

# BIOMEMS MARKET AND TECHNOLOGY 2020

## Market & Technology Report - June 2020

*Pressure, inertial, MEMS ultrasound, microfluidic chips and other sensors are driving the growth of the life sciences and healthcare market.*

### WHAT'S NEW

- A dedicated part on the COVID-19 impact at the sensor and end system level
- Analysis of the dynamics of the market in the short and long terms due to the pandemic
- Comparison of the different product developments and production cycle times and what to expect to reach the healthcare market
- Top bioMEMS ranking for IDMs (Integrated Device Manufacturers) and fabless companies
- Discussion of player origins: industrial, consumer and challenges to access to bioMEMS applications
- Analysis of emerging bioMEMS sensors: design, integration and usage challenges

### KEY FEATURES

- The key drivers of the healthcare system transformation and MEMS sensor advantages
- BioMEMS time to market to consider to serve healthcare industry
- COVID-19 impact on market trends – short term impact forecast (2019-2020)
- BioMEMS market forecast 2019-2025 in value (\$) and shipment (units)
- Market trends and main player market shares per bioMEMS device
- Ecosystem and supply chain, including top bioMEMS players, MEMS foundries serving bioMEMS market
- Technology trends: main technologies and drivers, challenges of the healthcare market

### BEFORE AND AFTER COVID-19: HOW ARE THE HEALTHCARE APPLICATIONS CHANGING?

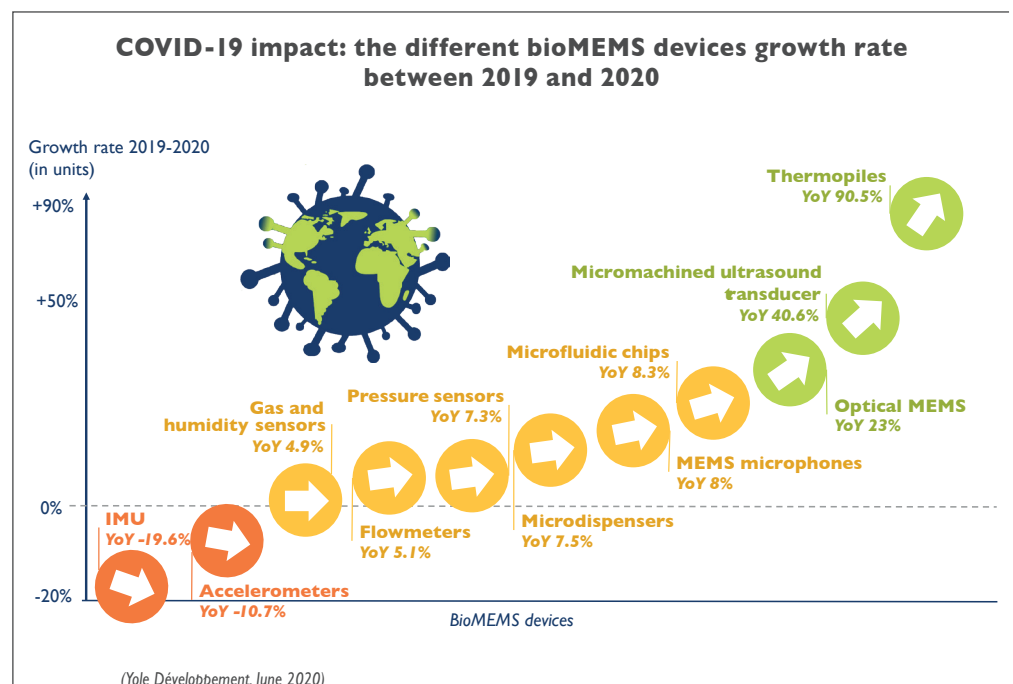
It is now a reality: the world and particularly the healthcare sector that existed before the COVID-19 outbreak will be different after it. The effects of the pandemic have strongly hit the medical device and in-vitro diagnostics (IVD) sector, with an impact on sales, applications and usage. However, the impact is slightly different in the healthcare sector than in other domains like consumer or automotive markets. Moreover, it is highly application-related. Thus, bioMEMS devices, defined as MEMS sensors and microfluidic devices integrated into medical devices and used for IVD and life sciences, are reflecting the market demand for the products in which they are integrated.

COVID-19's acute respiratory symptoms have generated a sudden need for interventional equipment like ventilators, influencing the requirements for MEMS pressure sensors and flowmeters. A huge demand for non-contact thermometers also came from Asia, particularly China. Infra-red (IR) thermometers play a big role for patient monitoring at hospitals and for preventive policies in public areas like airports or stations. Thus, IR thermopile shipments are increasing rapidly, with tremendous 90.5% growth expected from 2019 to 2020. In the IVD domain, many companies have started

development projects to provide either rapid point-of-care tests or high-throughput tests for use in the central lab as soon as possible. Some of these tests are built on microfluidic chips, as well as the DNA sequencing flow cells that are useful tools to study the virus and hopefully develop a treatment or vaccine.

Apart from the hospital and central lab requirements, the pandemic has also moved patients towards more telemedicine and home consultation, to limit physical contacts. It accelerated adoption of home testing and monitoring using point of care devices. One example is the Butterfly IQ probe, which uses micromachined ultrasound transducer (MUT) technology, allowing flexible use by nurses or general practitioners (GPs) for early diagnostics at the patient side. In the medium to long term, wearables and connected medical devices should find stronger interest from healthcare systems.

The impact of COVID-19 on bioMEMS market dynamics will definitely not be the same from one application to another. Increased demand for respiratory systems will raise the need for bioMEMS for the duration of the pandemic, while remote connected medical devices requirements will be intensified in the long term.



## INTEREST FOR MEMS DEVICES IN HEALTHCARE REMAINS STRONG, WITH A CAGR<sub>2019-2025</sub> OF 9.2%

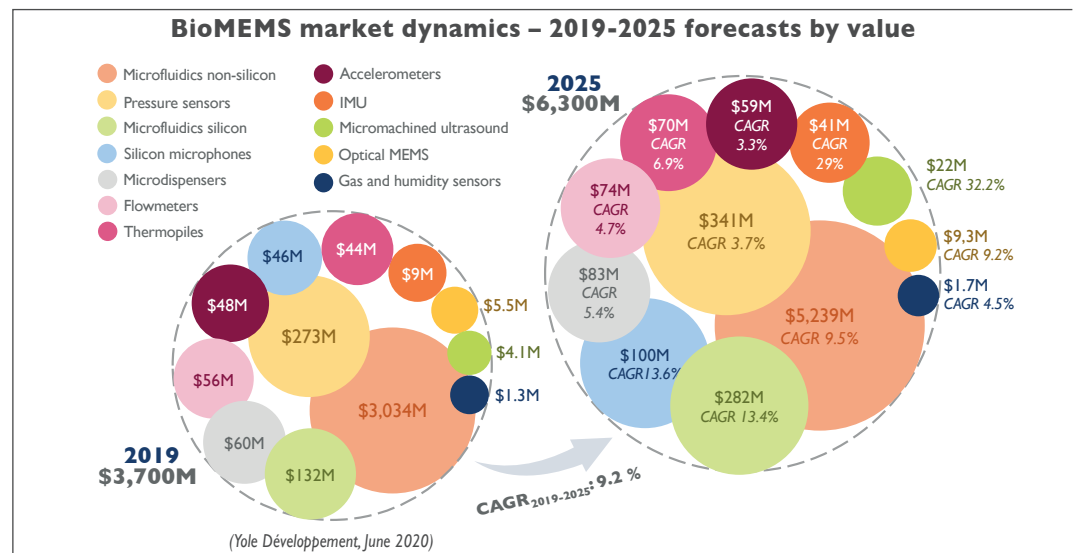
The bioMEMS device market reached \$3.7B in 2019 and is expected to reach \$6.3B in 2025 with a Compound Annual Growth Rate from 2019 to 2025 (CAGR<sub>2019-2025</sub>) of 9.2%. Microfluidic chips still represent the largest part of the bioMEMS market and compete with MEMS pressure sensors when counting only silicon microfluidics. It is also worth noting that the bioMEMS device market is growing faster than the medical device market, which has about 4.5% growth year over year on the last decade, showing greater penetration of MEMS technologies compared to conventional ones. BioMEMS are more than ever the technology of choice, selected for high levels of integration, miniaturization and low power consumption in a transforming healthcare sector.

MUTs are the latest newcomers in the bioMEMS field with 32% growth expected year-over-year in the next five years. Confirming the interest of the healthcare sector for a new type of highly integrated and affordable ultrasound imaging devices at the

point of care, like the success of Capacitive MUT (CMUT) based probes and future generation of ultrasound based catheters.

On the other hand, several devices like Inertial Measurement Units (IMUs) for fall detection wearables, including the Apple Watch Series 4 and 5, or MEMS microphones for hearing aids, are more severely hit by the economic downturn than other devices. Nevertheless, the market's drivers are linked to demography and ageing population. Recovery is expected very soon, at the latest in 2021 as healthcare companies need to serve patients and practitioners.

A special part dedicated to COVID-19 is included in this report to better understand its impact on market forecasts in the short and medium terms. As usual, the report provides dedicated analysis of market trends for each bioMEMS device in the next five years with market forecast in value and units, along with a comprehensive analysis of the overall bioMEMS market.

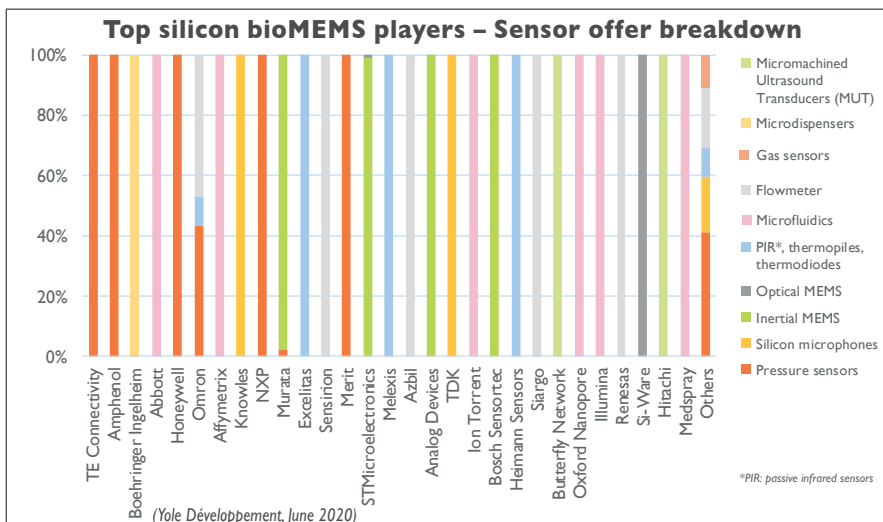


### IS THE BIOMEMS INDUSTRY RULE ‘ONE PLAYER, ONE MEMS DEVICE’?

Efforts to serve the healthcare sector that are related to MEMS device reliability, measurement accuracy and compliance with healthcare regulations,

requested by the integrators at the system level, require highly developed skills and long experience. Emerging bioMEMS devices like microneedles, MUT or optical MEMS devices sometimes have complex designs or are highly challenging for integration when the use case is not itself imposing other barriers. Analysis of the players and supply chain show that bioMEMS makers are often centered on a single MEMS device, or sometimes two device types. Most of the top bioMEMS players are also serving the industrial domain, having experience with high-end and highly regulated applications. MEMS foundries are playing a big role, working on high added value projects, developing key process steps like lead zirconate titanate (PZT) deposition or CMOS-MEMS integration.

A new wave of players is also getting increasingly involved, as the healthcare sector is currently moving to more preventive and personalized care. Consumer MEMS companies are strongly



interested in serving consumer healthcare applications, where volumes could be attractive and regulations less strict. However, the frontier between regulated and non-regulated markets is blurred.

*Discover in this report the latest changes in the bioMEMS landscape and the challenges new players must face, what opportunities are being created and who could take advantage of the current pandemic situation.*

**REPORT OBJECTIVES**

- The bioMEMS report is a comprehensive overview of MEMS devices including pressure sensors, microphones, inertial MEMS, microfluidic chips, microdispensers, optical MEMS, MUT flow meters, gas and humidity sensors integrated or used in the life science and healthcare domains
- It provides the latest main information and key facts of the bioMEMS industry
- It forecasts the bioMEMS market from 2019 to 2025 with graphics and market trends explanations
- The report helps to understand the dynamics of the market and the competitive landscape for strategic decision making
- It enables readers to understand the challenges for MEMS companies who want to serve the healthcare sector at the economic and technological level

**COMPANIES CITED IN THE REPORT (non exhaustive list)**

IOX Genomics, Abaxis, AEMtec, Affymetrix, Agilent Technologies, Amazon, Amphenol, Amplifon, Analog Devices, Apple, Azbil, BioFire (Biomérieux), Biotronik, Boehringer Ingelheim, Bosch Sensortec, Boston Scientific, Butterfly Network, Capital Bio, Cepheid (Danaher), CiDRA Precision Services, Cochlear, Demant, Excelitas, Facebook, Food & Drugs Administration (FDA), First sensors, Fitbit, Fraunhofer, GN Resound, Google, Heimann Sensors, Hitachi, Honeywell, Illumina, IMEC, IMT MEMS, IMTAG, Invenios, Ion Torrent, Knowles, Medspray, Medtronic, Melexis, Merit Sensors, Micro Liquid, Microfluidic ChipShop, Micronit Technologies, Microsoft, MiniFab (Schott), Murata, NXP, Omron, Oxford Nanopore, Perkin Elmer, Philips Innovation Services, Quidel Corp., Renesas, Robert Bosch, Roche Diagnostics, Rogue Valley Microdevices, Sensirion, Siargo, Siemens, Silex Microsystems, Sivantos, Si-Ware, Sonova, Sony, Starkey, STMicroelectronics, Stratec Consumables, TDK, TDK Invensense, TDK Tronics Microsystems, TE Connectivity, Teledyne Dalsa, Teledyne Micralyne, Thermofisher Scientific, ThinXXS, Tong Hsing Electronic Industries, TSMC, Withings, X-Fab, and many more...

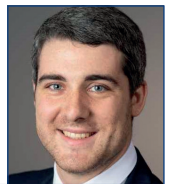
**TABLE OF CONTENTS** (complete content on i-Micronews.com)

<b>Glossary and definition</b>	<b>2</b>	<b>Market trends</b>	<b>101</b>
<b>Table of contents</b>	<b>6</b>	> For each bioMEMS device including pressure, microphones, inertial MEMS, microfluidic chips, microdispensers, optical MEMS, MUT, flowmeters, gas and humidity sensors:	
<b>Report scope/methodology</b>	<b>9</b>	- Market drivers, market shares, example key products	
<b>What we got right, what we got wrong</b>	<b>14</b>	- BioMEMS device market data 2019-2025 (value and units)	
<b>Executive summary</b>	<b>16</b>	- Main players location	
<b>Context</b>	<b>46</b>	<b>Market shares and supply chain</b>	<b>215</b>
> Medical technology market		> TOP bioMEMS market	
> Classification of medical devices and IVD tools		> BioMEMS players market shares	
> Healthcare industry trends		> BioMEMS company - Sensor breakdown	
> Healthcare time to market comparison		> MEMS foundries and offering	
> Medical device and consumer healthcare concept		> Supply chain and business models	
> Merger and acquisition activity		<b>Technology trends</b>	<b>235</b>
<b>Impact of the COVID-19 pandemic</b>	<b>77</b>	> Technology trends by devices	
<b>Market forecasts</b>	<b>86</b>	> Technology challenges for the healthcare sector	
> BioMEMS market data and forecasts 2019-2025 (value and units) by bioMEMS devices		> Technologies roadmap	
> BioMEMS market dynamics on the forecast period 2019-2025 and related analysis		> Focus on emerging MEMS and related challenges	
> BioMEMS market data and forecasts 2019-2025(value) at the segment level		<b>Conclusion and outlooks</b>	<b>258</b>
		<b>About Yole Développement</b>	<b>261</b>



**AUTHORS**

**Jérôme Mouly** serves as a Senior Technology & Market Analyst & Business Developer specialized in microtechnologies within the Photonics & Sensing team at Yole Développement (Yole). Jérôme actively assists and supports the development of strategic projects, working with leading customers of the company. Since 2000, he has also been engaged in more than 100 marketing and technological analyses for industrial groups, start-ups and institutes in the field of MEMS, bioMEMS, wearable & connected medical devices. Through the group's numerous activities at Yole, Jérôme covers the whole microelectronic supply chain including manufacturing processes and device development. Jérôme is also regularly involved in international conferences, giving presentations and delivering keynotes. Jérôme Mouly holds a Master of Physics from the University of Lyon (France).



**Sébastien Clerc** is a Technology & Market Analyst in Microfluidics, Sensing & Actuating at Yole Développement (Yole). As part of the Photonics & Sensing team, Sébastien has authored a collection of market and technology reports dedicated to microfluidics and other micro-devices for both market segments: medical (including diagnostics, pharmaceutical, biotechnology, drug delivery, medical devices) and industrial (including environment, agro-food). At the same time, he is involved in custom projects such as strategic marketing, technology scouting and technology evaluation to help academic and industrial players in their innovation processes. Thanks to his technology & market expertise, Sébastien has spoken in more than 20 industry conferences worldwide over the last 4 years. Sébastien Clerc graduated from Grenoble Institute of Technology (Grenoble INP - Grenoble, France) with a Master's degree in Biomedical Technologies. He then completed his academic studies with a Master's degree in Innovation and Technology Management in the same institute.

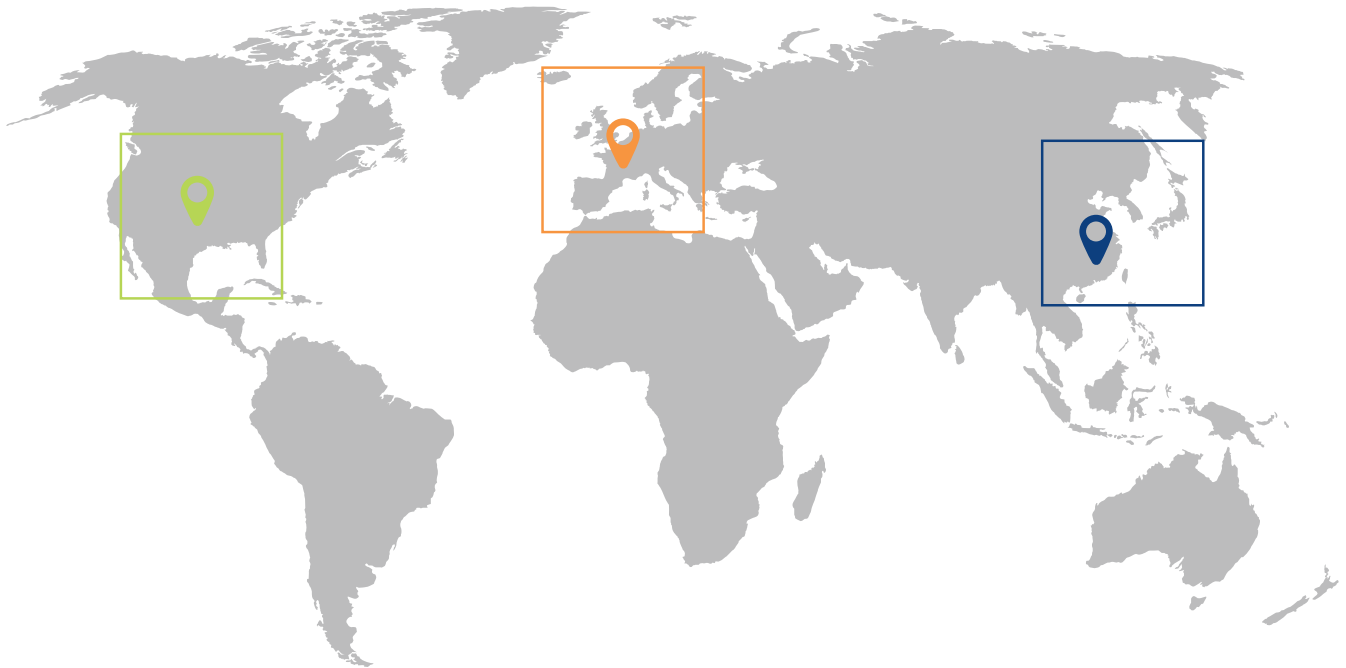
**RELATED REPORTS, MONITORS & TRACKS**



- Point-of-Need 2020 – Including PCR-Based Testing
- Status of the MEMS Industry 2019
- Thermal Imagers and Detectors 2020 – COVID-19 Outbreak Impact – Preliminary Report
- Artificial Intelligence for Medical Imaging 2020
- Medical Wearables: Market and Technology Trends 2019

More information and details about our offers and bundles opportunities on [www.i-micronews.com](http://www.i-micronews.com)

## CONTACT



### Western US & Canada

Steve Laferriere - [steve.laferriere@yole.fr](mailto:steve.laferriere@yole.fr)  
+1 310 600-8267

### Eastern US & Canada

Chris Youman – [chris.youman@yole.fr](mailto:chris.youman@yole.fr)  
+1 919 607 9839

### Europe and RoW

Lizzie Levenez – [lizzie.levenez@yole.fr](mailto:lizzie.levenez@yole.fr)  
+49 15 123 544 182

### Benelux, UK & Spain

Marine Wybraniez - [marine.wybraniez@yole.fr](mailto:marine.wybraniez@yole.fr)  
+49 69 96 21 76 78

### India and RoA

Takashi Onozawa – [takashi.onozawa@yole.fr](mailto:takashi.onozawa@yole.fr)  
+81-80-4371-4887

### Korea

Peter Ok - [peter.ok@yole.fr](mailto:peter.ok@yole.fr)  
+82 1040890233

### Japan

Miho Ohtake – [miho.ohtake@yole.fr](mailto:miho.ohtake@yole.fr)  
+81 34405-9204

Toru Hosaka – [toru.hosaka@yole.fr](mailto:toru.hosaka@yole.fr)  
+81 90 1775 3866

### Japan and Singapore

Itsuyo Oshiba – [itsuyo.oshiba@yole.fr](mailto:itsuyo.oshiba@yole.fr)  
+81-80-3577-3042

### Greater China

Mavis Wang – [mavis.wang@yole.fr](mailto:mavis.wang@yole.fr)  
+886 979336809 +86 136 61566824

### Sales Coordination & Customers Service

David Jourdan – [david.jourdan@yole.fr](mailto:david.jourdan@yole.fr)  
+33 472 83 01 90

Fayçal El Khamassi – [faycal.khamassi@yole.fr](mailto:faycal.khamassi@yole.fr)  
+33 472 83 01 95

## ABOUT YOLE DEVELOPPEMENT

Founded in 1998, Yole Développement (Yole) has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 120 collaborators worldwide covering MEMS and Image Sensors, Compound Semiconductors, RF Electronics, Solid-state Lighting, Displays, Software, Optoelectronics, Microfluidics & Medical, Advanced Packaging, Manufacturing, Power Electronics, Batteries & Energy Management and Memory.

The “More than Moore” market research, technology and strategy consulting company Yole Développement, along with its partners System Plus Consulting, PISEO and Blumorpho, supports industrial companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business.

### CONSULTING AND ANALYSIS

- Market data & research, marketing analysis
- Technology analysis
- Strategy consulting
- Reverse engineering & costing
- Design and characterization of innovative optical systems
- Financial services (due diligence, M&A)

More information on [www.yole.fr](http://www.yole.fr)

### MEDIA & EVENTS

- i-Micronews.com website, application & related e-newsletter
- Communication & webcast services
- Events: TechDays, forums...

More information on [www.i-Micronews.com](http://www.i-Micronews.com)

### REPORTS & MONITORS

- Market & technology reports
- Market and reverse technology quarterly monitors
- Structure, process and cost analysis and teardowns
- Cost simulation tool

More information on [www.i-micronews.com/reports](http://www.i-micronews.com/reports)

### CONTACTS

For more information about :

- Consulting & Financial Services: Jean-Christophe Eloy ([eloy@yole.fr](mailto:eloy@yole.fr))
- Reports & Monitors: David Jourdan ([david.jourdan@yole.fr](mailto:david.jourdan@yole.fr)) & Fayçal Khamassi ([faycal.khamassi@yole.fr](mailto:faycal.khamassi@yole.fr))
- Marketing & Communication: Camille Veyrier ([camille.veyrier@yole.fr](mailto:camille.veyrier@yole.fr))
- Public Relations: Sandrine Leroy ([sandrine.leroy@yole.fr](mailto:sandrine.leroy@yole.fr))

Definitions: **“Acceptance”**: Action by which the Buyer accepts these General Terms and Conditions of Sale in their entirety. It is done by signing the purchase order which states “I hereby accept Yole Développement’s General Terms and Conditions of Sale”.

**“Buyer”**: Any business user (i.e. any person acting in the course of its business activities for its business needs) placing an order pursuant to these General Terms and Conditions of Sale, with the exclusion of any individual consumer acting for his/her sole personal interest.

**“Seller”**: Headquartered in Villeurbanne (France), Yole Développement provides marketing, technology and strategy consulting, media and corporate finance services, reverse engineering/costing services as well as IP and patent analysis. With dedicated teams of technology & market analysts, Yole Développement operates worldwide with the key industrial companies, R&D institutes and investors to help them understand the market and technology trends.

**“Contracting Parties”** or **“Parties”**: The Seller on the one hand and the Buyer on the other hand.

**“Intellectual Property Rights”** (“IPR”) means any rights held by the Seller in its Products, including any patents, trademarks, registered models, designs, copyrights, inventions, commercial secrets and know-how, technical information, company or trading names and any other intellectual property rights or similar in any part of the world, notwithstanding the fact that they have been registered or not and including any pending registration of one of the above mentioned rights.

#### “Products”

Our products can be bought either on a unit basis or as a bundled offer (i.e. subscription for a period of 12 calendar months).

#### “Report”

Reports are established in PowerPoint and delivered in a PDF format with an additional Excel file. 30 min of Q&A session with an analyst/author can be included for all purchased reports (except the ones bought as a one user license). More time can be allocated on a fee basis.

#### “Monitor”

Monitors are established and delivered in Excel. An additional PDF can also be added. Q&A with an Analyst is possible for each monitor (except where specified otherwise). Frequency of the release vary according to the monitor or service (quarterly and monthly). All monitor products are eligible for a Corporate License.

#### “Tracks”

Yearly subscription to access a web-based interactive portal to view features and specs of a device or component based on a complete turnaround process.

#### “License”

For the reports 3 different licenses are proposed. Buyer has to choose one license type:

- One User License: The report is intended for only one identified user at the Company purchasing the report - Sharing is strictly forbidden
- Multi-User License: The report can be shared by an identified user at the Company purchasing the report with an unlimited number of employees of said Company, working in the country where the identified user is based. No rights are granted to any employees of any Subsidiaries or Joint Ventures of the Company.
- Corporate License: The report or monitor can be shared by an identified user of the Company purchasing the report with an unlimited number of employees of said Company on a global basis. Subsidiaries controlled by the Company are included, however Joint Ventures involving the Company are excluded.

**DISCLAIMER:** Notwithstanding the fact that certain persons within an organisation may be entitled to access a report pursuant to a Multi-User or a Corporate License, Yole Développement shall in no event incur any liability in any form whatsoever, if Yole Développement should sell one or more licenses directly to any such persons.

#### 1. SCOPE

1.1 Both Contracting Parties undertake to comply with these General Terms and Conditions of Sale.

**ANY ADDITIONAL, DIFFERENT, OR CONFLICTING TERMS AND CONDITIONS IN ANY OTHER DOCUMENTS ISSUED BY THE BUYER AT ANY TIME ARE HEREBY OBJECTED TO BY THE SELLER, ARE DEEMED WHOLLY INAPPLICABLE TO ANY SALE MADE HEREUNDER, AND SHALL NOT BE BINDING IN ANY WAY ON THE SELLER.**

1.2 These General Terms and Conditions of Sale shall be deemed valid and enforceable between the Contracting Parties after acceptance of an order from the Buyer by the Seller pursuant to Article 1.3 below. For such purpose, the Buyer, when signing the purchase order which mentions “I hereby accept Yole Développement’s Terms and Conditions of Sale” is deemed to have fully and unequivocally accepted these Terms and Conditions of Sale.

1.3 Orders are deemed to be accepted only upon written acceptance and confirmation by the Seller, within [7 days] from the date of order, to be sent either by email. In the absence of any confirmation in writing, no order shall be deemed to have been accepted.

#### 2. MAILING OF THE PRODUCTS

2.1 Products are sent by email to the Buyer after Seller’s confirmation:

- Within a few days from the Seller’s confirmation of the order for Products already released and paid; or
- Within a reasonable time for Products ordered prior to their effective release. In this case, the Seller shall use its best endeavours to inform the Buyer of an indicative release date and the evolution of the work in progress.

2.2 The Seller shall by no means be responsible for any delay pursuant to Article 2.1 above, in particular in cases where a new event or access to new contradictory information would require the Seller analyst to dedicate extra time to compute or compare the data in order to enable the Seller to deliver a high quality Product.

2.3 The mailing of the Product will occur only upon payment by the Buyer, in accordance with the conditions contained in Article 3 above.

2.4. The mailing is operated through electronic means either by email via the sales department or automatically online via an email/password. The Buyer is responsible for ensuring that the Buyers platform has the required capacities and authorisations to receive the Product(s) emailed by the Seller. If the Product’s electronic delivery format is defective, the Seller undertakes to replace it at no charge to the Buyer provided that the Seller is informed of the defective formatting within 90 days from the date of the original download or receipt of the Product.

2.5 The person receiving the Products on behalf of the Buyer shall immediately verify the quality of the Products and their conformity with the order. Any claim for apparent defects or for non-conformity shall be sent in writing to the Seller within 8 days of receipt of the Products. For this purpose, the Buyer agrees to produce sufficient evidence of such defects.

2.6 No return of Products shall be accepted without prior written notification from the Buyer to the Seller, even in case of delayed delivery. Any Product returned to the Seller without the Buyer providing prior notification to the Seller as required under Article 2.5 above shall remain at the Buyer’s risk. In no event shall the Seller incur any liability for Products erroneously ordered by the Buyer, or for any request from the Buyer to replace a Product previously ordered by a different Product.

#### 3. PRICE, INVOICING AND PAYMENT

3.1 Prices are given in the orders corresponding to each Product sold on a unit basis or corresponding to annual subscriptions. They are deemed to be inclusive of all taxes applicable in the country where the Seller is based (except for France where VAT will be added). The prices are re-evaluated from time to time by the Seller. The effective price is deemed to be the one applicable at the time of the order.

3.2 Payments due by the Buyer shall be sent by cheque payable to Yole Développement, or made by credit card or by electronic transfer to the following account:

HSBC, 1 place de la Bourse 69002 Lyon France  
Bank code: 30056  
Branch code: 00170  
Account n°: 0170 200 1565 87  
BIC or SWIFT code: CCFRFRPP  
IBAN: FR76 3005 6001 7001 7020 0156 587

To secure the payments due to the Seller, the Seller reserves the right to request down payments from the Buyer. In such case, the need for a down payment will be mentioned on the corresponding order.

3.3 Payment is due by the Buyer to the Seller within 30 days from invoice date, except as otherwise specifically agreed in writing by the Buyer and the Seller. If the Buyer fails to pay at the due date and fails to request and obtain from the Seller a payment extension, the latter shall be entitled to invoice interest in arrears based on the annual rate Refi of the “BCE” + 7 points, in accordance with article L.441-6 of the French Commercial Code.

3.4 The Seller publications (reports, monitors, tracks...) are due for delivery only after receipt by the Seller of any payment due by the Buyer prior to delivery.

3.5 In the event of termination of the contract by the Seller attributable to Buyer misconduct during the contract, the Seller will have the right to invoice all work performed at the time of termination, and to take legal action for damages.

#### 4. LIABILITIES

4.1 The Buyer or any other individual or legal person acting on its behalf, being a business user buying the Products for its business activities, shall be solely responsible for the choice of the Products purchased as well as for the use and interpretations the Buyer makes of the documents it purchases, of the results the Buyer obtains, and of the advice and acts the Buyer bases thereon .

4.2 In no event shall the Seller be liable for:

- a) Damages of any kind, including without limitation, incidental or consequential damages (including, but not limited to, damages for loss of profits, business interruption and loss of programs or information) arising out of the use of a Product or the use of or the inability by the Buyer to use the Seller’s website, or any information provided on the website, or contained in a Product;
- b) Any claim attributable to errors, omissions or other inaccuracies in a Product or interpretations thereof.

4.3 All the information contained in the Products has been obtained from sources believed to be reliable. The Seller does not warrant the accuracy, completeness adequacy or reliability of such information, which cannot be guaranteed to be free from errors.

4.4 Any Product that the Seller sells may, upon prior notice to the Buyer from time to time be modified by Seller or substituted with a similar Product meeting the needs of the Buyer. Such modification shall not lead to any liability of the Seller, provided that the Seller ensures the substituted Product is similar to the Product initially ordered.

4.5 In the case where, after inspection, it is acknowledged that a Product contain defects, the Seller undertakes to replace the defective product to the extent reasonably feasible and without indemnification or compensation of any kind for labour costs, delays, loss caused or any other reason being due by the Buyer . This undertaking from the Seller shall be effective for a maximum of two months starting from the delivery date but shall not be applicable in the event of force majeure as described in Article 5 below.

4.6 The deadlines that the Seller is asked to provide for the mailing of a Product are given for information purposes only and are not guaranteed. If such deadlines are not met, this shall not, without the agreement of the Seller lead to any claim for damages or right of cancellation of one or more orders by the Buyer, except for non-acceptable delays exceeding [3] months from the stated deadline. In such case only i.e. only in the event of a delay exceeding (3) months from the stated deadline the Buyer shall be entitled to ask for a reimbursement of any down payment previously made to the Seller, to the exclusion of any other damages.

4.7 The Seller does not make any warranties, express or implied, including, without limitation, those of sale ability and fitness for a particular purpose, with respect to any Products. Although the Seller shall take reasonable steps to screen Products for infection of viruses, worms, Trojan horses or other codes containing contaminating or destructive properties before making Products available, the Seller cannot guarantee that any Product will be free from infection.

#### 5. FORCE MAJEURE

The Seller shall not be liable for any delay in performance directly or indirectly caused by or resulting from acts of nature, fire, flood, accident, riot, war, government intervention, embargoes, strikes, labour difficulties, epidemics, major health event (e.g. Corona virus), equipment failure, late deliveries by suppliers or other difficulties which are beyond the control, and not attributable to the fault of the Seller.

#### 6. PROTECTION OF THE SELLER’S IPR

6.1 All the IPR attached to the Products are and remain the property of the Seller and are protected under French and international copyright law and conventions.

6.2 The Buyer agreed not to disclose, copy, reproduce, redistribute, resell or publish a Product, or any part of it to any other party other than employees of the Buyer Company (and only in the country of the Primary User for Multi-User Licenses). The Buyer shall have the right to use Products solely for its own internal information purposes. In particular, the Buyer shall therefore not use any Product for purposes such as:

- Information storage and retrieval systems;
- Recordings and re-transmittals over any network (including any local area network);
- Use in any timesharing, service bureau, bulletin board or similar arrangement or public display;
- Posting any Product to any other online service (including bulletin boards or the Internet);
- Licensing, leasing, selling, offering for sale or assigning a Product or any derivative thereof.

6.3 If the Buyer would like to use data coming from a Product for presentations, press announcements and any other projects, the Buyer needs to contact Yole Développement’s Public Relations Director (info@yole.fr) to get an official authorization and confirm that the data are up to date. In return the Seller will make sure to provide up-to-date data under a suitable public format.

6.4 The Buyer shall be solely responsible towards the Seller for any infringement of the obligation described in Article 6.3 above, whether such infringement originates from the Buyer’s employees or any person to whom the Buyer has sent the Products. Furthermore, the Buyer shall initiate and personally take care of any related proceedings in coordination with the Seller, and the Buyer shall bear the related financial consequences in their entirety.

6.5 The Buyer shall define within its Company an identified user who shall serve as a contact person for the License purchased by the Buyer. This person will be the recipient of each new report. This person shall also be responsible on behalf of the Buyer, for compliance with all copyrights and other obligations relating to the protection of the Seller’s IP rights and general compliance with the terms of the License purchased by the Company. In the context of Bundle and Annual Subscriptions, the contact person shall decide within the Buyer which person(s) shall be entitled to receive the protected link that will allow the Buyer to access the Products.

6.6 It is acknowledged and accepted by the Buyer that whether purchased in the form of Bundles or Annual Subscription, all unselected reports will be deemed cancelled and lost after a period of 12 month following acceptance of the corresponding order by the Seller in accordance with provisions of Article 1.3 above .

6.7 It is further acknowledged and agreed by the Buyer that any investor in the Buyer Company, any external consultant of the Buyer Company or any joint venture done with a third party in which the Buyer Company is involved , is not entitled to use a Product, without paying to the Seller the full price for a license to the required Product..

#### 7. TERMINATION

If the Buyer cancels the order in whole or in part or postpones the date of mailing, the Buyer shall indemnify the Seller for the entire costs that have been incurred as at the date of notification by the Buyer of such delay or cancellation. This may also apply for any other direct or indirect consequential loss that may be incurred by the Seller, pursuant to such cancellation or postponement.

#### 8. MISCELLANEOUS

8.1 All the provisions of these General Terms and Conditions of Sale are for the benefit of the Seller, but also for that of its licensors, resellers and agents. Each of them is entitled to assert and enforce these provisions against the Buyer.

Any notices under these Terms and Conditions shall be given in writing and shall be effective upon receipt by the other Party.

8.2 The Seller may, from time to time, update these General Terms and Conditions of Sale, and the Buyer, shall be deemed to have accepted the latest version of such General Terms and Conditions of Sale, once they have been duly communicated to the Buyer by the Seller.

#### 9. GOVERNING LAW AND JURISDICTION

9.1 Any dispute arising out or linked to these General Terms and Conditions of Sale or to any Licenses or Products purchased in application thereof shall be submitted to the French Commercial Court of Lyon, which shall have exclusive jurisdiction upon such issues.

9.2 French law (without reference to any applicable conflict of law provisions) shall apply to these General Terms and Conditions of sale and any agreement between the Buyer and the Seller made pursuant thereto.