Ongoing Value from MES as a Semiconductor Company Evolves and Innovates

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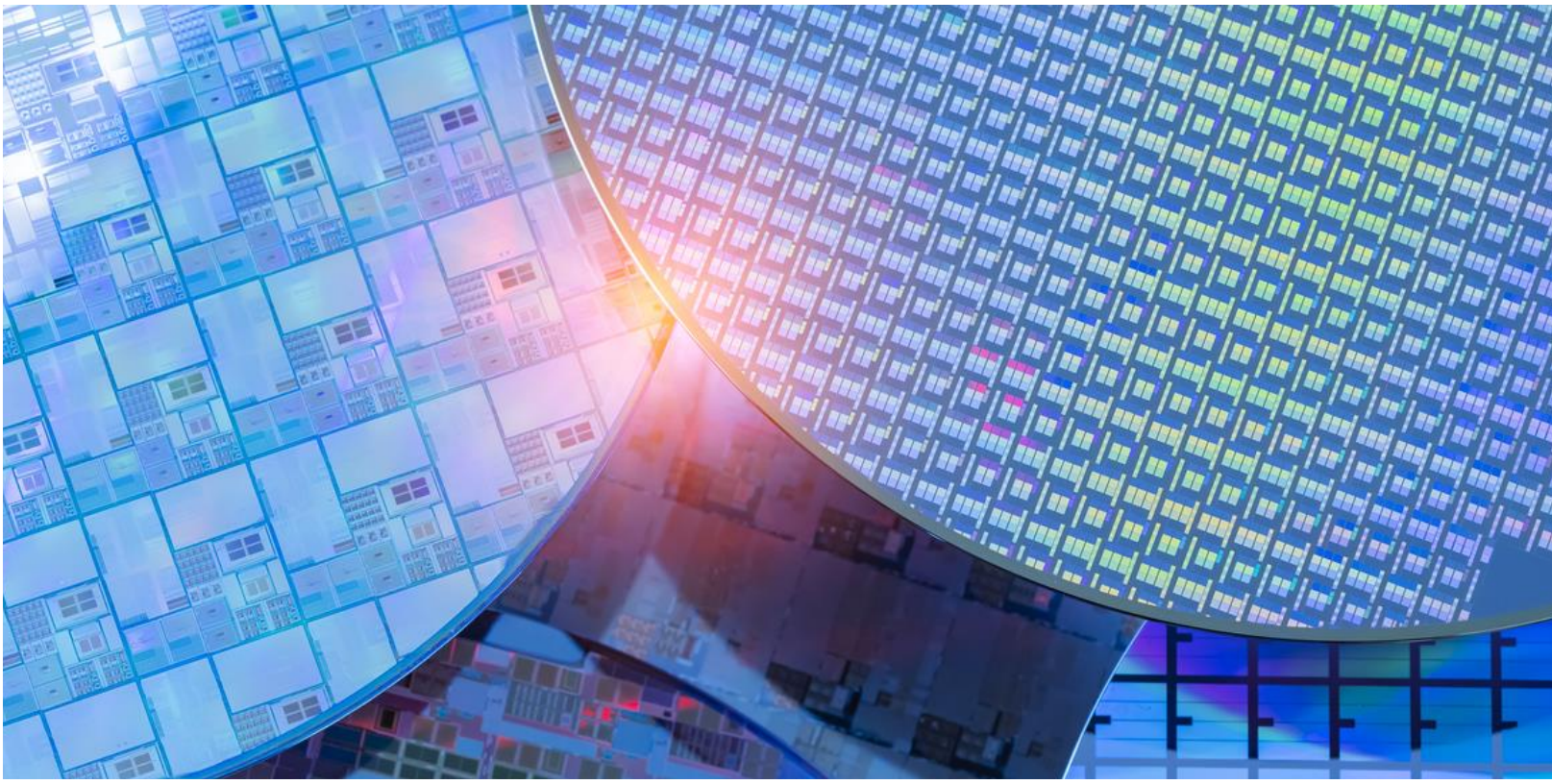
Executive Summary

The profitable and leading-edge segments of the semiconductor market are no longer just logic, where Moore's law applies to increasing performance and speed. Increasingly, specialty chips can also be great niches. They don't necessarily improve linearly or predictably. So, semiconductor companies must become more effective innovators rather than only seeking stability or increased product processing speed. Changing products, processes, and customers can boost win rates. No matter what, research and development (R&D) is a crucial foundation for business success.

Yet historically, innovation, changes, and R&D created significant challenges for legacy MES. As a result, these older systems have lost value over time. Semiconductor companies need MES that is reliable and flexible to keep up with innovation and evolving business and production processes.



Innovation for Applications

Customer-specific and product-specific needs are opening new opportunities for semiconductor makers. This is true across segments, as specialty semiconductors complement logic to make for pleasing electronics and smart everything. More data flowing through more types of devices means opportunity for semiconductors from sensors to processors to AI chips.

To succeed in addressing new applications, every semiconductor company must focus on R&D. Historically, experiments and special runs were a significant disruptor to ongoing production. Yet today's MES can simultaneously enable established product runs and effective, fully-recorded experimentation.

Evolving Company by Capabilities

Once a specialty chip or specific experiment for a new product succeeds, the company may find that that innovation pathway leads to additional products and applications. The company itself begins to evolve around their newfound capabilities in production processes. Building on successes and fully leveraging the equipment, lines, and know-how from each new product success can accelerate profitability. These related successes may also boost a company's reputation, leading to design wins.

Connecting Virtual to Real

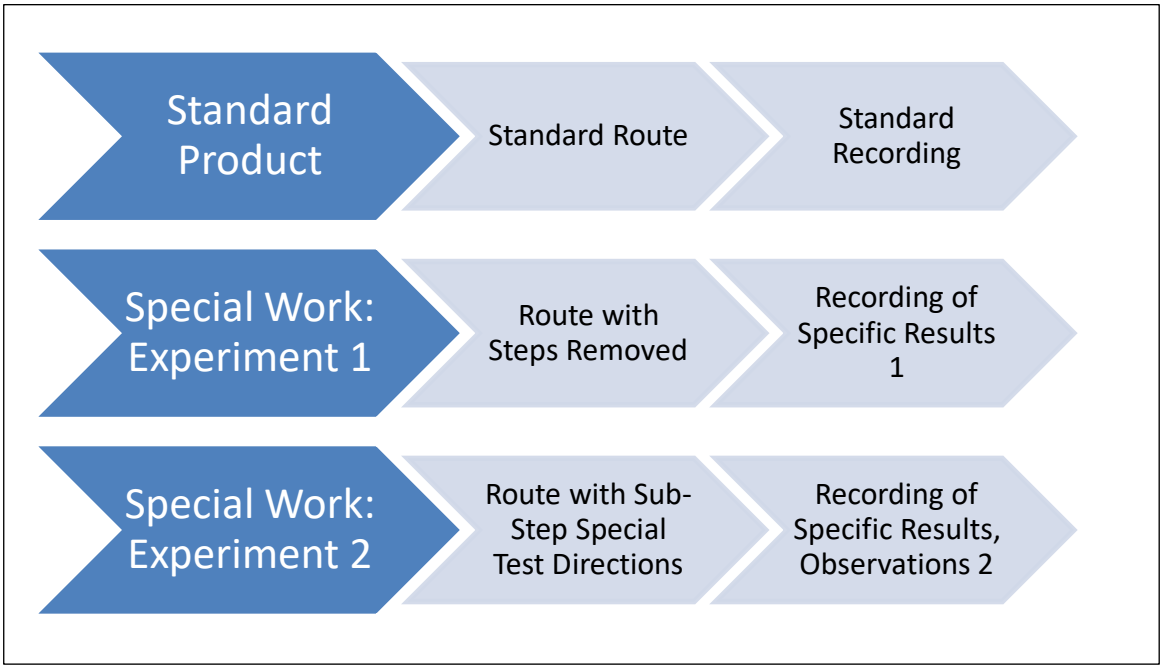
Specialty chips such as sensors, cameras, and displays combine with logic chips to connect to the real world – both to sense it and to communicate with humans.[1] This virtual-to-real interface is an expanding area of opportunity for semiconductor companies and their customers. This is how autonomous cars, electronically-enhanced processes, and smart devices of many flavors add value to the world.

In another setting, the chip production process itself is where virtual meets real. The fabs and back-ends are where semiconductor companies' ability to convert virtual design concepts into real-world capabilities takes place… or does not. For new or enhanced products, ramping up to full yield and quality requires exploring possibilities in special runs. This experimentation is at the heart of every product's success. Given that fact, MES needs to deliver value not just in stable but also in changing situations.

MES for Constant Innovation

Specialty and R&D houses inherently have a higher ratio of experiments to production runs, so ensuring this innovation is efficient is crucial. MES is intended to track and guide every aspect of the production process. However, older systems often are cumbersome to re-configure for new products or variants.

Modern MES is up to the task of constant change – these systems are designed for easier integration, configuration, and re-configuring for variants and equipment-specific issues. They can track special runs and experiments with as much precision as regular lots. Current semiconductor MES can handle a high mix of standard and special runs, tracking details and feeding an understanding of which approaches are most effective.



Ongoing R&D with Minimal Disruption

The best MES also include experiments management to ensure that innovation can be continuous and structured without too much disruption to established products' runs. R&D houses tend to choose MES for their flexibility and ability to create and track experimental and special runs. Many unique lots or experiments will be running at the same time typically. Since their stock in trade is the early experimentation to refine processes and product specifications, these companies clearly need flexibility.

Specialty chip makers are also seeking out flexible MES to support their high-variety, ever-changing production needs. Since the innovation in specialty semiconductors is not always focused on smaller geometry and speed, these operations must be open to a wide variety of explorations. Specifications, various aspects of the process, and fine details of process flow may all play a role. Today, specialty makers can find MES capable of supporting their needs.

Reliable Yet Flexible MES

To accommodate continuous innovation and company evolution, semiconductor companies need flexible MES. That includes

- semiconductor-specific with complex lot split and merge logic
- easy to configure and change to match new tools, processes, and products
- designed to support special runs and experiments as well as production runs.
- capable of continuous evolution to meet changing needs with minimal special skills.

All this flexibility must come without sacrificing the reliability of legacy MES. One contributor to reliability is a comprehensive yet modular system that covers quality, recipe, reticle, materials, and experiment, and special lot management, plus dispatching and maintenance. If these are separate systems, there are more opportunities for failure of integration points.

Another aspect of reliability that was not inherent in legacy MES is that they must be quick and affordable to implement and integrate into the environment. Integration must be streamlined both to tools and equipment and to other software. The MES must also be proven entirely in semiconductor with excellent customer reviews and ratings.

The good news is this exists today. Semiconductor companies can find proven, reliable, and flexible MES for R&D and specialty houses' constant evolution and innovation.

Agile to Innovate and Evolve

Semiconductor companies increasingly see the need to be more agile to evolve. Each company needs to review its goals and opportunities to evolve and innovate. Those goals must drive the manufacturing systems used to ensure fabrication, assembly, and test processes operate as needed, no matter the mix or rate of change.

The MES should foster this evolution and innovation and never hold it back. Being able to configure the MES as quickly as needed is not inherent to all semiconductor MES, but the best meet this need.

1 https://www.tsmc.com/english/news-events/blog-article-20200703 "Specialty Technology: Linking the Digital and Physical Worlds"

About the Author

Julie Fraser joined Tech-Clarity in 2020 and has over 35 years of experience in the manufacturing software industry. She is an enthusiastic researcher, author, and speaker. She is passionate about manufacturing progress and performance gains through Industry 4.0 strategies and supporting software technology.

Julie is actively researching the impact of digital transformation and technology convergence in the manufacturing industries, with a focus on supply chain and plant floor and how to use manufacturing data in conjunction with data from offices, labs, and the ecosystem.

About Tech-Clarity

Tech-Clarity is an independent research firm dedicated to making the business value of technology clear. We analyze how companies improve innovation, product development, design, engineering, manufacturing, and service performance through the use of digital transformation, best practices, software technology, industrial automation, and IT services.