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Optimizing the supply chain in India

Promise and peril

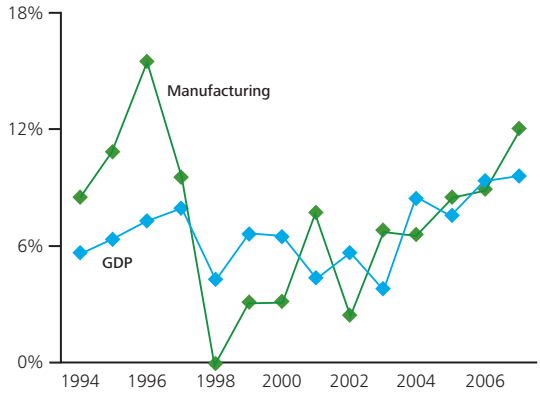
Contents

How India's operating environment alters supply chain strategies and rewards those who master its complexity

Over the last 5 years, a CAGR of 8.6% in India's manufacturing sector as compared to overall GDP CAGR of 7.7% (Figure 1), has fuelled confidence about its resurgent strength and long-term potential. The recently-approved 11th 5-Year Plan (the central government's planning and budgeting cycle) expects manufacturing to grow at a CAGR of around 10% over 2007-2012.

Designing an optimal supply chain configuration that can meet the expected growth rates is a challenging task, especially in India. While customers demand improvements in each aspect at ever-lower prices, producers and distributors in India are facing increasing competition in nearly every product category. The traditional methods of supply chain design and management do not always apply in the Indian context, owing to its complex tax regulations, non-standardized transportation, uncertainties across the value chain, and low rate of technology adoption. Nevertheless, those companies who have embraced these complexities and designed their supply chains in India to efficiently move products from sourcing through fulfillment are reaping the rewards of the market size and growth potential that India offers.

Figure 1. India YoY Manufacturing and GDP growth rates

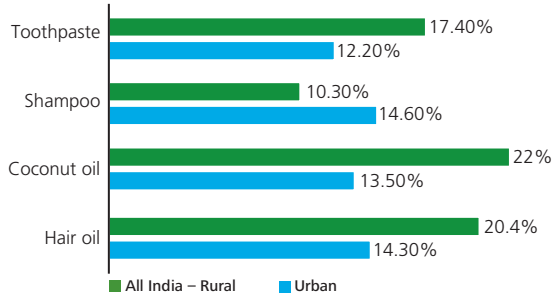


Source: CEIC Data

Supply chain complexities in India

Integrating the rural supply chain: The rural consumers, living in more than 600,000[2] villages across the country, constitute over 70%[3] of the population. They account for well over 60%[3] of the national demand for several product categories and have seen their income levels rise over the last 10 years. The number of rural households in the lower and lower middle classes decreased from 83%[3] in 1998-99 to 70%[3] in 2006-07 and is set to fall at a rapid rate over the next 20 years; the comparative fall for urban India has been from 53%[3] to 27%[3]. Figure 2 illustrates the differential growth rates between urban and rural consumption for specific personal care products.

Figure 2. Urban and rural growth rates (personal care products)



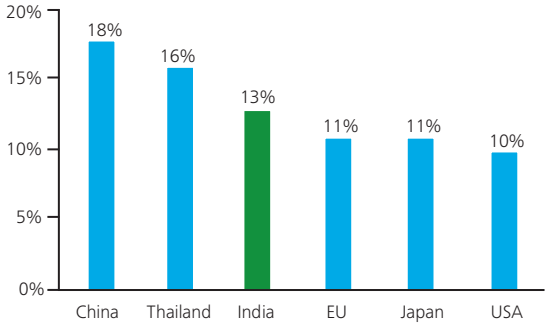
Source: Business Standard

The higher growth rates of rural consumption indicate that companies with an extensive supply chain network will have a better opportunity to serve such growing demand segments and potentially increase market share. This would be a challenging task given the infrastructure, geography and significant channel fragmentation.

Logistics Challenges: The highly fragmented trucking industry, which carries most of the business-related transportation within India, makes it difficult for companies to manage the plethora of carriers required to handle shipment volumes. Although outsourcing of logistic activities to 3PL providers is increasing, there are very few such organized providers in India. The situation

is further compounded by India's poor infrastructure facilities. India has one of world's largest road networks, yet less than half of the roads are paved and only about 7,000[4] kilometers are four lane roads, significantly lower as compared to China's over 34,000[4] kilometers. These national highways account for less than 2%[1] of the total road network, but carry 40%[1] of traffic. As a result, despite spending more of its GDP on logistics than developed nations (Figure 3), India will still face logistics challenges for years to come.

Figure 3. Logistics cost as a proportion of GDP



Source: ENAM India Research

Firms exporting out of India also face challenges relating to the lack of space and modern handling facilities at the airports and seaports. This leads not only to higher turn-around time and consequently higher costs, but also to peak time waiting periods that are several times higher compared to several modern ports in other parts of the world. Further, complex tariff structure as well as import-export restrictions often delay shipments.

Overall, logistics in India is still a traditional industry and has not yet developed the economies of scale that multinationals require to maximize efficiency.

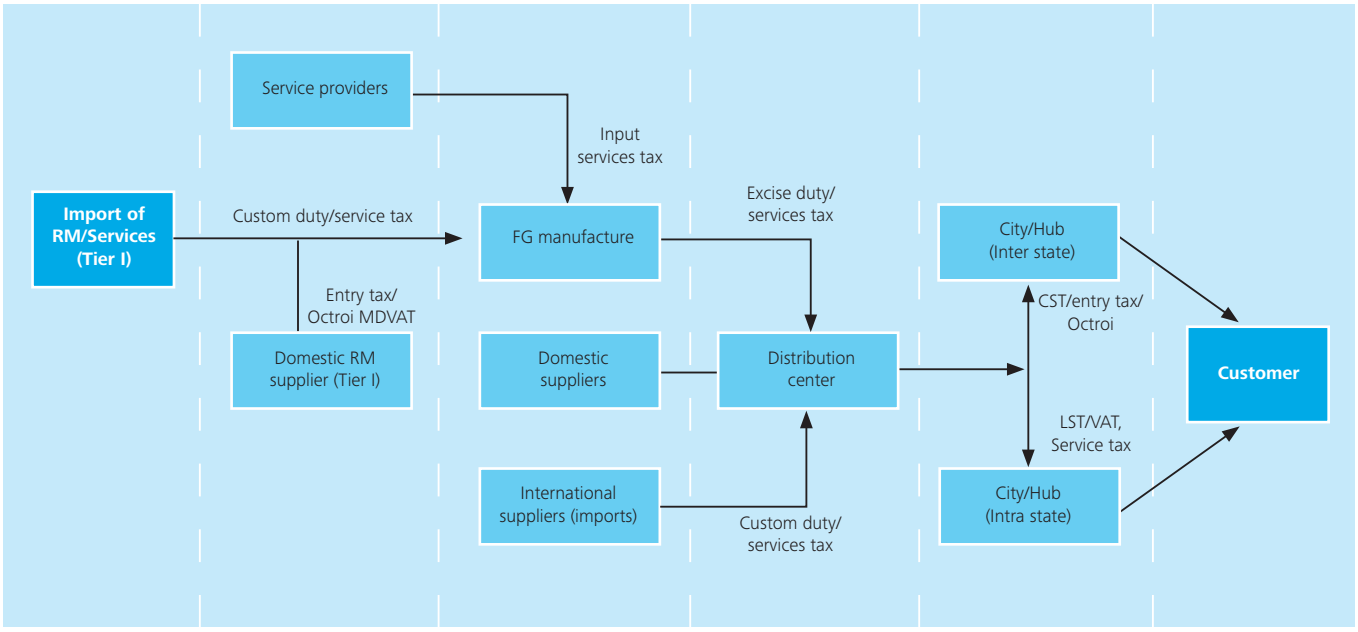
Complex Tax Structure: To say that India's tax regime has a significant impact on supply chain design is an understatement. Transaction taxes (import/entry, manufacture and sale of goods and provision/receipt of services) have a direct and tangible impact on the cost of goods or services. The taxation structure in India is complex, with products typically being taxed twice: once by the central government and then by the respective state governments. Figure 4 outlines some key tax components in a typical supply chain in India.

The **Central Sales Tax** (CST) effectively encouraged many companies to operate a warehouse in each state rather than pay CST while shipping to customers or stores across state boundaries. However, at present, CST has been reduced to 2%[2] and is slated to be phased out by March 31, 2010[2].

Excise Duty, a structure of selective regional exemption, complicates logistics design by creating a skewed manufacturing footprint in India. Companies are likely to resort to deploying production operations in regions which offer exemptions to excise duty in spite of incurring higher logistics costs, time-to-market and working capital.

Further, the impact of varying **Value Added Tax** (VAT) structure in different states, customs exemptions in **Special Economic Zones** (SEZ), **Service Tax** and corporate tax make supply chain design and optimization all the more challenging. As the tax and regulatory issues in India evolve, manufacturers and distributors must adjust their footprint and supply chain strategies, requiring greater flexibility and awareness than in most other markets.

Figure 4. Taxation in a typical supply chain in India

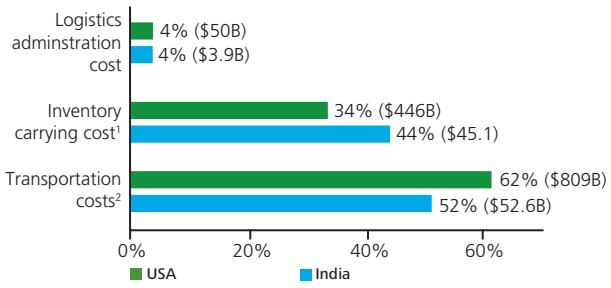


VAT= Value Added Tax, MODVAT=Modified VAT, CST=Central Sales Tax, LST=Local Sales Tax, Octroi=TAX on sales inside city limits

Benchmarking the India supply chain

India spends 13% of its GDP on logistics, next only to China and Thailand and 3% more than US (Figure 3). Though India spends a lower proportion of supply chain costs on transportation, the multiple stocking tiers in a typical Indian distribution system require higher costs be spent on inventory and warehousing (Figure 5). Where transportation costs in U.S. are fairly evenly distributed between driver, fuel and equipment costs; fuel accounts for the maximum transportation cost in India (Figure 6). The poor road infrastructure in India also results in high surface freight costs (Figure 7), while unpredictability, poor forecasting, limited technology and distribution tiers proliferation results in higher than average inventory days (Figure 8).

Figure 5. Distribution of Logistics Cost in India and U.S. (2006)



Source: ENAM India Research, www.logisticsmgmt.com

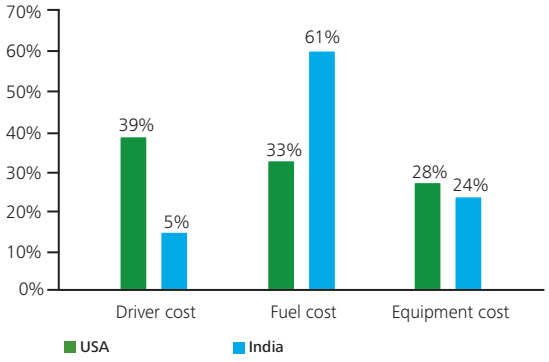
[1] Inventory carrying costs include warehousing, taxes, interest, depreciation, obsolescence, and insurance costs

[2] Transportation costs include transportation by all modes as well as forwarding and shipper-related costs

The lengthened turnaround time at Indian ports continues to be a significant bottleneck for companies importing raw materials or finished goods, with the lack of investment in technology being a major differentiator (Figure 9).

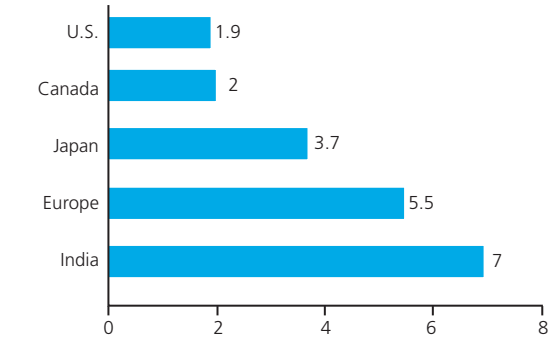
Though contribution of Indian 3PL providers to total logistics activities is less than 10% as compared to more than 50% in U.S. and Japan, they have the opportunity to grow as integrators in a highly fragmented market.

Figure 6. US and India Transportation Cost Break-Up (per km)



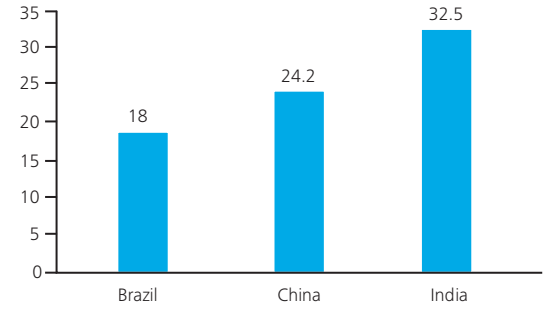
Source: www.scmr.com

Figure 7. Average surface freight cost per Ton-Km (cents)



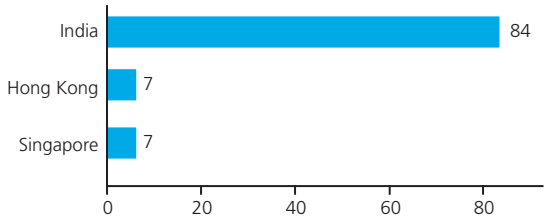
Source: KPMG-CII Report

Figure 8. Average inventory days



Source: KPMG-CII Report

Figure 9. Turnaround time at ports (hours)



Source: KPMG-CII Report

Supply chain success stories in India

In spite of the obstacles, India's market opportunity is significant and appealing enough to continue to attract manufacturers and distributors across sectors. Several companies have mitigated the supply chain challenges in India with specific strategies.

One such company is one of India's leading Fast Moving Consumer Goods (FMCG) company dealing primarily in personal and health care products. Implementation of a distributor information system, to attain visibility of sales data at the retail level and aid supply chain decisions, dramatically improved the company's supply chain responsiveness.

Another success story is about one of India's largest pharmaceutical company, primarily engaged in cardiovascular, antibiotics, respiratory and pain management segments. The company implemented a new production planning system that was capable of handling the complexities and requirements of an aggressive growth strategy. This allowed the company to be more responsiveness towards its customers, improving its competitiveness.

It is critical that companies optimize their network configurations to eliminate any inefficiency in their supply chain and prepare it for the potential growth opportunities in India. Supply chain network optimi-zation deals with identifying the lowest cost network including location and size of manufactur-ing/warehousing facilities, product routing, and raw material sourcing etc. to meet the desired customer service levels. The Indian landscape is unique in terms of its complexities and requires a distinctive approach to supply chain design.

Network Design considerations for the India supply chain

Conventional approaches to supply chain design may not work in India given the complexity involved. What is required is both a solid knowledge of operating realities and innovative approaches to optimization. Figure 10 outlines some of the key questions that a company should consider when optimizing its India supply chain network.

The following few sections outline some key considerations for designing a supply chain network, either by using a third-party network optimizer or by building an in-house mathematical model.

Demand points and product SKUs aggregation: Given the large number of end customers and SKUs sold by a manufacturer, considering each customer and product combination for modeling the footprint might lead to several million variables. However, in most cases, only a few key customers and product categories impact the supply chain footprint and the rest can be safely ignored.

Another approach to reducing the problem size is to aggregate products (and customers) based on certain important factors like weight, volume, etc. The right level of aggregation allows the underlying model to remain fairly accurate while at the same time making it computationally tractable.

Planning Horizon and Granularity: The complexity in the optimization process can be significantly impacted by the planning horizon and the granularity of demand, i.e., whether demand is being modeled in weeks, months or quarters. Higher granularity captures factors like seasonality of demand, but at the same time increases optimization complexity.

Figure 10. Key considerations addressed in network design

Raw Material Sourcing	• Who are the key raw material suppliers from a net landed cost perspective? • What is the optimal mode of shipment of RMs from their suppliers? • What is the effect of raw material substitutes for production? • What are the cost-benefit trade-offs of imports versus domestic purchase?
Manufacturing	• What is the optimal manufacturing configuration, with and without excise and IT? • What is the tradeoff between tax and logistics on the manufacturing footprint? • Does the existing manufacturing footprint have enough capacity to support demand for the next five years? • What is the impact of closing certain manufacturing plants on the overall cost? • What is the optimal production footprint: assignment of products, number/capacity of lines at each plant? • Post tax sunset, is it beneficial to move manufacturing to a non-fiscal benefit area for logistics reasons?
Transportation	• What are the incremental costs and risks incurred by closing certain lanes? • How does centralized distribution affect transportation costs? • How do service level requirements impact the transportation footprint? • What are the net in-transit holding costs and average in-transit inventory in the supply chain?
Warehousing	• What is the optimal distribution footprint - number, location and configuration of warehouses? • What is the impact of CST/VAT on the warehousing set up? • What are the average inventory levels across the supply chain? • To what extent is a reduction in inventory achievable by moving to a centralized distribution system? • Is it beneficial to outsource warehousing to a third party provider?

Source: Deloitte Consulting LLP

Incorporating Inventory and Service Level Requirements: Typical network optimization tools in the market require deterministic demand inputs and do not take into account the forecast uncertainty. This is justified because network optimization is strategic in nature whereas inventory and service level optimization are more tactical. Attempting to combine the two could add unnecessary complexity with low benefits. Usually, inventory optimization is carried out after an optimized network is in place. However, it is wise to address high-level inventory considerations while optimizing the supply chain.

Inventory requirements can be modeled by assuming certain days of inventory at the warehouses based on clients' past performance. Inventory pooling benefits may need to be captured outside the model. A potential limitation to this approach is in warehouse sizing. The size of a warehouse is determined by the maximum amount of inventory that it needs to hold at any point. The maximum inventory, in turn, is a function of the variability in the supply chain which is typically high in India. Therefore, one should ensure that the uncertainty in the supply chain is accurately captured so as to avoid under-utilized warehouses.

Inventory carryover across time periods cannot be ignored for products with seasonal demand variations. Such products usually have significant pre-build inventory (accumulated during lean periods) that needs to be considered and incorporated in the model to maintain accuracy.

Another challenge faced is that existing optimization tools may not allow for service levels to be included in network optimization analysis. However, most organizations would be able to classify customers as critical, moderate or noncritical customers and may wish to align their supply chains based on these criteria. A recommended approach for modeling such criteria is to force-open at least one warehouse within a distance specified by the level of service required by the customer. This can facilitate timely delivery to key customers.

Modeling potential manufacturing locations and warehouses: The number of variables in a network design model will approximately be the product of the number of manufacturing locations, warehouses, customers, products and number of time periods. To enhance the solvability of the model, the number of possible manufacturing and warehouse locations for a green-field project can be significantly reduced by dividing the geographical region into grids of a pre-determined size. Each grid can then be evaluated based on political stability, infrastructure, customer and supplier proximity, labor availability, taxes and regulations to yield a filtered list of possible locations.

Modeling taxes and duties: The complex taxation environment in India skews the network footprint towards fiscally beneficial locations. All the different taxes and duties need to be modeled differently for a network optimization exercise. For instance, excise duty can be added to the modeled product cost with exempt locations incurring only input cost.

On the other hand, income tax, levied on plant-level incomes, should be minimized separately in the overall objective function. Alternatively, income tax could be loaded on to production costs after careful examination of various plant-level cost elements.

In transportation and warehousing, CST, VAT and Octroi play an important role. Modeling CST, a tax on inter-state movement of goods, requires knowledge of source and destination locations and whether a lane is inter-state or intra-state. In order to overcome this tax, manufacturers typically move goods to a warehouse in each state as internal stock transfer and sales that take place are then shown as intra-state transactions. However, the impending phase-out of CST by March 31, 2010 would enable shift to centralized distribution networks.

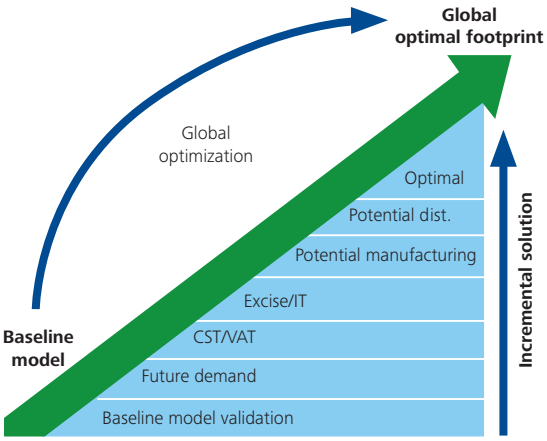
Since the Indian government is moving towards a uniform VAT across all states, ideally it should not have an impact on the future supply chain footprint.

Octroi, a tax levied on entry of goods into a town or city, forces manufacturers to locate warehouses outside city limits and move the goods into the city only when actual sales take place (to avoid paying taxes on inventory inside city limits). Thus, Octroi may lead to addition of a tier in the supply chain and consequently higher costs. However, Octroi has been phased out in most Indian states.

Baseline Validation: The baseline is a mathematical replica (including the flows) of the existing network modeled on past demand data. The purpose of baseline modeling is to validate assumptions made during the modeling exercise; such as those on the road distance calculations from latitude and longitude, aggregation of customer locations and products, etc. Any variance in the baseline model output from the actual costs needs to be explained and accounted for to achieve model accuracy. Typical reasons for such variances include promotional campaigns, contingency flows, network break-downs, new product introductions, etc. Once the baseline has been validated with actual costs, future models should utilize the same set of assumptions. Baseline validation is also important to the credibility of the analysis from the stakeholders' point of view.

Solution development and scenarios: Most of the tools in the marketplace have limitations on the size of problems that they can solve. Hence at times, one has to resort to incrementally building the solution as shown in Figure 11. This method can help illuminate the impact of each constraint on the model and provide more insights into the supply chain, thus enabling easy buy-in from the stakeholders. Needless to mention, a tool which can solve for a global optimal solution would be preferred over generating the solution incrementally.

Figure 11. Incremental solution development



Source: Deloitte Consulting LLP

Another important aspect of a supply chain network exercise is scenario analysis. Scenarios can help companies understand the impact of certain changes in assumptions and whether the recommended network is robust enough. Efforts should be taken to identify the right scenarios to evaluate, given that the lowest-cost solution is usually unlikely to be the optimal solution for the business. Most of the questions listed in Figure 10 can be answered through an iterative scenario modeling process.

Exports: With the Government encouraging exports through development of Special Economic Zones (SEZs) and Export Oriented Units (EOUs), several global manufacturing firms have been evaluating India as a potential manufacturing hub to cater to Asia-Pacific demand. The challenge lies in reconciling the export and domestic demands and creating an integrated supply chain that effectively addresses redundancies, overlaps and shortages.

Modeling exports requires a careful study of provisions for SEZs and EOUs and the associated clauses for settling the exemption claims. One approach is to treat exports as demand points at port locations like Chennai, Mumbai and Kolkata. However, export products should be treated as different from domestic products to capture the benefits associated exclusively with export production.

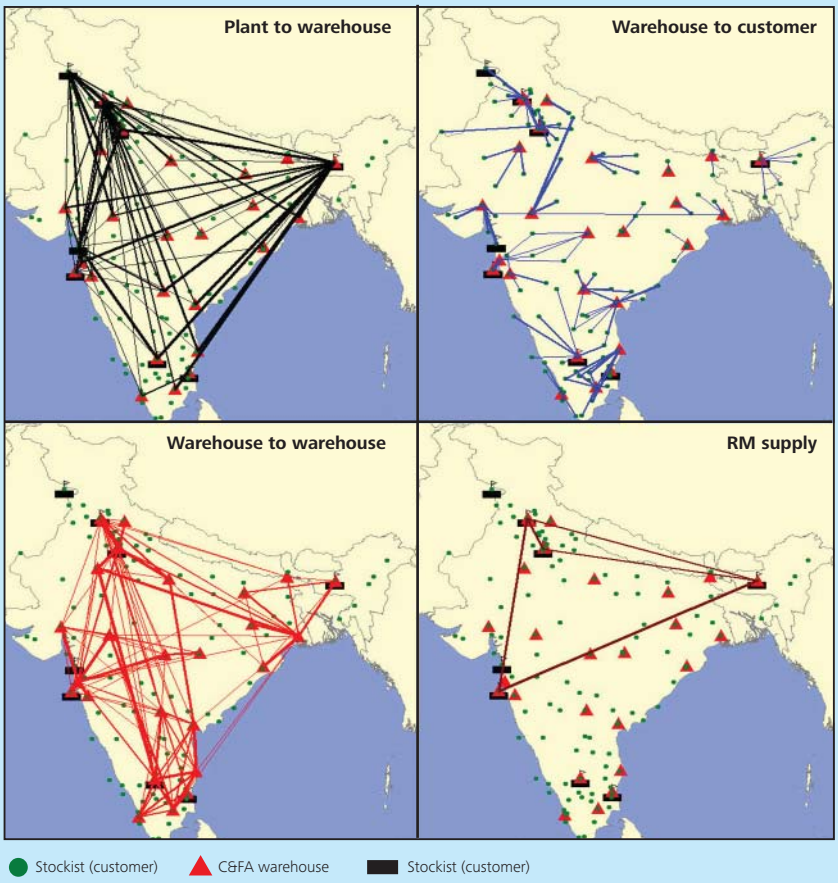
Case Study: How a global CPG manufacturer optimized its footprint to serve India

A global consumer products manufacturer recently reconfigured its supply chain in India to position itself for continued growth in domestic and global markets.

Deloitte's Assistance

Deloitte helped the company conduct in-depth mathematical analysis and leverage innovative methods for addressing complexity and uncertainty to develop a low–cost, agile and integrated supply chain footprint. Deloitte also helped the company employ an incremental approach to developing the solution since the problem size and variability were too complex to handle for global optimization. This not only helped the company clearly understand the rationale behind the recommended configuration, but also yielded a phased transition plan that minimized the impact on their existing business. Of particular relevance was the tax implication on the existing footprint. Some of the fiscal benefits that the company currently enjoys are phasing out and Deloitte helped them rethink their supply chain configuration to minimize the impact and move to a more optimal tax vs. logistics footprint. Figure 12 displays the optimized network footprint and the corresponding supply lanes opened as a part of the solution.

Figure 12. Optimized supply chain configuration



Source: Deloitte Consulting LLP

Conclusions: Look before you leap

Designing an India supply chain catering to over a billion people, spread across several hundred cities and more than half a million villages is a formidable task in itself. Considering the regional variations, complex tax structure, infrastructure obstacles, rising customer expectations and the uncertainties involved, the use of scientific methods may seem infeasible. Yet, a scientific approach enabled by technology is a better, and may be the only, way to tackle a challenge of such magnitude.

The multi-layered and complex Indian tax structure with regional tax incentives may lead to supply chain decisions that may appear logistically suboptimal or even inefficient. With the taxation structure in transition, several assumptions and considerations may need to be revisited periodically.

Though the complexities of the India supply chain may appear overwhelming, understanding and mastering them is a critical success factor for an organization attempting to serve customers in India. An efficient India supply chain design will help better position companies in what is becoming an increasingly competitive marketplace.

Endnotes

[1]Web site of the Planning Commission of India

[2]http://www.jansamachar.net/display.php3?id=&num=5433&lang=English

[3]NCAER data

[4]Cygnus Report, September 2006

Authors

Darin Buelow
Principal
Deloitte Consulting LLP
+1 312 486 2096
dbuelow@deloitte.com

Raman Nath
Consultant
Deloitte Consulting LLP
+91 40 6670 7983
rnath@deloitte.com

Mohan Ram Akella
Senior Consultant
Deloitte Consulting LLP
+91 40 6670 4829
makella@deloitte.com

Additional Industry Contacts

Pat Conroy
Vice Chairman
U.S. Consumer Products Leader
Deloitte LLP
+1 317 656 2400
pconroy@deloitte.com

Tim Hanley
Vice Chairman
U.S. Process & Industrial Products Leader
Deloitte & Touche LLP
+1 414 977 2520
thanley@deloitte.com

Nick Handrinos
Principal and U.S. Consulting
Leader, Consumer Products
Deloitte Consulting LLP
+1 203 905 2723
nhandrinos@deloitte.com

Tom Marriott
Principal and U.S. Consulting
Leader, U.S. Consumer & Industrial Products Leader
Deloitte Consulting LLP
+11 973 602 5340
tmarriott@deloitte.com

Adam Mussomeli
Principal and U.S. Supply Chain &
Operations Leader, Consumer Products
Deloitte Consulting LLP
+1 203 905 2646
amussomeli@deloitte.com

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