

# ***THE INTERNATIONAL JOURNAL OF BUSINESS & MANAGEMENT***

## **Forecasting and Supply Chain Performance: A Study of Telecom Sector in India**

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### **Abstract:**

*Telecom sector plays a crucial role in infrastructure development of a country and its economy. Supply chain management is management of linkages of interrelated or inter-woven activities of businesses for providing products and services to end-customers in a supply chain. Both supply chains as a concept and telecom sector in India came into limelight in the last 15-20 years. This paper deals with challenges in demand forecasting of equipment required in networks of telecom sector. Organisations who forecast effectively can gain trust across functions as well as across organisations with suppliers, distributors and customers leading to an effective supply chain which gives competitive advantage. Forecasting challenges impact performance of the supply chain. The Paper involves review of pattern of forecasting in telecom sector with details on the challenges to forecasting such as regulatory scenario, competitive environment for telecom operators and equipment vendors and its impact on supply chain management. Due to the sudden growth of the sector and rising pressure on revenues, network growth, and expansion across multiple technologies, industry approach towards demand forecasting remained on reactive rather than proactive basis. Due to this, industry could not enjoy the fruits of optimization of supply chain management and due to urgencies organizations in sector concentrated on inventory built-up to address customer service prospects leading to non-realization of the best value from its supply chain. Customer facing teams forecast aggressively to meet business targets to facilitate more than sufficient inventories to meet customer requirements, but requirement changes abruptly in last minutes due to sudden changes in environment. As a result teams avoids long and mid-term forecasts which results in sudden order of goods without appreciable forecast time resulting in delayed deliveries and lost opportunities.*

**Keywords:** *Supply chain management, telecom sector and forecasting*

### **1. Introduction**

The dominant role acquired by telecommunications in the global business management and its effect on national economies has seen telecom service develop as a vital backbone and utility service for business and industry. It is universally agreed that telecom sector contributes to the overall socio-economic development of a country. The development of a country to its full potential can never be attained without modern telecom services. Success story of telecom in India has got only few parallels in the world. With just about 5.07 million connections in 1991, when liberalization started, it has grown to be the world's second largest network with a subscriber base of 910 million at the end of 2014. (Telecom Regulatory Authority of India, 2013) (Telecom Regulatory Authority of India, 2010) Subscriber base had further expected to grow 983 million in April 2015. As a result of the policy and regulatory initiatives over the years, the growth of subscribers connected to the Indian telecommunications network has seen a compound annual growth rate (CAGR) of 44.66 percent over last five years. (Telecom Regulatory Authority of India, 2011)

The number of connections is projected to grow to one billion in this year taking the tele-density to about 100 percent. According to a KPMG report, (KPMG and FICCI with Department of Telecom (DOT) and others, 2010) the sector currently has about five million jobs and this number is expected to increase to 20 million. The prospects of continued aggressive growth and availability of a big pool of skilled manpower hold immense potential for the sector.

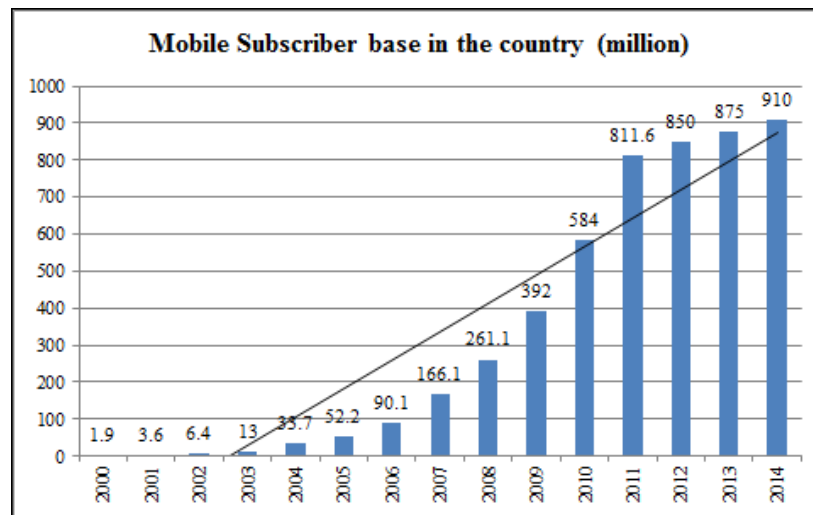


Figure 1: Number of Wireless Subscribers, 2000-14

Source: Telecom Regulatory Authority of India, Multiple data bases

1.1. Role of Telecom Sector in Country’s Development

Telecom sector plays a crucial role in infrastructure development of a country and its economy. In last two decades sector continues to be key growth sector for all leading economies Key contributions from telecom sector to the development of country are GDP contribution, employment to native citizens, infrastructure development of country, foreign direct investments, and growth of other sectors like IT, ITES, and financial. The telecom Sector has a multiplier effect on the economy and plays a vital role in economy by way of contributing to the increased efficiency through development basic infrastructure of the country. As per UNCTAD (United Nations Conference of Trade and Development) there is a direct relation between mobile tele-density and growth in GDP per capita in developing countries. In India, the impact from this sector to Indian GDP is swelling progressively from being one percent in financial year 1992-93 and in 2010 it contributed three percent to GDP. (FICCI, 2012) Sector gives employment to native citizens and with skilled expertise available in the field these resources become global resources as well and are considered assets for organizations globally. Sector is connecting to each and every part of country like any other basic infrastructure. Today, telecom is the one of the major sectors attracting FDI inflows after services and computer software sector. In the telecom sector FDI up to 49 percent is allowed under the automatic route and beyond that up to 74 percent is permitted through the Foreign Investment Promotion Board (FIPB), a government body. Development of telecom sector results into availability of inputs for basic infrastructures of IT-ITES sector and telecom become the backbone of this sector.

1.2. Brief Evolution of the Indian Telecom Industry

Indian telecom industry, though being 165 year old, was under government ownership until 1984. Post 1984 private sector was allowed entry in telecom equipment manufacturing. Until 1990 the Government of India held a monopoly on all types of communication because being driven by pre-independence Telegraph act of 1885. Post liberalization era (1990-99) Indian telecom market is one of the most liberalized markets in the world with private participation in all segments. Growth in the sector was further spearheaded with announcement of new telecom policy (NTP 1994 and NTP 1999) and with the formation of Telecom Regulatory Authority of India (TRAI-1997). Post 2000, Bharat Sanchar Nigam Limited was established and Videsh Sanchar Nigam Limited was privatized (2002). With launch of mobile telephony 2002 onwards there was no looking back for this sector and growth was fuelled further with an increase in limit of foreign direct investment (FDI) to 74 percent in year 2005. With explosive data growth, third generation (3G) and fourth generation (LTE) technologies are now the key drivers for telecom sector nowadays.

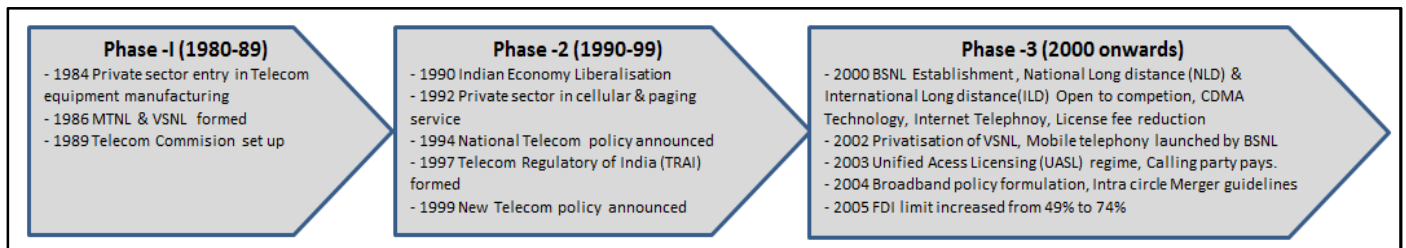


Figure 2: Major Phases of Growth of Telecom industry

Source: D & B Research, Overview of Indian Telecom Sector, Retrieved July 24, 2014, from <https://www.dnb.co.in/IndianTelecomIndustry/OverviewTI.asp>

### 1.3. Revenue and Debt Challenges

At present telecom industry is going through changing time wherein on one side revenue is under constraint and on another side cost is on the upward side because of the requirement of modernization of network to cater to new technologies. Major challenges which are being faced by the telecom industry are downward trend in subscriber growth, cost and efforts required for network re-engineering, maximization of return on capital, adaption to new technologies due to data explosion, tough regulatory scenario, renewal charges of the spectrum and ecological challenges due to electronic waste generation. Owing to these challenges telecom industry is going through a tough phase. While the industry hopes to hit the one billion subscriptions mark it continues to be deeply constrained by the negative growth witnessed in 2012. At the end of the calendar year 2012, the Indian telecom industry closed with revenues of Rupees 1,487 billion or USD 27 billion, a meagre 2.3 percent of the estimated global telecom revenues of USD 1.16 trillion. The industry's total debt is up 200 percent from Rupees 827 billion in 2008-09 to Rupees 2500 billion in 2012-13.

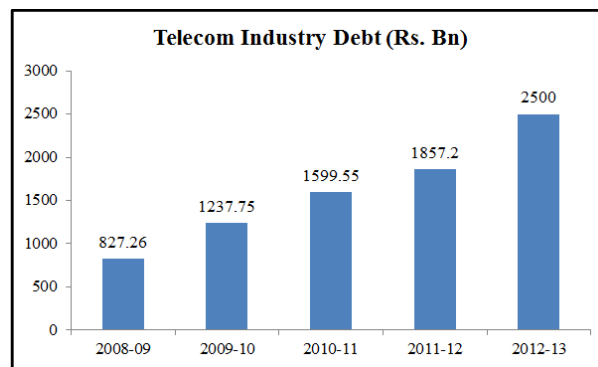


Figure 3: Mounting Debts in Telecom Industry  
Source COAI, company reports, PWC

Moreover additional costs coming from above mentioned challenges will also add further debt to debt ridden industry. The growth in the spread of telecom infrastructure and provision of services is humungous and this rapid growth resulted into some processes in supply chains which are modest as sector was prima facie revenue centric. Need is felt that it is high time that cost needs to be optimized to manage the risk getting generated through these challenges. On the basis of technical aspects telecom sector in India is bifurcated into two segments mainly on wireline and wireless technology. Wireline subscribers are only three percent of total subscribers hence throughout this study concentration is given to wireless subscribers and related organisations since they represent 97 percent of industry. (Telecom Regulatory Authority of India, 2013) To become a force in the global telecom space, India needs to create an efficient and globally competitive supply chain system across the telecom sector. Organisations need to minimise the cost wastage getting generated in the process by initiating critical thinking on components of process. This study brings out one such component of telecom industry which can help to improve the performance of industry, which is demand forecasting in supply chain management. Supply chain management's main role is to integrate processes or major business functions which run through or across organization. For management of risk in telecom sector, supply chain has to play a major role in synchronizing processes to boost organisational performances. Supply chain performance impacts the organisation's performance as it relates to its ability to deliver goods and services in the precise quantities and at the precise times required by customers'. (Green Jr, Whitten, & Inman, 2008) Bowersox et al. (Bowersox, Closs, Stank, & Keller, 2000) incorporate performance metrics such as customer satisfaction, delivery speed, delivery dependability, and delivery flexibility.

## 2. Relationship Matrix in Supply Chain of Telecom Sector

Every telecom circle in India out of these 22 circles is being managed by 3-4 network operators and these telecom operators spend a major portion of their capital budget to buy equipment from equipment suppliers. The major portion of this money is spent on buying imported equipment mainly from Europe and China. These equipment manufacturers source components globally from component suppliers. Multiple network operators take the services of tower companies for building, operating and maintaining the passive telecom infrastructure sites which can accommodate multiple service providers

### 2.1. Players in Relationship Matrix

The telecommunications supply chain originates with the sourcing of components like semiconductor chips and software. Components supplied by components' suppliers (C1-C6) are incorporated into telecom equipment manufactured and supplied by equipment vendors (E1-E4) purchased by telecom service providers (NO 1). In present times of telecom market upsurge globally, order books of these component and equipment suppliers are over booked and customer who forecasts timely or pay premium gets maximum supplies. The telecom service providers, then use this equipment to build new networks with the services of installation, infrastructure and logistics service providers (S1-S3). Telecom service providers provide services to the end users and charge them with the services of billing software providers. In the course of provision of services to end users telecom service providers takes services of equipment, infrastructure and logistics service providers for maintaining their existing network.

With the advent of new technologies and due to cease of service support for obsolete equipment or components, telecom service providers need to renew their network resulting into huge amount of electronic scrap getting generated. These electronic scraps need to be disposed in environment friendly manner through recyclers (R). All these constituents of telecom supply chain are connected with each other with their complex contracts and their ways of working. Following are major players in the relationship matrix of sector

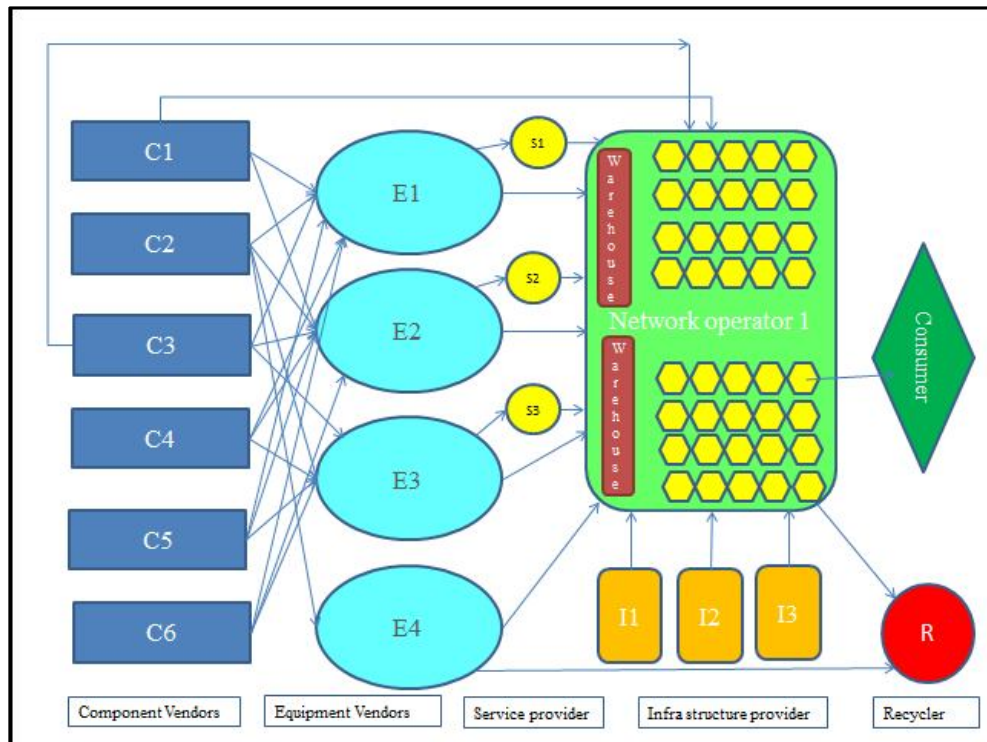


Figure 4: Supply Chain Relationship Matrix

### 2.1.1. Service Provider / Network Operators

Network operators in 22 telecom circles operate over multiple technologies. Major technologies in which they operate is 2nd generation GSM (Global system for Mobile communications) (2G), 3rd generation GSM (3G), WCDMA (Wideband Code Division Multiple Access) and 4<sup>th</sup> generation Long Term Evolution (LTE). Few operators like Sistema Shyam, Reliance communication and Tata DoCoMO etc. are also operating on older CDMA (Code Division Multiple Access) and fixed wire line technology. The core telecom service providers are Aircel, Airtel, Idea, Vodafone, Videocon, Loop , Spice, Reliance Communications, HFCL, Tata Tele, Telewings, Bharat Sanchar Nigam Limited (BSNL), Mahanagar Telecom Nigam Limited (MTNL) and Sistema Shyam Telecom. These telecom providers are associated with each other with two non-regulatory bodies - Cellular Operators Association of India (COAI) and Association of Unified Telecom Service Providers of India (AUSPI).

### 2.1.2. Equipment Suppliers

According to research agency Ovum Indian telecom sector will constitute 6.6 percent of the global demand for telecom equipment in 2014-15. (Gupta, 2014) The industry expects it will spend 467 billion rupees on buying telecom equipment excluding mobile phones. The major portion of this money will be spent on buying imported equipment mainly from Europe and China. According to the Telecom Systems Design and Manufacturing Association (TSDMA), Indian firms that design and manufacture and also have intellectual property had only three percent share of equipment market in 2012-13. Adding Indian made products from foreign companies that have factories in India raises the share to 10-12 percent. Moreover, work in India is limited to assembly, integration and packaging. The revenue for design, electronics component and the intellectual property which is a major portion of this value in telecom gear goes back to exporting or parent country in form of foreign exchange. Manufacturing telecom equipment in India is comparatively costly because of grant available to global companies in their own country in form of financial loans, lesser infrastructure cost, less power, costs as well as safeguarding available to them through the WTO in form of zero percent custom duty. However, in the recent budget in 2014 government of India increased custom duty on core telecom equipment to promote Indian manufacturing. The telecom equipment business is controlled by five companies - Huawei, ZTE, Ericsson, Nokia Siemens, and Alcatel, with limited representation from other equipment vendors like Samsung, Tejas, and ECI

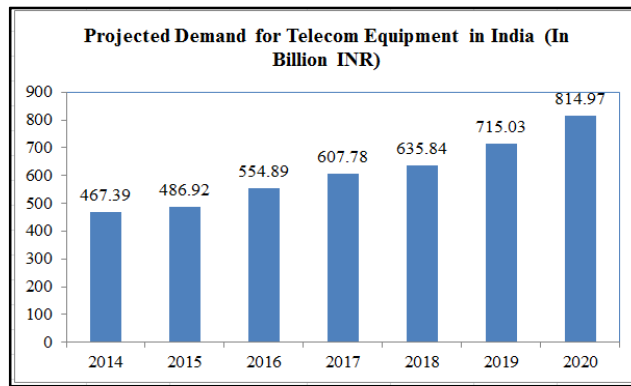


Figure 5: Projected Demand for Telecom Equipment (In BINR), 2014-20

Source: Gupta, S. D. (2014, Apr 29). Over 90 percent of telecom gear in India's Rs 50,000-cr market is imported. Retrieved July 29, 2014, from Business Standard: [http://www.business-standard.com/article/companies/over-90-of-telecom-gear-in-india-s-rs-50-000-cr-market-is-imported-114042900254\\_1.html](http://www.business-standard.com/article/companies/over-90-of-telecom-gear-in-india-s-rs-50-000-cr-market-is-imported-114042900254_1.html)

Out of total equipment market of 467 billion rupees only three percent Indian products and if we add share of Indian manufactured products then also this share goes to 12 percent. Situation can be recovered only if government initiates steps to boost local production. That would involve review of end to end cycle of manufacturing scenario in telecom sector and taking necessary steps to promote manufacturing of Indian products which can be optimization of duty structure over period of time to discourage imports, discounting license fees from network operator whosoever buy Indian products, providing funds for research etc. The government intends that by 2019-20 only 20 percent of telecom equipment in the country should be imported.

Year	Per centage share Indian companies manufacturing Telecom equipment	Per centage share of Indian Manufactured firms
2007-08	2%	9.16%
2008-09	2%	10.41%
2009-10	3%	12.32%
2012-13 estimate	3%	12-20%

Table 1: Share of Indian Manufacturing in Telecom Equipment Market, 2007-13

Source: Gupta, S. D. (2014, Apr 29). Over 90% of telecom gear in India's Rs 50,000-cr market is imported. Retrieved July 29, 2014, from Business Standard: [http://www.business-standard.com/article/companies/over-90-of-telecom-gear-in-india-s-rs-50-000-cr-market-is-imported-114042900254\\_1.html](http://www.business-standard.com/article/companies/over-90-of-telecom-gear-in-india-s-rs-50-000-cr-market-is-imported-114042900254_1.html)

Note: Indian companies means companies with intellectual propriety rights in country Indian Manufactured firms include foreign firms manufacturing in India, whose IPR resides overseas.

### 2.1.3. Component and Sub-Assemblies' Suppliers

Most of electronic components' suppliers are overseas suppliers such as Free-scale, ST Electronics, Intel, Flextronics, Harris Stratex, Marconi, and Volex who caters to global telecom and electronics customers. With present telecom market upsurge globally order books of these components suppliers are overbooked and customer who forecasts timely or pay premium gets maximum supplies. With advent of new economies like China and their economic policies for securing intellectual property rights of components had given opportunities to these global companies set their manufacturing facilities in China and transfer technology to those companies. But due to economical and technology transfer policies in India, country is still struggling to make in India rather than concentrating on Indian products. Other than these suppliers few suppliers with manufacturing facilities in India are Commscope, Jabil, ADC Krone, Delta, Sterlite, Amphenol and Agilent. Indian suppliers who have products of 100 percent Indian origin are very few in numbers, but there are few who are in low value addition cases manufactures as per imported technologies these are such as Shilpi cables, Surabhi Telecom. Most of these suppliers supplies their components and sub-assemblies to equipment vendors but in some cases based on individual business cases telecom service providers buys subassemblies like antennas system directly from these subassembly suppliers.

#### 2.1.4. Infra-Structure Providers

The skylines of Indian cities and villages have transformed over the past 10 years due to cropping up of telecom towers which mostly are on top of the tallest buildings. These towers provides network coverage to subscribers and present count of towers stands around 500,000+ covering more than 90 percent of the country's land area. Most of these towers fabricated from of iron angle bars with GSM antennas (Rectangular), radio unit and microwave antennas (mostly round) mounted on them which are connected with cables to a small shed at the base which houses radio frequency and transmission electronics. Tower industry has been separated from the telecom services sector to get this a status of infra-structure industry. Keeping tower companies separate give added benefits to telecom operators e.g. optimised capital investment, faster time to market, operational efficiencies, and revenue maximization etc. Tower Company's business model of infrastructure sharing is based on building, owning, operating and maintaining the passive telecom infrastructure sites which can accommodate multiple service providers. Maintaining these towers poses a tough challenge for the tower players due to multiple factors like fuel consumption for power generation, strict guidelines of radiations, power usage, theft of equipment from site, land lord and owner issues, terrorist activities, guidelines on green telecom, clearance from municipal, government, community, and environmental bodies etc.

#### 2.1.5. Service Providers for Contract Servicing, Logistics

Installation, operations and maintenance services for most of telecom equipment for telecom service providers are being carried out by equipment vendors by engaging authorised service partners. Similarly, infrastructure providers create, operate and maintain infrastructure of telecom towers and other telecom equipment either directly by themselves or through service providers. Telecom service providers had entered into multibillion contracts with equipment vendors or infrastructure providers for providing services related to creation and maintenance of networks. In order to ensure end to end responsibilities for deliverables of turnkey projects these equipment suppliers and infrastructure providers extend non-core services such as logistics service to their customers by engaging Indian or global logistics service providers such as DHL Logistics, D B Schenker, Sindhu Cargo , Kuhne Nagel, Panalpina , Blue dart, Om Logistics, AFL Logistics, Spear Logistics, Vision Freight carriers.

#### 2.1.6. Recyclers

As a resultant of renewal of their network due to need of upgraded technology to milk existing network huge amount of electronic scrap is getting generated. This shall certainly leave an impact on environment if not disposed properly, but there are limited recyclers available in country who disposes this scrap in an environmental friendly manner and majority scrap ends up in the open market damaging environment.

Other than above mentioned constituents, there are software providers in the telecom supply chain such as TCS, IBM, Microsoft, Oracle, Wipro and Infosys who provides basic telecom software as well as charging solutions.

### *2.2. Comprehensive View of Major Players in Supply Chain Relationship Matrix*

Indian network operators are credited with pioneering the business strategy of outsourcing of their business operations except marketing, sales and finance and building the 'minutes factory' model of low cost and high volumes. Success of this strategy has since been adopted by several operators globally. Operators' network base stations, microwave links are maintained by equipment manufacturer such as Ericsson, Huawei and Nokia Siemens Network and information technology support is provided by software support service providers such as IBM, Wipro and Microsoft. Transmission towers are maintained by infrastructure companies like Indus Towers, Bharti Infratel Ltd., Viom Networks, and Reliance Infrain India. Network operators in sector, collaborate with each other through two non-regulatory bodies. Cellular Operators Association of India (COAI) is the official voice for the cellular industry in India and it interacts on its behalf with the licenser, the telecom industry associations, the management spectrum agency and the policy makers. The core members are Aircel, Airtel, Idea, Vodafone, Videocon, Loop and Spice. The tower telecom companies and equipment manufacturers are also part of this association. Association of Unified Telecom Service Providers of India (AUSPI) is the representative industry body of Unified Access Service Licensees providing telecom services in the country with CDMA and GSM technology, fixed line services and value added services. The Association interacts on policy and regulatory issues with various government bodies and other apex industry organizations on behalf of its members. The association formulates expert opinion on industry issues and submits recommendations to the concerned authorities. The members of AUSPI are Reliance Communications, HFCL, Tata Tele and Sistema Shyam Telecom.

Most of equipment manufacturers have long term supply and managed services contracts with network operators where they design and maintain networks for telecom service providers on end to end basis. Equipment supplied by these equipment manufacturers are either imported or Indian manufactured. There is less than three percent share of Indian Products in total equipment of market of approximately 500 billion Rupees. Telecom operators because of their business cases do not put that much stress on Indian products because of price issue and no such product is designed and developed in India which can replace quality of foreign made products. Operators may be correct in their standpoint because they are busy in fighting a bitter battle for subscribers and operating margins. Tower industry has been separated from the telecom services sector to get this a status of infra-structure industry and to initiate cost optimization in telecom companies which are fighting for margins due to competitions. Keeping tower companies separate give added benefits to telecom operators, e.g. optimized capital investment, faster time to market, operational efficiencies, and revenue maximization etc. Tower Company's business model of infrastructure sharing is based on building, owning, operating and maintaining

the passive telecom infrastructure sites which can accommodate multiple service providers. The savings in budgets due to sharing of infrastructure can be used to other core fields which shall yield higher margins.

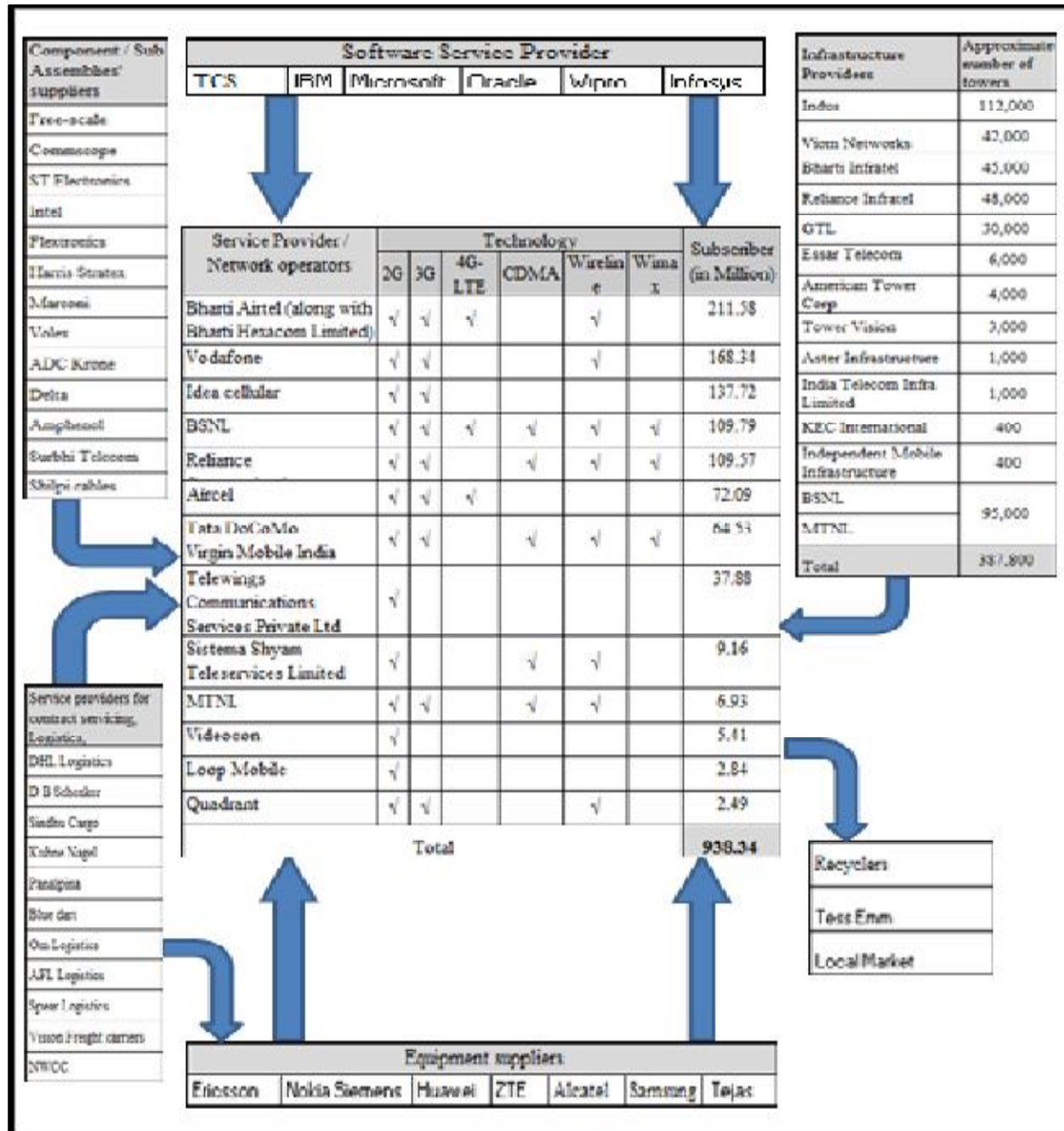


Figure 6: Interrelationship between Major Corporate Players in Telecom Supply Chain in India

Source: Telecom Regulatory Authority of India, Press Release No 37/2014, Highlights on Telecom Subscription Data as on 31st May, 2014. New Delhi, Wikipedia, Mobile network operators of India, Retrieved July 29, 2014, from Wikipedia: [http://en.wikipedia.org/wiki/Mobile\\_network\\_operators\\_of\\_India](http://en.wikipedia.org/wiki/Mobile_network_operators_of_India) and company reports

### 3. An Empirical Assessment of Forecasting Constraints

India is able to drive innovation when it comes to software services in the telecom space but the results are not encouraging when it comes to developing telecom equipment or its components. As a result, the domestic telecom equipment manufacturing segment is not able to meet the demand created by other segments of the telecom ecosystem forcing the telecom operators to import most of the equipment. Telecom sector being high-technology sector requires a number of technical and commercial decisions to be made timely and accurately. Many of these decisions depend upon knowing the likely numbers of customers and their usage patterns that means demand forecasting. In the absence of current operating data, these decisions can be made on the basis of forecasts of customers and usage. On analysis of responsibility matrix of supply chain it is clear that any change in traffic conditions of telecom service providers

requiring additional equipment may require a good amount of time because of series of partners required to execute multiple tasks. For equipment vendors demand forecasts are needed to guide availability of updated products with upcoming technology choices and decisions. Similarly forecasts are required by service providers to arrange and manage resources timely so that projects can be delivered in structured manner. During primary data collection of product delivery time we found out that delivery time of equipment are going up to or more than ten weeks in 43 percent of cases and if we add logistics and services execution time we found that most of the time by the time equipment is integrated in network either traffic conditions changes or it worsens requiring change is in original design. This ultimately results into both inventories over runs and shortages. During primary data collection from senior members of telecom sector, we found that at least 56 percent of respondents feel that forecasting is one of the top two important constituents of telecom sector supply chain and almost 72 percent feel that it is one of the top six important constituents of telecom sector supply chain.

Rank for Forecasting	1	2	3	4	5	6	7	8	9	10	11	Total
% of Respondent	40%	16%	Nil	4%	4%	8%	4%	Nil	Nil	8%	16%	100%

Table 2: Ranking of Forecasting among Supply Chain Constituents

Note: Ranking was obtained through primary data collection among eleven supply chain constituents such as forecasting, purchasing, vendor development, logistics, analytics, IT and ERP tools, warehousing, human resources, inventory management, training and, any other tool from respondents associated with most of telecom sector companies.

At least 68 percent of respondents feel that forecast accuracy level for long term forecasts can touch 40 percent or lower and at least 12 percent among those feels that annual forecast accuracy level may drop to 15 percent as well. Situation is little bit better when we analysed the forecast accuracy level of mid-term forecast where in only 28 percent of respondents feel that forecast accuracy level can go as low as 40 percent but still here we find here only 8 percent of respondent feels that they can forecast with accuracy level greater than 90 percent that means organisations are not able to visualise their demand with 90 percent accuracy even in one quarter advance.

Forecast Accuracy	Accuracy < 15%	Accuracy 15% to 39%	Accuracy 40% -64%	Accuracy 65%-89%	Accuracy > 90%
Long term scenario (Annual)	4%	8%	56%	28%	4%
Mid term Scenario (Quarterly)		4%	24%	64%	8%
Short term (Monthly)	4%	8%	8%	12%	68%

Table 3: Achievable Forecast Accuracy in Present Scenario

Note: Accuracy inputs were taken out through primary data collection among eleven supply chain constituents from respondents associated with most of telecom sector companies.

Only during short term monthly forecast we found that 68 percent respondents feel that they can achieve forecast accuracy level greater than 90 percent. To summarise, with product delivery lead times running up to ten weeks and only eight percent of time forecast accuracy level greater than 90 percent challenges to supply chain are inevitable leading to impacts on supply chain and organisation performance.

#### 4. Forecasting Challenges

Having briefly outlined the present scenario of forecasting in telecom sector in India, we are able to identify following challenges to forecasting:

##### 4.1. Regulatory Scenario and Business Approach

With sudden growth in this evolving industry marred by multiple scams regulator is forced to impose tough and too much dynamic regulatory norms. This dynamism in regulatory scenario is spreading confusion in industry resulting into difficulties in prediction and anticipating the future demand. With new government in place in 2014, expect that tough regulatory environment shall prevail in next five years at least. Tough regulatory scenario impacting revenue growth is putting pressure on industry to monitor and control cost and is resulting into business approach of putting pressure on faster rollouts of projects with short term or negligible forecasts. These urgencies and approach of addressing projects in killing time leaves the important aspects of forecasting and results into addressing the immediate requirement with available technology or product line.

##### 4.2. Forecasting Tools Techniques and Metrics for Measuring Supply Chain Performance:

In absence of any tool for forecasting which can capture variability of business environment of telecom sector and translates into product or component level forecasting most of forecasting in sector is manual. This manual forecasting approach is based on predictive or judgmental capabilities of individuals which vary overnight resulting into very low or negligible forecast accuracies.



Forecasting doesn't seem to appear in hierarchy of structured supply chain metrics of telecom sector's organisation in India and it becomes difficult to judge approach to continuous, effective, and efficient performance measurement and improvement in forecasting. Hence it becomes difficult to identify the most effective corrective action to take lack of IT tools, processes, and professional competencies to achieve accurate forecasts.

#### 4.3. Fast Changing Technical Environment

With influx of smart phones, data growth is clearly visible and expects a data explosion in next five years. Industry especially operators have to refocus their efforts on engaging customers through services and experience. With advent of new technologies every year to address data growth and due to competitive requirement, telecom service provider finds forecasting tough across multiple technologies.

#### 4.4. Consumer Reaction to Market Strategies

Forecasting of any equipment or a service requires considerations of dynamics of market and which is not easily attainable in Indian scenario. Sometimes trend data from other global markets is available but an unsettled market environment may render past data almost non useable but this data may obstruct the forecaster from recognizing new opportunities, variations in trends, and market dynamics. When so ever new product and service is launched by telecom service provider considerable opportunity exists for each consumer regarding the product and service characteristics, and as a result significant uncertainty exists to forecast the likely levels of demand as consumer reaction towards opportunity is un-predictive. In addition, the long planning and implementation periods required for many new telecommunications services may add to the forecasting uncertainty.

#### 4.5. Synchronisation of Deliverable across Constituents of Supply Chain

Multiple products components or subassemblies are required to address requirement of a new site. To optimise the immediate cost of purchase buyer goes for buying the product from multiple sources but by virtue of different supply chain for these products lead times of these varies and some of the time these variations can go up to 8-10 weeks as well impacting deliveries and future forecasting of projects.

#### 4.6. Understanding of Supply Realities

Most of the time key decision makers do not or do not want to understand supply realities of organisations associated as they consider threat of business loss will drive supplier to deliver the goods in timely manner without forecast. This results into short term forecasts based on their immediate requirement making it challenging for supply chain.

#### 4.7. Trust and Collaboration Level amongst Supply Chain

Due to competitive scenarios across equipment vendors there are aggressive marketing approaches to commit deliveries to telecom service providers without forecast. Failure to meet those commitments reduces trust and transparency levels among constituents resulting into increased challenges to forecast towards equipment and component vendors. In case supply chain constituents understand and collaborate with each other to identify and de-risk the challenges to forecasting the accuracy level of forecasting reduces but in case these constituents remain in their water tight boundaries of their respective contract challenges to forecasting remains.

### 5. Conclusion

This study primarily is an effort to understand the present dynamics of telecom sector supply chain relationship and forecasting scenario in telecom scenario. Fast changing environment of telecom sector coupled with unclear regulatory scenario, lack of adequate tools or methods for forecasting often contributes to deviation in forecast accuracies. None of us knows the future exactly hence no forecast can ever be entirely accurate but question here is of accuracy of prediction and justification with which one can clarify acceptable assumptions in support of a particular forecast. Moreover the forecast process has to be dynamic because environment is not sacrosanct and challenges keeps on changing daily basis. In our view opportunity exists for software developers to develop product package which can capture dynamics of market during start up or execution of a service and convert it to forecasts for supplier and service providers. In order to bring efficiencies into supply chain and organisations there is a need to define a structured software package based system to capture the changing environment and alert its constituents to increase the speed and agility of company in responding to changes in its external environment.

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