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E-Book

Semiconductor Manufacturing Analytics Maturity:

How Does Your Operation Measure Up?

Imagine a manufacturing line in which every tool and every process, including the interactions among them, were being optimized automatically for precision, accuracy, and speed.

What if you had a data clean room, where data pertaining to every process and tool in the production line was ready to use—standardized and clean—and you could quickly apply any AI model to any data set across every process and tool?

What if tools could automatically order the consumables they need when they need them and notify you with a high degree of accuracy when service would be necessary? What if your equipment could alert you before you begin if one tool in the production line might fail before you complete your process?

This could be the fab of the future. More and more, advanced analytics and Industry 4.0 solutions are being recognized as the key to increased uptime and yield improvement in semiconductor manufacturing. An analysis by McKinsey calls advanced analytics "the next leap forward in semiconductor yield improvement,"[1] and a recent report by Deloitte notes that leading Japanese semiconductor manufacturers are already seeing improvements in productivity and yield from using AI to build real-time predictions about errors, equipment failures, and more.[2] "An AI system," the report notes, "can check data thousands of times in a minute, providing nearly 600 times the efficiency of staff."[3]

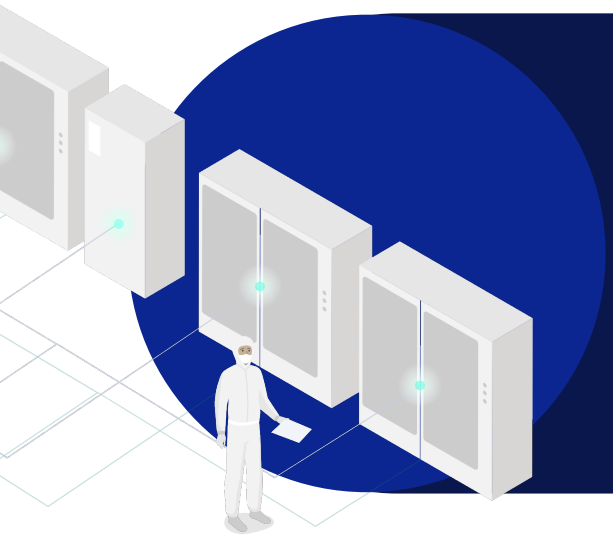
For most semiconductor manufacturers, gathering data isn't the problem. Sensor-laden fabs are sitting on enormous amounts of data.

What's challenging is the process of turning the data into actionable intelligence. For most semiconductor manufacturers, this is still a manual, labor-intensive process. To set up thousands of charts, watch them, and react to them is extremely inefficient. And with hundreds of parameters and the interactions among them to track on a daily basis, manual analytics processes can't keep up; there are simply too many factors to comprehend.

Some chip manufacturers use AI-enabled predictive and prescriptive analytics for certain isolated processes or tools. But according to a recent survey, only 26% of semiconductor manufacturers have access to this type of advanced analytics.[4] Moreover, there are substantial impediments to achieving AI-enabled analytics integration across the entire production line.[5]

Yet, achieving this level of advanced analytics capabilities is a goal semiconductor manufacturers must work toward to realize significant yield improvement and increased output in the context of increasingly complex manufacturing processes.

1. Koen De Backer, Ray Justin Huang, Mantana Lertchaitawee, Matteo Mancini, and Choon Liang Tan. (April 2018). Taking the next leap forward in semiconductor yield improvement. McKinsey & Company. https://www.mckinsey.com/industries/semiconductors/our-insights/taking-the-next-leap-forward-in semiconductor-yield-improvement.
2. Deloitte. (April 2019). Semiconductors — the Next Wave: Opportunities and winning strategies for semiconductor companies. https://www2.deloitte.com/tw/en/pages/technology-media-and-telecommunications/articles/semiconductor-next-wave.html
3. Ibid.
4. Fabscape. (2022). Post-Pandemic Semiconductor Supply Chain: Can Software Solve the Problems That Persist? https://content.fabscape.net/download-fab-analytics-survey-report-2
5. For an in-depth discussion of these challenges, see Fabscape. (2022). A New Framework: Opportunities of Open Access for Optimizing Yield in Semiconductor Manufacturing. https://content.fabscape.net/download-new-framework-white-paper .



Investing in Industry 4.0 solutions will help improve performance and efficiency, but turning an operation into the fab of the future can't happen overnight.

To achieve a more advanced degree of manufacturing analytics maturity, it's important to know where your greatest impediments lie.

Typically, barriers to achieving advanced manufacturing analytics maturity come from three sources:

Hardware:
Chip manufacturers typically use a mix of legacy and highly advanced manufacturing equipment, networks, and sensors. The capabilities range from mere logging of descriptive data to receiving real-time data feedback and optimizing based on deep vendor-specific intelligence.

Analytics Software:
There isn't a standardized platform for semiconductor manufacturing analytics, so 73% of semiconductor manufacturers weave together multiple disconnected equipment analytics solutions to get the information and intelligence they need.[6] Capabilities range from pulling basic data for viewing and manipulation to sending AI-driven feedback to equipment for performance optimization.

Data Management:
Chip manufacturers have access to enormous amounts of data, but the way it's received, stored, and accessed impacts their ability to turn it into meaningful insights. Data management solutions range from basic data storage in a single file to vast, frequently updated databases.

Fabscape has developed a semiconductor manufacturing analytics maturity model to help chip manufacturers think about how to resolve barriers to progress toward meaningful advanced predictive and prescriptive analytics.

	1.INITIATE	2.PROPAGATE	3.INTEGRATE	4.AUTOMATE	5.RADIATE
HARDWARE	Basic data is logged and able to be accessed.	Multiple equipment logs can be accessed in a single database.	Multiple equipment logs are being fed into and stored in a single database.	Equipment is feeding data in near-time, and feeds/ data sets are standardized across all equipment.	Equipment data is fed regularly into the database and equipment is getting feedback to adjust as necessary.
SOFTWARE	Basic log is able to be viewed and data manipulated.	Individual data sets can be visualized for statistical analysis.	Data from multiple sources can be cross-analyzed and visualized.	Data is automatically ingested into a visualizer and automated analyses are programmed.	AI is optimizing production by predicting and minimizing failure points and thereby maximizing yield.
DATA	Basic log is data stored in a single file.	Multiple logs can be cross-analyzed or stitched together.	A single database exists where all data is readily available and can be called upon.	A single database is being updated in near-time and current and historical data can be viewed.	Data can be used to create advanced AI models that further optimize the production line in meaningful ways.

6. Ibid.

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Semiconductor manufacturers can answer a few simple questions to find out where they are among the five stages of semiconductor manufacturing analytics maturity and get recommendations for what steps to take to remove barriers and start on a path towards greater analytics maturity.

Plotting where your operation is on the framework can help you think about how you're using data to drive meaningful insights and uncover strategies to systematically remove barriers to achieving full analytics maturity. The journey may not be linear for some, but our goal is for this framework to help chip manufacturers fill important gaps and develop a roadmap to achieve advanced analytics maturity.

Are you ready to get started?

Take Assessment

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