

From centralized to decentralized: The next era of smart healthcare

Jerome Mouly – Deputy Director,
More than Moore Business line



ABOUT YOLE GROUP

— 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

OUR PRODUCTS & SERVICES

REPORTS

INSIGHT

- Yearly published reports
- Market, technology and strategy analysis
- Reverse costing and reverse engineering
- Performance analysis

FORMAT

- PDF files with analyses
- Excel files with graphics and data
- Web access

TOPICS

- Battery, Compound Semiconductor, Power Electronics, Radio Frequency
- Computing & Software, Memory, Semiconductor Packaging
- Display, Imaging, Photonics and Lighting, Sensing and Actuating
- Semiconductor Equipment and Materials
- Global Semiconductor Trends

115+ reports per year

QUARTERLY MONITORS

INSIGHT

- Quarterly analysis with market data and technology trends in units, value at wafer level
- Direct access to the analyst (except for Wafer Data Monitor)

FORMAT

- Excel files with data
- PDF files with analyses graphs and key facts
- Web access

TOPICS

- Advanced Packaging
- Compound semiconductor : RF electronics, power electronics, optoelectronic
- Computing: Microcontroller, Processor
- Memory: DRAM, NAND
- Semiconductor Test: equipment, consumables, wafer fab, subsystems
- Wafer Data

13 different monitors quarterly updated

TEARDOWN TRACKS

INSIGHT

- Teardowns of phones, smart home, wearables and automotive modules and systems
- Bill-of-Materials
- Block diagrams
- Interactive zooming

FORMAT

- Web access
- PDF and Excel files
- High-resolution photos

TOPICS

- Consumer: Phones, smart home, wearables, tablet, computing and gaming
- Automotive: ADAS, infotainment, telematics, electrification and other ECUs
- Telecom: Baseband unit, active antenna unit, CPE and others

315+ Single Teardowns Tracks per year - Daily updates

CUSTOM SERVICES

INSIGHT

- Specific and dedicated projects
- Strategic, financial, technical, supply chain, market and other semiconductor-related fields
- Reverse costing & reverse engineering

FORMAT

- Direct work with the analyst team
- PDF files with analyses
- Excel files with graphics and data

TYPES OF ANALYSIS

- Company profiling
- Cost model/ design
- Finance project: DD, M&A buy side, M&A sell side
- Market analysis
- Marketing analysis, market segmentation
- Patent analysis
- Strategy analysis
- Technology analysis
- Workshop

190 custom projects per year

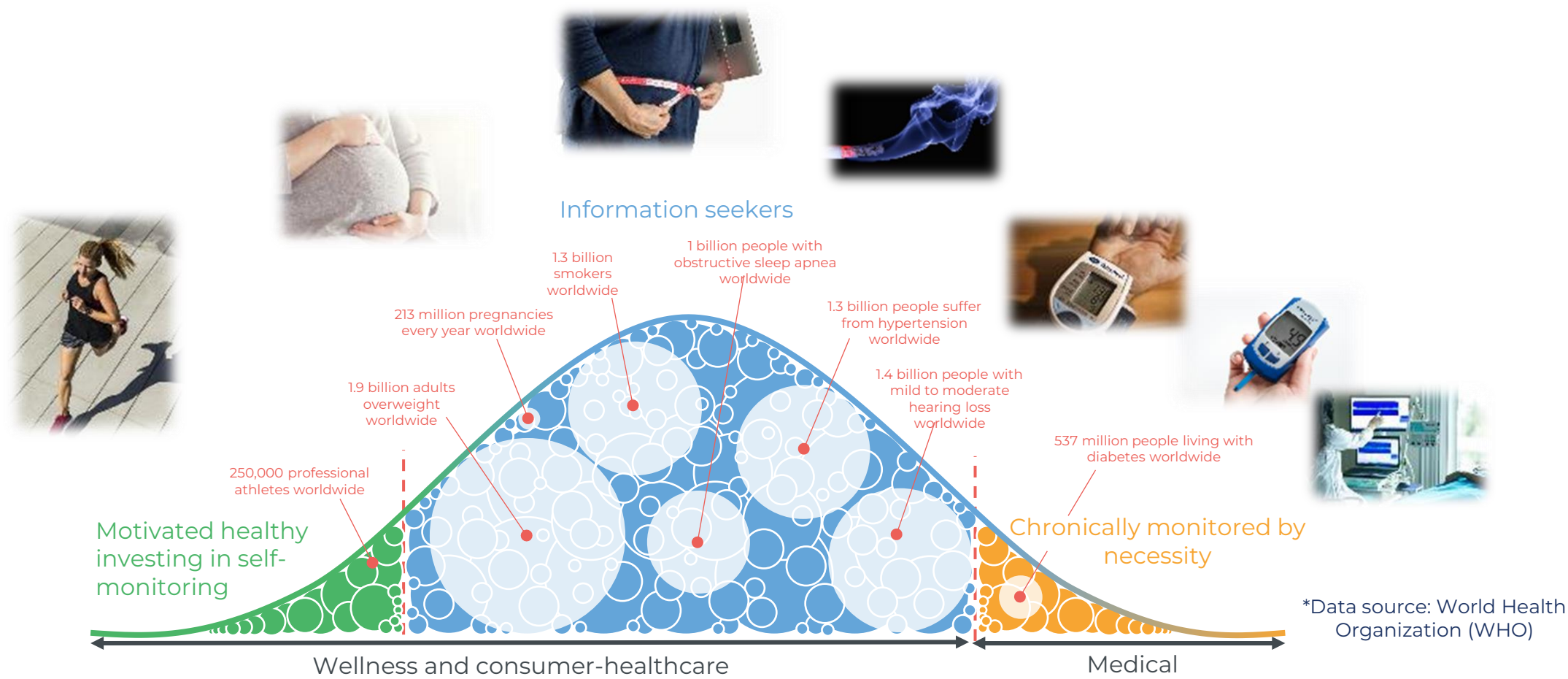
— OUR EXPERTISE —

SEMICONDUCTOR INDUSTRY

- | | |
|-------------------------------|---------------------------|
| • Imaging | • Memory |
| • Battery | • Photonics and Lighting |
| • Display | • Power Electronics |
| • Electronic Systems | • Radio Frequency |
| • Computing and Software | • Semiconductor Equipment |
| • Compound Semiconductor | • Semiconductor Packaging |
| • Global Semiconductor Trends | • Sensing and Actuating |

Presentation

FROM WELLNESS TO MEDICAL

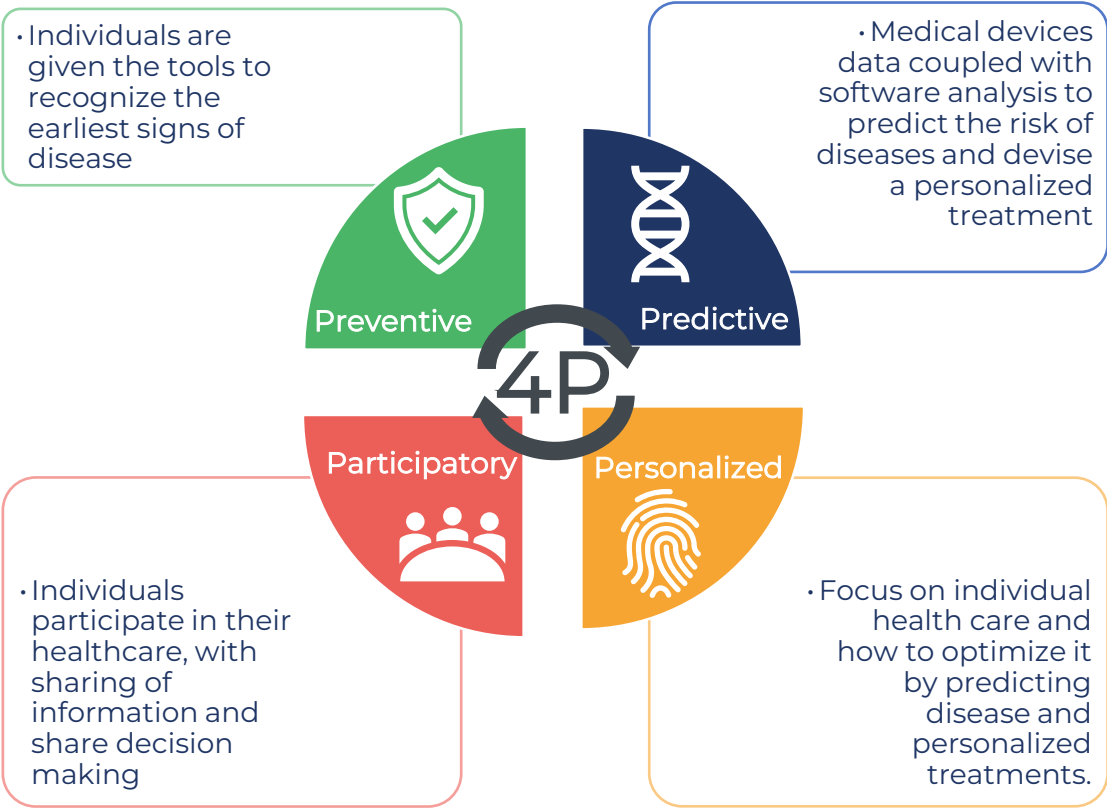




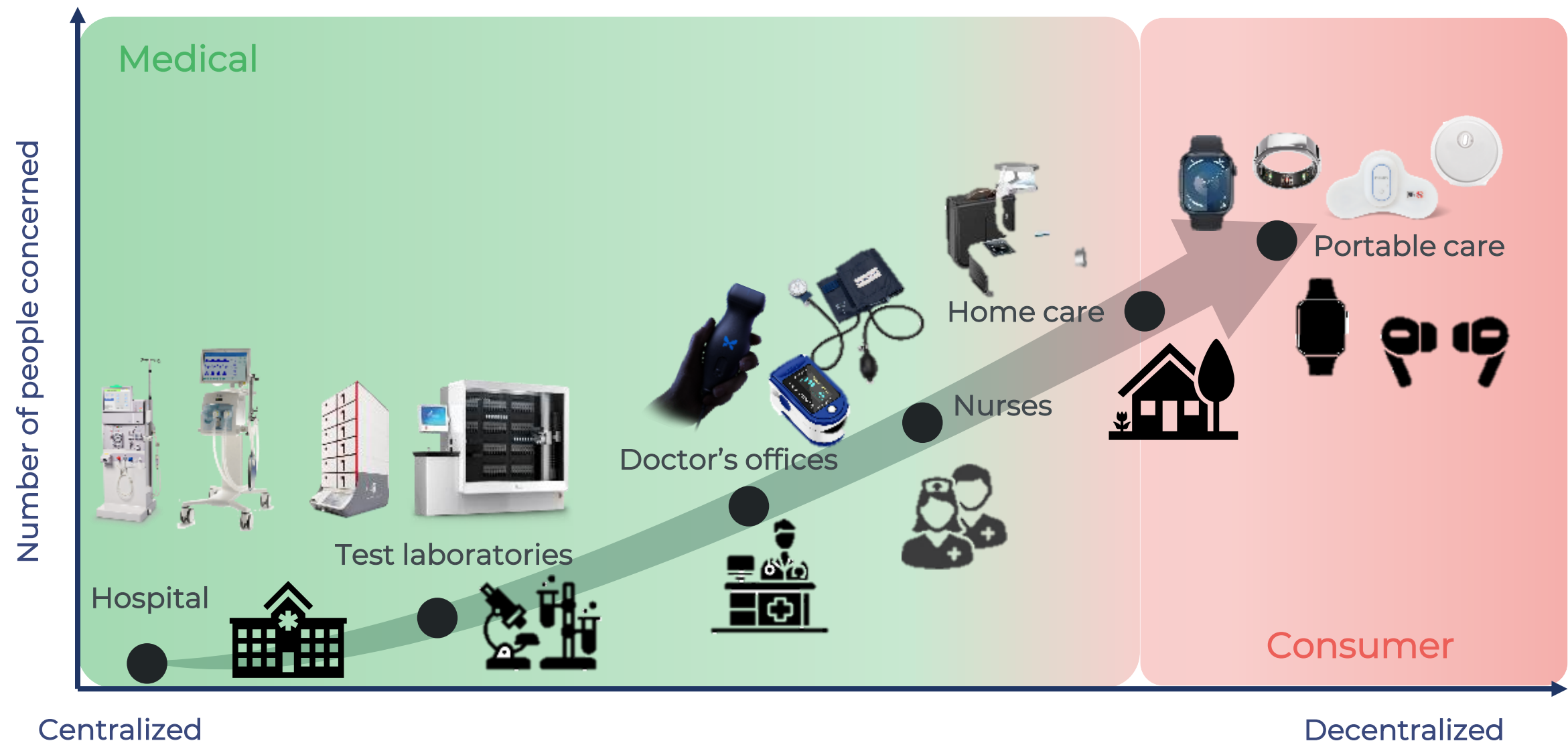
Challenges



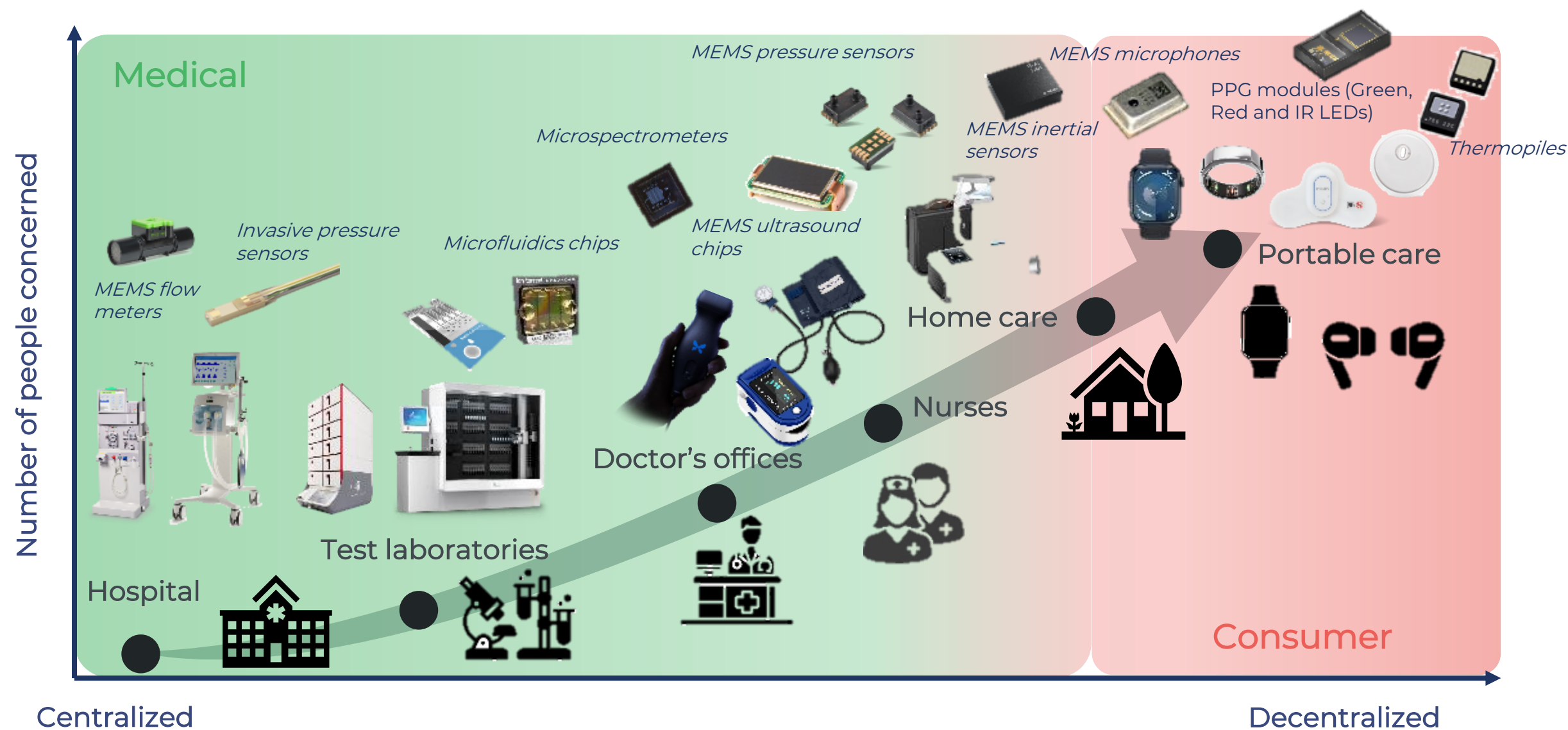
Transformation



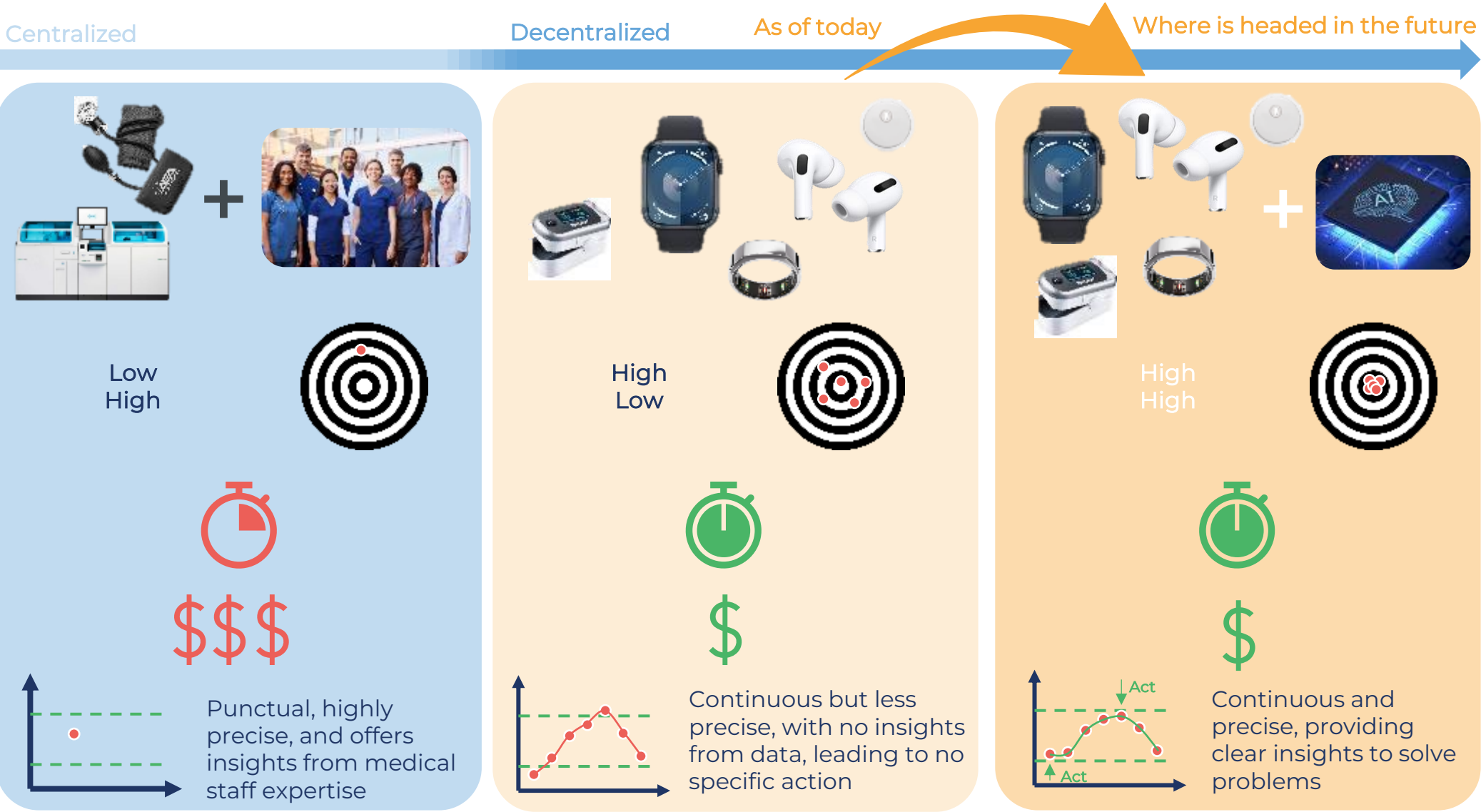
FROM CENTRALIZED TO DECENTRALIZED



FROM CENTRALIZED TO DECENTRALIZED



FROM RAW INFORMATION TO MEANINGFULLY INFORMATION



END-MARKETS ARE COMING CLOSER AND CLOSER



Consumer Healthcare



Fitness and well-being applications
No approval
From 10k to a million units
Retail stores

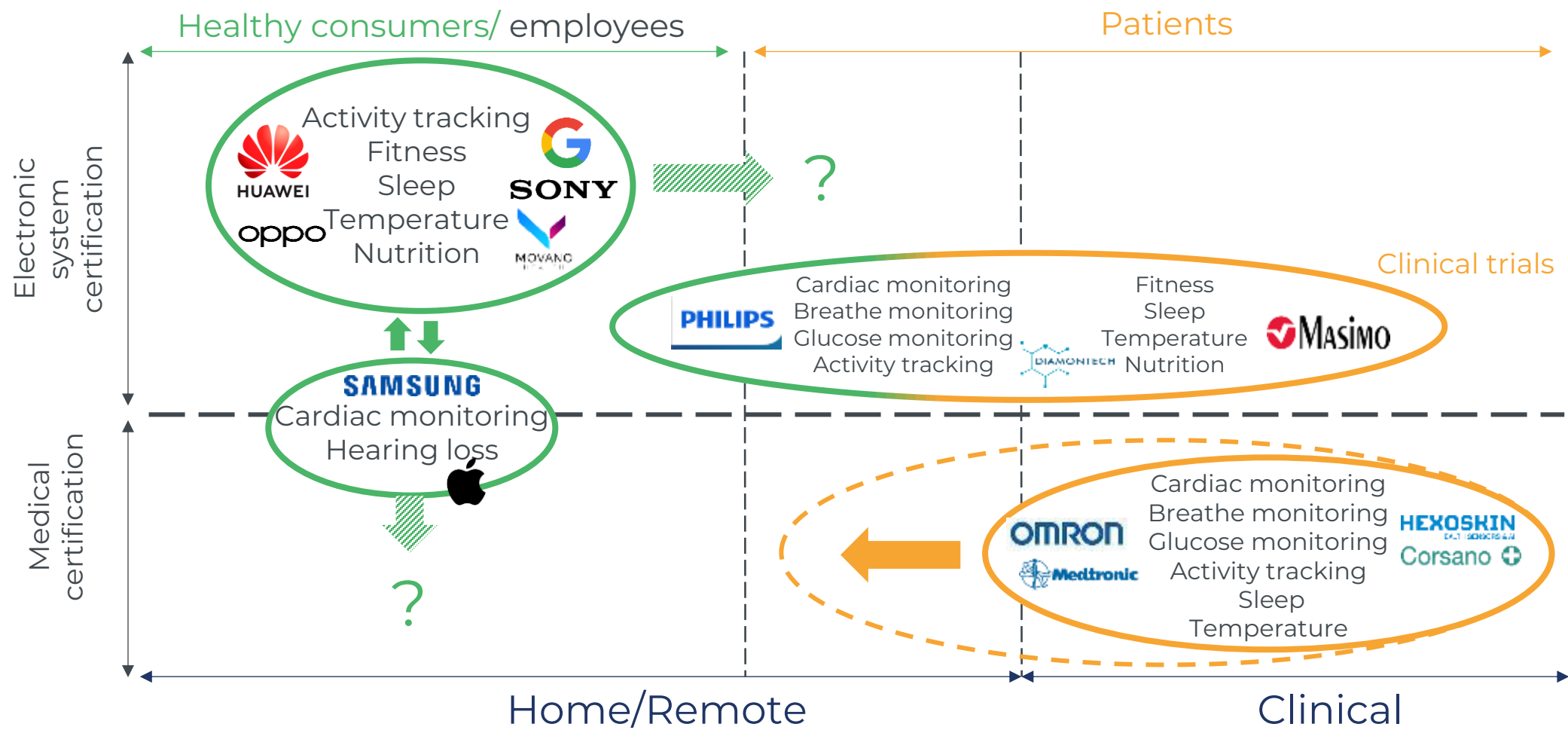
Consumer healthcare (OTC)
Approval, or function approved by a health organization
From thousands to millions of units
Over the counter

Medical device
Approval from health organization
From thousands to 100k units
Prescription mandatory

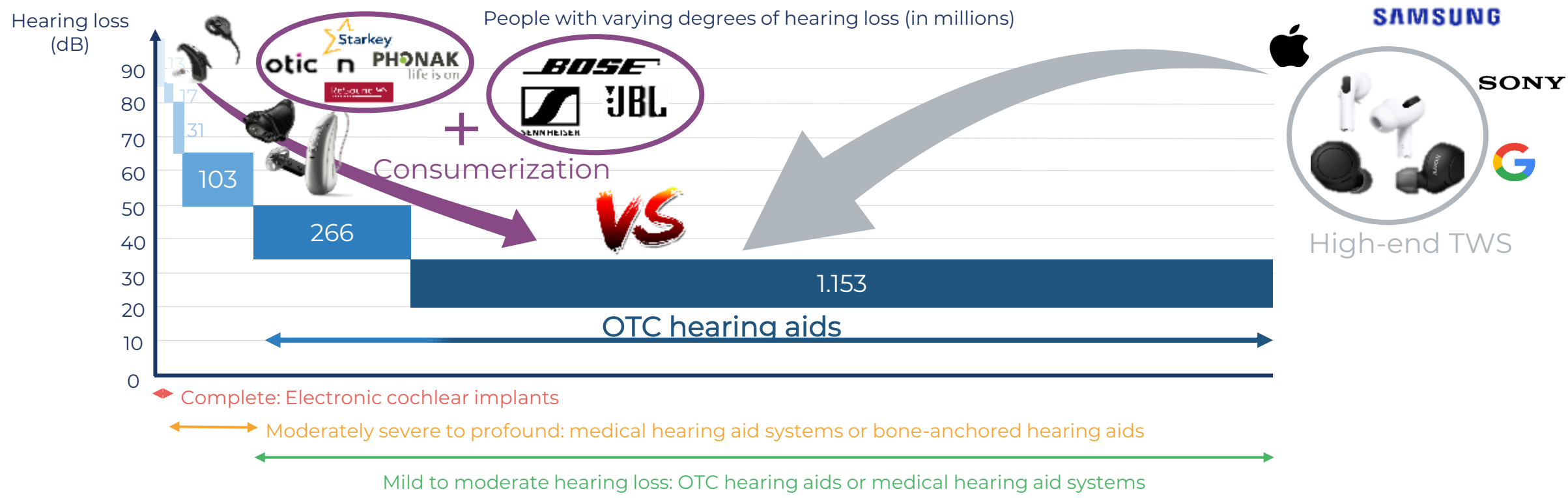
Cumulative FDA cleared functions per companies



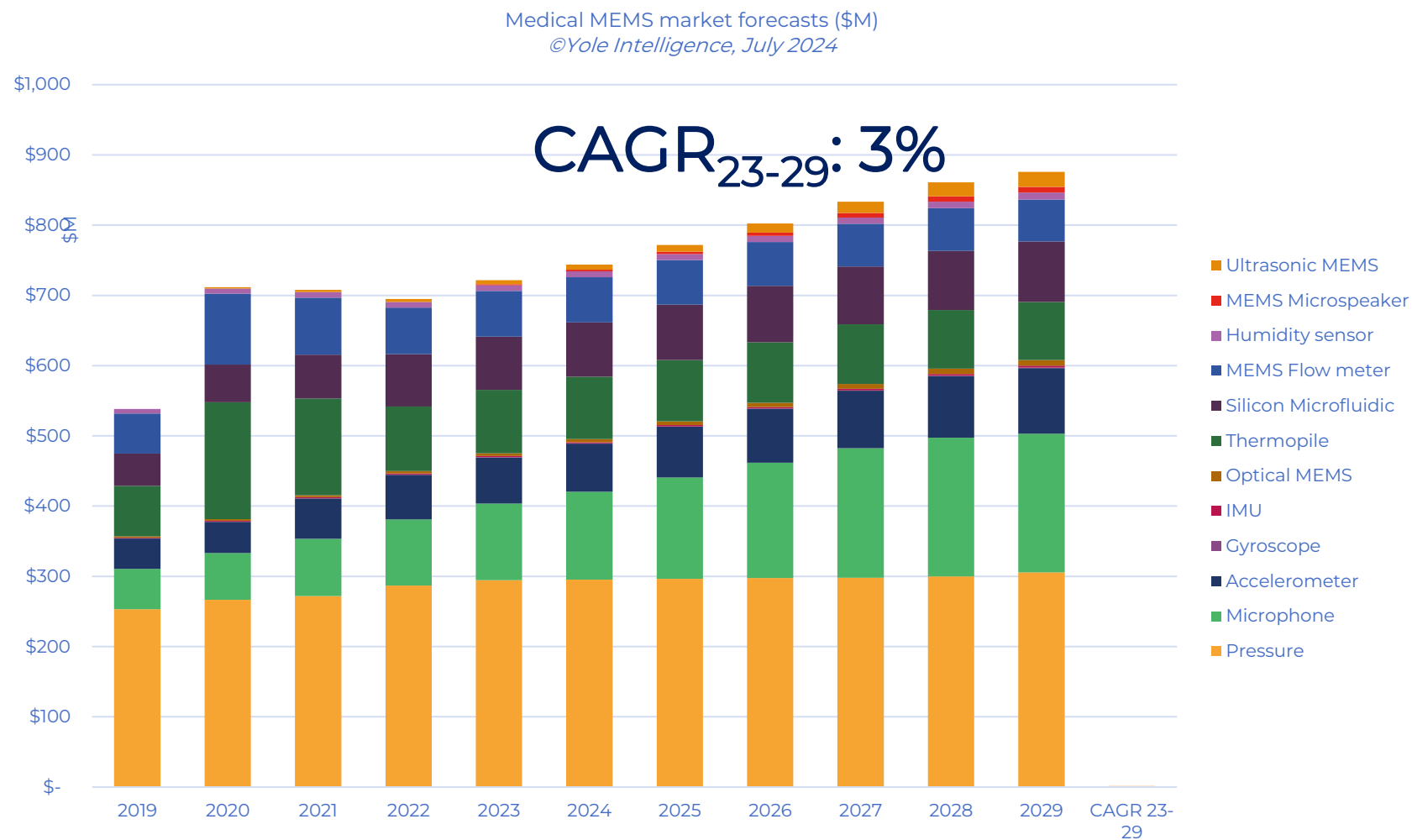
HOW HEALTHCARE AND MEDICAL MARKETS COULD EVOLVE



HEARING AIDS OVER THE COUNTER – THE NEXT OPPORTUNITY



MEDICAL MEMS MARKET FORECAST (\$M)



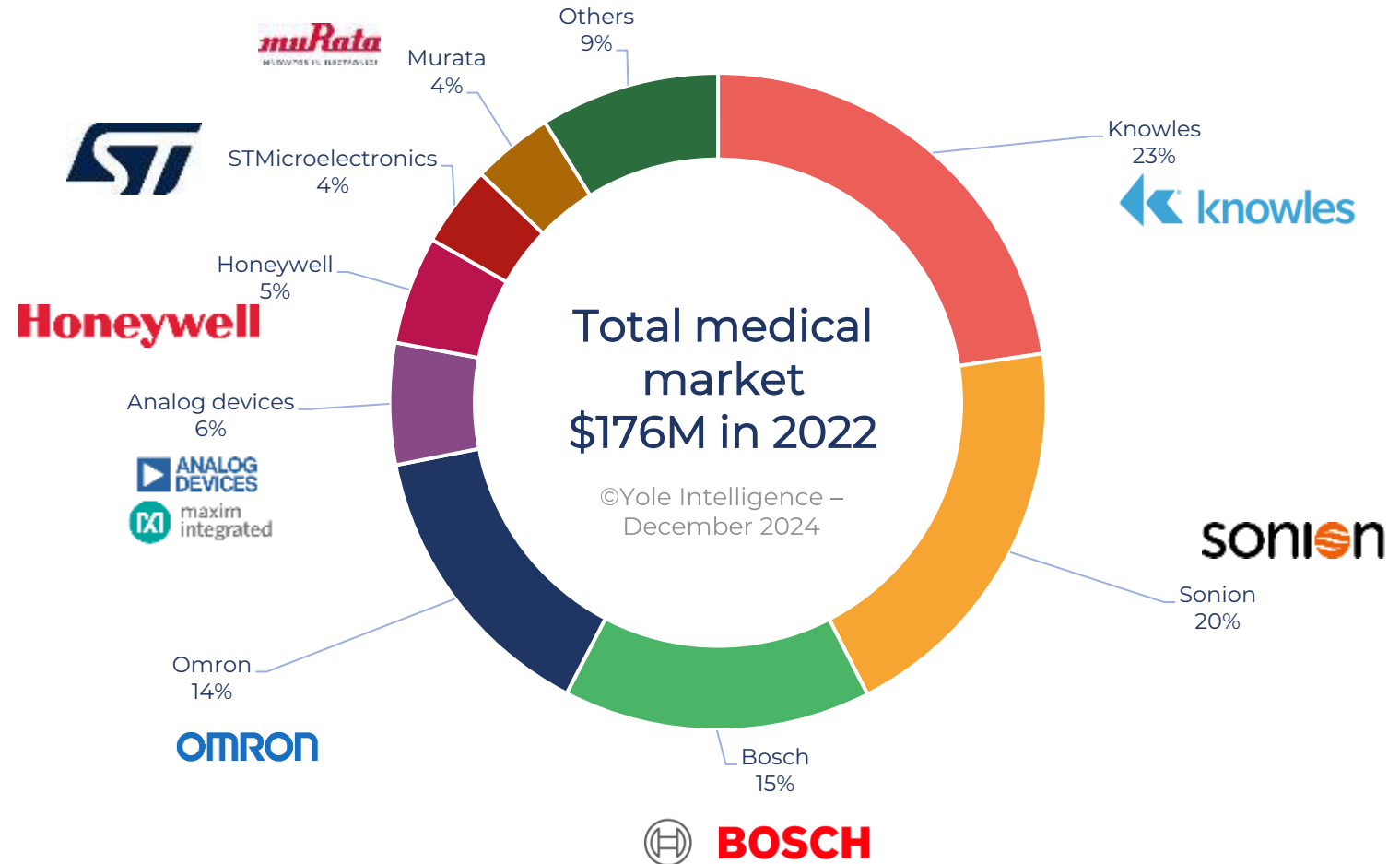
SENSORS & ACTUATORS MARKET SHARES

For medical wearables

*Excluding CGMs systems 

- Knowles and Sonion are leading the way in MEMS microphones
- Bosch is following with its IMU sensors in hearing aids, pulse oximeters, smart bracelets, smart clothing, and smart patches.
- Omron is driving the production of MEMS pressure sensors and temperature sensors
- Analog Devices, Murata, and STMicroelectronics are also taking market share with their IMU sensors for medical systems.

Sensors & Actuators for medical Wearables market shares (in revenue)

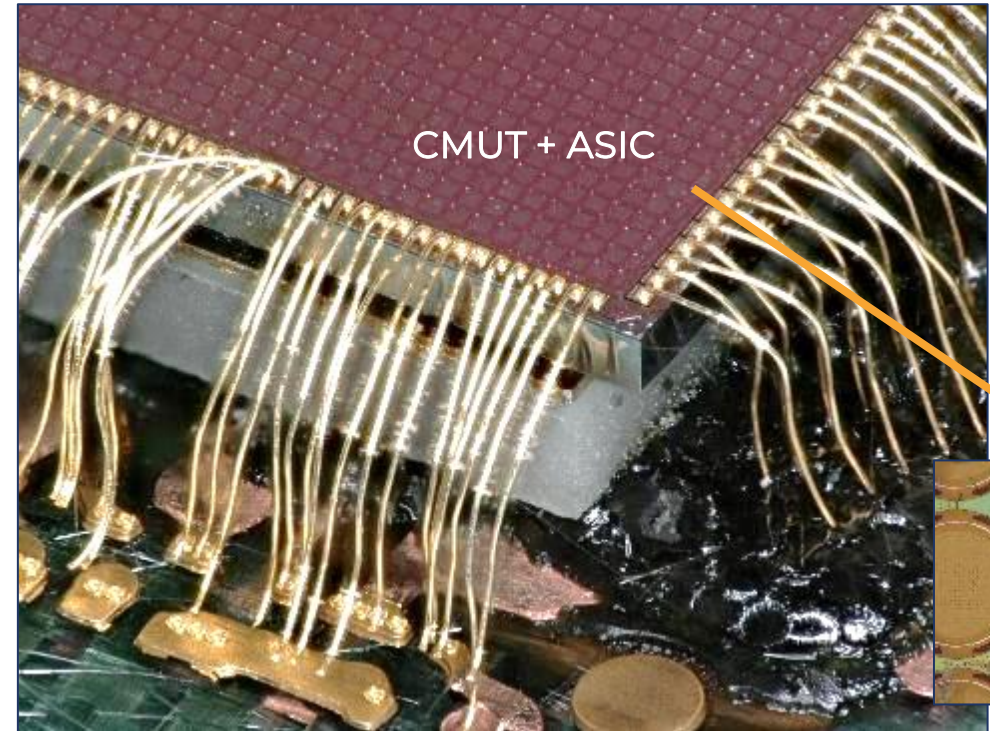


This only considers players involved at the **first-level packaging** level. Players assembling modules (like touch and force sensors, PPG, ECG, etc.) are not included.

*Top view
of the lens*



iQ3 butterfly

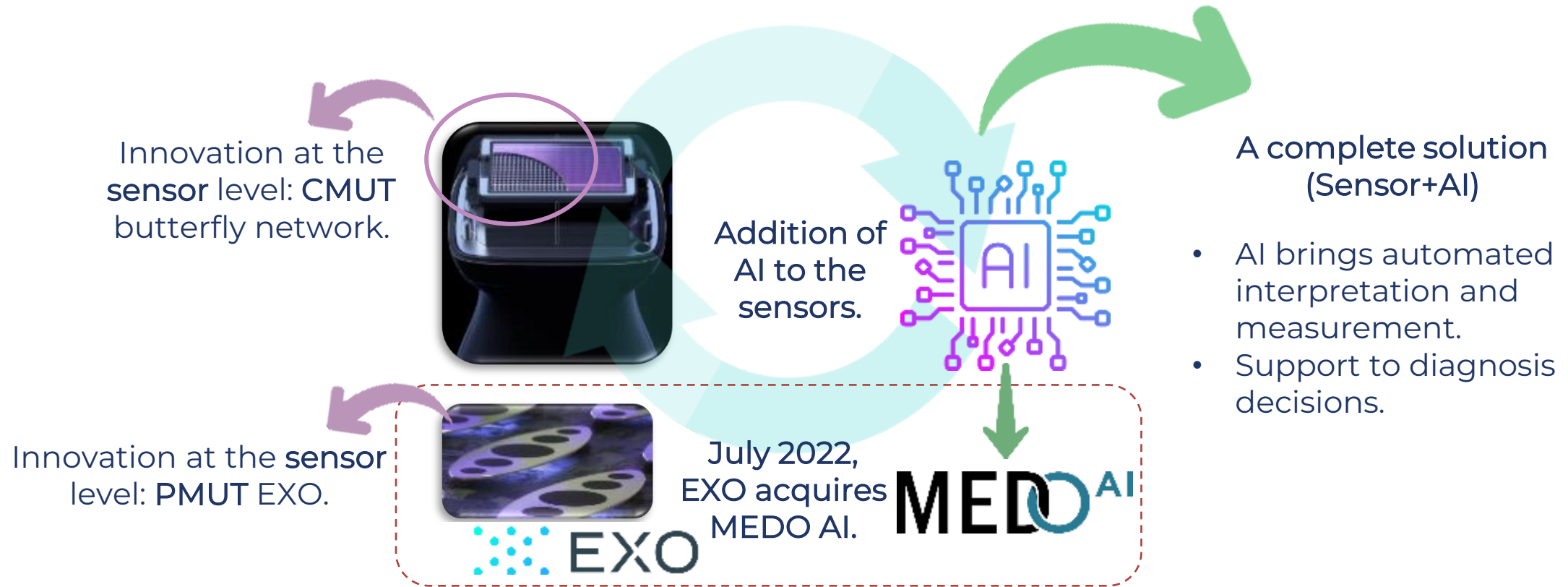


Under the lens – CMUT

- Micro-machined Ultrasound Transducers is allowing
 - Miniaturized device with high-level of integration (CMUT-on-ASIC)
 - Large bandwidth, tunable – All-in-One probe for different applications
 - Technology envisioned for very small procedures like intravascular exploration

EDGE PROCESSING: RETURNING INTELLIGENCE CLOSE TO THE SENSOR

AI to make medical imaging easy



YOLE'S DEFINITION OF MICROFLUIDICS



Microfluidic instruments

Detection systems



Microfluidic modules

Microfluidic Chips



Systems built mainly with one material

Microfluidic Cartridges



Systems built on several parts

Microfluidic flow cells



Often a system built on glass or silicon

Microfluidic Microphysiological systems

Systems used to mimic human organs

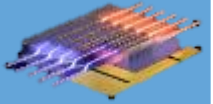


Printheads



Systems link to printing technologies

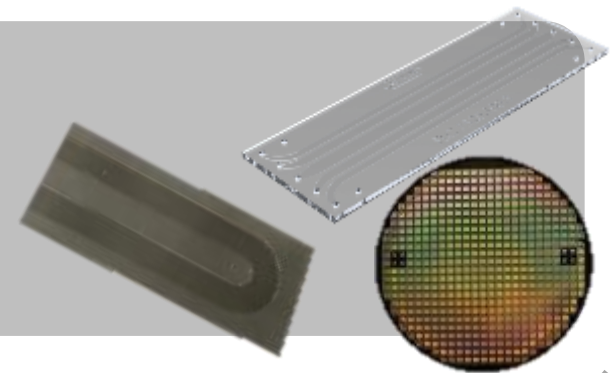
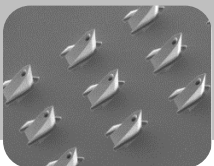
Chip cooling



Systems used for electronic cooling

Microfluidic devices

Microstructured raw materials



Value/Complexity/Integration

MARKET TRENDS - POC

A multitude of purposes

Standalone or expandable systems require solving four main challenges:

- Equivalent performance to clinical laboratories (accuracy, type of samples such as blood, urine, saliva)
- Time to results (for PoC, it is essential to have results in minutes, not in an hour, for example)
- Ease of use (intuitive as an electronic consumer product, suitable for different users and environments)
- Cost-effective (example: molecular tests \$45-50)

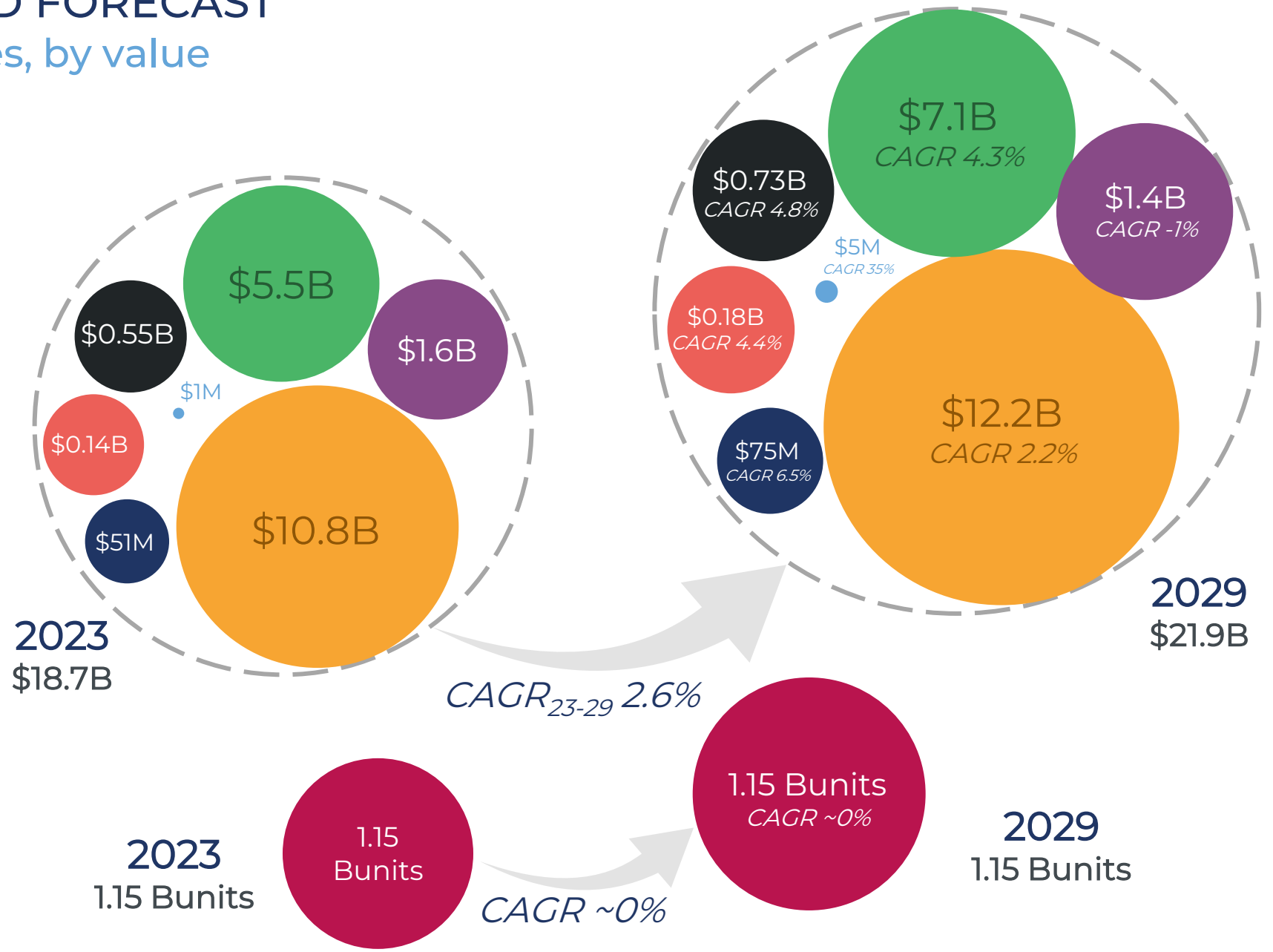


MARKET DATA AND FORECAST

Microfluidics modules, by value

- Chips
- Cartridges
- Flow cells
- Microphysiological systems
- Printheads
- Chip cooling
- Others

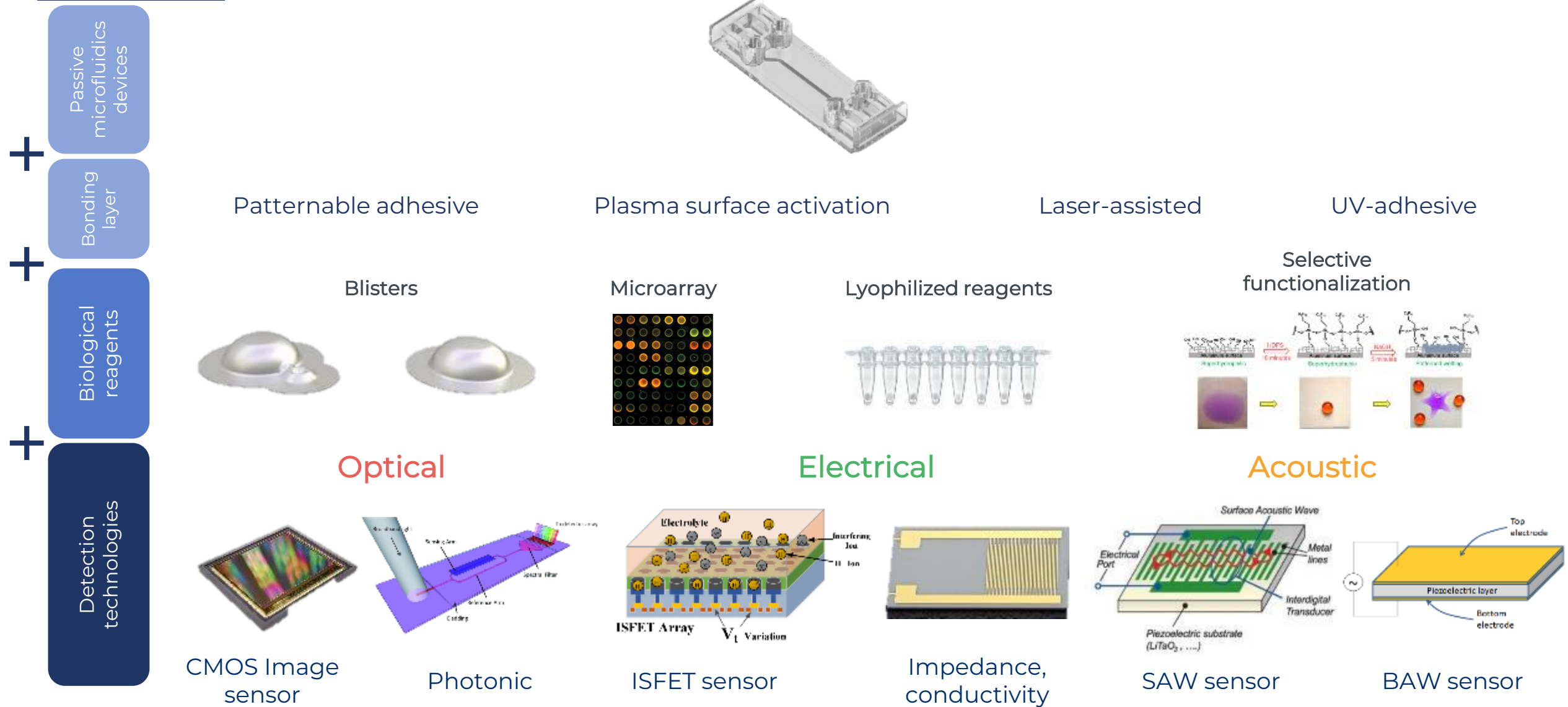
Revenues
\$
CAGR₂₃₋₂₉





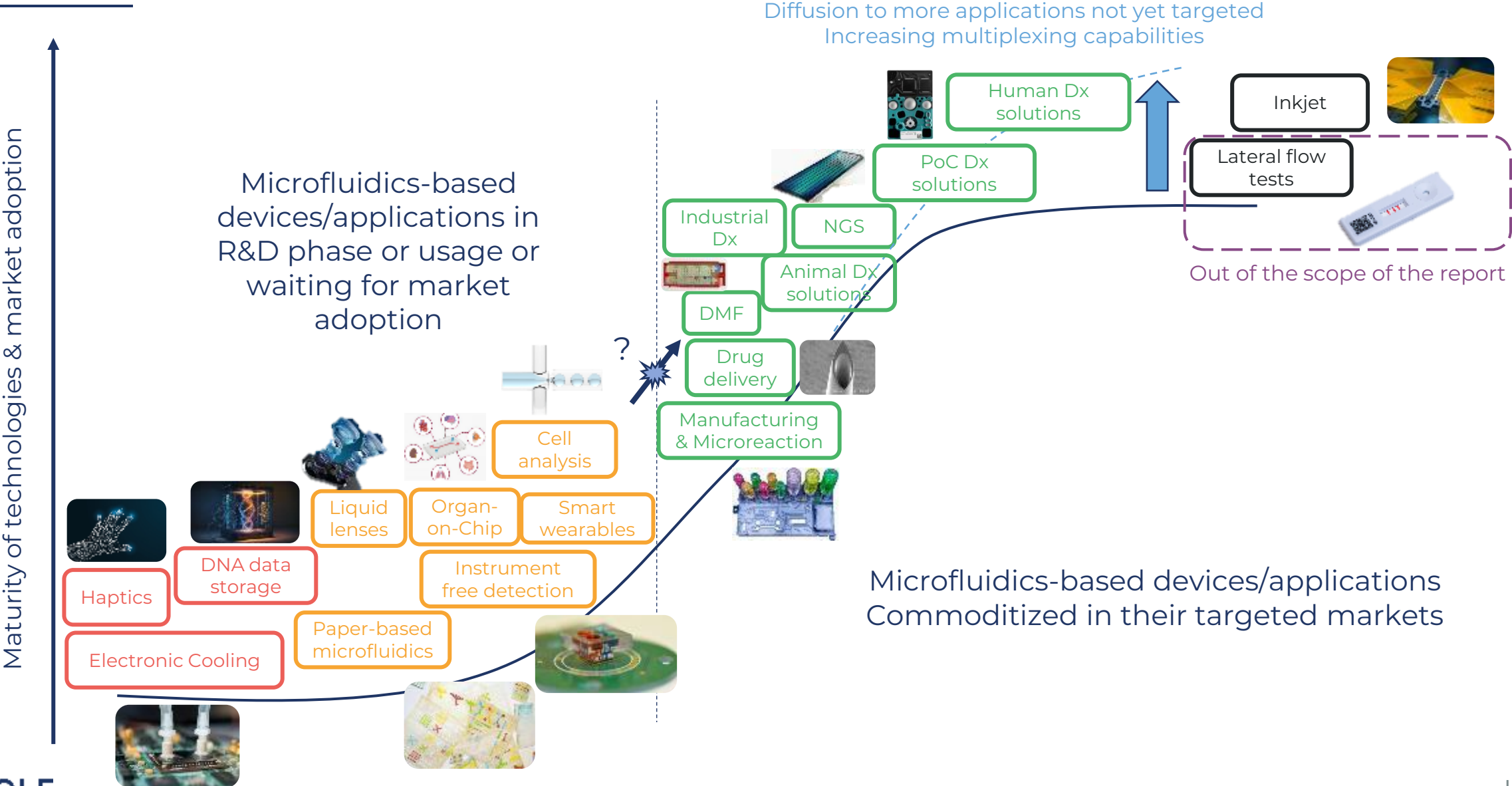
DEVELOPMENT OF BIOSENSORS

Integration of sensors in microfluidics modules



MARKET TRENDS

Maturity of microfluidics devices/applications





- Healthcare sector is facing different challenges while moving from evidence medicine to 4P medicine
- Medical end-systems like wearables or point of care devices allow a decentralized medicine, more affordable, miniaturized, smarter and smarter.
- More consumer players are showing interest to the 7 billion individuals requiring possible monitoring
- Decentralization challenges mean:
 - Miniaturized, cost effective, low-power solutions
 - Ease of use and meaningful information
- Microtechnologies are at the heart of these end systems:
 - Medical MEMS-based sensors are expected to reach \$880M by 2029
 - Microfluidics cartridges and flow cells are expected to reach \$19.3B
- Microtechnologies improvement enable intelligence to get closer to the sensor.

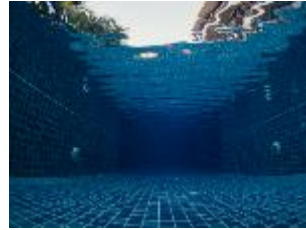
THANK YOU FOR YOUR ATTENTION!



The presentation is based on the following reports:



Status of MEMS Industry 2024



Status of Microfluidics Industry 2024



Sensors & Actuators for Wearables 2023

2025 release coming soon!



Yole System Plus consumer tracks



Butterfly Network iQ3 CMUT Sensor

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