Recent Trends in Industrial Machine Vision: Challenging Times

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YOLE GROUP

We provide industrial companies, financial investors and R&D organizations, with market research and marketing analysis, technology, supply chain and cost analysis, as well as performance evaluation, to help our customers in their decision-making about their future business and manufacturing strategy in the semiconductor, photonic and electronic sectors.

3 CORE ACTIVITIES BASED ON DEEP SYNERGIES

Market & Technology

- Market, technology, and strategy consulting

- M&A, Due Diligence and evaluation of companies

Teardown Reverse engineering and costing

- Technology, process & cost analysis

- Teardown and reverse engineering

- Comparative analysis

Performance analysis

- Test of electric and electro-optical performance of devices

- Comparison of performances and related technical choice

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Agenda

- Industrial machine vision – the global picture

- Technology trends: focusing on software?

- Ecosystem: new competitors

Industrial Machine Vision – Global Picture

Machine Vision: Definition and Examples

"When the machines use images to sense the world"

Focus of this presentation:

Mobile & Consumer

Automotive & Mobility

Industrial

Facial recognition

Other 3D sensing

ADAS

DMS

Factory and warehouse automation

Data Matrix
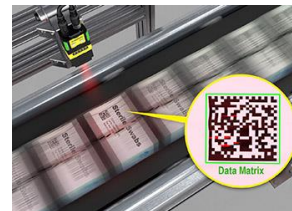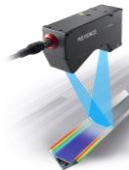
Retail

A Wide Range of Cameras and Systems

High-end CMOS image sensors inside

Low-end CMOS image sensors inside

PC-based cameras

3D laser profilers

Smart cameras

Fixed-mount industrial barcode scanner

3D camera module for robots

Fixed barcode scanner for retail

Handheld barcode scanner

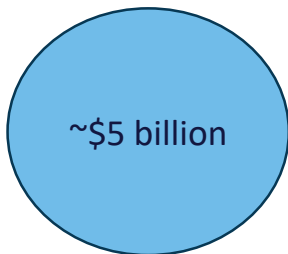**Camera market evaluation for 2023:**
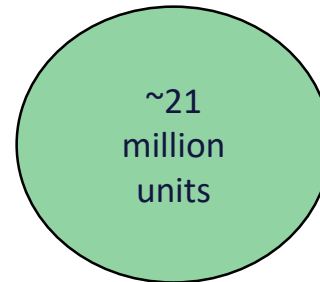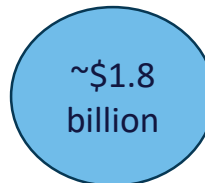
Camera market evaluation for 2023:

Market Value

Volumes

~$5 billion

~7 million units

~$1.8 billion

~21 million units

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Use of Cameras by Application and Industry Sector
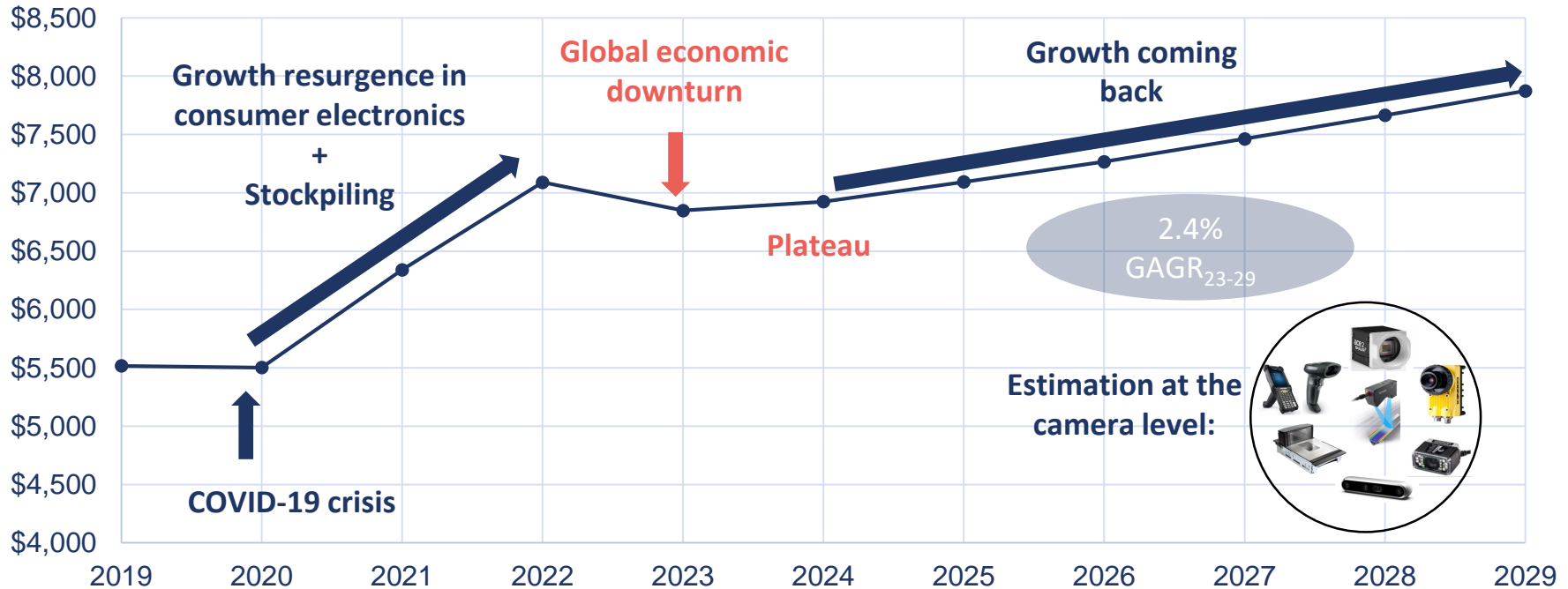
Low-performance cameras ➡ **High-performance cameras**

Major market driver ⬆

Minor market driver

Application / Industry sectors	Identification	Guidance	Gauging	Inspection
Consumer electronics and semiconductor	Low	Low	Moderate	High
Automotive manufacturing	Low	Low	High	Moderate
Logistics, transportation and retail	High	Moderate	Low	Low
Food and beverage	Low	Low	Low	High

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Market Forecast

Growth resurgence in consumer electronics + Stockpiling

Global economic downturn

Growth coming back

Plateau

COVID-19 crisis

2.4% GAGR$_{23-29}$

Estimation at the camera level:

2023 has been a challenging year for the machine vision industry, after two years of intensive growth.

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Market Drivers in a Nutshell

Long term trends:

Population aging:

Labor and energy cost increase:

Ecology:

➡️

**Need for automation technologies
=
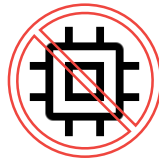Need for machine vision**

| Negative impact |
| Positive impact |

Short term trends:

Pandemics:

Component shortage:

Global economy:

Car electrification:

- **Lower production rate**
- **Stockpiling**
- **Investments in new local supply chains**
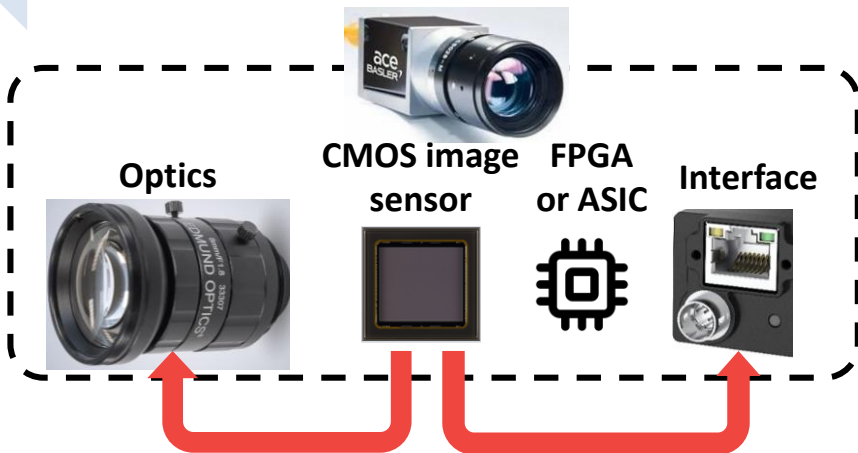
- **Lower production rate in 2023**

- **Investments in battery factories**

Technology Trends: Focusing on Software

Hardware: a Stagnation in Innovation?

High-end cameras

Low-end cameras

Optics

CMOS image sensor

FPGA or ASIC

Interface

Towards lower cost, lower power, smaller footprint

Investment on hardware is on hold due to challenging market conditions.

Average characteristics:
- **Global shutter**
- **Monochrome**
- **1-3 Megapixels**
- **Backside illuminated**
- **Interface: GigE**

Average characteristics:
- **Global shutter**
- **Monochrome (NIR or ToF in robotics)**
- **<= 1.3 Megapixels**
- **Frontside illuminated**
- **MIPI**

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Growing Interest in "Exotic" Features

Extended spectral sensitivity:

X-ray | UV | VIS/NIR | SWIR
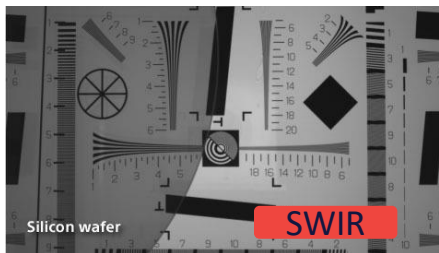
Wafer inspection
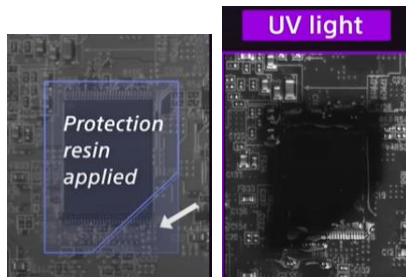
Monitoring liquids and resins

3D (stereo, structured light, ToF):

Bin picking, depalletizing

AMR guidance

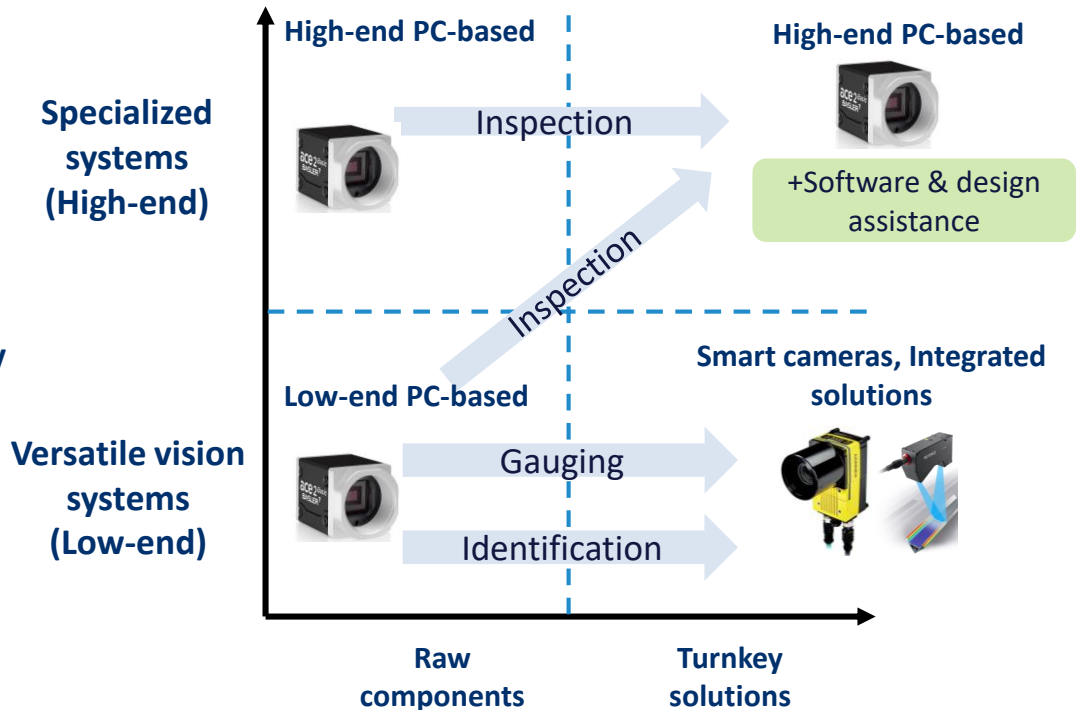# Towards Simpler Systems

Demand from customers:

Reduce vision system complexity

Customers designing their own vision system

Customers choosing turnkey solutions
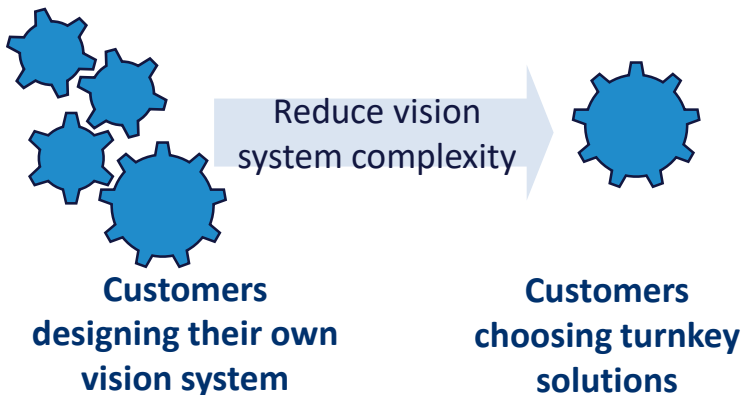
Camera manufacturers are focusing on software development

Evolution of product offer:

High-end PC-based

Inspection

High-end PC-based

+Software & design assistance

Specialized systems (High-end)

Inspection

Low-end PC-based

Gauging

Identification

Smart cameras, Integrated solutions

Versatile vision systems (Low-end)

Raw components

Turnkey solutions

Ecosystem: New Competitors

Towards an Aggregation of the Ecosystem?

Leaders by segment (non-exhaustive!):

Cameras specialists for factory automation:

Sensing solutions for factory automation:

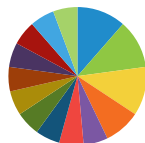**Barcode scanner specialists:**

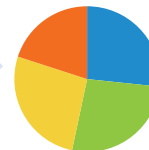**Modules for robotics (and 3D):**

Former machine vision ecosystem
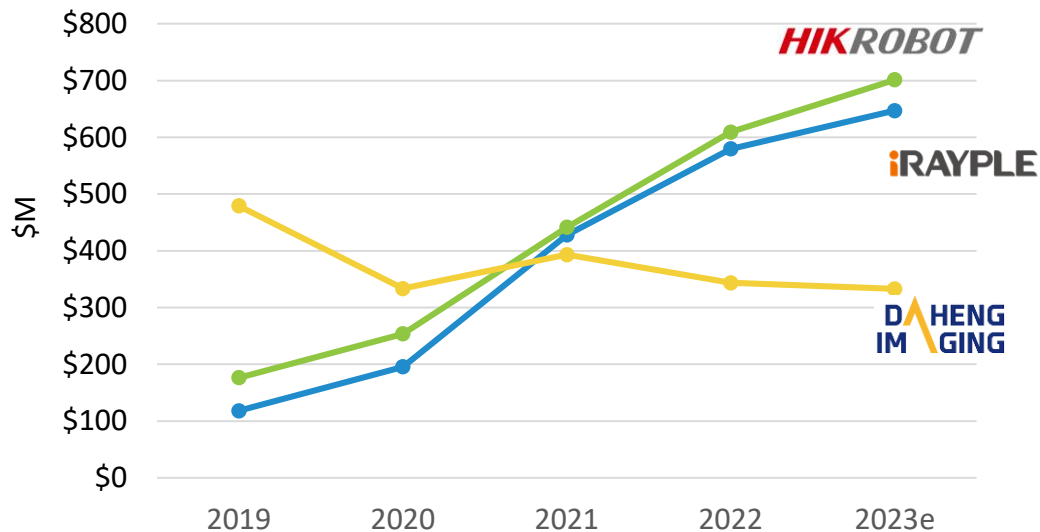
Future machine vision ecosystem

Many mergers and acquisitions

The Rise of the Chinese Ecosystem

The three Chinese leaders are now among the **Top 6 companies** in PC-based cameras
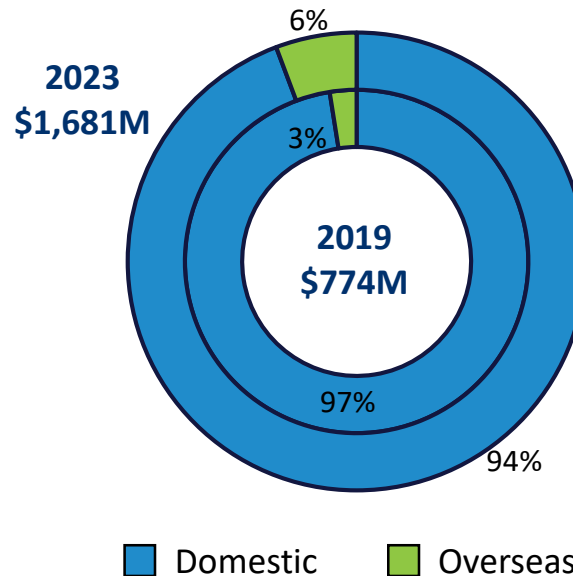
They are driven by a strong local demand and become more and more present overseas.

2019-2023: Chinese top player revenues
(in $M)

Top 3 Chinese players revenues: geographical breakdown

- Domestic
- Overseas

Newcomers Outside of the Visible Range

Latest SWIR imagers:

- **Quantum dots**
- **6.3 Megapixels**

- **InGaAs**
- **5.3 Megapixels**

Markets:

Defense players

Defense

Very high-end Machine vision

High-end Machine vision

Machine Vision players

SONY

Mature technology platforms:

- **High performance SWIR InGaAs image sensors**
- **Cooled technologies**
- **Microbolometers**

Challengers
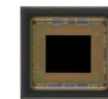
Efficient market access:

- **Existing sales channels**
- **Complementary sensing offerings (visible range)**
- **Easy-to-use sensors**

Conclusion

Key Takeaways

- The machine vision market has declined in 2023 but is still driven by positive long-term trends.

- Camera suppliers are increasing their efforts on software to satisfy an increasing demand for plug-and-play solutions.

- Chinese leading suppliers are becoming global leaders in their segments.

- There is increasing demand for non-visible technologies, which is an opportunity for defense-oriented players to diversify.

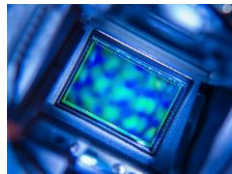**Thanks for your attention!**

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Resources

Yole Group reports

Imaging for industrial – Machine Vision 2024
https://www.yolegroup.com/product/report/imaging-for-industrial-machine-vision-2024/

Yole Group Related Products

Imaging for Industrial - Machine Vision 2024

Status of the CMOS Image Sensor Industry 2023

2024 edition coming soon

Neuromorphic Computing, Memory and Sensing 2024

SWIR Imaging 2023

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