



THE OJO-YOSHIDA REPORT

Technology in Context

2022 SEMICONDUCTOR INDUSTRY OUTLOOK & INVESTMENT OPPORTUNITIES

Junko Yoshida & Bolaji Ojo

The Ojo-Yoshida Report

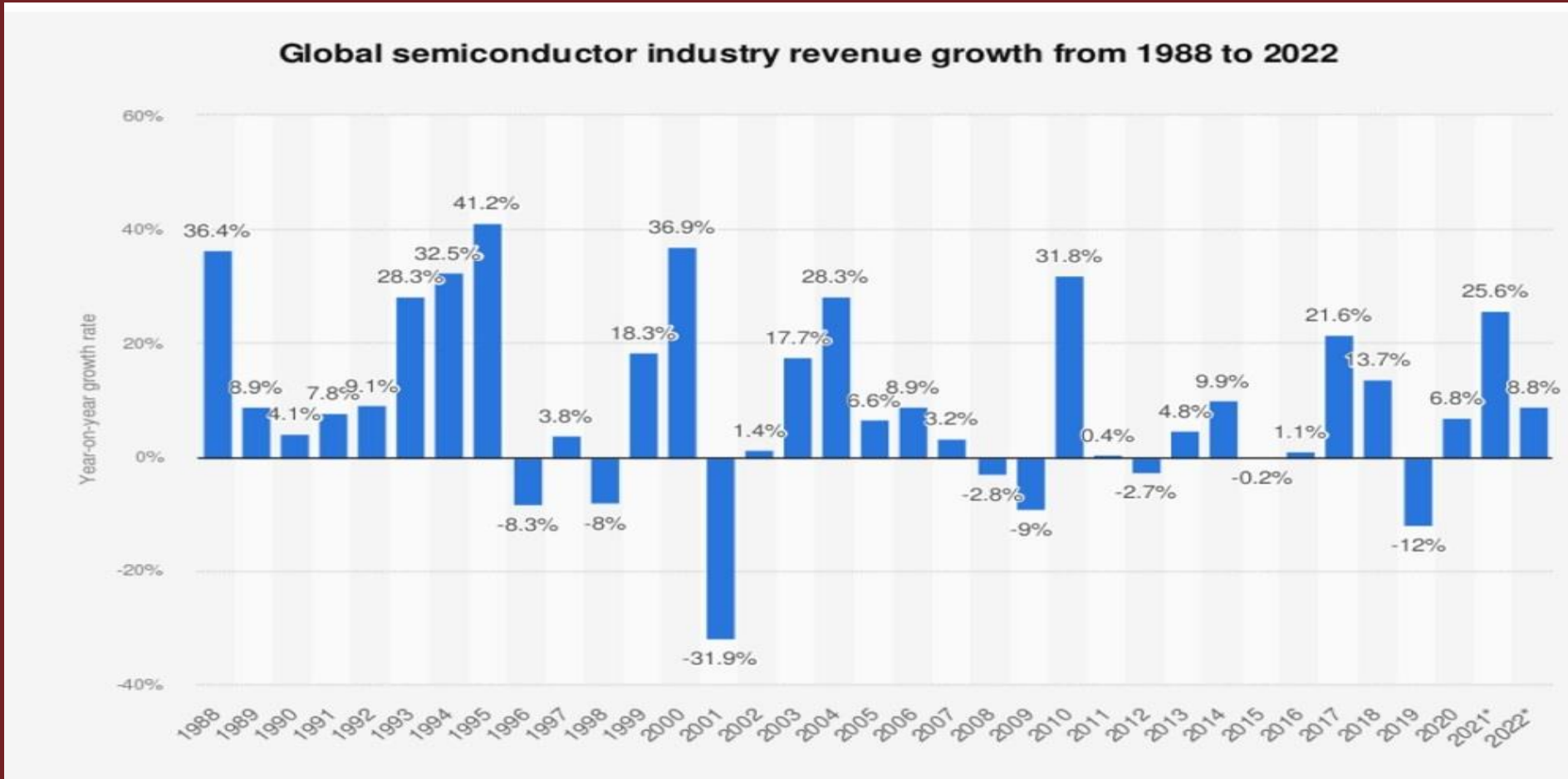
www.ojoyoshidareport.com

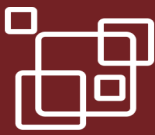
Jan. 19, 2022



SEMICONDUCTOR INDUSTRY OUTLOOK

(SOURCE: WSTS)





NEW FABRS ANNOUNCED AS OF 2021

MORE TO COME

NEW FABRS TO SOLVE THE CHIP SHORTAGE?

Almost all of the new fabs are for advanced technology nodes, rather than the mature nodes used in automotive applications. An exception is the Bosch fab in Dresden and UMC's investment.



Nov 2020: TSMC will open a \$12B fab in Arizona.

Feb 2021: Samsung to open a \$17B fab in Texas.

March 2021: Intel invests \$20B in two new fabs in Arizona.

April 2021: The USA government voted for a \$50B budget for chip manufacturing and research.

May 2021: TSMC plans fab investment increase from \$12B to \$36B.

March 2021: Intel to create a \$7B fab extension in Ireland.

June 2021: Bosch opened a \$1.2B fab in Dresden.

April 2021: TSMC to spend \$100B on new fabs and R&D over the next three years.

April 2021: Automotive customers of UMC invest \$700M in 28nm chip production.



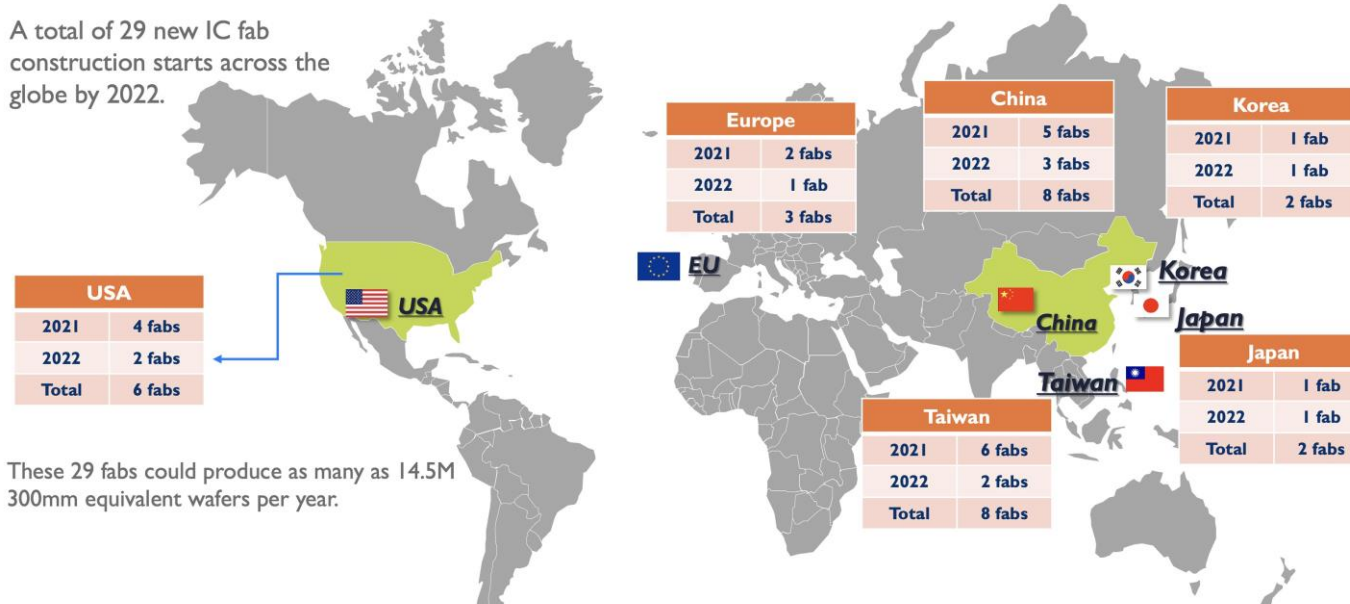
FABS ACROSS THE WORLD

(SOURCE: YOLE DÉVELOPPEMENT)

Massive investment in IC fabs across the world

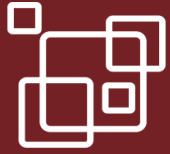
(Source: Status of the Power Electronics Industry report, Yole Développement, 2021)

A total of 29 new IC fab construction starts across the globe by 2022.



These 29 fabs could produce as many as 14.5M 300mm equivalent wafers per year.

Is there enough investment in assembly and packaging capacity to match the fab expansions over the next five years?

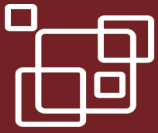


3 BIG TRENDS IN AI

AI is becoming as “ambient” as the Internet

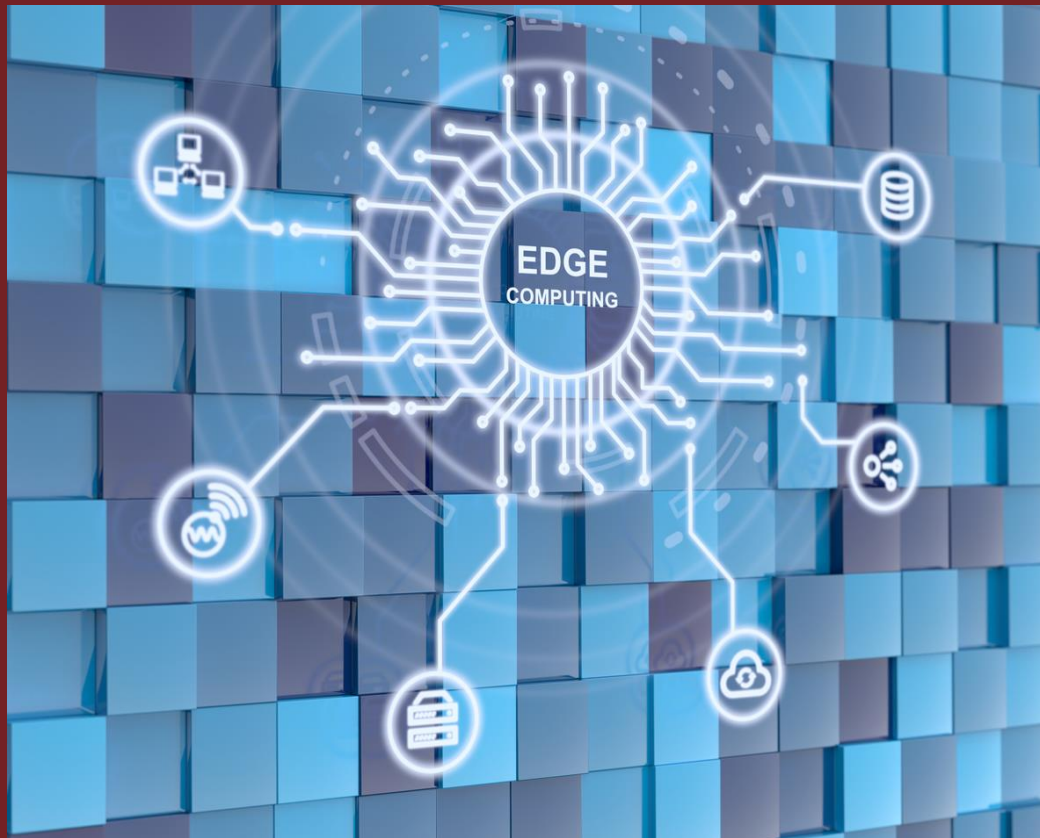
AI race shifts from TOPS to “performance per watt.”

AI startups expected to offer “full stack.”

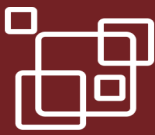


AI STARTUPS:

FIND PARTNERS, GET ACQUIRED OR COMPETE WITH MCU GIANTS AT THE EDGE

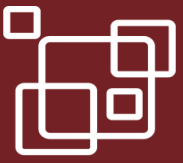


- STMicroelectronics acquires French AI Software Company Cartesiam (2021)
- NXP Semiconductors partners with Hailo (2022)
- Infineon rolls out a new Aurix MCU family with affordable AI capabilities (2022)



AI RACE SHIFTS FROM TOPS TO PERFORMANCE PER WATTS

- Nvidia's DRIVE Atlan, >1,000 TOPS, offers AI data center on wheels for next-gen Autonomous Vehicles (2021)
- Ambarella joins TOPS race by unveiling CV-3 High offers a neural vector processor with 500-eTOPS (8-bit) AI compute. (2022)
- Mobileye reveals EyeQ Ultra, consumer AV SoC, running at 176 TOPS. (2022)



SENSORS: KEY TO EXPAND OPERATIONAL DESIGN DOMAIN

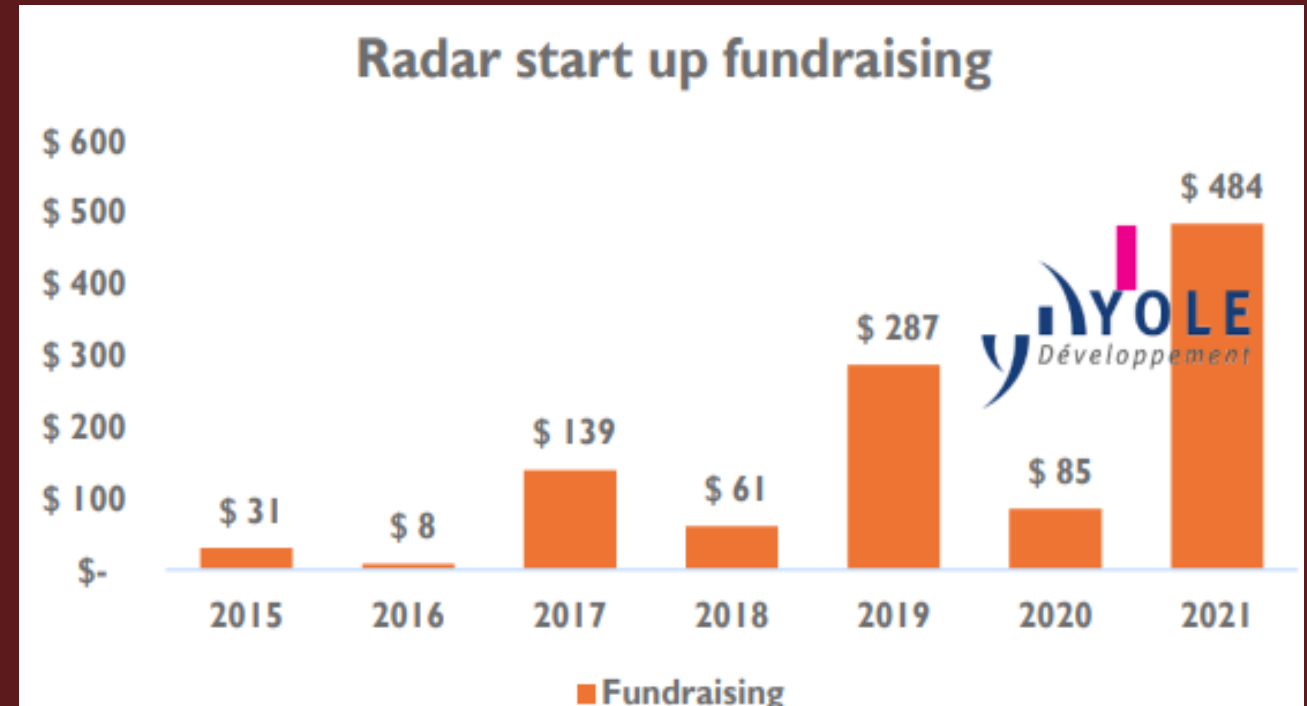
- 4D imaging radars (Arbe, Mobileye's new imaging radar, Oculli acquired by Ambarella)
- Thermal imaging (Critical to ADAS to trigger automatic emergency braking in all conditions.)
- The death of lidars are greatly exaggerated. (Luminar-Volvo 'lidar-first' approach)





RADAR IN 2021: RECORD YEAR FOR INVESTMENT

- Close to \$0.5B was invested in radar companies in 2021
- Almost 10 companies in later stage or post IPO
- Most companies focusing on improved performance / imaging radar.
- (source: Yole Développement)





SOFTWARE- DEFINED SENSORS?

- Startups are developing software that bypasses image signal processing and focuses on the embedded perception stack.
- The software tools optimize the accuracy of any existing cameras by up to 20 to 25 percent
- e.g., Algolux, Stradvision





O-YOSHIDA R
Technology in Context

NEUROMORPHIC TECH IN AI COMPUTING & SENSING

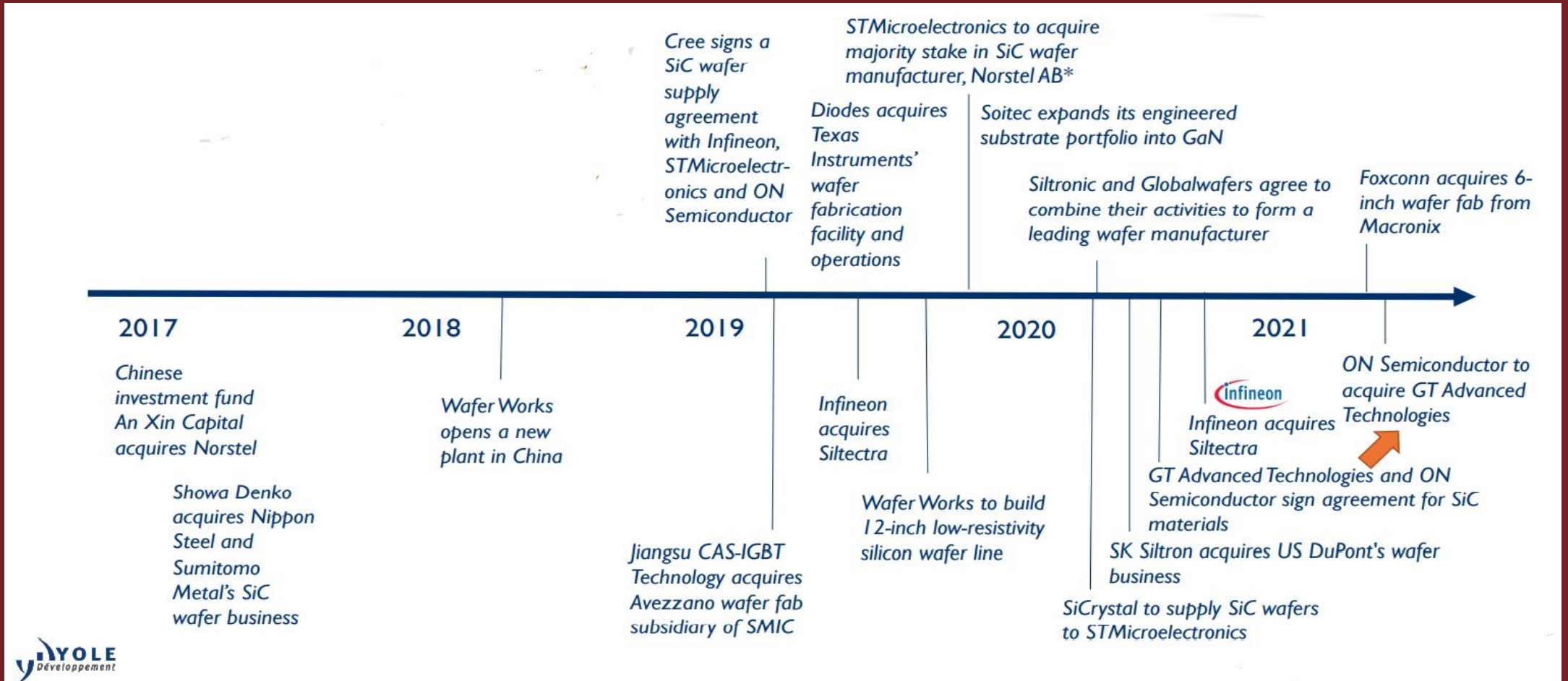
- Neuromorphic technology goes into sensing and computing.
- Why?
- *“Brute force, currently used to leverage the power of AI, will hit a heat wall, a data wall, and a cost wall, affecting the semiconductor industry’s ability to deliver the incremental cost to performance improvements at a certain pace.”* -- Adrien Sanchez, Technology & Market Analyst, Computing & Software division at Yole Développement
- E.g., Prophesee, Brainchip, Nepes AI, General Vision





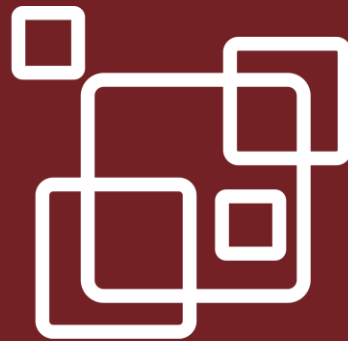
FOCUS ON WAFER MANUFACTURERS

(SOURCE: YOLE DÉVELOPPEMENT)



THANK YOU

Please sign up for the Ojo-Yoshida Report at www.ojoyoshidareport.com



THE OJO-YOSHIDA REPORT

Technology in Context