Critique of India's Electronics Policy

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Executive Summary: In the last decade, India has experienced one of the fastest growing demands for electronic goods; due to its demographics, the trend will continue into the foreseeable future. Unfortunately, the Indian electronics manufacturing industry has not been able to keep pace with the growing demands. Most electronic products are imported; it causes a substantial drain on foreign exchange creating an unsustainable scenario. Older mechanisms like raising tariffs to protect and promote local industry are no longer permitted as India has become a signatory to ITA – 1. Since 1998, several reports have been published by government appointed standing committees, Industry associations and private think tanks; they have all reached the same conclusions a lack of infrastructure, complicated tax and labor laws, high rates of interest on industrial loans, lack of proper supply chains and shortage of trained manpower being some of the reasons for an unsustainable scenario. All these factors have been lumped into what is defined as the "cost disadvantage" that is pegged between 19 – 22%. Though all these committees have been able to pin-point the reasons for the lack of growth of the electronics industry in India, successive governments – due to various reasons - have not been able to do much too much alter it. In the light of this, the National Policy on Electronics (NPE) – 2012 was supposed to be a game changer. It tried to address all the recommendations put forward by the planning commission. It is a mix of subsidies, tax rebates, promises and good intensions. Three years have passed since the unveiling of NPE 2012; statistical data and the situation on ground do not provide any indication of major success. It can be said that the factors affecting the growth of the Indian electronics industry are systemic and would require a longer and sustained effort for effective change. India will have to pursue both; short term strategies of subsidies and tax rebates and long term strategies of improving infrastructure and effective higher education reforms. It would not be a wise to bank on India's growing population and thus its growing demand for electronics products and that it would eventually force the development of local value chains.

Methodology:

This report is based on the evolution of the electronics industry and the corresponding policy formation in selected countries. It is prepared through literature survey, personal interviews (DEIT, IESA, SEMA, and members of the ESDM community) and author's experience in this area.

Introduction:

According to a report from the Bookings Institute [1], by 2020 India is projected to be the world's third largest middle class consumer market right behind the United States and China with an expected spending of US$ 3.77 trillion. By 2030 India will overtake both the above mentioned countries to take the number one spot with an aggregate consumer spending of US$ 12.78 trillion. It is implicit that India's consumer market boom will be led by a large pool of its youth population (45% of the people under 25) along with rising income levels. These projections point to the fact that India's consumer market which was traditionally defined as a pyramid with a very small affluent class at the top, a middle class at the centre and a huge economically disadvantaged class at the bottom, is steadily turning into a diamond structure with a relatively large affluent class at the top, a massive middle class and a small economically disadvantaged class at the bottom.

#	2009			2020			2030		
1	USA	4377	21%	China	4468	13%	**India**	**12777**	**23%**
2	Japan	1800	8%	US	4270	12%	China	9985	18%
3	Germany	1219	6%	**India**	**3733**	**11%**	US	3969	7%
4	France	927	4%	Japan	2203	6%	Indonesia	2474	4%
5	UK	889	4%	Germany	1361	4%	Japan	2286	4%
6	Russia	870	4%	Russia	1189	3%	Russia	1448	3%
7	China	859	4%	France	1077	3%	Germany	1335	2%

8	Italy	740	3%	Indonesia	1020	3%	Mexico	1239	2%
9	Mexico	715	3%	Mexico	992	3%	Brazil	1225	2%
10	Brazil	623	3%	UK	976	3%	France	1119	2%
Source: Homi Kharas, Brookings Institution. June 20, 2011									

Table 1: Middle Class Consumption - Top 10 Countries (billions of 2005 PPP$ and Global Share)

This rising demand for consumer goods is nowhere more apparent than in the electronics and communication sector. According to the 2011 census, 63.2% people have access to either a landline or a mobile phone and almost half (47.2%) of the population own a television.

Item	Sales in units(Source)	% Growth
Mobile phones (feature + smart)	257 million (IDC)	18%
Smartphone	44 million (IDC)	273%
Laptops	6.84 million (MAIT)	55%
Tablets	4.14 million(IDC)	56.4%
Television (CRT + LED)	4 million + 6.5 million	15-20% 75-80% (after 36% custom duty imposition in Aug 2013

In last decade, the Indian market for electronics and telecommunication equipments has seen a double digit growth rate and the trend are expected to continue well into the foreseeable future. One would expect the increased demand to help the local electronics manufacturing industry and create employment opportunities. Unfortunately this does not hold true for India. This country remains a major importer of electronic material, components and finished products. It is a matter of concern that India which is ranked second in the world in terms of the mobile services market has failed to create a

mobile manufacturing ecosystem. According to the data collected by Indian Cellular Association (ICA), 67% of the approximately 250 million mobiles sold in India in 2013 worth INR 360 billion were imported. There are around 100 local handset brands available in the market but the bulk of their offerings are direct imports from the "white box" handset manufacturers in China. Companies which claim to do some local value addition in India, restrict themselves to manufacturing phone chargers and battery packing. Apart from mobile phones, Indian electronics manufacturers do some assembling of TVs, computers and set-top boxes with single digit value addition. In 2013, India imported US$ 33.5 billion worth of electronics, up from US$ 31 billion in 2012 and according to the market analysis by Frost & Sullivan; the import would touch US$ 42 billion by the end of 2015.

The trends are quite clear. According to the data published in the Exim bank report of 2012 (Exim bank annual report 2012-13 2013), the electronics goods import bill is the third largest component behind gold and petroleum products totaling to about US$ 30 billion.

Item	Import bill in US$ in 2012	Import bill as % of total
Total Import Bill	490 B	100
Petroleum	168.4 B	34.4
Gold	53.9 B	11
Electronic goods	31 B	6.3
Machinery	26.95 B	5.5
Pearls, precious/semi stones	22 B	4.4
Source: Exim bank report, 2012 (from DGCSI, MOCI)		

Table 2: Top 5 imports in India

In 21st century, the idea of electronics manufacturing has gone through a major change. Every year a huge variety of products hit the market. These electronic products have

become bedrock of communication, transportation, education, defense, entertainment and medical industries. A large number of companies from dozens of countries act as suppliers for a single final product. Each company may specialize in particular intermediate products. With the help of standardization, the process of manufacturing has become like building a structure using Lego pieces. This maze of outsourcing has created a very potent concept of global value chains (GVCs). Following is an example of the level of GVC used in creating an iPhone 6. Parts are sourced from total of 14 companies with global manufacturing sites and having their own global suppliers.

#	Part	company	Country of Incorporation
	Application Processor	**Apple** A8 APL1011 SoC	US
	RAM	**SK Hynix** 1GB DDR3	Korea
	Modem	**Qualcomm** MDM9625M LTE Modem	US
		Skyworks 77802-23 Low Band LTE PAD	US
		Avago A8020 High Band PAD	Singapore
		Avago A8010 Ultra High Band PA + FBARs	Singapore
		SkyWorks 77803-20 Mid Band LTE PAD	US
	sensors	**InvenSense** MP67B 6-axis Gyroscope and Accelerometer Combo	US
	RF Amplifiers	**Avago** ACPM-8020 Power Amplifier Module Avago ACPM-8010 Power Amplifier Module	Singapore
	Power Amplifier	**SkyWorks** SKY77356-8 Power Amplifier Module	US
	Antenna	**RF Micro Devices** RF5159 Antenna Switch Module	US
	Ultra small, tri axial low – g sensor	**Bosch Sensortec** BMA280	Germany
	Flash memory	**SanDisk** SDMFLBCB2 128 Gb (16 GB) NAND Flash	US
	Wi-Fi module	**Murata** 339S0228 Wi-Fi Module	Japan
	Touch screen IC	**Broadcom** BCM5976 Touch screen Controller	US
	Motion Coprocessor	**NXP** LPC18B1UK ARM Cortex-M3 Microcontroller (also known as the M8 motion coprocessor)	Netherlands
	NFC chip	**NXP** 65V10 NFC module + Secure Element (likely contains an NXP PN544 NFC controller inside)	Netherlands
	Audio Codec	**Cirrus Logic** 338S1201 Audio Codec	US
	Touch sensor	**Texas Instruments** 343S0694 Touch Transmitter	US
Source : iFixit			

Why Indian companies are not part of the GVC? What prevents the growth of the electronics industry in India? Why did other Asian countries like post world war II Japan, Korea, Taiwan and China which were at a similar stage of development till the late 1950s, race far ahead leaving India behind? There exists a large body of work [2] [3] [4], which addresses this issue and their findings revolve around six main points:

1. Systemic problems with Indian infrastructure which prevents the growth of manufacturing industry in general
2. Obligation to allow custom duty free import of key electronics products under the ITA-1 agreement
3. Very weak local supply chain for components and basic raw materials compounded with inverted tax structure
4. Non availability of finance at a competitive rate
5. Lack of trained manpower and low spending on R&D
6. Complicated tax and labor laws

India's weakness in the manufacturing sector is well documented. According to the World bank report on global manufacturing and manufacturing strategy report for the 12^{th} 5 year plan (2012 -2017) for the past 30 years, India's manufacturing sector contribution has stagnated around 15-17% to the total GDP which would place India's share in global manufacturing at 1.3 - 1.8%. Corresponding figures for the manufacturing sector in China is about 32-34% of the total GDP and share in global manufacturing at 13.7%, up from 2.9% in 1991. Several reasons have been put forward for the stunted growth of the manufacturing industry and one of the major reasons is the "cost disadvantage" factor which takes into account the high logistics cost due to a poor transport network, unreliable power supply, outdated land acquisition and labor laws and cumbersome procedures for shipping manufactured goods.

Apart from these common problems faced by the Indian manufacturing industry, electronics manufacturers have to contend with a deluge of custom duty free goods imported under the provision of the Information Technology Agreement – 1 (ITA-1). India joined ITA – 1 in 1997 and according to its terms, it had to abolish custom duty on 800 IT related products (247 tariff lines) in stages between 1998 and 2005. This agreement was quite helpful with respect to the booming Indian software industry, which required IT related hardware products at reasonable costs to sustain its high rate of growth. The Indian IT services industry has performed spectacularly in the past couple of decades and the ITA -1 agreement deserves some credit for it, at the same time, it cannot be denied that it's beneficial effect has been overshadowed by the floundering of the domestic electronics manufacturing industry as a direct consequence. When India joined ITA – 1 regime in 1997, it was from a position of weakness with its electronics industry being in infancy. This is in stark contrast to China, which joined the same agreement in 2003 from a position of strength while it was already the 4th largest exporter of ITA – 1 listed products. As a direct consequence of cheap imports, the Indian electronics manufacturing industry is in a sharp decline. Many manufacturers have become traders as the price of imported goods is far less than what it costs to manufacture in India. According to a report published by the "Electronics Industries Association of India" (ELCINA), around 1000 electronic component manufacturers were forced to close down their businesses as they could not compete against Chinese imports. As an inevitable consequence, the share of domestically manufactured electronic components in the final "made in India" product has gone down from 50% to 20%. [5] [6]

Lack of thriving component manufacturing industry has long been recognized as an impediment to the growth of Indian electronics industry. This industry is dominated by small scale industrial (SSI) units and lacks major players with good financial backing. SSI units are not able to produce and sell large volumes of their products hence, the unit cost shoots up. Most of the basic raw materials like copper wire, plastics, non-ferrous metals which are required in the production of electronic components have to be imported. The import raw materials not only attract higher custom duty than the finished

products but are also dependent on the fluctuations of the conversion rate of Indian rupee. As the individual SSI units do not have large import volumes, their bargaining power is limited. [5]

Electronic component market can be divided into four segments; active components, passive components, electro-mechanical components and other associate components. According to the data published by ELCINA, demand for the active components which consists of Integrated circuit (IC) chips, Diodes, Transistors and LEDs is largely met by imports. Only bright spot is the production of Cathode Ray Tube (CRT), which is getting obsolete in the developed market and India has a chance to grab a major share of demand coming from developing market. In Passive component segment consisting of “wound components”, capacitors, resistors, piezo-electric crystals and crystal oscillator situation is no different. Indian component manufacturers are able to produce wound resistors, which is a low tech, high labor industry but are not able to produce high-tech thin film and chip resistors. Similarly, Indian manufacturers are able to produce film and electrolytic capacitors but are lagging behind in the production of the state of the art ceramic capacitor. Wound components segment, consisting of transformers, chokes, inductors and coils presents the same story. India is almost self-sufficient in terms of inductor manufacturing but most of the chokes and transformers are imported from China. India lacks copper wire manufacturing industry hence the wound component manufacturers have to import it from China and Korea. Printed Circuit Boards (PCBs) along with connectors, speakers, relays, Fuses and stepper/micro motors are examples of the electro-mechanical component segment. Out of these products, PCB manufacturing is doing well as far as the annual growth is concerned. In the associate component segment, India is totally dependent on imports for RF tuners, heat sinks, magnetrons and to some extent magnets.

	Active Components (in Million USD)				
#	**Type of Components**	**Total Market**	**Local Production**	**Imports**	**Exports**
1	Integrated Circuits (ICs)	1163	47	1116	-
2	Cathode Ray Tube (CRT)	789	631	158	7
3	Diode	104	20	84	2
4	Transistor	83	17	66	3
5	LED	60	5	55	-
6	**TOTAL**	**2199**	**720**	**1479**	**12**
Source: ELCOMOS report prepared by ELCINA, January 2012					

Table 3: Active Components Market

	Passive Components (in Million USD)				
#	**Type of Components**	**Total Market**	**Local Production**	**Imports**	**Exports**
1	Wound Components	1413	424	989	17
2	Capacitor	269	48	221	40
3	Resistor	81	5	59	2.83
4	Piezo-electric Crystal	63	-	63	-
5	Crystal Oscillator	54	-	54	-
6	**TOTAL**	**1880**	**477**	**1386**	**59.83**
Source: ELCOMOS report prepared by ELCINA, January 2012					

Table 4: Passive Components Market

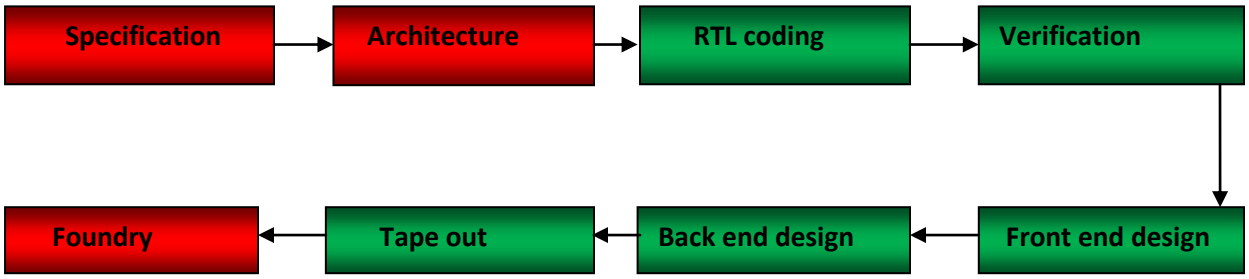
	Electro-Mechanical Components (in Million USD)				
#	**Type of Components**	**Total Market**	**Local Production**	**Imports**	**Exports**
1	Printed Circuit Boards (PCBs)	630	157	473	52
2	Connector	607	256	351	97
3	Speakers	409	327	82	2
4	Switch	377	226	151	80
5	Cables	373	300	73	33
6	Relays	31	17	14	2
7	Fuse	15	9	6	1
8	Micro/Stepper Motor	22	-	22	-
9	**TOTAL**	**2464**	**1292**	**1172**	**267**
Source: ELCOMOS report prepared by ELCINA, January 2012					

Table 5: Electro-Mechanical Components Market

	Associate Components (in Million USD)				
#	**Type of Components**	**Total Market**	**Local Production**	**Imports**	**Exports**
1	Optical Disc	298	238	60	834
2	Magnets	110	11	99	Negligible
3	RF Tuner	100	-	100	-
4	Heat Sink	67	-	67	-
5	Magnetron	55	-	55	-
6	Magnetic Tapes	10	-	10	-
7	Other Components	2022	202	1820	-
8	**TOTAL**	**2662**	**451**	**2211**	**834**
Source: ELCOMOS report prepared by ELCINA, January 2012					

Table 6: Associate Components Market

Out of all these components, it is a matter of concern that India has negligible capacity to fabricate ICs. India has a thriving IC design (or VLSI design) industry, mainly driven by the local captive units of mainly US and European Multi National Companies (MNCs). [7]



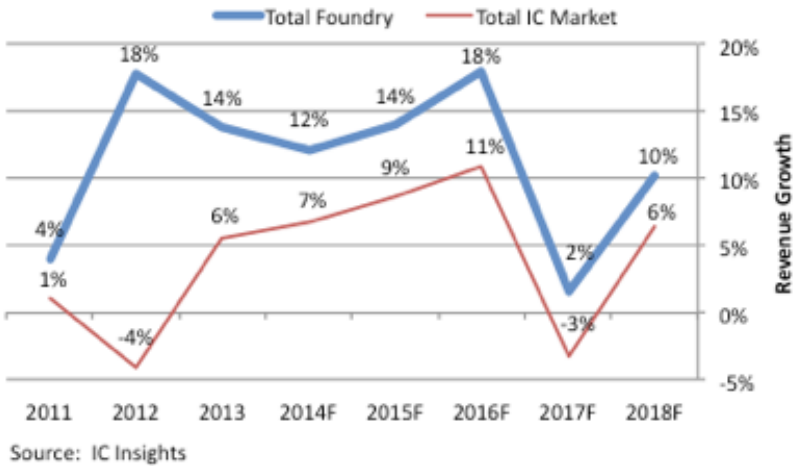
Source: IESA report, April 2011

There are around 120 foreign and Indian owned IC design houses in India (design activity involves first seven steps and the final step of "IC fabrication" involves a foundry to produce a physical IC). It is rather unfortunate that "end to end" design ownership starting from specifications to tape out is rare occurrence in Indian context. Main reason being that in the MNC owned design houses, the high-end and prestigious activities like specification and architecture definition are carried out in the global center. Even for Indian owned design centers, the role is limited to mainly verification, front end (synthesis) and backend design. India has fifth highest number of IC design houses in the world and it should be a matter of time before local companies take up the role of ODM and participate in the end to end design activities. As far as the fabrication or IC manufacturing activities are concerned, there are no commercial foundries in India capable of fabricating chips on a large scale. Foundries can be classified in to two segments; "pure-play and Integrated Device Manufacturer (IDM). According to the IC insight definition, pure-play foundry is an entity which does not produce a significant amount of ICs of its own design but instead focuses on fabricating ICs for other "fab-less" companies. TSMC, UMC, Global Foundries and SMIC can be defined as pure-play foundry. On the other hand, IDM companies are the ones which primarily fabricate their own ICs and depending on the spare capacity, offer foundry services to other "fab-less

companies". Samsung, Intel and Fujitsu can be classified as IDMs. It is interesting to note that a major IDM company, IBM may decide to exit the IC manufacturing business.

Total Foundry vs Total IC Market Revenue Growth

Year	Pure-Play Foundry ($B)	% Chg	IDM Foundry ($B)	% Chg	Total Foundry ($B)	% Chg	Total IC Mrkt ($B)	% Chg
2011	27.0	2%	4.9	20%	31.9	4%	265.6	1%
2012	31.1	15%	6.5	33%	37.6	18%	254.8	-4%
2013	36.2	16%	6.6	2%	42.8	14%	269.1	6%
2014F	41.2	14%	6.8	3%	48.0	12%	287.1	7%
2015F	47.8	16%	6.9	1%	54.7	14%	311.8	9%
2016F	57.2	20%	7.3	6%	64.5	18%	345.9	11%
2017F	58.3	2%	7.2	-1%	65.5	2%	335.0	-3%
2018F	64.6	11%	7.6	6%	72.2	10%	356.5	6%
2013-2018F CAGR	12%		3%		11%		6%	



Source: IC Insights

In the absence of such foundries, Indian companies can only design a chip but cannot produce a "made in India" chip. This is a matter of concern to the local IC design industry and the government. Citing various reasons starting from the local value addition to the national security, government has tried to encourage establishment of IC foundries in India. It seems that China's "foundry first" approach has some appeal to Indian policy makers. In this policy, it is believed that if you establish a foundry to build electronics chips, the chip designing ecosystem will quickly develop. According to Loren

Brandt and Thomas G Rawski [8], Chinese semiconductor industry was in a primitive stage till early 1990s; to give it a boost, the Chinese government launched Project 908. It assisted a state owned Huajing Electronics to get 0.9µm technology from Lucent Technologies. One year, Project 909 was launched under which NEC was chosen as a joint-venture partner to construct an 8-inch, 20,000 wafers per month processing line. Successful implementation of this project created a positive environment for further investment in wafer fabrication unit and encouraged local chip design business and the related eco-system.

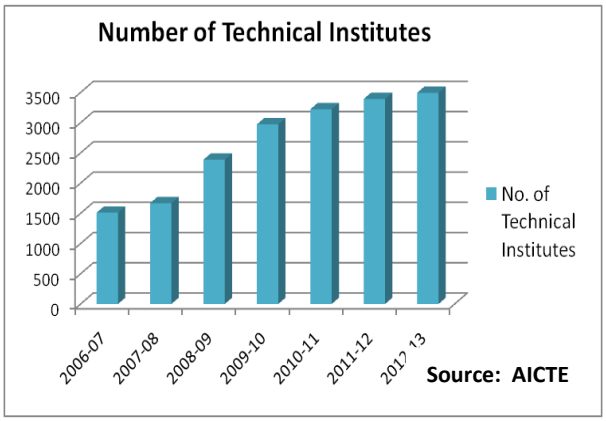
High-end electronics manufacturing is a very capital intensive business due to rapid changes in the manufacturing technology and fast rate of obsolescence. In India, most of the electronics manufacturing is concentrated in the small and medium enterprises (SME). Due to the lack of Venture Capital (VC) funding, this sector primarily gets its finance from banks. Bank loan rates in India are around 5-6% point higher than that of China. High cost of finance along with low volumes of production, contributes to the cost disadvantage factor. [5]

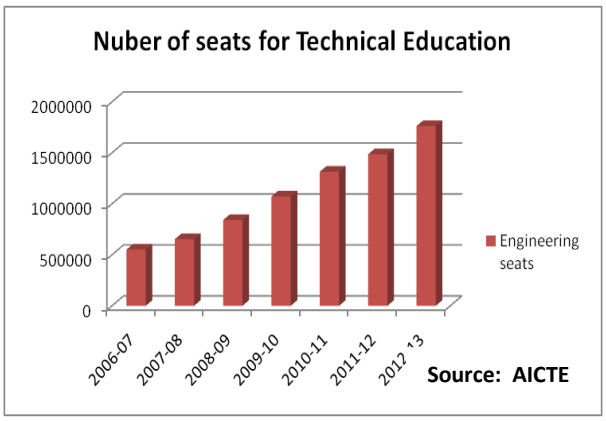
Indian telecommunication equipment manufacturing industry is facing similar predicament. According to a study carried out by telecom market research firm Ovum, Indian telecom companies will constitute 6.6% of global demand for telecommunication in 2014-15. These companies would purchase INR 460 B worth of telecom equipment – excluding mobile handsets, and bulk of these purchases would be made from the EU and China based companies. According to the Telecom Systems Design and Manufacturing Association (TSDMA), only 3% (overall INR 615B market in 2013-14) of Indian companies are involved in the design and manufacturing of telecom equipment as well as in the development of intellectual property. Companies such as HFCL, Tejas Networks, Coral Telecom and VMC have a presence in the core Indian telecom space. These companies offer Transmission, Access and Core network equipment such as Carrier Ethernet solutions, SDH-based multiplexers (STM-1, STM-4, STM -16 & STM-64), RF & Microwave antennas, Repeaters, Switches and Testing & Measurement

equipment. Contribution from foreign companies, with manufacturing plants in India, would push this number to about 10%. [9].

The key to developing and sustaining any high-tech industry is to have adequate and suitably trained manpower. This is especially true of the electronics design industry which needs a constant stream of “ready to deploy” graduates to survive and prosper. In the first decade of the 21st century, India has witnessed an explosive growth in the IT and electronics design segment, thus sharply pushing up the demand for fresh graduates. The Indian academic community responded by tripling the number of technical institutes in just one decade. Building a good educational institute requires experienced faculty members and adequate infrastructure. The older, established institutes had the luxury of time to incrementally build up man power as well as infrastructure. Newly founded institutes are expected to achieve that level in just three to four years

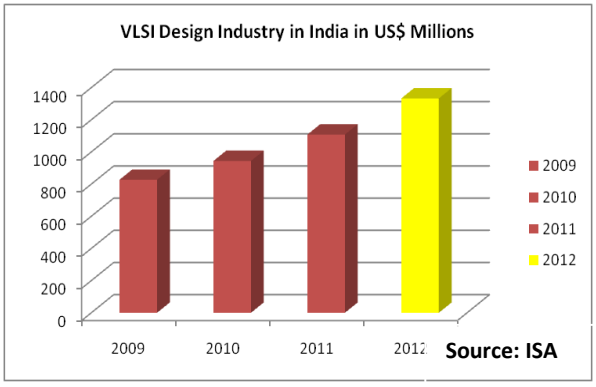
According to the Ernest and Young [10], India produces 4 million graduates every year. Records of the All India Council for Technical Education (AICTE) claim that in 2011, India produced more than 1 million engineering graduates.

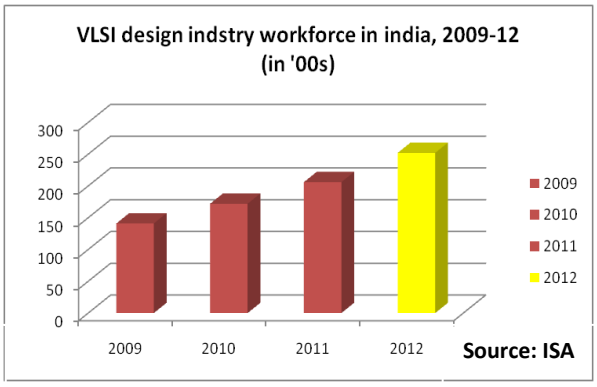




All these numbers may paint a slightly misleading picture of having an abundant pool of engineering talent in India. When it comes to specialization in electronics, the

“employable” or “ready to deploy” talent pool shrinks dramatically to a small number. According to the survey conducted by the Indian Semiconductor Association (ISA) with the help of Ernest & Young, one of the major challenges for the Indian IC design industry is “The difference in expectations between the industry and the Indian education system results in low skill-sets in the talent pool graduating from non-premier institutes. This implies higher training costs and a considerably large gestation period before an engineer becomes productive”. According to the same report, Indian semiconductor sector employs over 163,000 engineers of which an estimated 20,000 serve in the IC Design Services industry, worth one billion US$ in 2011.





For the continued growth of the Indian IC design services industry it is necessary to create a large pool of well trained fresh graduates who are “ready to deploy” in the industry. For the overall growth of the electronics industry, India requires a wide range of talents starting from good engineers to well trained technicians and skilled labour.

Indian Government’s Response:

Before the advent of GATT and ITA agreements, industrial policy was an instrument used by governments to nurture key industries or institutions through active intervention or assistance. Industries selected for such a facility were expected to fulfill one or more of the criteria; its relevance for nation building, capacity for sizeable employment generation, expected revenue generation through exports and requirements for national defense. Government intervention involved preferential tax treatment, trade barriers

against imports, preferential procurement by government agencies, direct financial assistance and the rescue of failing firms. Industrial policy was closely linked with or supported by the innovation policy, competition policy, trade policy and education/training policy. Together they formed an ecosystem for an overall industrial development. Asian industrial giants exploited this path to the hilt for maximum benefit to their local industries. [11] [12] [13] [14]

Comparison of the performance of countries shows that countries that managed to catch up with the earlier industrialized, high-income countries were the ones whose governments proactively promoted structural change. Therefore Industrial Policy, with a focus on manufacturing, is back on the national agendas of many countries. The critical question now is not whether there should be an industrial policy (in which 'manufacturing' is invariably the dominant component), but what the paradigm and the industrial policy architecture should be. Successful industrial policies have generally not been an outcome of centrally planned economies but that have had the involvement of private enterprise and other non-governmental stakeholders. Successful strategies evolve from on-going productive interactions between government and producers. Therefore the government should improve the process of interaction, collaboration, and learning amongst producers and itself.

This is very different from the paradigm of Indian industrial policy prior to India's economic reforms that commenced in the 1980s. In that era, industrial planning was a top-down control activity with Government determining who should produce what, where and how much of it. The paradigm shift of collaboration and learning has been attempted while formulating the manufacturing roadmap starting from 9th five year Plan and beyond. [15][16][17][18]

Decade of 80's heralded a change in the Indian approach, transpired by the world events. China which suffered under Chairman Mao's failed economic policies, decided to break away from the legacy. In 1978, under the leadership of Deng Xiaoping China embarked on a gradual economic reform process with a major emphasis on the

modernization of science and technology through a pragmatic approach. With changing world scenario, India decided to shift its goal from “self sufficiency” to “self reliance”. This was reflected in the industrial policy statement of 1980 under the leadership of then Prime Minister Mrs Indira Gandhi. It laid the groundwork for encouraging foreign investment in high technology areas and increasing export based industry. According to Mr Dinesh C Sharma – author of “The Birth and Growth of India’s IT Industry, “*post 1980, Indira Gandhi was a changed person, It was as if she was trying to make amends for her excessive socialist policies in the 1970s*”. She set in motion many ground breaking policies which were formalized after her death in 1984. The technology policy of 1983 was an effort in this direction. Next Prime Minister Mr Rajiv Gandhi continued this trend and decided to give major fillip to the budding IT industry. In what is known as the “Computer policy” of 1984, the hardware imports were liberalized. There was also a provision for allowing software exports via satellite links, which brought in the first major multinational company (MNC) Texas Instrument (TI) to India. This was a major win for the Indian government as it sent out signals to the high-technology communities of the world to consider India as their next business destination. In these heady developments of India emerging as an IT destination, the development of electronic hardware industry was put on back burner. The result was that by 1999, Department of Electronics was merged in to a newly formed Ministry of Information Technology (MIT) which in 2002 acquired the name Department of Information Technology (DIT). Electronics industry had to wait till 2012 to get back into prominence when the name “Department of Information Technology” was changed to “Department of Electronics and Information Technology” (DEIT).

By mid 1990s it became apparent that trade in IT and IT related products would be a major driver of the world economy. In order to provide a boost to the world trade in IT related product, during the Singapore Ministerial Conference of the WTO, a proposal was adopted known as the “Ministerial Declaration on Trade in Information Technology Products”. It was later adopted as “Information Technology Agreement” or ITA. It is a pluri-lateral trade agreement that requires member countries to eliminate their tariffs on a specific list of IT and telecommunications products by a specified year. The

agreement covered around 97 percent of world trade in defined IT products. Agreed upon list contained computer hardware & peripherals, software, telecommunication equipment, electronic components, semiconductor manufacturing and testing products and some miscellaneous items. India joined this agreement on 25th March 1997 and the consequences were that in all 217 tariff lines were identified, out of which 97 were reduced to zero level by 2000, 4 by 2004, 2 by 2004 and rest 116 by 2005. In short, from 2005 onwards about 800 products could be imported in India with no custom duty.

National Taskforce on IT and Software development 1998

Right after signing ITA -1, Planning commission of India decided to form a taskforce with Mr. Jaswant Singh – then deputy chairman of the planning commission – as its chairman. The taskforce contained members from the government bodies and industry associations. This taskforce submitted two reports; the first report was titled as "IT action plan on development and export of software and data communication" followed by the second report on "development, manufacture and export of IT hardware". In the second report, recommendations were mainly on the lines of custom duty exemptions, tax breaks and working capital loans from banks and venture capital companies (TDICICI).[19]

Standing Committee on Information Technology 2002

In 2002 a standing committee was formed under the chairmanship of Mr. Somnath Chatterjee to find out ways to keep up the growth rate of software industry and to save the hardware industry. It was very clear from the introduction of the report, which stated that "the Indian Hardware Industry has been passing through a transition and is under a lot of pressure and the very issue of survival of the Hardware Industry has been a matter of major concern". Committee concluded that infrastructural constraints, inverted tariff structure, high incidence of overall duty, lack of strong engineering and design base and R&D infrastructure, lack of availability and high cost of finance, policy and procedural issues relating to Industrial, Fiscal and EXIM policy and Inspector Raj, low

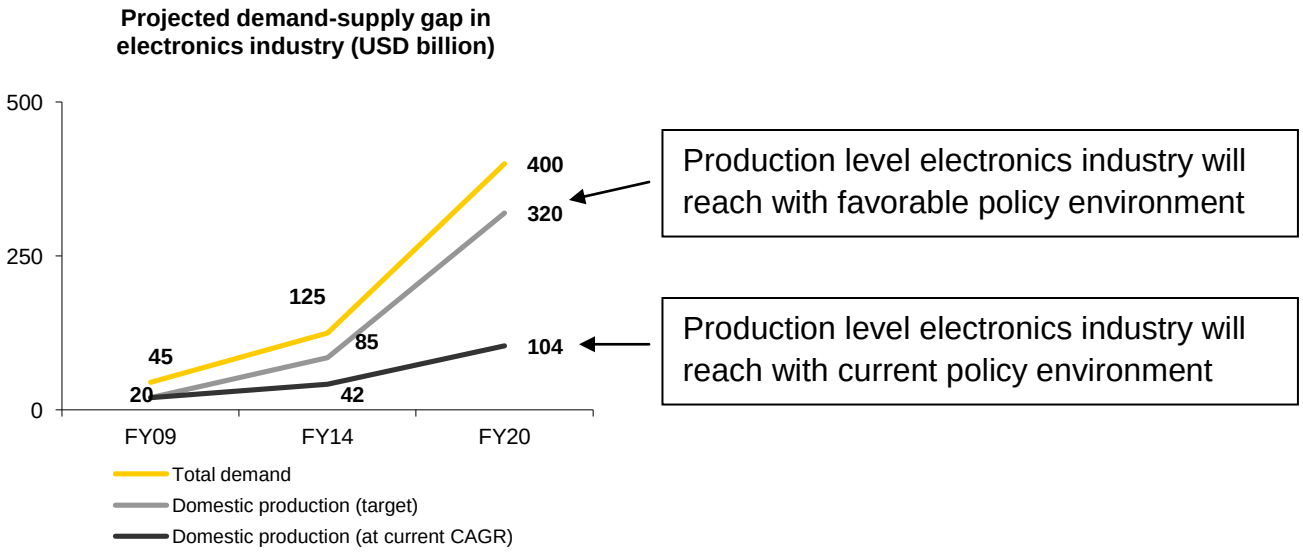
volumes of production, large inventory levels, low technology level, low degree of automation, lack of investment and a modern Fab and emerging competition from china and other MNCs. This makes a fascinating reading because same issues have been raised again and again in all subsequent reports including the latest National Policy on Electronics outlined in 2012. [20]

SIPS 2007

The Indian government and various professional bodies representing the electronics manufacturing industries predicted such a scenario, as a result of which in March 2007, the first “Special Incentive Package” (SIP) scheme was offered by what was then called the department of Information Technology (DIT). This scheme was primarily to attract investment in the “semiconductor fabrication” (fab) and other micro and nano technology manufacturing industries in India. Any company wanting to setup a fab in India with a minimum investment of INR 2500 crore (or INR 1000 crore for the manufacture of any ecosystem product), was eligible for capital investment with an incentive of 20% of the capital expenditure during the first 10 years for the units in the Special Economic Zone (SEZ) and 25% for the same in non SEZ. Units in non SEZ, it was announced would be exempt from paying Countervailing duties (CVD). It was hoped that these incentives would result in the setting up of 2 to 3 fab units and up to 10 ecosystem units. It seemed that the government was trying to follow China’s “foundry first” approach to kick start the IC manufacturing industry. Some interest was shown by a consortium called SEMINDIA to setup a fab unit in Hyderabad, Reliance group and a startup company Hindustan Semiconductor Manufacturing Company (HSMC) for setting up a fab unit in Jamnagar and Hyderabad respectively. Reliance formed a company called “Reliance Semiconductor” to carry out this project with plans to invest up to USD 3B. Both companies later decided not to go ahead with their announced plans. It was clear that the SIP failed to attract any sizeable investment. [21]

In August 2009, alarmed by the ballooning demand of electronics items and the ever increasing gap between the local production and imports, the Ministry of

Communication and IT formed a joint DIT – Industry taskforce with a charter to "suggest measures to stimulate the growth of IT, ITES and Electronics hardware manufacturing industry in India". This report published in late December 2007 conducted by the Frost & Sullivan (F&S) predicted that India's electronic chip and component demand would reach $400 Billion by 2020. Considering India's minuscule electronics design and manufacturing capacity which is of no match to the projected demand, created fear that by 2020, India's "chip import bill" will become larger than the oil import bill.



Recommendations made by this taskforce were taken into consideration by the working group on IT that was constituted in 2011 by the planning commission of India for the 12th five year plan (2012 -2017). Issues related to the electronics hardware industry were taken up by the "e-industry" subgroup. The detailed report finally led to what is now known as the "National Policy on Electronics" (NPE) -2012.

NPE 2012:

The objectives of NPE 2012 are quite ambitious:

1. To create an ecosystem for the Electronics System Design and Manufacturing (ESDM) sector to achieve a turnover of US$ 400 billion by 2020 involving

investment of US$ 100 billion and employment for about 28 million people at various levels

2. To achieve leadership in the area of VLSI chip design and embedded system software to achieve a turnover of US$ 55 billion by 2020
3. To build a strong supply chain of raw materials, parts and electronic components to raise the indigenous availability of these material from existing 20-25% to over 60% by 2020
4. To increase export in ESDM sector from US$ 5.5 billion to US$ 80 billion by 2020
5. To increase skilled manpower with emphasis on post graduate education and to produce 2500 PhDs annually by 2020
6. To create an institutional mechanism for developing and mandating standards including certification for electronic products and services for quality assurance
7. To develop an appropriate security eco-system in ESDM for its strategic use
8. To create a long term partnership between ESDM industry and strategic / core infrastructure sectors like Defense, Atomic Energy, Space, Railways, Power and Telecommunication
9. To create Intellectual Property (IP) in ESDM sector by increasing fund flow for R&D, seed capital and venture capital for startups
10. To develop electronic products to cater to domestic needs including rural needs
11. To become a global leader in Electronic Manufacturing Services (EMS) sector by promoting progressive higher value addition in manufacturing and product development
12. To expedite adoption of best practices for e-waste management
13. To create specialized governance structures within Government to cater to the specific needs of ESDM sector
14. To facilitate cost effective loans for setting up ESDM units in identified areas
15. To source, stockpile and promote indigenous exploration and mining of rare earth metals used in electronic components

Implementation of the Objectives and recommendations

The Indian government adopted a two pronged approach to achieve these objectives. To boost the supply of ESDM business a number of schemes were floated. In the working group report on e-industry it was mentioned that in India, the disability cost in manufacturing was as high as 19-22% due to among other reasons, poor infrastructure and non availability of finance at affordable interest rates. To overcome these two problems, a “Modified Special Incentive Package” (M-SIP) scheme was announced for the establishment of Greenfield and Brownfield clusters. Under this scheme, a subsidy worth 20-25% on capital expenditure is made available to the qualifying units from the 29 verticals identified in the Electronics System Design and Manufacturing (ESDM) sector. A sum of INR 1000 billion has been allocated in the 12th five year plan. More than 14 states and the union territory of Pondicherry have applied for opening of ESDM clusters. Along with this a commitment of financial support has been offered to companies or consortiums interested in establishing two fabs.

On the demand side, a major initiative was launched called the Preferential Market Access (PMA). This policy was a genuinely new initiative offered in NPE 2012. According to the provisions of PMA, Department of Electronics and IT (DEIT) identified seven products, which included Desktop, laptop & tablet PCs, contact & contactless smart cards, LED products and dot matrix printers. All government departments are required to procure minimum 30% of the requirement of these products from sources which would provide a minimum amount of local value addition. The amount of local value addition was fixed at 25% for the first year and then would increase by 5% every year till the figure reaches 45%. This PMA policy was made possible due to the fact that India has not yet signed Government Procurement Agreement (GPA) under WTO. China has enacted similar Government Procurement Law (GPL), under which government agencies have to purchase Chinese products. China defended this policy of “buy China” as part of its stimulus package and very much in line with US’s “buy American” stimulus provision. With these examples to follow, India must follow through with “buy India” policy.

Similar policies have been announced by telecommunication department, which has listed 23 products, ranging from Encryption/UTM platforms, core/edge/enterprise routers, SDH/Carrier- Ethernet/packet optical transport equipment, Wi-Fi based broadband wireless access systems, Network management systems and security and surveillance communication systems and repeaters. Some of these products are considered as sensitive products and under the national security clause, 100% of the procurement has to be from India based companies. The required value addition is in the range of 25% to 45% in the first year, incrementing by every year and would reach maximum value of 45% to 65% in the 5^{th} year.

Indian government has been trying hard since 2005 to invite companies to setup fab units to help promising IC design industry. India is probably guided by China's "Fab first" approach, which meant that build the fab and orders would follow. China started heavily investing in fabs. In 2000-2005 periods they were able to attract investment in fabs from Semiconductor Manufacturing International Corporation (SMIC), Grace, Huanhong and Hejian. In the next phase they managed to bring in Intel and Hynix. These companies were provided with generous government incentives.

Policy Analysis:

Has NPE 2012 been successful? It has been around for past three years – which may not be enough to pronounce a judgment but it is surely sufficient to gauge the trend. From industry perspective, NPE 2012 rests on four pillars; MSIPs, Electronic Manufacturing Cluster (EMC) scheme, Preferential Market Access (PMA) and recently announced Electronics Development Fund (EDF).

MSIP scheme has received a limited response. Among the large players, only those players with existing businesses like Samsung, Bosch and Micromax have applied and received approval for setting up their units in Noida. These gains were compensated when Nokia closed down its Chennai unit for mobile handset production in November

2014, affecting 8000 jobs. One month later Foxconn also closed down its Sriperumbudur citing lack of orders. DeITY in its May 2014 e-newsletter sounded optimistic regarding applications under MSIP scheme. It should be noted that the largest contribution in the estimate is from two proposed water fabrication plants in Noida and Prantij. According to the newspaper and looking at the situation on ground, the fab's future is not very certain. In the mean time, there is an indication by a US based chip manufacturing company called Cricket Semiconductor to invest USD 1B to setup an Analog FAB in Madhya Pradesh. It was announced in IESA vision summit in early Feb, 2015. Its implementation remains an open question.

#	**Electronics Vertical**	**Application amount in Rs (crore)**
1	Semiconductor	64500 (?)
2	Telecom Products	9339
3	Strategic Electronics	2330
4	LED	1993
5	Automotive Electronics	883
6	Consumer Electronics	367
7	Industrial Electronics	330
8	EMS	104
9	Avionics	98
10	Medical Electronics	53
	Total Proposal 41	79997
Source: DEITY e-newsletter May 2014		

MSIP scheme has not created much enthusiasm among the Micro, Small and Medium Enterprises (MSME) segment. As of August 2014, it received only 6 proposals with investment worth INR 1.77B. The MSIP scheme remains open till 26th July 2015 hence there may be some increase in this figure.

#	**Sector**	**Investment in Rs (Crore)**
1	LED	12.92
2	Electro-mechanical Components / Passive components	23.43
3	Industrial Electronics	19.52
4	Health and Medical Electronics	22.76
5	Avionics	97.93
6	Total 6 applications with investment of	176.55
Source: DEITY e-newsletter August 2014		

PMA scheme was very warmly received by the domestic manufacturers. It was seen as a way of leveling the playing field. Predictably it invited a backlash from the domestic telecom operators and the foreign telecom equipment suppliers. It is unfortunate that some of the major business houses in India are in the business of telecommunication services and are net buyer of electronics/telecom equipment. On the other hand, the electronics / telecom equipment producers are mainly SMEs. There is a differing perception about the quality, supplying capacity and cost of local products between telecom equipment buyers and Indian producers.

Some of the government departments like NICSI have started empanelling domestic manufacturers of electronic goods for internal needs. As it can be seen from the amount of goods purchased, it sounds very marginal.

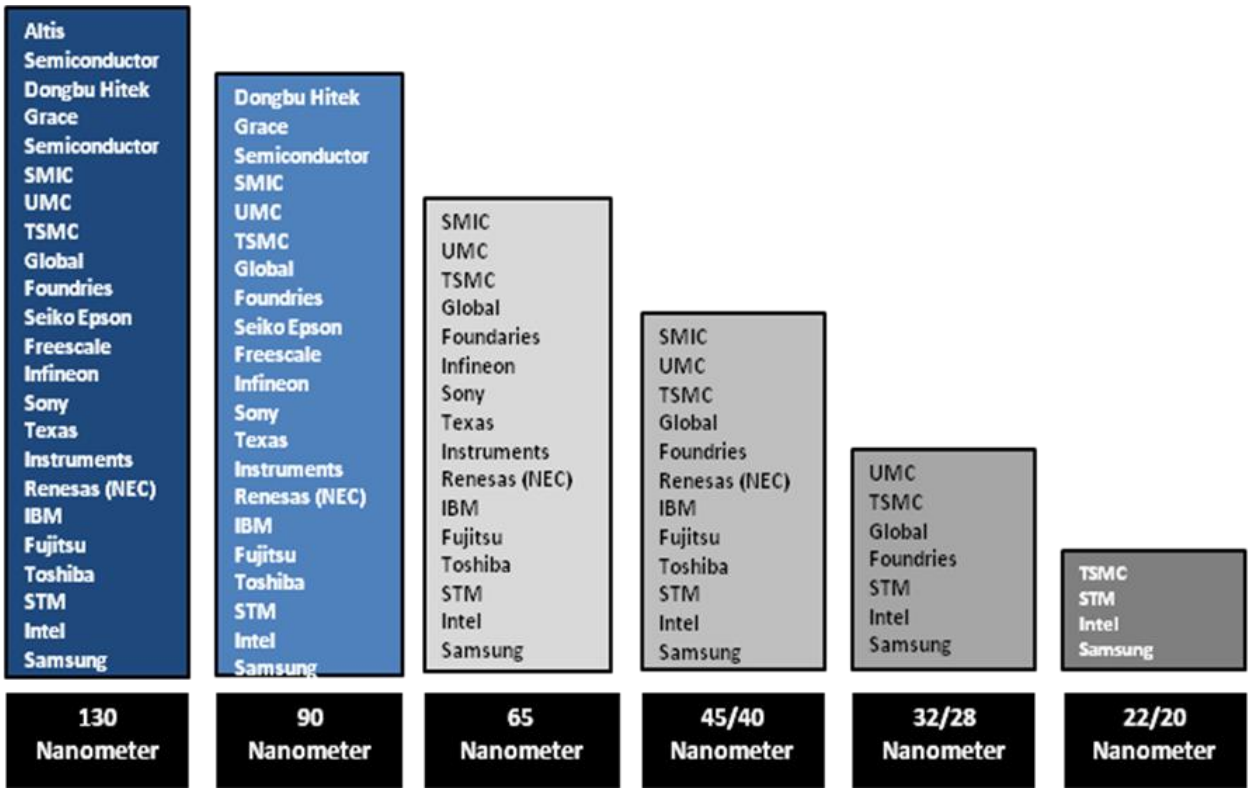
#	**Name of the Product**	**Name of the empanelled OEM/Vendor**	**Amount of procurement made by NICSI and % of domestic value addition**
	Dot Matrix Printer	1. WeP Solution Ltd 2. Lipi data system Ltd 3. Espon	NICSI purchased printers worth INR 23 lakh from WeP Solution. 50% domestic value addition

	Contact Smart Card	1. M-tech innovation pvt ltd 2. Rosmerta technologies	INR 4.04 crore purchase from M-tech. 30% domestic value addition is claimed
	LAN (passive copper, Fiber cables & GPON	1. Online Micro 2. Qi Network 3. Wipro Ltd	INR 32.67 lakh purchase from Online Micro. They have claimed domestic value addition of 1. Passive (Copper) 60% 2. Fiber Cable and Components 90% 3. GPON Equipment 100%
Source: DeITY e-Newsletter, May 2014			

Indian government has only two options; either forget about increasing local value addition and developing a thriving electronics manufacturing industry or persist with PMA policy and give local industries a chance. It must be said that the PMA policy is not discriminatory in terms of nationality of the original company. Any company which sets up a manufacturing plant in India is defined as an Indian company for the purpose of PMA.

Can India replicate China model in terms of “Fab first” policy? The answer, considering present state of the global semiconductor industry trends, is disappointing. IC fab has become a risky business with very high initial investment, cyclic nature of the demand, continuous technological upgradation requirement and oligopolistic nature of the industry. It would cost $4.0-$5.0 billion for a high-volume state-of-the-art 300mm wafer fab and the cost to build 450mm wafer fab will be twice as much. According to one report by Gartner, The Semiconductor Manufacturing International Corporation, one of the most advanced foundries in mainland China, reported a profit of only $23 million in 2012 on sales of $1.7 billion. In 2011, it reported a loss. Similarly, Taiwan's UMC made a profit of only $107 million on revenues of $4 billion in 2012, a profit margin of less than

3 per cent. It would be very difficult for a new player to enter into IC fab business and run a sustainable business. It would be wise for India to concentrate on the fabless IC design business, where it already has an edge. PMA - if implemented properly – may help India based foundry to survive by providing and assured business.



As it can be seen from the above figure, the number of surviving fabs reduces drastically as the technology node becomes smaller and smaller. Very few companies can afford the cost of innovation and refurbishment.

Should government fund R&D?

R&D funding for private companies has been tried out by Japan, EU and the US with mixed results. All these countries provided funding to a group of companies. Some of these companies were business rivals. The outcome of this policy presented a mixed picture with some success stories (Japan, VLSI industry) and other total failures due to professional rivalries between companies which prevented free flow of information.

It seems that group funding is not a great idea. Helping individual company with R&D funding would invite charges of favoritism. It would be best for the Indian government to continue the policy of providing tax incentives for R&D spending. Government provides sizable funding to Indian universities. Most of the funding is absorbed by the top 30 to 50 institutions. It would be better if there is more equitable funding which would enhance R&D culture in the so called tier 2and 3 institutions. It would not be a bad idea to look into the possibility of establishing common R&D facilities and infrastructure where the institutes from nearby areas can take advantage of the tools and equipments. This may also be useful as an incubation center for startup companies.

Government has to work hard to improve the skill level across the board to make India an attractive destination for chip design or high-tech manufacturing. In 1998, the Indian government realised the need to develop quality man-power to boost investment in the IT and electronics based industry. In order to increase India's share of the world's IC Design market from 0.5 percent to 5 percent by the 2002, The Department of Information Technology (DIT), initiated the "Special Manpower Development Programme for VLSI Design and Related Software" (SMDP-I). Under this program, a total of 19 Government funded academic institutions were chosen, out of which 7 institutions were marked as Resource Centres (RC's) and the remaining 12 were designated as Participating Institutes (PI's). Each RC had two or three PIs attached to it. The DIT setup a working group consisting of various Governmental agencies and academics to come up with a "model curriculum" and a plan for establishing state of the art hardware/software facilities at these institutions. This plan was extended in 2005 (SMDP II) with a further addition of 13 government funded institutions as PIs. This program was assisted by the EDA companies like Cadence, Synopsys, Magma, Mentor Graphics, Xilinx and Co-ware by providing their software Bundles at quite a low rate. The idea was that by using these facilities and resources, all RCs and PIs would produce quality Doctorate, Masters and Graduate level students. It is claimed that with the successful implementation of this program, a combined total of 1930 students per year are available in the job market. These efforts are obviously not enough. It has to be expanded to generate more than 10,000 "industry ready" graduates per year. DEIT and

Department of Telecommunication (DST) has taken some initiatives in this area. DEIT has floated National Institute of Electronics and Information Technology (NIELIT) converted from what was earlier known as DOEACC society. It is visualized to be a standard curriculum setting examination and certification entity. Along the same lines, Electronics Sector Skill development Council (ESSC) and Telecommunication Sector Skill development Council (TSSC) have been established to create a standard curriculum and conduct certification exam across a broad swath of skill areas. These are commendable initiatives and its success depends on the acceptance and support it receives from industry.

In conclusion, it is clear that India must have a vibrant electronics industry. To achieve this goal, a PMA policy is essential along with full support from the government. M-SIP and foundry support are good initiatives but their success is dependent on the implementation of PMA. Electronic Industry does require government support to negate the effect of "cost disadvantages" in term of subsidies and tax rebates. It should be noted that these measures should be seen as temporary measures. In the long term, the government has to work on improving infrastructure along with simplifying tax structures with redesigned labour laws. It is felt that the effective implementation of a PMA policy and reforms in the above mentioned areas will give an impetus to the establishment of value chains. The directive of requiring registration for all electronics goods with the Bureau of Indian Standards (BIS) to prevent dumping of substandard goods will help local manufacturers against unfair competition. Some long term goals of improving the education sector require persistence and innovative ideas. Institutes involved in R&D activities should be encouraged to focus their efforts on specific areas with clear end goals rather than what is known as "the blue sky" research.

A success story:

On 5th January, 2015, Prime Minister Mr. Narendra Modi launched a scheme for LED bulb distribution scheme under the Domestic Efficient Lighting Program (DELP) declared by the power ministry. It was initially launched for Delhi and by March 2016 would cover 106 cities in India. Under this scheme, users who pre-register on www.eeslindia.org/Delhi-Launch would be eligible for getting four 7W LED bulbs at a

discounted price of INR 93/-. This scheme has given a great push to the PMA policy announced by the Deity especially for LED based products. According to the notification issued on 22nd May, 2014, 50% of the government procurement for LED based products has to be from domestic manufacturers, and to call a product “domestically manufactured”, it must have 50% domestic value edition on BOM right from year 1 [22]. By now the program has spread over Delhi, Maharashtra, UP, Rajasthan and Himachal Pradesh and over 20 million LED light bulbs have been distributed through the public sector firm Energy Efficiency Services Ltd (EESL). It is visualized that through this project around 150 million LED bulbs will be procured and distributed [23].

Predictably, this program has done wonders for domestic manufacturers of LED light bulbs. It has been reported that there has been a 30 fold increase in the monthly production of LED bulbs [24]. More importantly, it has attracted traders of the electronic goods to the local assembling and manufacturing. If such policies - combined with government programs - are announced, then Indian electronics manufacturing industry will surely take the flight.

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