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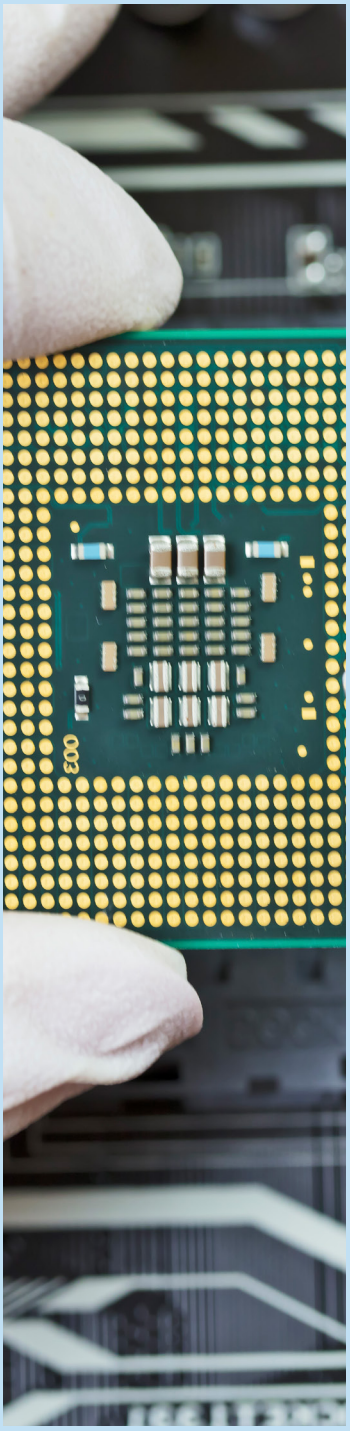

HOW DIGITAL TWIN TECHNOLOGY CAN MATURE TO KEEP PACE WITH EVOLVING VALUE CHAINS IN THE SEMICONDUCTOR INDUSTRY

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As the world changes to adapt to the new normal, the semiconductor industry has had to be one step ahead in anticipating the chip needs of other industries. Whether it is to provide for automotive electronics, infotainment, or the telecom sector, semiconductor companies and original equipment manufacturers (OEMs) have their plates full in making sure the world stays connected. Furthermore, the growing acceptance of disruptive technologies such as AI, Big Data Analytics, and IoT offers significant opportunities for growth and innovation. The global semiconductor and circuit manufacturing market is projected to reach US $522.7 billion by 2027, at a CAGR of 4.3% during the forecast period[1].

Semiconductor businesses are now reevaluating their value chains to make sure they meet the needs of allied industries and thrive in the new landscape. The time is ripe to implement intuitive virtualization solutions like digital twin technology to meet the needs of the industry now and through to the future.

Adapting to specific semiconductor industry needs

Although digital twin technology has been adopted by other manufacturers, those in the semiconductor industry have been hesitant to implement it for a variety of reasons.

- The blue-collar workers in the industry are still old-fashioned. They are only versed with older technologies like Windows 98 that is enough to operate the machines in the fab. This manpower will have to be adequately trained to put the digital twin to optimum use.
- Each machine in a fab is unique, performing one of the thousands of steps required to manufacture a semiconductor chip. The iterative process spans 1600 or more steps over 15-30 days, making it a complex and costly process to create a digital twin for.
- The race to design and manufacture newer and better versions of semiconductor chips often pushes the application of digital twin technology for training and maintenance purposes to lower priority.
- So far, digital twins have been largely used for aircraft engines that have greater design longevity. They will have to be adapted at scale to fit the dynamic nature of the semiconductor manufacturing floor, where cycles change dramatically each day.

Harnessing the power of data

The inherent adaptability of digital twin technology can help it evolve to meet the specific requirements of the semiconductor industry. The opportunities for implementing it throughout the stages of a product lifecycle – from development to maintenance – are immense. By integrating people, data, processes, and systems, it can provide product information support and optimize the process as it goes on.

Spreading the scope of digital twin technology across business processes in a manufacturing unit will result in a wealth of data from disparate sources. Over 18 months, semiconductor chips move from the conceptualization to rollout phase across a variety of machines that can generate a great amount of data. This is especially valuable in the testing phase, where each chip is repeatedly put through the rigors till it achieves at least 99.99% efficiency. There's great scope for harnessing this data to make such complex processes leaner and smarter. Herein lies the opportunity for digital twin technology to evolve from being a passive replica to an insightful tool.

Reverse engineering these machines using the learnings from digital twin technology can help with tasks like image processing and failure prediction, among others. This can go a long way in reducing the margin of error and fab downtime. A digital view of data provides visibility into the manufacturing unit across platforms, process nodes and factory production lines. There is ample opportunity for it to be used with design information to create optimized predictive solutions that can be applied to individual components for preventive maintenance as well.

Tapping into the cloud for better manufacturing

The power of AI/ML in bringing out value from this data is unquestionable. The implementation of robust cloud computing toolsets, with consumer-facing data mining and enhanced data articulation techniques, has brought with it a great level of personalization. Microsoft's Azure cloud is one such tool with enriched data, analytics, and AI services that help build sophisticated digital twins. Infosys's expertise in designing and building comprehensive digital models helps us target efficiency first. The aim is to focus these robust computing capabilities on increasing collaboration, speeding up production and improving margins for profitability in the rapidly-changing semiconductor landscape.

To conclude

Understanding the value of data-led insights and real-time reactions on a virtualization platform like digital twin technology can be a game-changer for chip manufacturers and OEMS in semiconductors. Digitization of the semiconductor industry will help it become more efficient, translating to higher yields, better productivity and greater ROI.

Many companies are realizing these benefits and are now willing to bring scalable digital twin options to the shop floor in the semiconductor manufacturing landscape. The factories of the future, riding on IoT and Industry 4.0, have the opportunity to harness phygital strategies for manufacturing. And the semiconductor industry is at the forefront of this shift. The next few years will see a significant jump in the adoption of digital twins and data digitization, leading to smarter decision making on the shop floor.

And while the industry has the potential to become more efficient with digital twins within the next 5-10 years, it also has the opportunity to lead by example. Pervasive deployment of virtualization techniques within these enterprises will also have a great impact on the proliferation of digital technologies in other industries in the future.

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Venkat is an Associate Vice President with the Hitech business unit and champions Infosys's client relationships in the US and Europe markets. He is very passionate about the happenings in the Hitech industry value chain, and brings with him deep domain expertise in the Semiconductor space – the engine that drives the Hitech industry. He has advised multiple clients on their Digital Transformation programs and has helped solve for the 2 key care-about - 1. Time to Revenue and 2. Cost to Serve. As a trusted advisor to multiple CXO's, he continuously looks for industry leading ideas that can help solve complex issues pertaining to Engineering, Customer Success and Operational Cost management.

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As a Practice Head, Sankar Konduru, was responsible for Business Strategy, Go-to-Market, Marketing, Pre-Sales, Operations and Service Delivery of Infosys Engagements - executed on various COTS platforms / solutions both on-premise & cloud. Has more than 24 years of IT consulting and leadership experience in practice management, managing and incubating new service lines (Consulting Solutions for Microsoft Biz Apps & Power Platform, HCM practice, HRO Platform offerings, Workday and WFM practices in Infosys), governance and delivery management of large Transformations & outsourced engagements.

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