

# Future of Chip Design Industry

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**E**LECTRONICS, A USD 1.75 trillion market, is the largest and fastest growing manufacturing industry in the world. The year 2020 has special significance for the Indian Electronic Systems Design and Manufacturing (ESDM) industry with the Government announcing its vision for the years to come as per the National Policy on Electronics 2011. “Vision 2020” is an ambitious yet strategically crucial vision of the Indian ESDM industry reaching a turnover of USD 400 billion by 2020.

The Indian chip design industry – including VLSI design, embedded software development and hardware/board design - is an integral part of the ESDM ecosystem. Pegged at USD 7.5 billion in 2010, the industry is expected to reach USD 10.2 billion in 2012. As part of Vision 2020, the government aims to make India a global leader in Very Large Scale Integration (VLSI), chip design and other frontier technical areas, and achieve a turnover of USD 55 billion by 2020.

If Vision 2020 defines the future

of the Indian ESDM industry and consequently the future of the Indian chip design industry, the question that is pertinent is, “How do we realize this dream?”

## Evolution of the Chip Design Industry

To put these numbers into perspective, let us take a look at how the semiconductor chip design industry has evolved over the years. A relatively young industry, the Indian semiconductor industry was initiated in the late sixties when the country took its first step towards R&D in germanium and silicon technologies, and the first saleable integrated circuits were made and marketed domestically. MNCs such as Texas Instruments and Indian companies such as Arcus (later acquired by Cypress Semiconductor and Broadcom) were the first movers in the Indian market at a time when the industry was dominated by state-run companies. It was during the years of the IT boom (1995-2000) that an ecosystem consisting of Indian and global companies began to develop in the country. And it was only as late as 2000 that the industry witnessed the first signs of

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explosive growth, driven primarily by growing domestic demand, strong government support and availability of talent. In fact, about 42 percent of the companies that currently operate in the country, made their India foray during 2000-2005.

Post 2005, the industry is in, what is popularly termed as, the “Innovation Phase”. Perhaps, the most defining times for our industry, today we see the ecosystem gradually moving up the value chain towards design innovation and product development. Companies, both captives and non-captive, are orienting themselves to execute projects of enhanced strategic value.

### Where We Stand Today

Growing demand for consumer electronic goods, a burgeoning telecom / networking market and significant growth in the use of portable / wireless products is driving the growth of the semiconductor design industry. With the top 10 global cable companies and the top 25 semiconductor companies present in India today, we have found our unique place on the global radar. While India currently has little claim to success in manufacturing, the fabless design industry has been on to a good start. With over 120 design units as on

2010, India is well recognised as a favourable destination for fabless design services.

### Embedded Software Development

Embedded software development, estimated at USD 8.6 billion in 2012, is the biggest contributor to the industry’s revenues. Product customization due to localization and legislative requirements, lower entry barriers and adaption to open-source platforms provide an impetus to this segment.

The embedded software industry is expanding as third-party service providers are moving up the value chain to offer more high-value activities relating to middleware, driver design and associated applications. Captives now prefer to work on the hardware abstraction and the device driver layers and outsource application-related work to third-party design companies to shorten their time-to-market.

### Board / Hardware Design

Estimated around USD 672 million in 2012, this is the smallest segment in the Indian semiconductor design industry. The growth of this segment can be attributed to captive design centres of major product companies concentrating on pure-play VLSI activities and preferring to outsource their reference and new

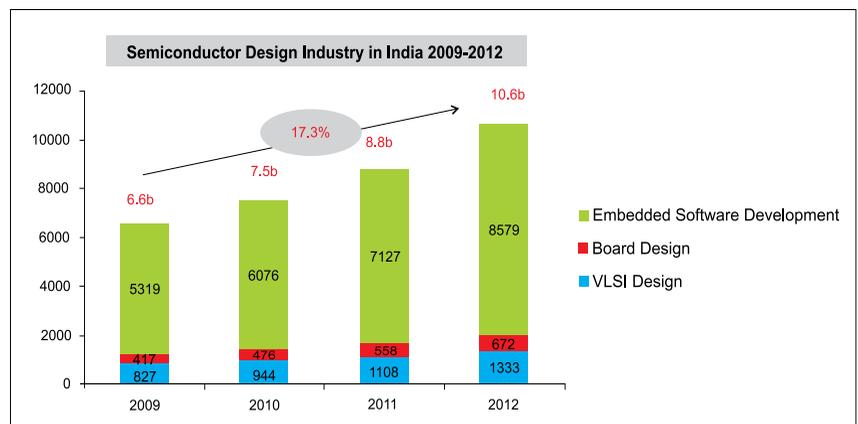
board design activities to Indian design companies. The multiple reengineering and localization opportunities available in the Indian markets provide further impetus to this segment. Most projects in board/hardware design are between six to eight layers. Projects in the 10+ layers space are mostly related to telecom/network gigabit ethernet switches.

### VLSI Design

Total revenues from VLSI design are estimated at USD 1.3 billion in 2012. Despite captives and third-party service providers building capabilities to service the entire value chain, end-to-end product ownership does not typically rest within the country. This is primarily because product ownership is a function of proximity to the end customer. With most of the VLSI business for India originating from USA and Europe, higher-end activities like specification definition and architecture design, are restricted to the regional headquarters that directly interact with the end customers. It is, however, interesting to note that given the distributed and collaborative development methodology adopted by most global semiconductor companies, no single centre holds total ownership of a product. IPR rights for all designs continue to remain with the headquarters of these companies.

### Who is Making Design Decisions?

As the industry is maturing, companies have begun investing in India to develop their IP within the country. Several captives are beginning to partner with third-party service providers to participate in early chip development programmes and provide modular IPs to reduce their time-to-market.



Reinforcing India’s competitive position in the design services segment is the fact that global companies are increasingly moving their high-end work to their Indian locations. In terms of complexity, more than 50 percent of the projects completed in India in 2009 were in the 1M–10M gate range. While this gate range continues to grow at a steady rate, there is significantly increased activity in projects in the 10M–20M gate range.

While captive centres continue to account for about 70 percent of the total revenues for the segment, third-party design and development partners are beginning to gain equal importance in the market. According to a recent VSLI design services study, outsourced product design companies in India include industry behemoths such as Wipro as also relatively young companies such as Smart Play Technologies and Sasken Communications. Companies like Mindtree are also fast moving from design implementation to high-end product design development.

Outsourced product design companies are also increasingly in a position to influence the Bill of Materials. On the one hand, these companies are taking “socket decisions” for their customers –

deciding on crucial parameters like which microprocessor to choose, which IP provider to integrate with, etc. On the other, they are independently making crucial decisions related to soft IP and development of SoCs to replace discrete chips to reduce overall cost.

Apart from scaling in size and volume, these companies today attract a talented pool of resources capable of serving major industry verticals as also niche domains. Indian design engineers have proven their ability to handle complex projects by taping out some of the world’s best chips used in several devices. Indian companies have designed chips on a 28 nm scale that have already been successfully taped out. In 2012, it is expected that 22 nm scale chips designed in India will also be taped out to hit markets across the world. Further, it is expected that Indian companies will graduate to 3D chip designing in the forthcoming quarters. In fact, it would be safe to make the statement that there is practically no chip in the world today, which is not “touched” by India [design centres] in some way.

### The Age of Value Addition

As Indian companies continue to inch higher up the value chain, the

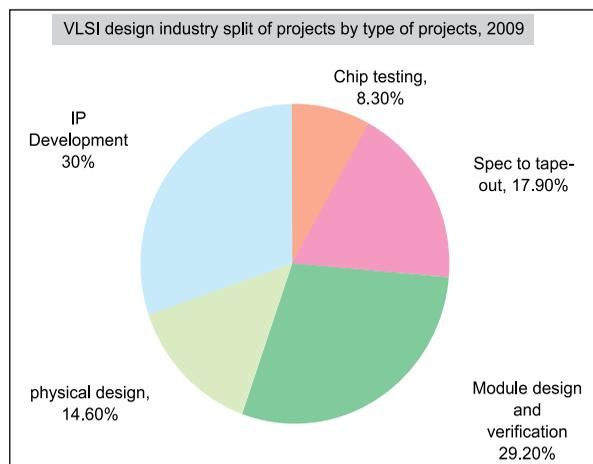
time is ripe for us to collectively build and present Brand India to the world. While the move towards product design and development is significant in this regard, there is an urgent need for Indian companies to establish their leadership by developing IP within the country.

IP creation generates about 10 times more revenues in the form of royalties than ‘creation costs’. Currently, as users rather than owners of IP, although India creates as much as 90 percent of the value, we are credited only for about 10 percent. If the IP is owned by India, we will be given credit for the full value chain and also earn significantly higher revenues.

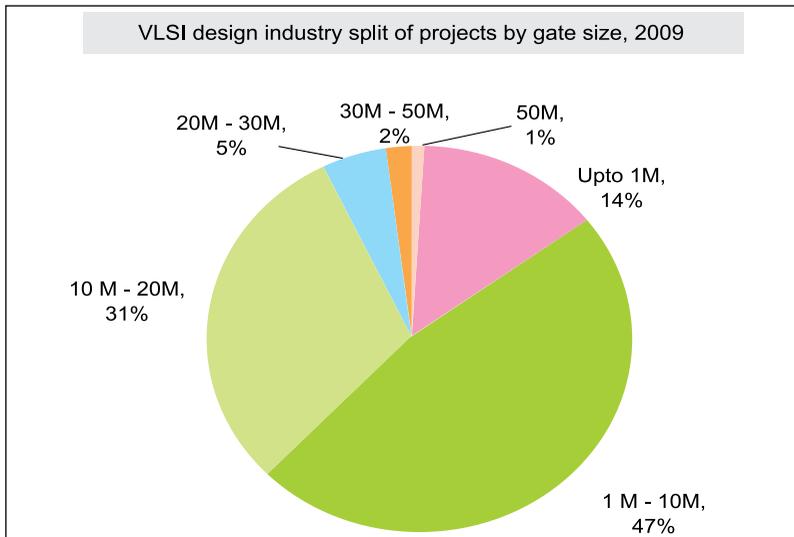
There are very few Indian companies that today have the capability to create IP. Cosmic Circuits is one such company which started with power management IP and now has over 300 analog and mixed-signal IP offerings. Cosmic Circuits has been profitable from the very first year. Ittiam Systems is another Indian company that has deployed an IP licensing model. The company recently announced that more than 35 percent of their annual revenues come from royalties.

### Talent Availability

Semiconductor IP creation is a long-drawn process where the IP has to be proven before it is marketed, making it a very difficult to sustain in the initial years. Industry trend watchers, however, believe that more IP will be generated here in the years to come. According to analysts from Frost & Sullivan, India accounted for less than 1 percent of global chip IP in 2005 but currently produces about 5.5 percent, making our country the second largest IP producer along with the U.K.



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The industry has a young workforce with close to 78 percent consisting of engineering graduates and close to 60 percent with less than eight years of work experience. The industry cites six months to a year for talent graduating from colleges to become deployable and industry-ready. Only about 8 percent of the total workforce hold post graduate degrees. Diploma holders are mainly recruited in the board segment. Around 6 percent of graduates, who are relevant to the semiconductor industry, come from tier 1 institutes such as the IITs and NITs. One major cause for concern is the critical shortage of PhDs in the country. Innovation and IP development can happen only if the workforce is not only of high quality but also capable of conducting quality R&D.

In all, although in terms of availability of skilled talent, India is among the best placed countries for semiconductor design, there is a clear deficit of people who are capable of high-level R&D and innovation.

### Realizing the Dream

Clearly there is a lot that is working well for the Indian chip design industry; and there are an equal number of challenges to be

overcome.

While the Indian semiconductor, and also the overall electronics, industry is growing rapidly, we still have a long way to go before catching up with other international players like China or Taiwan.

While the Indian fabless industry has made a mark for itself in the global marketplace, our presence in the manufacturing space is close to negligible.

While our design companies are creating a lot more value indigenously, we are not creating enough IP to own the entire value chain.

While we are generating adequate number of graduates to skillfully deliver projects, the industry is singularly lacking in PhDs who can lead innovation.

While we are happy to note that the domestic market for electronics will leapfrog in the years to come, we are also facing a possible scenario where India's import bill for electronics is likely to be more than the bill for crude oil unless remedial action is taken immediately.

As is evident, these wide ranging challenges require intervention at all

levels from different stakeholders of the ecosystem. ISA is working closely with all the stakeholders - government policy makers, industry and academia - to achieve our common goal of Vision 2020.

### Fab and Fables: Creating a Symbiotic Ecosystem

ISA is very upbeat about the initiatives announced by the government in the recent past for promoting the fabless industry and also setting up an India fab to kick-start manufacturing activity in the country. We strongly believe that a vibrant fabless industry is the key - not only to take us closer to the revenue targets we have set ourselves as per Vision 2020, but also to provide impetus to the proposed India fab.

Fab is expensive, depreciates rapidly and needs high turnover to remain profitable. The India fab, when it comes up, will have to find customers and generate enough volumes quickly to stay profitable. It is here that Indian fabless companies can contribute towards the growth and sustenance of the India fab by becoming its "customers". So while these fabless companies can fulfill all their manufacturing requirements right in their backyard, the fab will have the opportunity to match up to the scale and volumes requirement while retaining reasonable margins. Such a symbiotic relationship between the fab and the fabless industry can be ideal to boost the industry as a whole.

Also, once we start creating IP within the country and start owning end-to-end product design and development indigenously, we will find that we have all the right pieces ready to be put together and offer to the world, electronics that are truly Made in India. □

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