DESTINATION INDIA FOR ELECTRONICS DESIGN

The availability of skilled talent and cost advantages are driving the growth of chip design services in India

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If China is considered the production house of the world, India can draw a bead on becoming the design capital. Say hello to a small but growing phenomenon that is steadily finding its place in the sun—electronics design service. Indian companies are leaders here.

A tectonic shift is underway in the high-technology world. Chip manufacturing activities moved out of US markets around 15 years ago in favour of Asian foundries, and now the back-end, verification and design services have also begun their eastward march. The centre of gravity of the high-tech industry is steadily moving eastwards, opening the doorway to huge opportunities for Asian nations, particularly India.

According to the global research firm Research and Markets, India's design service industry will continue to grow at double-digit growth until 2010. Communications and consumer electronics are the major growth drivers of the design services market in India. The cost advantage, availability of skilled manpower and software process maturity have compelled original design manufacturers (ODMs) to either outsource part of their design activities to third-party design firms in India or set up their own captive centres in the country. The captive centres of the ODMs work on cutting-edge technologies and the latest process nodes and contribute to the development of products for a global customer base.

However, the industry is facing a lot of challenges, like increasing salaries and lack of analogue/mixed-signal expertise in the country. The companies are building strengths to overcome these challenges and explore new opportunities.

How the market looks like?

Currently, India is emerging as a key destination for integrated circuits (ICs), field-programmable gate arrays (FPGAs) and system-on-a-chip (SoC) designs. According to Indian Semiconductor Association (ISA), a rough estimate of the types of designs being done in India is ASICs 40 per cent, SoCs 20 per cent, structured ASICs 5 per cent, gate array 10 per cent, CPLDs/FPGAs 15 per cent and fully customised products 10 per cent.

The market is huge. The 'fabless' trend continues to soar and the US Fabless Semiconductor Association predicts that the market shares of fables companies will jump from just over 10 per cent today to 50 per cent by 2010. Additionally, there is the IP design market opportunity.

The Indian design services industry will maintain an impressive growth rate of 20.2 per cent during the 2007–12 timeframe as against a 6 per cent year-on-year growth globally, and reach US$3.4 billion by 2012.

The electronics design ecosystem consists of many elements including captive centres of ODMs like Cadence, Synopsys, Mentor Graphic, Magma and Texas Instruments; subsidiaries of Indian OEMs like NXP, TATA Elxsi and Freescale Semiconductor; independent engineering design firms like Rabyte, Evolute, Alpha Design, SLN Technologies and Jupiter Electronics; and Indian design services firms like TCS, Wipro, Infosys, Tata Elxsi and KPIT Cumins.

The VLSI design activity in India is concentrated in mainly four cities: Bengaluru followed by Hyderabad, Delhi/Noida and Chennai. Bengaluru is now home to 70 of the 130 firms (including multinationals) engaged in chip design in India, making it comparable to

Silicon Valley (in the US), Cambridge (in the UK) and Taiwan, in terms of chip designing clusters.

India is also emerging as a prominent player in wireless IC design with about 38 per cent of Indian designers working on designs targeting wireless and mobile applications compared to just about 22 per cent in Europe.

Why India?

Traditionally, Taiwan has been the favourite destination for chip designing, but during the last few years, India has also seen the market grow. The availability of a large engineering talent pool and cost advantages as compared to other countries have been the key growth drivers for this industry in India.

Sanjay Mittal, managing director of Yogasa Systems, mentions that some of the other influencing factors include a strong technical education system, reduced entry barriers, government support in the form of STPI and EOU schemes, and a strong intellectual property rights (IPRs) framework.

He adds, "India is at the forefront of VLSI design owing to the cutting-edge chip design activities taking place in multinational design companies that have large-scale engineering operations here. These captive units take advantage of the availability of skilled and low-cost workforce to develop products for global markets. If the same is to be done in their respective countries, the development cost will be at least 300 per cent higher than in India."

Factors that make India an attractive destination

- Highly skilled and cost-effective workforce
- Respect for intellectual property rights (IPRs): India has a good track record of safeguarding the IPRs of foreign companies, which encourages them to establish design centres in India
- Emergence of R&D and design centres of homegrown companies, including software providers like Wipro and TCS
- Emergence of start-up design firms
- A rise in outsourcing: Asia is the hub for electronics manufacturing services, primarily because of low manufacturing cost and relatively low-cost labour, and pressure from consumer electronics/telecommunications industry

Challenges that need to be addressed

- Need to provide end-to-end services
- Poor infrastructure facilities
- High investment costs for R&D
- Competition from other Asian countries
- Inadequate support from government for the capital-intensive semiconductor industry
- Talent shortage
- Demand-supply gap for chip design engineers

Up to the value chain

India has been quick to tap into this opportunity. The semiconductor industry in India has grown rapidly in the last three to five years with the establishment of captive design centres of US chip companies and the evolution of IP-leveraged design services firms. Well-known IT services firms have also entered the market with the setting up of separate practices for electronics design services. Local companies and design subsidiaries are also evolving from the 'build-to-spec' model.

Anil Kumar, managing director of SLN Technologies, observes a discernible transition among many captive design centres from being engineering subsidiaries to becoming product companies.

"Increasingly, companies are realising that cost arbitrage will take them only to a certain level, and thus they are seeking avenues for 'value' creation with innovative designs. It may create good opportunity for Indian indigenous design service providers," says Rajiv Batra, managing director of Rabyte.

As of today, the companies in India are involved in various phases of the product design cycle. There are a number of companies which have been in this area for a long time to have built capabilities to move up the value chain. Some are trying to tie-up with architecture providers such as ARM, Intel, Marvell, Maxim, NXP and Texas Instruments and then develop products based on their architectures. These companies are getting to a level where, right from using the architecture, they can start with specifications to rolling out the final product.

"The potential for growth is huge for Indian design service providers. The top five end-user products that are expected to drive growth would be mobile handsets, desktops and notebooks, GSM base stations, set-top boxes and energy meters."

—Partha Pratim Roy, Advisor, Global Consumer Lab, Ericsson-Market Unit India & Sri Lanka

Global slowdown, rising opportunities

Globally, the design industry and the worldwide market for semiconductors

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have matured and appear headed for single-digit growth in coming years, compared to the double-digit growth of yesteryears. However, the scene in the Indian semiconductor industry is quite different. Rising middle-class income levels have created a huge market for semiconductor-intensive products and we may see this trend to continue for some more years.

According to Kumar, globally, the number of new design start is declining, whereas the value of each new design is increasing mainly due to the continuing trend of system-on-chip integration.

Amid this recession, there is a great opportunity coming up for low-cost electronic products. The Indian electronics industry is bracing up to take on the opportunity with a few advantages it already has. India, however, remains a major importer of electronic materials, components and finished equipment amounting to over $12 billion in last five years. The electronics hardware output of India is worth $11.6 billion at present. The Indian electronics industry thus has the resilience to withstand the recession.

Partnering for success

Among the more enduring examples is the partnership between Nortel and Wipro, which goes back 20 years. In 1991 Nortel set up an offshore development centre (ODC) at Wipro to develop and support telecom products for service providers and enterprise customers worldwide. Today, more than a thousand engineers at Wipro work on Nortel projects.

Nortel has since partnered with many more Indian design companies (including Infosys, Sasken and TCS), fueled by its initial success. Wipro has also benefited from the success of the Nortel ODC and now has similar centres for such clients as Ericsson and Nokia.

More recently, Japan's Renesas Technology set up its first ODC at KPIT Cummins Infosystems to strengthen its design and development capabilities. KPIT Cummins previously executed design projects for Renesas in several areas, including SoC products for use in digital consumer electronics, analogue circuit designs and embedded software.

Brand India

India is well-recognised in the international chip design services market for its technical skill, domain knowledge and access to a large talent pool.

Buoyed by these strengths, the sector is growing at almost twice the rate of application software. There are currently around 150 chip design and 100 embedded system players in the ecosystem and more and more companies are eyeing this potential market.

"Indian companies are migrating from being centres of resource augmentation to product innovation and design centres. The last few years have seen a huge growth in the number of small and innovative companies doing complete design of innovative embedded products. A similar trend exists in the captive design centres of multinationals and Indian service companies. These are becoming accountable for more and more of complete product design/delivery/ownership," says Praveen K. Ganapathy, director-DSP business development, Texas Instruments India.

Access to local customers driven by domestic consumption will only enhance product knowledge and further catalyse the maturation of India companies to be able to do complete product development, drive product strategies and roadmaps, and do high-end consulting.

EDA solutions 'made in India': Fact or fiction?

Advances in electronic design automation (EDA) technology have barely kept pace with the increasing complexity in IC designs and growth in the semiconductor industry. Will we ever see a 'made in India' tag for EDA products and services?

Recent focus in the EDA industry has been on topics that affect manufacturing and yield, such as DFM and SSTA. Such topics warrant a deeper understanding of the semiconductor

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process technologies and physics of deep-submicron devices. Given that the Indian semiconductor industry is mostly design oriented, with minimal experience in IC fabrication, will the EDA industry be curtailed in its growth? Can Indian universities step up to play a significant role to groom the EDA industry, similar to the roles played by Stanford and UC Berkeley during the EDA industry's infancy?

It is clear that the absence of EDA products 'made in India' from the large EDA companies (Cadence, Synopsys, Mentor and Magma) was perceived by many to be a disincentive to the graduates in this field. This is, however, not entirely true, as there are EDA products made in India. For example, much of Atrenta's R&D occurs in India, leading to some of its products being designed in India. A major new EDA product has also been developed by Mentor in India, with its key customer being the Broadcom design centre in India. Perhaps, the EDA companies need to do a little more publicity about their products, to boost the morale and recruitment in the Indian arena.

Moving to new edge

In a couple of years, lots of designs will shift from the present 90- and 65-nanometre process to 45 nanometres. The transition to 45nm has already begun. "Indian design service companies are gaining an increasing share of designs in advanced process nodes. Designs in new process nodes bring their own set of challenges with them, but at the same time, as they are cutting-edge, they also result in fatter margins for vendors," says Roy.

The semiconductor integrated circuits (IC) industry is driven by the need for small, low-cost, high-performance devices. The impact of Moore's Law as well as the increasing demand from the consumer electronics and telecom sectors are all fueling the need for miniaturisation and the move towards ever-shrinking form factors. Different types of materials and device configurations are being investigated to reduce the size of a chip without compromising on the functionalities of the device.

For example, scaling is an issue with eDRAMs (embedded dynamic random access memories) below the 45nm node. However, by using a different configuration of eDRAM, such as capacitorless

Evolution of design life-cycle

The life cycle depends on the design. If I have to design a microprocessor for Intel or some big company, the design time is typically years. If I start designing today a microprocessor, it will take two years before I will be able to bring it to the market and then whether the market accepts it or not is a different issue. So it takes a lot of investment, whether you design a microprocessor or a DRAM.

Typically, we do not have that much time, if we have to design a new multimedia recorder or iPhone, to design all the chips from scratch. In the 1990's we still did customise design or cell-based design or ASIC design. Nowadays, ASIC design is also very complicated as it takes six months to one year, which again is very slow. If I have to make a competitor of iPhone, I will have to get the money and design the chip around. Then I need to complete the whole work within 10-12 months. So for designing the chip, I have less than 3-6 months. So when you have that very little time, what you do for a digital design is only FPGA-based designing. At the most, you design an ASIC. As soon as you prove the design on FPGA, you prototype it and can translate it into ASIC with some modifications using software.

Ten years ago, if I were to design a chip, the actual architecture of it was very important. So people used to spend a lot of time and money on designing the chip and it was very difficult for someone to compete with them because of the intensive design part. But now time is very critical, so if you have to design the next-generation cell phone you have to come up very quickly within six months. So people prefer not to spend so much of time in design process.

Once I have designed it and worked on it, I have to test the chip using simulation tools. Basically, after designing we have EDA tools. Earlier design was done in logic level or transistor level but now everything is done in RTL level.

The main difference between doing chip design ten years ago and now is the time factor. People do not care if the design is not 100 per cent efficient or the best. They are just interested in that the design works and that they finish it within the number of months that they have decided. The competition is so high that if you do not come to the market in ten months, somebody else will. The design may not be efficient but as long as it works it is fine.

If Intel were to design a microcontroller and if they were to make it 10 per cent more efficient in terms of power and faster, they could charge much more money for the microprocessor and they knew the CPU chip was going to be running for several years. So over the life of the chip, that 10 per cent more power efficiency or 10 per cent faster performance of the chip was very important and very critical. Whereas, if I have a wireless router that is 10 per cent less efficient, you will not even notice it.

—As told by Manish Sharma, associate professor, Centre for Applied Research in Electronics, IIT Delhi, to EFY's Abhijit Paul Chaudhury

"Taking inspiration from the Nano, if we start building more products they are bound to be successful anywhere in the world. This is because the products designed in India, for India, are made keeping many constraints in mind while also considering the high demand."

—Jayaram Pillai, managing director for India, Russia & Arabia, National Instruments

Innovative designs from India

Texas Instruments (TI) has announced a scalable OMAP35x portfolio of devices available for the broad market that is ideal for manufacturers wanting to redefine the standard for advanced user interfaces, Web browsing, productivity and multimedia experience, making it easier than ever to access information and media.

The OMAP devices are an attractive solution for both big and small players. Target markets include portable consumer entertainment devices like portable media players and portable TV (broadcast and streaming TV content within the home), portable navigation devices, point-of-sale systems, patient monitoring and other medical applications, software-defined radio, IP-based communications, smart home media controllers and edutainment (eDictionaries).

Praveen K. Ganapathy, director-DSP business development, Texas Instruments, India

Ganesh Guruswamy, vice president and country manager, Freescale Semiconductor India

Freescale India design centre has completed many designs in last several years in the domains of wireless, networking and microcontrollers. MCF5225x MCU, Freescale's latest, was created by the India team in a record time. The MCU is well suited for a broad range of industrial networking, building/lighting control and medical applications that require high performance and connectivity options (Ethernet and USB).

Axis Aerospace and Technologies (AAT), formerly known as Jupiter Strategic Technologies, has developed a multi-radar data fusion system for the Southern Air Command of the Indian Air Force. AAT has designed and developed the decision-making algorithms indigenously and the entire solution runs on a real-time operating system developed in-house. It claims to be the first and only company in India to integrate civil and military radars to generate a real-time air situation picture of the entire theatre of operations and provide decision support system for air defence.

Sharadhi Chandra Babu P, vice president (corporate), business development and technology, AAT

Nirav Shah, director of marketing, eInfochips

eInfochips' team of 50 engineers has worked on a design across two sites for a customer in USA. The design was of a transcoding appliance which houses multiple DSPs and a host processor running at higher speed to support video streaming to various display sizes at different bit rates through the Internet.

NXP has unveiled its cutting-edge technology solutions in the set-top box market. The STB 150 system solution, developed by NXP, delivers a complete production-ready platform for the fast growing digital cable TV services market. It integrates the powerful single-chip CX2448x MPEG-2 decoder and QAM demodulator for DVB-C reception with a TDA18252HN silicon tuner and complete software stack, giving cable operators a cost-effective silicon platform for a new range of advanced, feature-rich digital entertainment services. This is a low-cost reference design, designed for the Indian market keeping SD MPEG4 plus DVB-S2 focus. This hybrid solution also includes an Internet connection for IPTV solutions.

N.S. Murthy, director, new business initiatives, NXP Semiconductors

DRAM, it is possible to scale eDRAM devices below 45 nm. As opposed to conventional eDRAMs which consist of a transistor and a capacitor, these capacitorless DRAMs employ one or two transistors, which can scale down to the 22nm process node.

According to Ganesh Guruswamy, vice president and country manager, Freescale Semiconductor, "One key trend in product design is going 'green,' i.e., lower power and longer battery life. Another trend is to develop single-chip solutions for any application by integrating analogue and digital technologies in one chip, i.e., analogue mixed-signal design."

Nirav Shah, director of marketing, eInfochichips, says, "Video has taken a centre stage across all electronics, which is driving many architecture and design changes at chip and system level. We are witnessing 'real time' phenomena where everybody wants information/data 'now' at his fingertips."

What's ahead?

With Indian firms continuing to demonstrate skills in part life-cycle services such as design, verification and front-end/back-end services, Evolute's managing director Parag Mehta is hopeful that they will be able to bag increasing numbers of turnkey projects.

"Currently the captive units execute about two-thirds of all the work done, with the rest being done by third-party design houses. Over the next five years, the split between captive and third-party will become 50-50," predicts Kumar.

However, "to win turnkey designs, the Indian design companies will need to augment their analogue and mixed-signal capabilities. They will have difficulties doing this quickly if they tap only the Indian pool of engineers, and will need to look for international partnerships or acquisitions," says Partha Pratim Roy, advisor, Global Consumer Lab, Ericsson-Market Unit India & Sri Lanka. ●

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