

# SENSING AND COMPUTING FOR ADAS VEHICLE 2020

Market & Technology Report - May 2020

*Advanced Driver Assistance System functionality will attract customers and restart growth of the automotive business.*

## KEY FEATURES

- Market data on key sensors, camera, LiDAR and radar:
  - Revenue forecast and volume shipments for each sensor type
  - Market shares with detailed breakdown by player
  - Application focus of each sensor
- In-depth understanding of the main sensor value chain, infrastructure and players:
  - Who are the sensor players and how they are related?
  - What is the supply chain of these sensors?
- Key technical insights and analysis regarding future technology trends and challenges:
  - Have a deep understanding of how these sensors work together in a car
  - Analysis of the electric/electronic (E/E) architecture of a car and how it will evolve

## GREATER ADAS FUNCTIONALITY WILL RESTART THE INDUSTRY AFTER THE CORONAVIRUS CRISIS

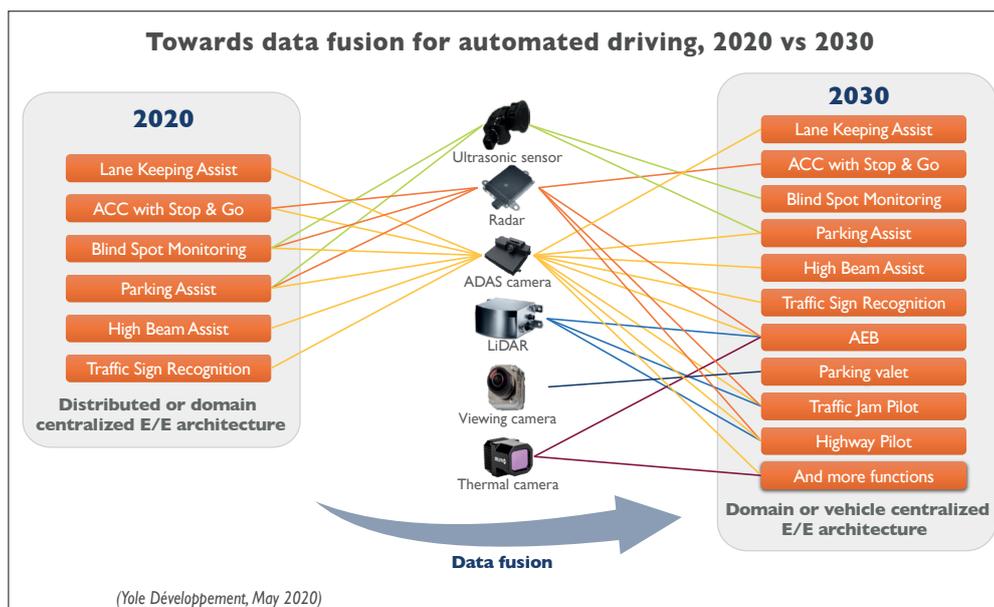
The auto industry has seen the impact of the coronavirus crisis evolve from a supply shock to a global demand shock. The production of new cars is expected to decline by 30% compared to the 2019 production level. The direction of the automotive industry towards the four major megatrends of connected, autonomous, shared and electric driving is expected to remain unchanged going forward. However, the speed of adoption might change due to the emergency. Electrification will be the main focus for OEMs as restrictions and associated penalties on CO<sub>2</sub> emissions should remain valid.

The second target for OEMs will be related to the development of Advanced Driving Assistance Systems (ADAS) for safety and automated driving features. The development of advanced emergency braking systems (AEB) is a great step to avoid forward collisions but is still perfectible, as demonstrated by the American Automobile Association (AAA) in October 2019. Automated driving features in traffic jams or on the highway will also be

developed by OEMs as consumers are looking for these to ease driving. The development of such features will be a way for OEMs to differentiate themselves.

To do so, the addition of more sensors, more computing power and a new electric/electronic (E/E) architecture will be required. Audi and Tesla have initiated this trend using a combination of radars, cameras and a LiDAR in Audi's case. To fuse the data generated Audi and Aptiv developed a domain controller, the zFAS, for front sensors. Tesla goes one step further in the development of domain controllers with its Autopilot hardware. Autopilot is much more complex and has more functionality, with the ability to perform frequent over-the-air (OTA) software updates. Innovation brought by such features will be a key differentiation factor for OEMs looking to relaunch the market.

*This report presents a complete overview of E/E architecture and its possible evolution, including details on the computing power needed for data fusion.*



## A SENSOR MARKET WORTH \$22.4B IN 2025, LED BY RADARS

The production of vehicles will be heavily impacted by the coronavirus crisis. It is expected that three years will be needed to recover and get back to the same level of

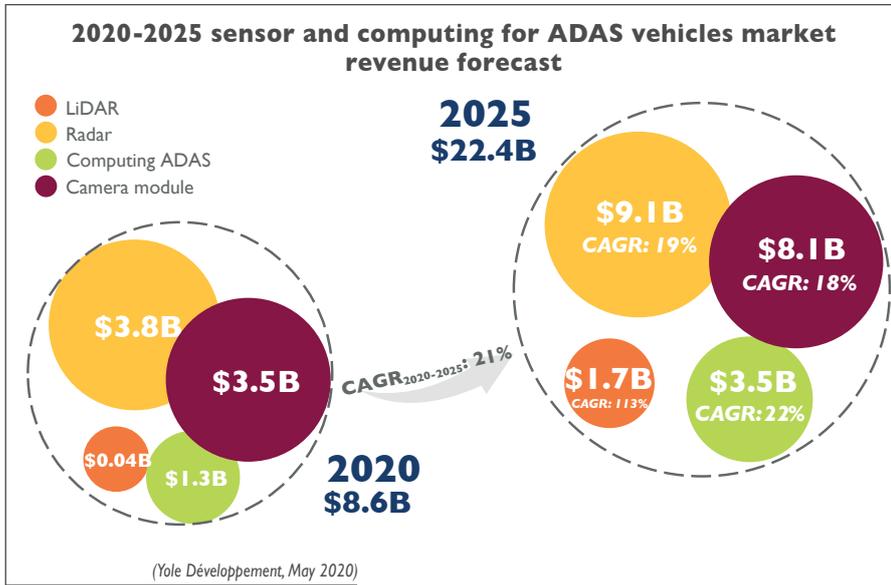
output. In 2020, it is expected that the global market for radars, cameras, LiDARs and computing ADAS should reach \$8.6B. Almost half of this market revenue will be generated

by radars with \$3.8B, followed by cameras with \$3.5B. LiDARs will not be significant, accounting for \$0.04B and computing ADAS will generate \$1.3B.

With high penetration rates of radars and cameras in cars, the associated market revenues will

recover rapidly from the coronavirus crisis. Radar market revenue is expected to surpass 2019's revenue in 2021 and will reach \$9.1B in 2025 at a Compound Annual Growth Rate (CAGR) of 19%. Camera market revenue will also surpass 2019's revenue in 2021 and will reach \$8.1B in 2025 at a CAGR of 18%. Market revenue from computing ADAS is expected to reach \$3.5B in 2025 at a CAGR of 22%. LiDAR market revenue is quite limited today as only one OEM like BMW or Volvo are implementing this sensor as an option in some of its cars. Other OEMs like BMW or Volvo are expected to follow in coming years, but the implementation will remain limited to high-end vehicles, and therefore limited volumes are expected. In this context, LiDAR market revenue is expected to reach \$1.7B in 2025 at a CAGR of 113%. LiDAR is a complex sensor for OEMs and Tier-1s to integrate and radars and cameras are, at the same time, continuously improving their performance.

This reports presents the main sensors needed for ADAS and their associated market revenue for the period 2020 – 2025, with details concerning the industry related to each sensor.

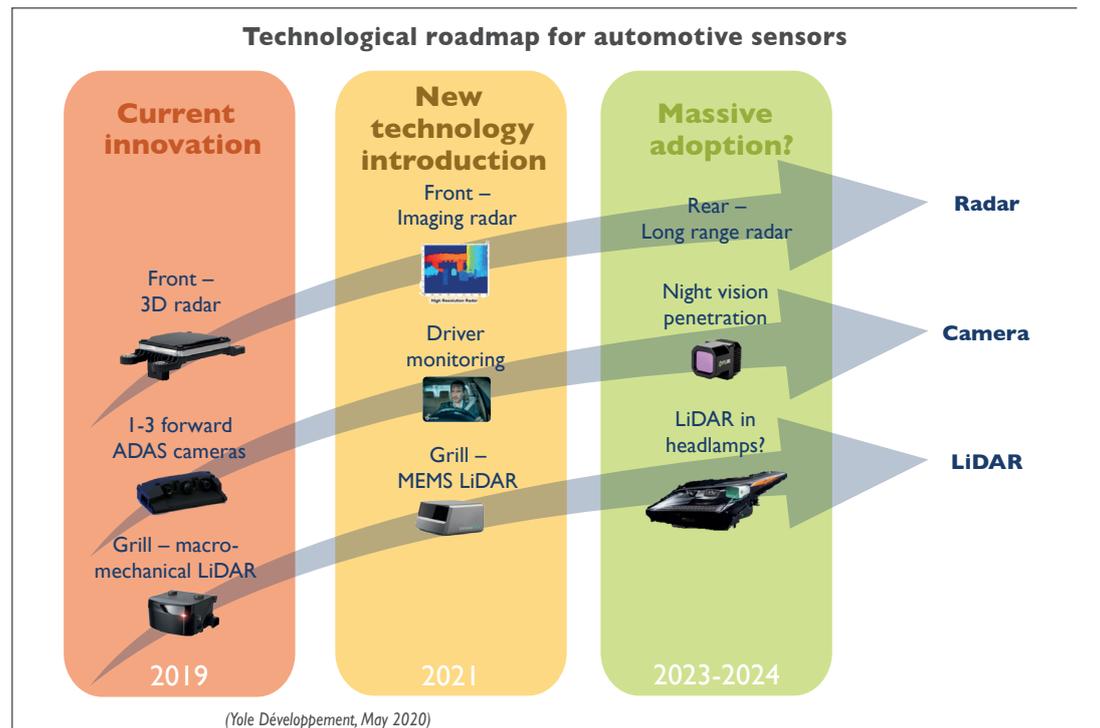


### BETTER SENSOR PERFORMANCE TO ENABLE AUTOMATED DRIVING

Today, radars and cameras are the main sensors used by OEMs to develop safety and automated driving features. Consequently, the penetration rate of forward ADAS mono cameras will increase from 51% in 2020 to 85% in 2025. This type of camera is multi-purpose and is used for AEB for also for other functionalities like Lane Keeping Assist (LKA) or Traffic Sign Recognition (TSR) in mainstream cars. For most advanced cars, forward ADAS triple cameras are used to develop advanced automated driving features like Tesla's.

Radars are keeping pace, and the technology is continuously improving. Starting in 2019, the use of 3D radar with a better vertical field of view enabled detection of vehicle height. Radar performance will keep increasing with the implementation of imaging radars expected to start in 2021. This use of imaging radar will be combined with the use of artificial intelligence and deep learning.

On the LiDAR side, technology is moving from a macro-mechanical scanning to MEMS scanning and flash. Most LiDAR manufacturers are involved



in these solid-state technologies. One of the issues for LiDAR is its integration into the vehicle. Today it is integrated in the grill, but that may not be the ideal solution. Two other positions, in headlamps or behind the windshield, are targeted by Tier-1s and OEMs. To do so, more R&D will be necessary to reduce the volume of this sensor and allow its integration. Another issue for LiDAR is the need to process the large quantity of data it generates. High computing power, over 25

teraoperations per second (Tops), will be necessary. The last issue with LiDAR is its cost compared to the two other technologies. It is about 10 times costlier than an ADAS mono camera. Alongside volume reduction, cost reduction will also be required for significant adoption by OEMs.

*The report presents the camera, LiDAR and radar sensors with details concerning their supply chain, the trends and roadmaps.*

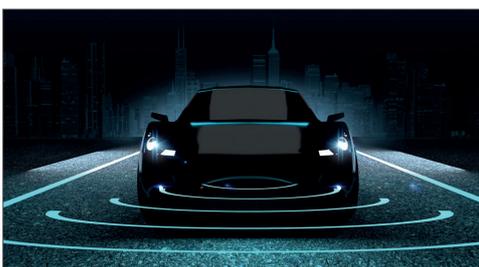
**COMPANIES CITED IN THE REPORT (non exhaustive list)**

AGC, Algolux, Altera, Ambarella, ams, Apple, Aptiv, Argo, ARM, Audi, Aurora, Avis, Baidu, Blackmore, Blickfeld, BMW, Bolloré, Bosch, BrightWayVision, Cambricon, Cepton, Chevrolet, Continental, Cruise, Delphi, Denso, Didi, Dodge, Excelitas, EyeSight, Fiat, First Sensor, Flir, Ford, Freescale, Fujitsu, Geely, GM, Google, Hella, Hitachi, Honda, Horizon Robotics, Hyundai, Hyundai-Mobis, Ibeo, II-VI, Infineon, Innoviz, Jabil, Jaguar, Kalray, Koito, Kostal, Land Rover, Laser Components, Lattice, LeddarTech, Lexus, Lumileds, Luminar, Lumotive, Lyft, Magna, Marelli, Maxel, May Mobility, Mazda, Melexis, Mercedes, Metawave, Micron, Mobileye, Nichia, Nidec, Nissan, Nvidia, NXP, Omnivision, OnSemiconductor, Osram, Ouster, Panasonic, Peugeot, Pioneer, Pony.ai, Porsche, Qualcomm, Quanergy, Renault, Renesas, Robosense, SAIC, Samsung, Seeing Machine, Semtex, Silc, Smart Eye, Sony, STmicroelectronics, Sunny Optical Technology, Tesla, Texas Instrument, Toshiba, Toyota, Trieye, Trilumina, Trumpf, TSMC, Uber, Valeo, Velodyne, Veoneer, Volkswagen, Volvo, Waymo, Xenomatix, Xilinx, Xperi, ZF, ZKW and more.

**TABLE OF CONTENTS** (complete content on [i-micronews.com](http://i-micronews.com))

<b>Context</b>	<b>43</b>	<b>Technology trends</b>	<b>140</b>
<b>Market forecasts</b>	<b>69</b>	> Camera	
> Initial statements		- Device and technology segmentation	
> Impact of COVID-19 on forecasts		- Comparison of cameras for different applications	
> Image sensors and camera module forecast (in M units)		- Forward ADAS cameras are becoming increasingly complex	
> Image sensors market revenue forecast (in \$M)		> LiDAR	
> Camera module market revenue forecast (in \$M)		- LiDAR principles and components	
> LiDAR volume and revenue forecast – Split by type		- Technology roadmap – Potential winner in the next five years?	
> Radar module volume and revenue forecast – Split by frequency		- LiDAR integration in ADAS vehicles	
> Computing hardware volume and revenue forecast by segment		> Radar	
> Overview of sensors and computing market revenue		- Radar capabilities	
<b>Market trends</b>	<b>88</b>	- From assisted driving to automated driving	
> The road to automated driving		- Main components in a radar system	
> Different sensor technologies embedded		- The road to high resolution	
> Euro NCAP 2025 roadmap - in pursuit of “vision zero”		> Cost breakdown of sensors	
> AEB is still perfectible		- Camera teardown – Example of Denso camera	
> Set of sensors per car segment		- LiDAR teardown – Example of Valeo LiDAR	
> The “10+ cameras per car” roadmap		- Radar teardown – Example of Aptiv Radar	
<b>Market shares &amp; supply chain</b>	<b>99</b>	> E/E architecture and computing	
> Industry overview		- Evolution of E/E architecture	
> Industry trends		- The emergence of automotive Ethernet	
> Market shares		- Evolution of sensors: From smart to dumb sensors	
> Supply chain		- ADAS implies more computing power	
		- Data fusion for automated driving	
		- Future car architecture	
		<b>Conclusion</b>	<b>246</b>
		<b>About Yole Développement</b>	<b>248</b>

**RELATED REPORTS, MONITORS & TRACKS**



- Radar and Wireless for Automotive: Market and Technology Trends 2019
- Artificial Intelligence Computing for Automotive 2019
- Imaging for Automotive 2019
- Automotive Teardown Track - System Plus Consulting
- The Audi A8 zFAS ADAS Platform by Aptiv - System Plus Consulting

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



**AUTHORS**

As part of the Photonics, Sensing & Display division at Yole Développement (Yole), **Pierrick Boulay** works as Market and Technology Analyst in the fields of Solid State Lighting and Lighting Systems to carry out technical, economic and marketing analysis. Pierrick has authored several reports and custom analysis dedicated to topics such as general lighting, automotive lighting, LiDAR, IR LEDs, UV LEDs and VCSELs. Pierrick holds a master degree in Electronics (ESEO – Angers, France).



As a Technology & Market Analyst, specialized in RF devices & technologies within the Power & Wireless division at Yole Développement (Yole), **Cédric Malaquin** has authored multiple market and technology reports and custom analysis related to radar and 4G and 5G RF Front End. Cédric graduated from Polytech Lille in France with an engineering degree in microelectronics and material sciences.



As a Software & Market Analyst, **Yohann Tschudi**, PhD is a member of the Semiconductor & Software division at Yole Développement (Yole). Yohann is daily working with his team, to identify, understand and analyze the role of the software and computing parts within any semiconductor products, from the machine code to the highest level of algorithms. Yohann has a PhD in High Energy Physics and a master degree in Physical Sciences from Claude Bernard University (Lyon, France)

## 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.