

## **The state of Set Top Box Industry in India: Issues and road ahead. A Tech-business ecosystem perspective**

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**Abstract:** *This paper provides a detailed analysis of the current trends prevalent in the Set Top Box (STB) industry in India. The persistent demand -supply gap for STBs and the lacunae of Indian electronic hardware manufacturing is under review. This paper attributes the chequered and lopsided growth as well as heavy reliance on the imported components and finished products to the technology business ecosystem in which STB industry is operating. The immediate context of ecosystem of STBs is focused in terms of the concentric yet overlapping circles of STB manufacturing companies, producers of sub-systems and the component manufacturers. Subsequently, the way in which the policy regime and economic system which in short can be called as the wider tech business ecosystem has significantly contributed to the present state of STB industry in particular and electronic hardware in general has been brought out. Finally, the policy considerations that emerge from the immediate and wider tech business ecosystem have been identified and presented.*

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### **I. Introduction**

This article maps the trajectory of growth of Set Top Box industry in India. It analyses the context of rapid rise in demand for set top boxes and how the domestic as well as the international manufacturers and suppliers are meeting this demand. This paper attributes the chequered and lopsided growth as well as heavy reliance on the imported components and finished products to the technology business ecosystem in which set top box industry is operating. Technology business ecosystem provides a point of departure and helps to capture the dynamics in terms of interrelated networks within this segment of electronic hardware (with the associated, embedded and application software). The tech business of ecosystem of STBs is analysed in terms of the concentric yet overlapping circles of set top box manufacturing companies, producers of subsystems and the component manufacturers. Each one of these verticals is analysed in terms of their market presence, strengths and weaknesses in the wider network of tech business ecosystem comprising of technology relevant policy regimes, protocol processes and facilitators of technology transfer and commercialisation. An analysis of these issues helps to capture the dynamics at work in the technology business ecosystem for the electronic hardware industry in general, helping to draw wider policy inputs.

### **II. Satellite Television and Set Top Box Industry: Growth and Technology**

This section brings out the growth of the satellite television, set top box sector and the concepts of Digital Video broadcasting (with the attendant Controlled Access).

#### **a. Satellite Television**

High demand for satellite TV and its concomitant set top box has become a settled fact today. However, it all started few years back. It won't be entirely incorrect to state that discovery of set top box laid the foundation of present day satellite TV channel services. Upon its emergence, it threatened to end almost twenty year old monopoly of cable operators. The resentment from cable operators soon followed. However, by that time it became clear that set top boxes will be an integral part of future in house entertainment package. Unfortunately, the innovation received a lukewarm response. But soon satellite TV service providers followed and everything changed. With this, set top box too had its share of success as it featured a prominent part of the package of services offered. Disappointing service standard of cable operators is inciting people to switch to satellite TV along with set top box. This automatically means the future looks quite bright for being in the business of set top box, not just about manufacturing set top boxes.

#### **Set top box and the modern Television**

Set top box is one device that is connected to television. The device serves as a connecting link between television and satellite. Thereafter, the set top box translates signal received via satellite and convert it into television content. To make it simpler, it acts as television that guarantees seamless transfer and conversion

of link into television content. Currently, a set top box has become a compulsory accessory i.e. part of every satellite TV package.

**b. Digital Video Broadcasting and Conditional Access (DVB-CA)**

Digital Video Broadcasting (DVB) is suite of open standards for digital television. The DVB Project is an Alliance of about 200 companies, originally of European origin but now worldwide. Its objective is to agree specifications for digital media delivery systems, including broadcasting. It is an open, private sector initiative with an annual membership fee, governed by a Memorandum of Understanding (MOU).

DVB is a standard defining a one to many unidirectional data network for sending digital TV programmes over satellite, cable, and other topologies. The standard enables the broadcasting industry to offer hundreds of pay-tv channels to consumers. The expanded capacities make the broadcast signals more valuable and attractive to signal thefts. To protect a DVB data network, the DVB standard integrates into its broadcasting infrastructure, an access control mechanism, commonly known as conditional access, or CA for short.

The DVB CA architecture manages end users access to protected contents with three elements: Data Scrambling, Subscriber Authorizations System (SAS) and Subscriber Management System (SMS). Together, they form three layers around the protected contents. Data scrambling encrypts the digital TV contents at the centre. The subscriber authorization system controls the data scrambling element by handling the secured distribution of descrambling key to authorized subscribers. Knowing which subscriber is entitled to what content, the subscriber management system deliver access permissions to the SAS for enforcement. The protection scope of the DVB CA architecture ends at the boundary where protected contents are legitimately descrambled.

**c. Set Top Box: Technology and Architecture**

Set top box (STB) means a device, which is connected to a television set at the subscribers' premises and which allows a subscriber to view encrypted pay channels of his choice on payment. The basic function of the set top box is to decrypt the signals of those pay channels which the subscriber has been authorized by the multi system operator to receive and to convert the digital signals into analogue mode for viewing on television sets.

A set top box is a device that enables a television set to become a user interface to the internet and also enables a television set to receive and decode digital television (DTV) broadcasts. DTV set top boxes are sometimes called receivers. In fact they are like a specialised computer with internet usage. A set top box is necessary to television viewers who wish to use their current analogue television sets to receive digital broadcasts.

Digital television set top boxes is used for satellite, cable and terrestrial DTV services. They are especially important for terrestrial services because they guarantee viewers free television broadcasting. In India, a set top box price ranges from INR 850-1000 for basic features to over INR 4000-5000 for a more sophisticated box. It is often labelled as part of signing up for service.

The trends in Indian Television industry is changing drastically and a very simple question which arises in every consumer mind is What is Digital TV? Digital TV is the new technology for the broadcasting television signals. Traditionally analog TV transmission has been the traditional method of broadcasting TV channels. But analog TV is not as sufficient as that of the Digital TV. Digital TV is the transmission of audio and video by digitally processed and multiplexed signals, in contrast to totally analog and channel separated signals used by analog. The government had also passed orders making digitisation mandatory by the end 2015 i.e. replacing analog TV with Digital TV.

At present, DTH subscribers are the major customers of STBs in India, however with the government directives to digitize entire pay TV network including cable TV platform (which is majorly analog based); the market for India STBs has gained a significant momentum. The sale of Set Top Boxes is growing at a rapid pace in India with a compounded annual growth rate of 22.3 per cent. Indian Set Top Box (STB) market is expected to reach \$1,877.3 million by 2017, at a CAGR of 26.0% from 2012-2017. In the past few years there has been a phenomenal shift from analogue cable signals to digital transmission using Set Top Box (STB) as the underlying Technology. The increase in digital TV homes has further boosted the growth of Set Top Boxes (STBs). With the increasing number of television households in India, there is a great potential for Set Top Box industry in India not only for the foreign manufacturers but also for the local Indian manufacturers. Benefits like clarity of digital picture, the availability of more channels, Video on demand and Digital Video Recording (DVR) have helped in increasing the demand for Set Top Boxes (STBs).

### **III. Technology Business Ecosystem and the Set Top Box Industry**

Business ecosystem refers to the network of organizations – including suppliers, distributors, customers, competitors, government agencies and so on – involved in the delivery of a specific product or service through both competition and cooperation. The idea is that each business in the “ecosystem” affects and is affected by the others, creating a constantly evolving relationship in which each business must be flexible and adaptable in order to survive, as in a biological ecosystem. Gediminas, Jesse *et al.* (2007) propose a conceptual model for understanding technology evolution that highlights dynamic and highly interdependent relationships among multiple technologies. It is argued that, instead of considering technologies in isolation, technology evolution is best viewed as a dynamic system or ecosystem that includes a variety of interrelated technologies. By considering the interdependent nature of technology evolution, they identify three roles that technologies play within a technology ecosystem. These roles are components, products and applications, and support and infrastructure. Technologies within an ecosystem interact through these roles and impact each other’s evolution.

It is an obvious fact that business is influenced and shaped by the context and environment in which it operates. The concept of business ecosystem describes the wider canvas of economic, social and political processes that enable or constrict the entry and growth of businesses. This is a generic concept covering various sectors, segments, industry and trade. Though it is a heuristically helpful notion, dynamics of various business processes associated with technology are unique. For instance, the business ecosystem for mining has a different set of influencing factors compared to that of business system for electronic hardware. Though there is a certain amount of overlap with the wider concept, a new concept of tech-business ecosystem has been taken as a point of departure to be able to capture the networks, processes, products and their interrelationships within the set top box industry. In a wider sense, tech-business ecosystem entails an examination of the trade and technology policies, research and development, institutions, science technology innovation policy, policies regarding collaboration and transfer of technologies and finally the human capital with required skill set.

Taking this clue, in this paper the Eco System of STB industry is analysed in terms of various dynamics of companies, sub domains and component manufacturers.

Technology Business Eco system overlays the various parameters of business ecosystem with augmentations like research and development with field specific expertise, government support in terms of regulations and subsidies, appropriate marketing strategies with networking, risk taking with investment and experimentation, infrastructure with technological acquisition, technology transfer with easy accessibility for public domain. For example, smart manufacturers in India import chips because of lack of manufacturing units for such silicon components due to a gap in field specific expertise and lack of incentives from governments to invest in manufacturing hubs in India.

It is a complex network of tech business people that assist business in executing their goals or processes. Their main goal is to contribute to the design, development and implementation of information related systems within their relevant domain to address both operational and strategic challenges. It helps in the commercialisation of new knowledge, ideas and application of scientific knowledge for practical purposes. It provides proprietary advantage to the entrepreneurs in the field of research, technology, business and marketing. It provides better network facilities and opportunities for technology transfer. The main role of technology business ecosystem is diffusion of technology so that it can come in the public domain in a much more significant way.

Being in the Set-Top-Box business is not just about manufacturing Set Top Boxes. The entire ecosystem of Digital Video Broadcasting is a huge setup of various sub domains. Numerous foreign and Indian companies play in these areas, doing design & manufacturing, system integration, installation and support, in addition to a huge chunk of software development. In order to fully understand the India’s indigenous footprint on DVB in India, it is necessary to describe these sub domains. The STB architecture can be divided into four layers, namely, Hardware Layer (HL), Subsystem Service Layer (SSL), Application layer, Split into Application Service Layer (ASL) and Application Layer (AL).

In the following sections, a detailed discussion on the domains and sub domains of the set top box industry in terms of the presence of various domestic and foreign producers is presented. This is followed by an analysis of the leading domestic and foreign companies that have significant presence in Indian set top box market. The way in which Chinese companies are dominating the market and Indian companies are responding to the market is presented and subsequently an analysis of the manufacturers at the component level is taken up. Thus, a journey traversing the terrain from major companies in the finished product market to that of micro component manufacturers helps to capture the nuances of the entire tech ecosystem.

### **IV. Domains & Sub Domains**

We will only consider the domains which have direct impact on the STBs namely: Hardware engineering, STB Component design and manufacturing, STB manufacturing, Software engineering and STB applications.

### **1) Hardware engineering - STB Microprocessor design, foundry and chipset design.**

Microprocessor (also called SoC System on a Chip) is the heart of the set top box. STBs use specially designed microprocessors which have in built interfaces such as demodulators, networking stacks, communications stacks, signal processing units, etc. These microprocessors are produced in a very complex industrial setups called as Foundry. The Companies which design and manufacture SoC also design the chipsets which house the SoCs. These chipsets are taken as a reference by manufacturing and software engineering companies. Major companies manufacturing are ST Microelectronics (French), Broadcom (American), ALI (Chinese), Media Tek (Chinese), National Chip (Chinese), etc. It may be specially noted that there are no Indian companies in this segment.

### **2) STB component design & manufacturing**

STB components include remote control units, Tuners, PCB active & passive components. Major companies: Nxp (Philips), Panasonic, ALPS (Chinese), Chang Hong (Chinese), ORCA are the only one significant companies present here.

### **3) STB manufacturing Units**

A STB is a complex embedded system, right from design to development. The manufacturing units for STBs are specialized units. There are very few fully functional STB manufacturing units in India. These major Units in India are Videocon, D2H, My Box Technologies, New Delhi (manufactures for self), Frontline Electronics (manufactures for Videocon, D2H), Uniword Electronics, Noida (manufactures for Logic Eastern) UKB Electronics, Noida (Job work) Earthma, Noida (manufactures for LRIPL).

### **4) Software engineering**

It comprises of STB device drivers and Middleware. Device and middleware are the basic beginning of a set top box software stack. They are needed to develop applications for a set top box. Interestingly, India's position in embedded software is strong as compared to hard ware. Major Indian companies are: ST Microelectronics, TATA ELXSI, Wipro InfoTech, Infosys, Broadcom, ALI, Media Tek, National Chip, Corpus Media Labs, Masamb Electronic System, etc.

### **5) STB Application, DVB stack, CAS & GUI**

In this segment companies specialize in writing applications for Set Top Boxes. There are numerous Indian players. Important among them are: Nagrakudelski, NDS, Open TV, Freeview, Conax, Suresoft (Indian), Wipro, InfoTech (Indian), Corpus Media Labs (Indian), Vermitrix, Enigma systems, Amagi Media Labs (Indian), Irdeto, STB Labs (Indian), Latens systems (Indian) Safeview (Indian), etc. There are lot of companies, foreign and Indian which specialize in just one or a few of these sub domains. Together they constitute business eco systems which have laid the foundation of the digital TV revolution in India. In addition, there are certain sub domains which have indirect relevance.

The sub domains of DVB business which are indirectly related to STBs are Digital Channel broadcasting, Digital Head end Integration and O&M, Development of conditional access system, and Development of subscriber management system.

From the foregoing, it can be clearly seen where the core hardware like microprocessors are there, the overseas companies mainly the Chinese ones dominate the domain/sub domain whereas in case of manufacturing units which are primarily component integration driven, the presence of Indian companies is also visible. By the time we reach the software engineering and apparatus, Indian presence is very strong.

## **V. Company Analysis**

### **A. Import of STBs in India**

The Indian STB manufacturing market is affected by numerous Korean and Chinese vendors which offer STBs at very cheap rates. This onslaught is the reason that indigenous manufacturing is not picking up pace. Major companies are: Humax, Korean STB, Gospell, ALI, ABV, Changhong, Huawei and ZTE. Chinese telecom equipment makers, Huawei Technologies Co. and ZTE Corp. are rapidly expanding the Indian market despite local regulatory uncertainties and intensified competition. Both the Chinese telecom equipment makers have seen their Indian business taking off very well over the past decade.

### **ZTE**

Huawei, the world's second biggest telecom equipment manufacturer, based in Shenzhen, considers India is one of its most important strategic markets. The company operates in more than 140 countries and regions. Huawei has invested more than \$400 million in research and development in India since it entered the market in 1999. Huawei is currently investing \$150 million to construct a new state of the art R&D campus in

Bangalore with a capacity for 5,000 people. Huawei is about to invest @2 billion over the next four years in India as it looks to aggressively market consumer devices and set up the global R&D centre. India is also the largest single country overseas market for ZTE, the world's fifth largest telecom equipment provider. ZTE has recently won part of a mobile network expansion contract, worth around \$1.09 billion, from India's state run mobile operator BSNL to supply equipment and software technology. ZTE have operated in India for more than a decade. Looking ahead, ZTE is determined to expand operations and be more localized in India.

ZTE has been engaging in R&D of the IP STB for many years to devote itself to providing effective and stable STB products for its customers all the time. ZTE IP STB includes two categories: Linux STB and Android STB. In the self-developed product of ZTE adopts high performance chips to provide high cost effective chip solution. It can rapidly respond to the customer's service customization requirement and has powerful customization capability to provide powerful and consistent technical protection for the value added service.

When ZTE revealed its annual sales in India, they reached a record high of \$1.5 billion in 2009, from about \$100 million in 2004. However, its annual revenue in India in 2010 and 2011 slightly slipped, because of the down turn of the whole telecom markets.

### **Huawei**

Huawei is poised for a bright future in the field of set top boxes. Their innovations give them a strategic edge over their competitors. Huawei is investing a lot in India. It is also setting up lot of centres in India in order to employ local citizens. This improves their brand recognition and adds value to their products. Huawei is not looking at India as just another market to gain customers or set up service centres. It is in fact investing a lot by building a state of the art, world class R&D centre in India. This shows their dedication towards building quality products goes beyond the boundaries of China.

Huawei currently employs 6000 plus direct staff members in India, with 90 per cent of them being local residents. Huawei clocked \$1.2 billion was contributed by its network business driven by 3G deployment and network expansion by operators. The remaining \$300 million came from devices such as handsets, software protection keys known as dongles and set top boxes.

In 2010, the Indian government temporarily banned 25 Chinese network equipment suppliers, including Huawei and ZTE, from taking part in infrastructure projects. It is reported that the Indian government fears malicious software in foreign equipment could put national security at risk.

### **Broadcom and STMicro**

Broadcom and STMicro tied in unit shipments for the worldwide set top box IC market in 2012, with both delivering between 85 and 86 million video SoCs for set top boxes. In third place, Ali Technology saw significant growth within free to air terrestrial boxes by Chinese OEMs and delivered an impressive 65 million SoCs.

### **Chinese Companies: Issues and Trends**

Developing quickly in the Indian telecom market was by no means an easy thing. One of the biggest obstacles for Chinese telecom companies was adverse policies. Because of security concern, Indian authorities made Huawei and ZTE jump through hoops to get a foothold in India's vast telecommunications known as dongles and set top boxes. In August 2006, the Foreign Investment Promotion Board of India rejected ZTE's application seeking approval to undertake trading activities. ZTE has not been given permission by the FIPB to carry out cash and carry activities with telecom equipment, which prevents ZTE from undertaking retail and bulk selling of products. At the same time, Huawei which also wanted to trade its telecom products in India had been in negotiations with the FIPB over the previous four years regarding security concerns and managed a wriggle out.

Instead of continuing to import and directly sell, the large Chinese companies are investing huge amount of money in the Indian facilities unlike in many other industries. This is also possibly because of strong integration requirements in which the STB sale is service providers driven. They are the ones who have the customer interface.

### **B. Indian companies**

MCBS (M/s Modern Communications and Broadcast Systems Pvt. Ltd.) in association with NICIT (National Institute of Communications and Information Technology) has started R&D in embedded system design and is currently training more than 60 engineers in this field. MCBS has been selected and chosen by the Department of Electronics, Ministry of IT of Research and Development.

### **Logic Eastern**

Logic Eastern's research, designs, manufactures and provides integration services to service providers so as to enable them to trade next generation services in their networks. It manufactures high quality set top boxes (Both DVB-C and IPTV) switched and routers. LE's end to end triple play IPTV solution is designed for truly converged next generation networks that enable telecom carriers and cable operators to greatly enhance revenue and reduce customer churn. Their partners are Microsoft, Tandberg, Enigma, Intel, STM, and 3 COM. However, this company does not operate in the high volume, low cost competitive niche.

### **MYBOX Technology**

MYBOX technology has gained reputation in the Indian Market as a leader in STB Technology. It emerged as start-up in early 2008 and rolled out its first commercial STB design after two years of R&D in 2010. Their business expansion started with tie ups with Nagra for open TV middleware, CONAX for CAS/SMS and with a number for DVB-S and DVB-C service providers for STB sales. Prominent satellite TV brand dish TV was one of their first tie-ups. They also supply STB to KCCL, Kerala's largest multi service operator for cable STBs. The future for MYBOX also holds a brighter side with the company allocating a fair share of funds to R&D. They are Govt. of India approved Electronic R&D centre. MYBOX has brought together people with the passion and vision to ensure. MYBOX represents in becoming a strong digital set top box brand competing with global brands. However, it could not keep pace with the onslaught of competition and the need for large re-investment for latest products that can compete in the market.

### **Dixon**

Dixon Technologies Pvt. Ltd. is an ISO 9000:14001 company with very strong financials and high experience in the Indian consumer electronics market with their own brand as well as being an ODM (Original Design Manufacturer) to some major brands in the Industry. They have emerged as India's largest and most cost effective complete solution provider for consumer electronics, appliances and IT modules for the domestic and international markets.

### **Videocon**

Videocon D2H is the DTH service provided by the Video group. Video group is an industrial conglomerate with interests all over the world and is an Indian multinational company. The group has 17 manufacturing sites in India and plants in China, Poland, Italy, and Mexico. It is also the third largest picture tube manufacturer in the world. The group is a USD 4 billion global conglomerate. Videocon d2h has been providing DTH services in India since its inception in Aug 2009. Videocon d2h became the first DTH service provider in India to offer a 3D ready set top box in India. Videocon Industries has collaborated with digital direct broadcast to provide a set top box less technology.

### **Amagi**

With digitization of the cable TV industry in India soon reaching its sunset date, MSOs are making large capital expenditures to provide STBs to their subscribers. However, with few significant revenue opportunities, VAS (Value Added Services) is becoming an important strategy by which operators increase their revenues and profits. VAS brings in multiple opportunities, some of them in the form of video on demand, video conferencing, local classifieds listing, TV commerce, games, viewership measurement and advertising. To begin with approximately 50 MSOs across India have partnered with local television advertising specialist Amagi Media, where in the latter will bring in its patent pending technology, work flow and business model to generate local advertising on satellite TV Channels. This, in turn, will leverage the existing cable MSO infrastructure. The partnership includes names such as Hathway, Incable, Digicable, GTPL, Fastway cable, and Manthan. However, this is a niche of the company. It is not significantly present in the STB itself but in advertising. Amagi is a company which shows good prospects in India. Their key USP is their knowledge and partnership with local entities. Their diverse clientele show how far they have progressed in such a short span of time. Amagi's strategy to provide city level advertising throws new light on the possibilities of set top box innovations in India.

### **Indian companies: Trends**

STB market in India started with the introduction of digital TV and digitization of television networks all over. Now as the market is technologically stabilizing towards a set of standards, the Indian companies are gearing up their design process, build quality and product support to ensure, they stay in the business for a long term. Being a mass scale kind of technology, the primary focus of the new companies is to drive sales and naturally, ramping up the productions of devices and equipment. Conversely, companies like Videocon, MYBOX Technology etc. which already have stabilized their production and market position are now shifting

their focus to cater to each and every segment of consumer discretely with customized designs, both in terms of hardware/software and subsequent pricing segments with focus on Medium range boxes with DVR (Digital Video Recorder) facilities and HD Range of STBs, Android STBs, Home Media Services, the innovative features are like UI in local languages like Hindi, Tamil, Telugu, etc. and games.

The above analysis clearly demonstrates the unparalleled presence of Chinese manufacturers and the low, yet, significant presence of Indian companies that have either collaboration with a huge import component contributing to their finished products. In addition to this, an important fact that needs to be appreciated is that this sector is not an entry free for all sectors. A significant entry barrier is the requirement of prior buying arrangements with the satellite service providers. The products cannot be sold in an off the shelf mode with plugged play type of choice. Here, it is very interesting to note that, the Competition Commission of India in a recent judgement has observed that though in principle, any user should be able to buy a set top box in a free market and be able to play it with an inter changeable card. The pre-mediated arrangements and the alleged tie up of service providers with the set top box manufacturers is promoting monopolistic trade practices and vitiating the market. This kind of distortions form a part of the tech business eco system of set top box industry in India today.

## **VI. Component manufacturers**

STB domain is an integration of embedded systems development and IT. The Indian IT power house is backing this revolution but local STB manufacturing & design is also picking up pace in the country. The Indian companies are dealing with the technological integration as follows:

### **1. Chips and Chipsets**

Chip manufacturing in India is non-existent at the moment with no foundry existing in the scale of nanometre designs which are required to manufacture microprocessors used in STBs. Thus, microprocessors are largely being imported from foreign vendors. The companies ST and Broadcom are the major non-Chinese chipmakers. Chinese chip makers are Media TEK, ALI and National Chip. These manufacturers also support Indian design teams by sharing reference design of circuit boards and software development kit (SDK). For example, STMicroelectronics recently launched its H273 DVB-C demodulator chip for SD/HD cable STBs with reference designs using the chips. They also provide SDK and reference embedded application to help Indian embedded companies start quickly on the development.

### **2. Manufacturing**

Owning an assembly line is an expensive affair. Only few companies are able to afford this kind of setups. STB manufacturer in India are mostly outsourcing their manufacturing to local assembly lines. MYBOX is one of the only companies with its own assembly line. Logic Eastern gets all job work done at Uniword Telecom, Noida. Videocon gets all job work done at Frontline Electronics, Pune. Only a few manufactures in India are equipped with the latest SMT lines capable of manufacturing complicated STBs.

### **3. Middleware**

It is said that in embedded projects like STB, nearly 90 % of the R&D is done in middleware itself. Indian companies are following two approaches. Either they are using branded middleware such as open TV, Nagram Irdeto, Conax, etc., one such example is Videocon DTH. They are setting up own teams to do in house middleware development. Middleware is largely handled in house or by contract software vendors in India. One such recent example is of MCBS India which outsourced the development of its STB middleware to Corpus, Bangalore for its new series of STB based on ST's H273 DVB-C chips. MYBOX and Logic Eastern are two companies which do middleware related development in house.

### **4. Conditional Access System/Subscriber Management System is following the same trend as Middleware.**

There are: 1. Indian CAS Vendors which are offering to integrate their CAS/SMS into networks, 2. internationally known vendors such as Irdeto, Conax have in house development teams for CAS/SMS. Logic Eastern is one of the few Indian companies with its own CAS/SMS and middleware.

### **The significant trends and challenges:**

Firstly, the absence of chip and microprocessor level design and manufacturing is the biggest challenge. Secondly, lack of assembly lines due to the constraints of huge investments and time lag in the face of immediate demand and uncertainty of future is a big limitation faced by the Indian Companies. Due to huge competition from imports, this process of integration on assembly lines which normally takes place huge manufacturing units is being outsourced to local assembly lines on job work basis.

Thirdly, though some of the Indian companies are importing in the branded middle ware, Indian manufacturers are undertaking the in-house development of middleware in a significant way.

Finally, in case of CAS, the presence of Indian vendors is predominant because of the fact that this CAS/SMS software development is contiguous with Indian software companies' strength in the development of applications.

## **VII. STB Industry: Issues in Tech Business Ecosystem**

Currently in India there is a demand supply gap of STBs. Companies are not able to fulfil the huge demand for STBs. There is a tremendous scope for new units to emerge and set up their units in the domain. However, growth of business is something that relies on technology business eco system. Following are the focus areas in the STB companies which should have a strong ecosystem of silicon vendors, manufacturers, marketing personnel, IT vendors, etc. This helps to prevent a gap in demand supply. Companies such as Indian Technologies, Bangalore is incapable of meeting the demand for new products, much to the reason that they don't have a strong network of product designers to work with. The in house engineering teams are not well geared up for manufacturing set up.

Investment in R&D is necessary to keep rolling out new designs and improve the already running models. Outsourcing engineering tasks (board design, middleware development etc.) to other companies is an expensive solution that doesn't go in the long run. In order to increase technical capability, a company needs an engineering team with a strong technical background. Strong teams can be hired or gradually built internally.

### **Focus on quality, service & support:**

In the modern markets, customer is king. Quality, excellent service and support are the major deciding factors for choosing a manufacturer company. The business relationship between a customer and a company starts with sales and continues through service and support. Excellent build quality ensures minimum trouble with a product. Excellent service ensures that any problems in running products are fixed as soon as possible. These points are the deciding factors for MSO while choosing any STB manufacturer for a tie up.

Having identified the growth trends in STB Industry and considered critical issues and bottlenecks in immediate Ecosystem, now we will move on to the issues of the wider ecosystem in STB & EHT (Electronics & Hardware Technology) in general.

## **VIII. Technology Business Ecosystem of STB and Electronic Hardware Industry: Policy Regimes and Economic System**

A careful look at the wider canvas of policy regime and economic system which in short can be called as the wider tech eco business system reveals that though the changes in the regulatory climate as well as the economic framework have come, there are still serious bottlenecks that set top box industry in particular and electronic hardware sector in general are facing in India.

India's innovation eco system comprising of political economy and policy culture has been presented starting from the era of indigenization and self-sufficiency that stood as a hallmark of the policy - Institutional Framework 1960s&70s in India. In the absence of strong corporate presence and in the wake of post-colonial conditions, the Research and Development (R&D) system was by and large promoted only in the state sector i.e. the Government R&D Institutions. From 1980s there has been a change in the National Vision. Concerted efforts on the part of the government, particularly since 1980s and host of other factors like Government-Diaspora relationship, private initiatives, emergence of software technology parks, patterns of spatial agglomeration in the IT sector and public private partnerships gave a boost to certain segments of S&T, especially Information Technology (IT). Since 1984, India has been pursuing liberalization policies that have helped the IT industry develop. More specifically the computer policy of 1984 and 1986 policy on computer software export and software development and training gave a much needed fillip to the software industry.

In this phase in India, there were several restrictions on the import of vital components and other technological inputs due to global political economy considerations. In certain strategic and thrust areas like space, nuclear energy, bio-technology, remote sensing and electronics, government agencies like DRDL, ISRO, NRSA, IICT, CCMB and IMB have achieved significant breakthroughs on par with the frontier research in the global scientific community.

However, the products of these scientific and technological developments have not reached the market and the wider population. The benefits remain in the domain of exclusive applications only. Even though there are scientific and technological developments, lack of collaboration with the corporate houses and the market is what is missing in Indian context. The similar developments in US and several other western countries have led to a series of marketable products and provided a base for further innovation. This in fact, is a major historical burden on the growth of innovation systems in India. In case of the satellite and television sector, this is amply

clear fact that we have developed the telecommunications and the satellite networks with high end satellite launches but have not taken the consumer end to the digital revolution till the time it become a necessity.

Thus, from 1990s, the National System of Innovation in India has been going through a transition from an inward-looking (with main focus on self-reliance) to an outward-looking NSI (to become globally competitive), driven by economic liberalization policies at home and globalization from outside. This shift is mainly triggered by the severe economic problems faced by India in the late 1980s and early 1990s with a critical break from the past in 1991.

Over the years in India, the NSI has developed a higher education system with a strong emphasis on science, engineering and technical disciplines and also created extensive S&T infrastructure. India has been investing about 3 to 4% of GDP in education and skills. Its investment in R&D has been between 0.7% to 0.8% of GDP (about 20% by business enterprises and 75% by the government). In this background, India has begun to put a strong emphasis on developing its high-tech industries by fostering innovation and entrepreneurship.

Given the diversity, vastness and the varied levels of development in different areas in the country, another major feature of Indian NSI is the regional dimension. The major cities that account for about nearly 90% of the growth are Bangalore, Chennai, Hyderabad, Delhi, Mumbai and Kolkata. Bangalore is considered to be the *Silicon Valley of India* because it is the leading IT exporter. In the wake of economic liberalization there was a scramble among the state governments for investment. Respective governments have provided a host of incentives for establishment of software technology units, mainly MNCs. States like Karnataka, Telangana, Andhra Pradesh and Tamil Nadu found the creation of an enabling investment climate as new channels for fast paced growth. Thus we can observe a clear clustering of the new IT and ITES, pharma, bio-tech industries around these centres. Thus, in tune with this broad trend, the set top box units have been established in and around these hardware clusters. Development of hardware clusters has of course been a much later development. There was clear prior base of hardware technology units except for public sector units like ECIL, ITI, etc.

Hardware based industries are the last ones to arrive in the train of development. Thus, we find Indian companies doing well in the applications, middleware, integration and advertising segments of set top box industry and their lagging in the manufacture of core components. This lacunais on account of three reasons. Firstly, enabling policy climate comprising of investment, financial incentives, friendly regulatory regime, open competitive atmosphere and recognition of need for larger changes has not fully unfolded. Secondly, this sectors' growth is also contingent upon facilitation and promotion of technology transfer and commercialisation for which backward and forward linkages between various players in this sector are essential. Thirdly, sustained technology business incubation is required to keep pace with the changing consumer demands, ever increasing drive for cost cutting and integration and miniaturisation. So far as the policy and processes are concerned, they have been amply described above. But, one fact that emerges significantly is that when the arrival of digital satellite television was imminent and round the corner, the policy makers and the industry has not seized the opportunity and made required strides both in terms of the establishment of manufacturing companies and the regulation required as an attendant to digital transmission. This has left a huge vacuum which is filled by the Chinese manufacturers who have become a dominant force in this sector. Finally, a regulatory framework for satellite transmission has given a fillip to this sector.

So far as the development and commercialisation of these set top box related technologies is concerned, the eco system in India comprises of specific efforts by CDAC, NICIT (National Institute of Communications and Information Technology) and other dedicated knowledge transfer organisations such as NRDC, Consultancy Development Centres focusing on technologies and the initiatives to encourage technology leadership and innovation such as New Millennium India Technology Leadership Initiative (NMITLI) and the Small Business Innovation Research Initiative (SBIRI). In addition, the business incubation attempts like Start-up Village, an India's first telecom incubator and some of the innovations like GVCs set top box chips show the way forward.

While the Indian government has invested special thought and efforts for improved commercialization of technology, it has failed to achieve the required momentum for sustainable and inclusive growth. The Indian Technology transfer and commercialization system is deficient in the following:

(1) Minimal private sector involvement in R&D supports programmes (2) Lack of policy and decision making ability of public institutions (3) Rigid bureaucratic resource allocation procedures (4) Conservative and safe approach that discourages high risk ventures (5) Barely existing cooperative or professional education in the academic institutions or universities (6) Lack of monitoring, accountability and utilization of fiscal incentives by the industry and private sector (7) Lack of vision: for instance, research agenda in organizations with primary focus on fundamental or basic research often gets diluted due to unreasonable expectations of commercialization and vice versa. Further important challenges are issues like: technology obsolescence, educational background & business soft skills, experience, etc.

## **IX. Policy considerations and recommendations**

**Technology transfer office:** Each R&D institution and company must dedicate a technology transfer office (TTO) for the purpose of review of university policies and decision-making.

**Industry capabilities:** The Indian Government and universities should incentivize public-private partnerships to ensure successful technology transfer. Several schemes such as Small Business Innovation Research Initiative (SBIRI) by the DBT, Science and Technology Parks of IIT Kharagpur, NIT, Tiruchirappalli; New Millennium Indian Technology Leadership Initiatives (NMITLI) and Fund for Accelerating Start-ups in Technology (FAST) have been launched.

**Fiscal incentives:** The existing fiscal incentives should be redesigned in order to minimize transaction costs and maximize technology incubation and commercialization in order to encourage collaboration between academia and industry.

**IPR policies:** The application of strong intellectual property rights (IPR) policies and regulatory checkpoints ensures patenting of appropriate technologies while making other technologies accessible for use by the public and other research entities. While patents are imperative incentives for technology transfer, the transmission of institutional research by non-patent means needs to be understood.

**Education:** Professional cooperative education and cross-disciplinary programmes such as those in the US are excellent platforms to encourage professional networking and transmission of ideas.

**Access to venture capitalists and moderate risk exposure:** Growth is best characterized by willingness to expand scope of research while concentrating on core competencies. A conservative approach could damage the spine of university spin-offs and entrepreneurship.

**Defined mission and vision:** Stratification of universities based on nature of research (e.g. fundamental versus applied) will improve the research focus and efficiency.

There is growing emphasis in India on the flow of technology between universities, government and industry with equal flux in order to lubricate the friction between science, economics and policies called the triple-helix model. Pursuing this through concerted policy and action would bridge the gap between academia and industry and encourage a tectonic shift from innovation in single direction to growth of technology along different trajectories.

## **X. Conclusion**

Set top box industry demands a huge attention these days after it has become mandatory by the central government. The demand for the set top box is increasing after coming up of the digitalisation of cable TV networks in India by the Ministry of Information and Broadcasting. This article provides a detailed analysis of current trends of set top box as well as how we are procuring components from the other countries. Currently in India, there is a demand supply gap of set top boxes. Companies are not able to fulfil the huge demand of set top boxes.

According to the current scenario, foreign set top box makers are dominating in India by exporting components at a very minimal price. Due to this, Indian electronics hardware market is relying heavily on importing rather than manufacturing their own products. Also we can say that government policies are quite rigid in India. In that way, this contributes to creating a gap between Indian industries and foreign industries. If the domestic product industry is strengthened, we are not only hedging against the foreign markets volatility but creating a lot of employment opportunities. There is an urgent need to fill this gap by giving our people an opportunity to learn and manufacture their own products as lots of foreign companies are doing by providing the training to their own people so that they can start their own manufacturing units.

As we know that business ecosystem is all about producing and commercialising the new technology. In the current scenario, after the digitalisation of mass production, the need of the hour is the ability of the domestic electronic industry to meet the rapidly growing demand. This can happen only through a favourable technology business ecosystem. Through the ecosystem, we can facilitate all round development of technology which not only helps in promoting growth but also create employment opportunities for youth.

Government should encourage enabling environment by addressing the issues relating to investment, patenting, regulation, etc. which constitute ecosystem. As a part of larger sectorial business plan or policy push we have to decide what it would cost to manufacture subsystem. It's a huge capital investment and low margin. It's a great market intact yet. It needs the policy thrust.

The hardware chips are currently being imported and to produce them may be beyond immediate possibility. However, software is our unique strength; so, we should invest more into applications based on software. We could add innovation into that part that is a big opportunity for us.

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