information about the specific port locations used for both domestic and international transportation.** Results of the models suggest variable effects of origin and destination locations on the uncertainty of the transportation time. It might be helpful to identify the exact ports so as to investigate the specific geographic locations that are more likely to be uncertain.

2. **Collect and use relevant information about port operations for international shipment analysis.** Results suggest that regulatory factors like customs and screening process play a significant role in explaining variability in transportation time. It will be helpful to collect relevant information like level of automation at

the Indian ports, number of administrative documents that need to be filled etc. to understand the specific impacts of regulations on the transportation time.

3. **Collect and incorporate information related to the state borders to understand the impact on transportation time.** The number of state borders explain significant amount of variability in domestic shipments. It might be helpful to collect more relevant information like number of tollbooths, average time spent at these booths, a measurement of "level" of infrastructure (roads, trucks etc.).

4. **Analyze the effect of specific origin and destination pairs on the variability in transportation time.** Specific origin and destination locations or "trade lanes" are identified to understand the variability in transit time across these lanes. This would give us a new point of view of investigating specific locations in India that are more susceptible to large variations in transit time.

5. **Investigate the effect of predictor variables on other measures of uncertainty (other than standard deviation).** Other measures could include *coefficient of variation*, which has the advantage of measuring uncertainty relative to the mean as compared to standard deviation, which is explained in absolute terms.

6. **Conduct analysis on a larger dataset (**one can get access to relevant information from a company's SAP system**) to ascertain that the causal links discovered in the analysis discussed in the report is generalizable than just being specific to the current dataset.**

7. **Research relevant literature to ascertain the different transit time distributions observed in practice**. Normal distribution was used for this analysis. It is because my past research experience suggests that ocean transit time distributions are frequently normally distributed for freight transported over ocean. While in the ideal case, the distributions are best known from transit time data collected over a period of time, survey did not provide us access to it.

8. **Use information about the percentage of instances that transportation time can exceed the average.** This information could not be included into the simulation model because of scarcity of time. However, the information should be included in the future to give us a more realistic scenario of transit time values.
   [A suggestion of how to incorporate it in the simulation: Use "dichotomy" algorithm to narrow down to the value of standard deviation that best fits all the other available parameters of the distribution (shortest, longest, mean and the percentage of instances that transportation time can exceed the average value]

Appendix

I. Results of the Regression models

The estimate values with a p_value >0.5 (or smaller significance) is shown in italics in the table above and all the following tables that shows the results of the models

1. Domestic Purchase

Dependent Variable: **Uncertainty in the total transit time (represented by standard deviation) for the largest supplier of raw material 1 (in days)**							
Predictor Variable	Estimate _Model1	Estimate _Model2	Estimate _Model3	Estimate _Model4	Estimate _Model5	Estimate _Model6	Estimate _Model7
Intercept	-0.2	0.2	-0.5	-0.2	-0.3	-0.2	-0.1
Sector (With respect to Auto)							
Electronics					*0.04*		
Textile					*-0.005*		
Engineering					*0.08*		
State Borders		0.2		0.09	0.09	0.09	0.09
Distance of the manufacturing facility from supplier location for the largest supplier)	0.0004						
Log(Distance)			0.4	0.08	0.08	0.08	0.09
Revenues						*0*	
COGS						*0.0006*	
Composition							*-0.002*
Profitability						*0.0004*	

Adjusted R^2	55%	64%	63%	67%	66%	65%	67%

Dependent Variable: **Mean value in the total transit time for the largest supplier of raw material 1 (in days)**		
Predictor Variable	Estimate _Model1	Estimate _Model2
Intercept	-4.1	0.6
State Borders		1.2
Log(Distance)	2.9	
Adjusted R^2	79%	82%

Dependent Variable: **Uncertainty in the total transit time (represented by standard deviation) for the largest supplier of raw material 1 (in days)**				
	1 or 0 state borders		More than 1 state borders	
Predictor Variable	Estimate _Model1	Estimate _Model2	Estimate _Model3	Estimate _Model4
Intercept	*-0.2*	-0.2	*-0.7*	*-0.9*
Sector (With respect to Auto)				
Electronics		*0.1*		*0.001*
Textile		*-0.01*		*0.05*
Engineering		*0.1*		*0.2*
State Borders				
Log(Distance of the manufacturing facility from supplier location for the largest supplier)	0.08	0.08	0.2	*0.2*
Adjusted R^2	35%	43%	10%	2%

2. Domestic Sales

Dependent Variable: **Average total transit time (in days)**		
Predictor Variable	Estimate _Model1	Estimate _Model2
Intercept	*-0.2*	-0.5
Average distance between the origin and customer location	0.01	0.01

Average number of state borders crossed		*-0.3*
Adjusted R^2	9%	12%

Dependent Variable: **Uncertainty in the total transit time (represented by standard deviation) for major customers (in days)**									
	Across all sectors	Auto Estimate		Textile Estimate		Electronics Estimate		Engineering/Fabrication Estimate	
Predictor Variable	Estimate_Model1	Model2	Model3	Model4	Model5	Model6	Model7	Model8	Model9
Intercept	*0.4*	0.2	-3.5	*0.9*	*-1.0*	2.4	1.5	2.7	-16
Average distance between the origin and customer location	0.002								
Log (Avg. distance between the origin and customer location)			0.7		*0.4*		*0.5*		*2.8*
Average number of state borders crossed	*-0.1*	0.2		*0.1*		*-0.05*		*-0.03*	
Adjusted R^2	7%	37%	57%	0%	10%	0%	0%	0%	4%

3. Imports

	Dependent Variable: **Average total transit time (in days)**						
	Across all sectors			Auto Sector		Electronics Sector	
Predictor Variable	Estimate_Model1	Estimate_Model2	Estimate_Model3	Estimate_Model4	Estimate_Model5	Estimate_Model6	Estimate_Model7
(Intercept)	40	54.9	30.0	42.9	49.9	48.9	*-72.3*
Revenues (in INR cr)	*-0.0002*		*-0.0006*	*-0.01*		*-0.0002*	
Profitability (in %)		*-1.4*			*-1.1*		*-3.1*
Americas			*-2.4*				
Europe			*-19*				
Rest of Asia			*-27*				
Singapore			*-8.9*				
China			45.8				
Germany			*12.7*				

Taiwan			*9.3*				
Japan			43.7				
Adjusted R^2	0%	0.1%	15%	13%	20%	0%	0%

Note: (1) The other two sectors (textile and engineering are not shown because of very low import responses corresponding to these sectors)

Dependent Variable: **Average time taken for the customs process (days)**			
	Across all sectors		
Predictor Variable	Estimate _Model1	Estimate _Model2	Estimate _Model3
(Intercept)	3.9	4.6	4.4
Revenues (in INR cr)	*-0.00001*		
Profitability (in %)		*-0.1*	
Americas	*0.04*	*-0.2*	*1.4*
Europe	*-0.7*	*-0.7*	-2.1
Rest of Asia	*-0.3*	*-0.3*	*-0.9*
Singapore	*-1.2*	*-1.3*	*-1.4*
China	*1.6*	*1.5*	*0.7*
Germany	*-0.1*	*0.3*	*0.3*
Taiwan			*-0.1*
Japan	*1.4*	*0.7*	*1.1*
If the freight requires special screening process (yes vs. no)			2.3
Adjusted R^2	4%	5%	16%

Dependent Variable: **Percentage of orders delayed**		
	Across all sectors	
Predictor Variable	Estimate _Model1	Estimate _Model2
(Intercept)	*-1.8*	*-7.9*
Revenues (in INR cr)	*-0.0003*	
Profitability (in %)		*0.4*
Average distance of the port from the manufacturing facility	0.04	0.04
Destination port dwell time in days	2.2	2.4
Adjusted R^2	25%	19%

Dependent Variable: **Total transit time from Destination port to final destination (in days)**		
	Across all sectors	
Predictor Variable	Estimate _Model1	Estimate _Model3
(Intercept)	4.3	3.9
Americas	*0.3*	

Europe	-1.7	-1.6
Rest of Asia	*-0.03*	
Singapore	-1.6	-1.5
China	*-0.6*	
Germany	*-0.08*	
Taiwan	-1.9	-1.9
Japan	*-0.2*	
Adjusted R^2	15%	25%

Dependent Variable: **Uncertainty in the total transit time (represented by standard deviation) for the largest value import supplier (in weeks)**			
	Across all sectors		
Predictor Variable	Estimate _Model1	Estimate _Model2	Estimate _Model3
(Intercept)	*0.85*	*0.4*	*-1.1*
Revenues (in INR cr)		*-0.000002*	
Profitability (in %)	*-0.05*		*0.14*
Percentage of total purchase of imports from largest supplier (denoted by %_largest_supp)	*0.02*	*0.01*	0.07
Profitability*%_largest_supp			-0.004
Adjusted R^2	5%	0.5%	23%

4. Exports

Dependent Variable: **Average total transit time (in weeks)**							
Predictor Variable	Estimate _Model1	Estimate _Model2	Estimate _Model3	Estimate _Model4	Estimate _Model5	Estimate _Model6	Estimate _Model7
Intercept	6.5	2.4	*0.6*	4.5	3.4	5.0	*-0.5*
Sectors (WRT Auto)							
Electronics	-4.6					-3.6	
Textiles	-2.9					*-1.7*	
Engineering/Fab.	*-1.1*					*-0.1*	
Profitability (in %)		*0.2*					
Location groups (WRT not exporting to a country in that particular group)							
Asia +Australia			*0.1*				2.7
Americas			*0.9*				*0.2*
Europe			*0.2*				*1.4*
Africa			0.04				2.6
Infrastructure (WRT							

owning none)							
Own excellent Infrastructure				-2.8			
Own moderate amount of infrastructure				*-2.7*			
Total exports as a % of total revenue (WRT the value being less than 10%)							
11%<=value<=20%					*0.8*	*0.6*	*0.8*
21%<=value<=50%					2.4	2.0	3.0
Value>=51%					*-0.6*	*-0.006*	*-0.04*
Adjusted R^2	38%	8%	7%	10%	12%	41%	27%

Dependent Variable: **Average time taken for the customs process and port dwell (days)**				
Predictor Variable	Estimate _Model1	Estimate _Model2	Estimate _Model3	Estimate _Model4
(Intercept)	4.6	5.1	2.8	3.1
Location groups (WRT not included in that particular group)				
Asia +Australia	*0.3*	*0.2*		*1.1*
Americas	*0.05*	*0.2*		*0.2*
Europe	*-1.9*	-2.2		*-1.4*
Africa	*-2.1*	*-2.3*		*-1.8*
Special Screening process (WRT no such special process required)		-1.6		
No. Of carriers/transporters (WRT having less than 5)				
Having between 6 &10			2.3	2.3
Having >10			*-0.4*	*-0.8*
Infrastructure (WRT owning none)				
Own excellent Infrastructure				
Own moderate amount of infrastructure				
Adjusted R^2	5%	9%	8%	15%

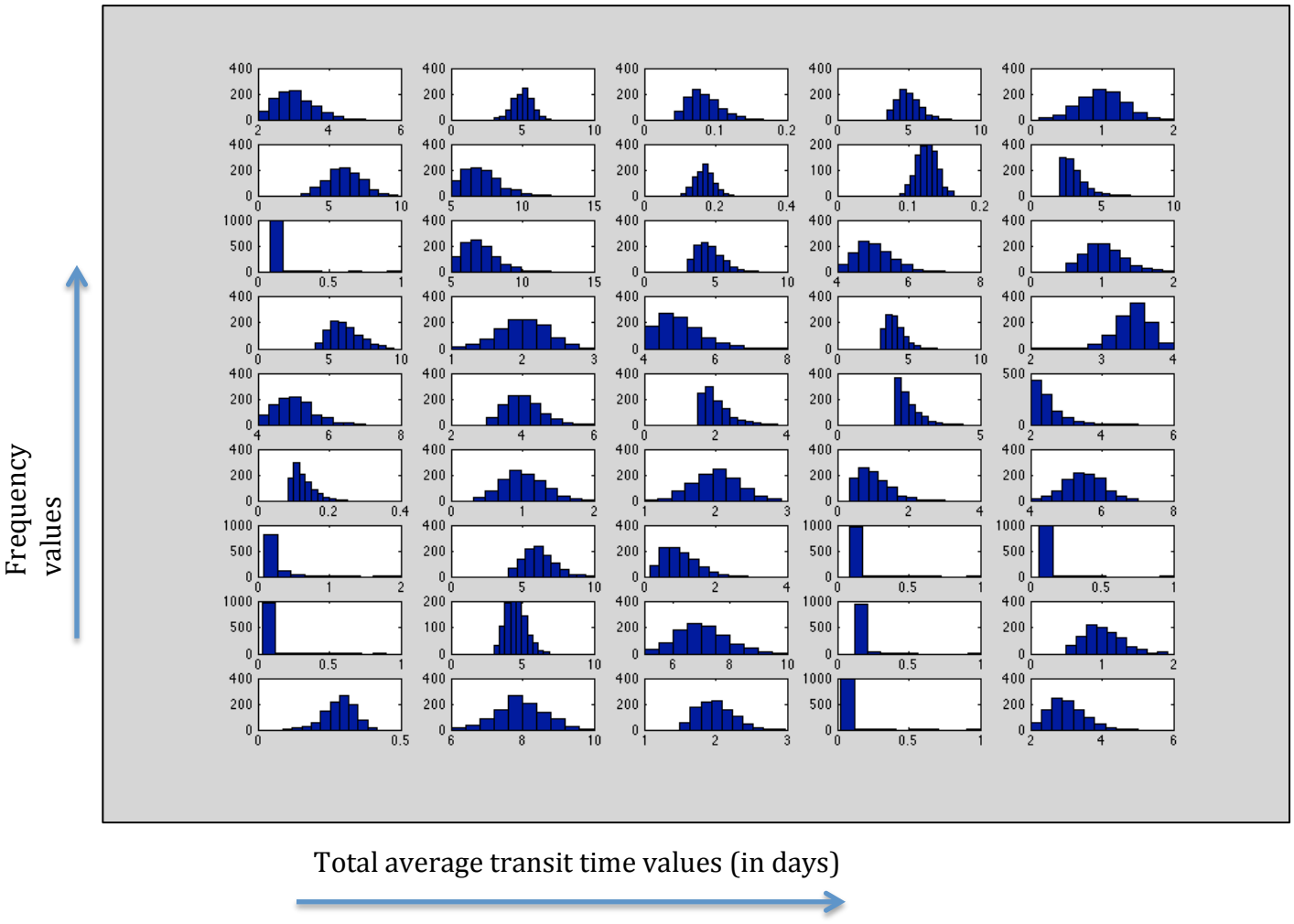
Dependent Variable: **Uncertainty in the total transit time (represented by standard deviation) for the largest value import supplier (in weeks)**	
Predictor Variable	Estimate _Model1
(Intercept)	1.4
Location group of the largest market (WRT Africa)	

America	*-0.1*
Asia	-1.0
Europe	*-0.4*
Adjusted R^2	25%

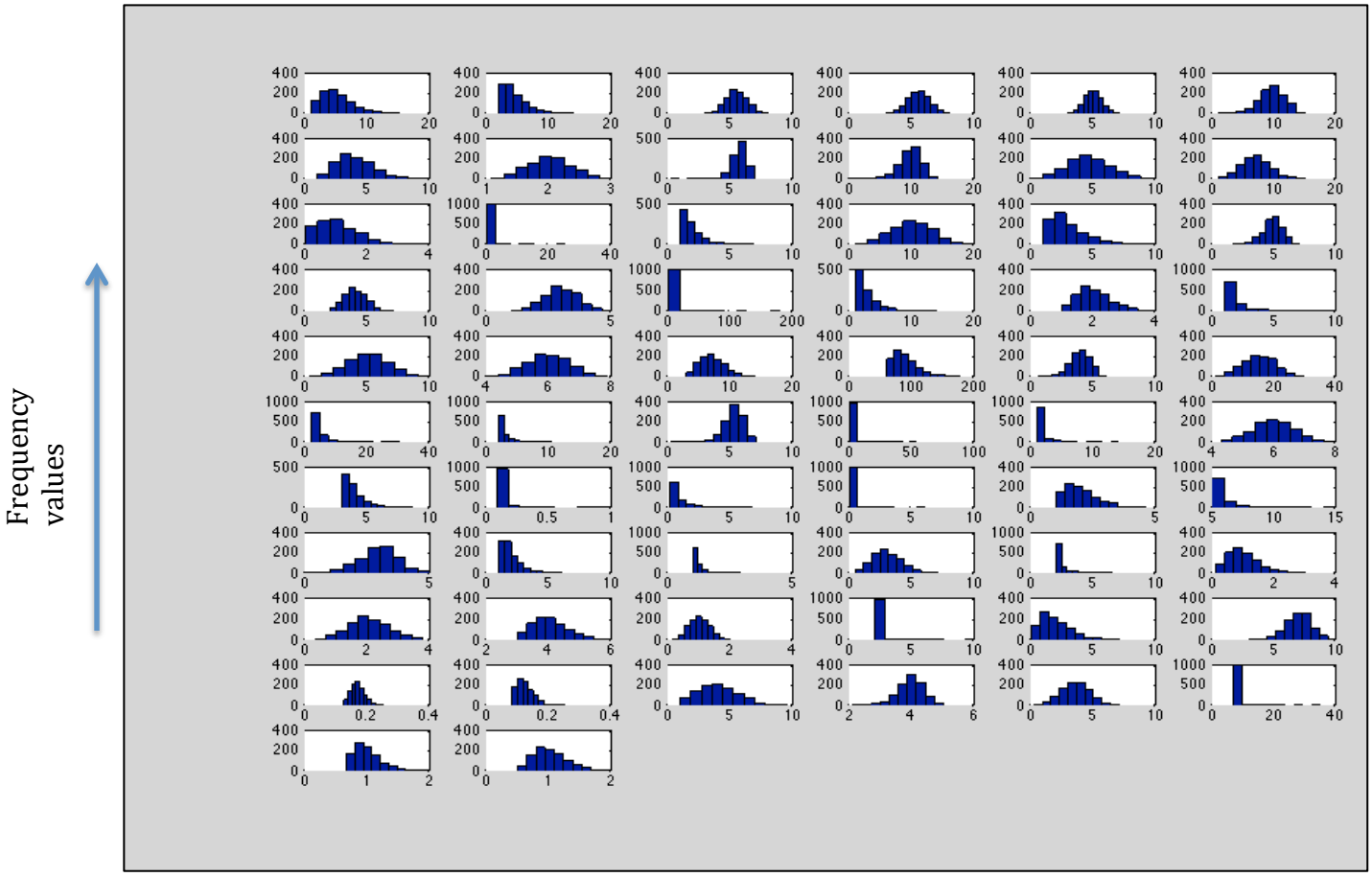
II. Distribution of the transit time for the largest supplier/customer

(a) Histograms of the approximate normal distribution simulated for the largest market

1. Domestic Purchase



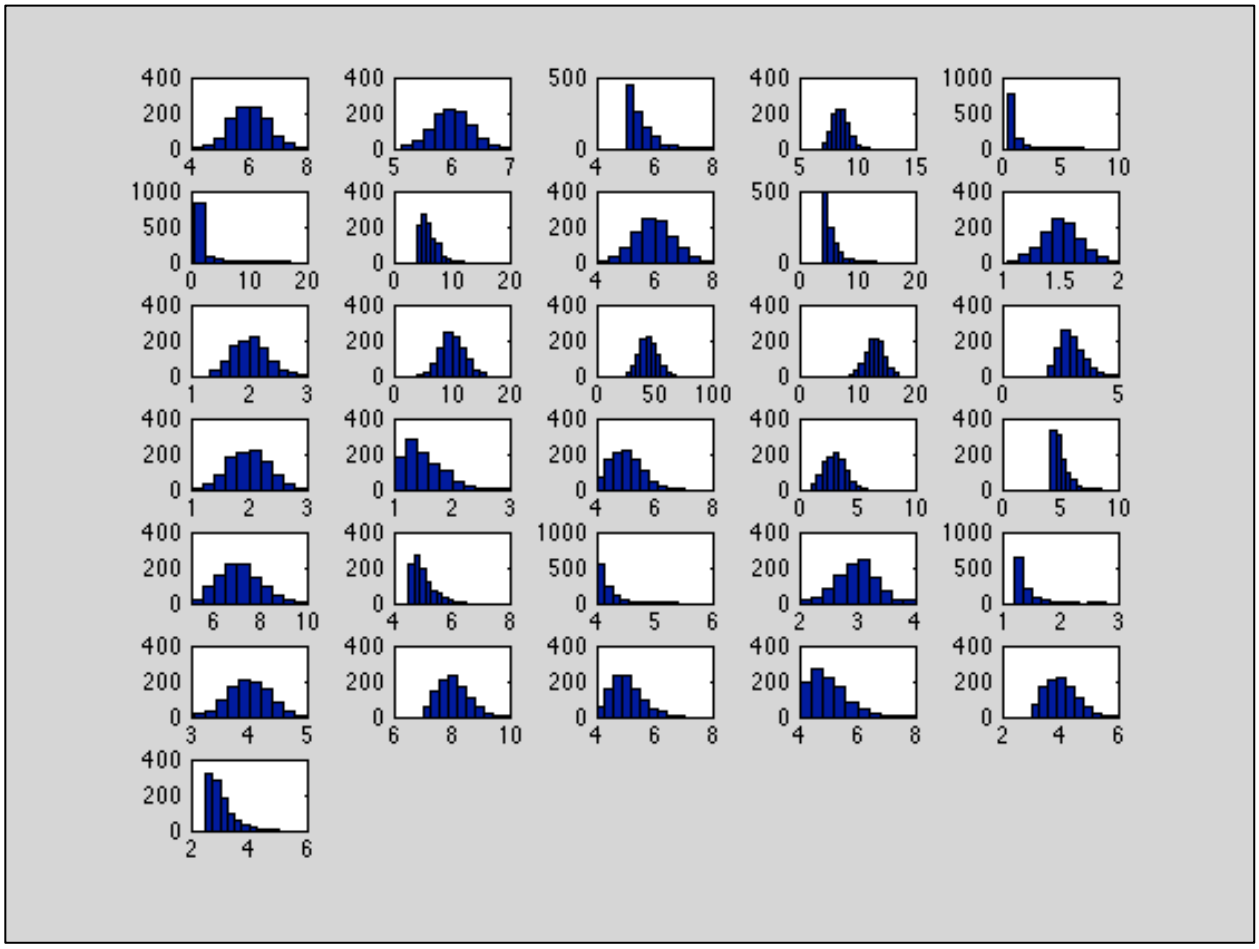
2. Domestic Sales



Frequency values

Total average transit time values (in days)

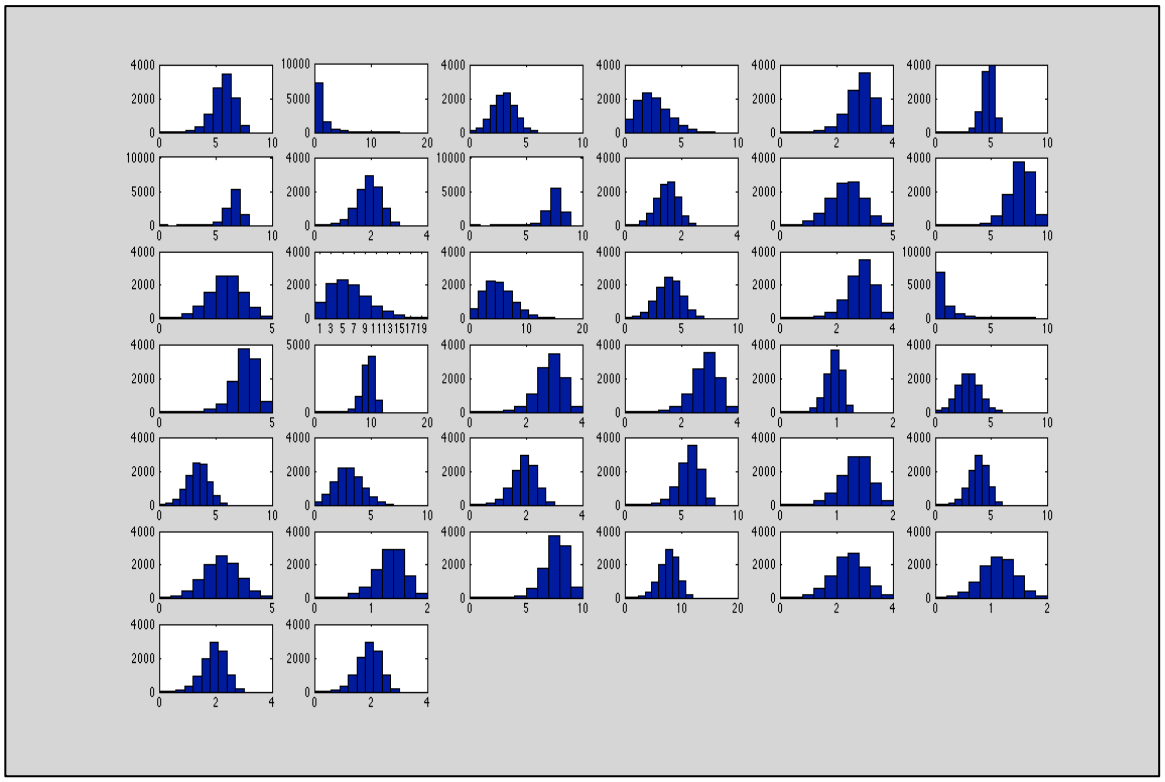
3. Imports



Frequency values

Total average transit time values (in weeks)

4. Exports



Frequency values

Total average transit time values (in weeks)

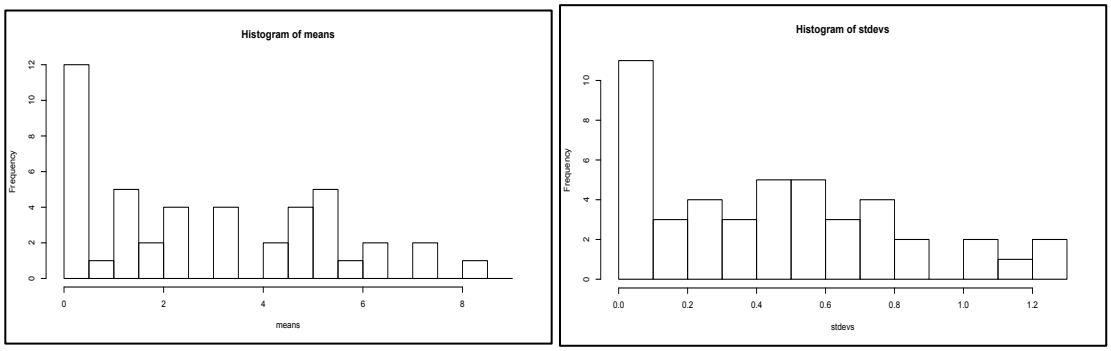
(b) Mean and standard deviation ranges for the largest supplier/customer

1. Domestic Purchase

Parameter	Minimum Value	Maximum Value
Mean	0.031 days	8.01 days
Standard Deviation	0.01 days	1.22 days
Coefficient of Variation	0.03	2.67

Histogram for Mean value of transit time

Histogram for Standard deviation value of transit time

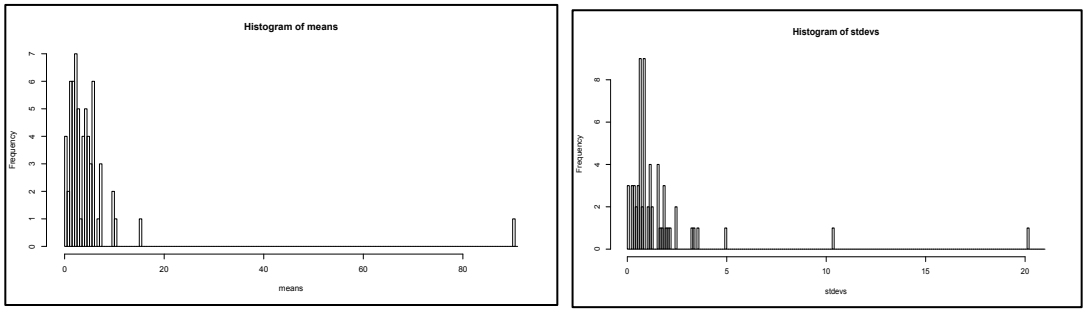


2. Domestic Sales

Parameter	Minimum Value	Maximum Value
Mean	0.61 days	91 days
Standard Deviation	0.34 days	20 days
Coefficient of Variation	0.11	4.15

Histogram for Mean value of transit time

Histogram for Standard deviation value of transit time

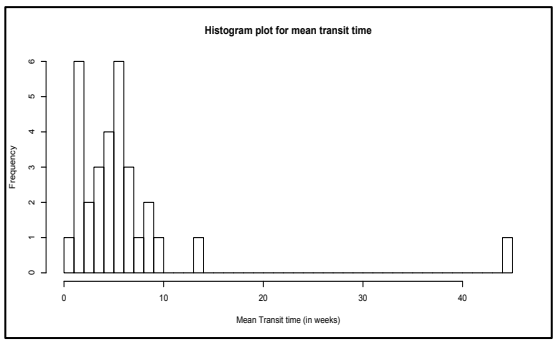


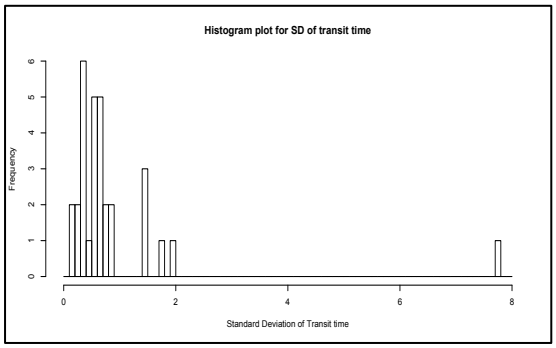
3. Imports

Parameter	Minimum Value	Maximum Value
Mean	0.88 weeks	45 weeks
Standard Deviation	0.17 weeks	7.74 weeks
Coefficient of Variation	0.05	1.01

Histogram for Mean value of transit time

Histogram for Standard deviation value of transit time



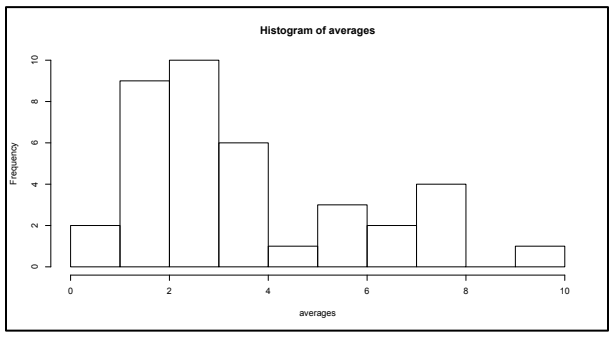


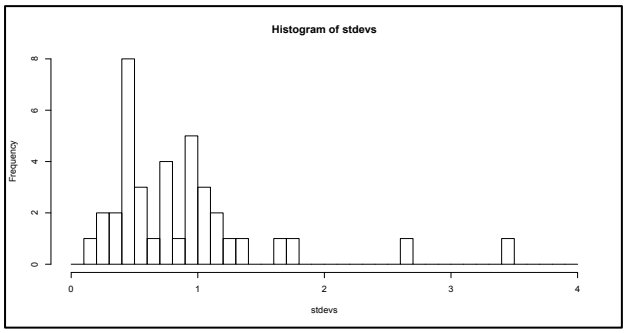
4. Exports

Parameter	Minimum Value (Weeks)	Maximum Value (Weeks)
Mean	0.86 weeks	9.45 weeks
Standard Deviation	0.15 weeks	3.48 weeks
Coefficient of Variation	0.09	1.43

Histogram for Mean value of transit time

Histogram for Standard deviation value of transit time





III. International supplier and customer locations grouping

1. Imports

Country Group	Frequency
Americas	17
Europe	29
Rest of Asia	29
Singapore	13
China	27
Germany	19
Taiwan	10
Japan	12

2. Exports

Country Group	Frequency
Americas	22
Europe	29
Asia (and Australia)	34
Africa	8