Hesai Group (HSAI US)

Road towards scalable intelligent driving starts from here; initiate at BUY

BUY (Initiate)

Target Price	**US$16.30**
Up/Downside	**26.7%**
Current Price	**US$12.86**

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Stock Data

Mkt Cap (US$ mn)	1,735.8
Avg 3 mths t/o (US$ mn)	18.2
52w High/Low (US$)	13.92/3.55
Total Issued Shares (mn)	135.0

Source: FactSet

Shareholding Structure

Lightspeed	11.0%
Kai Sun	8.0%

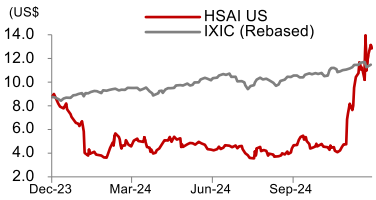
Source: NASDAQ

Share Performance

	Absolute	Relative
1-mth	171.3%	157.4%
3-mth	193.6%	164.9%
6-mth	199.1%	161.2%

Source: FactSet

12-mth Price Performance



Source: FactSet

Hesai Group (HSAI) is one of the global leaders in three-dimensional light detection and ranging (LiDAR) solutions, and it has developed and produced a full range of LiDAR solutions and products for various applications in advanced driver assistance systems (ADAS), autonomous mobility (AM) and Robotics. Aided by strong technical capability, including vertical integration technology and in-house manufacturing, HSAI is able to offer LiDAR products with greater performance, higher quality and consistency at lower cost, which enables it to enhance ties with core customers and enlarge the scale effect. HSAI has already recorded industry-leading financial performance, and we are positive that it is poised to grow alongside the rising demand for LiDAR products. More use cases in robotics and industrial markets should propel further TAM expansion for HSAI over the long-run, in our view. We expect HSAI to see an inflection point in profitability in 2024, and estimate non-GAAP NP of RMB9mn/141mn for 2024E/2025E, aided by increased adoption of its existing LiDAR products and the potential launch of cost-effective new AT series product in 2025E, as well as operating efficiency improvement. Our target price of US$16.3 per ADS is based on 4.8x 2025E PS. Initiate at BUY.

- **Poised for strong growth in a rising market.** Yole Intelligence estimated that global automotive LiDAR market could reach US$3.63bn in 2029 with a 2023-2029E CAGR of 38%, of which the market size of passenger car (PC) and light commercial vehicle (LCV)/robotaxi LiDAR market is expected to reach US$2.99bn/638mn in 2029, respectively, with 2023-2029E CAGR of 39%/31%. HSAI enjoys a leading position in both the global and China LiDAR solutions market and is poised to benefit from the strong market growth, in our view. In 2023, HSAI ranked the first with 37% market share in terms of revenue in global LiDAR market; it also led in both PC&LCV and robotaxi markets, with a market share of 26% and 74%, respectively.
- **Global leader in LiDAR sensor solutions with clear competitive edges.** As of 3Q24, the company had secured ADAS design wins with 20 OEMs globally across 75 vehicle models. In our view, HSAI's ability to continuously maintain its leading position derived from following edges: 1) continuous cost optimization capability driven by the in-house development of ASIC chips through a leading technological strength platform; 2) self-owned factories and highly automated production methods endow it with a leading mass production capacity; and 3) robust customer relationships and market penetration.
- **Initiate at BUY with target price of US$16.3 per ADS.** We value HSAI at RMB15.9bn (US$16.3 per ADS) based on 4.8x 2025E PS, 10% above the overall indsutry average at 4.4x, which in our view is justified by its industry-leading financial performance and robust product shipment pipeline in 2025E, thanks to incremental volume contribution from leading auto OEMs.

Earnings Summary

(YE 31 Dec)	FY22A	FY23A	FY24E	FY25E	FY26E
Revenue (RMB mn)	1,203	1,877	2,062	3,324	4,570
YoY growth (%)	66.9	56.1	9.8	61.2	37.5
Net profit (RMB mn)	(747.2)	(476.0)	(108.9)	21.5	312.0
Adjusted net profit (RMB mn)	(195.5)	(241.3)	9.3	141.2	434.7
EPS (Adjusted) (RMB cents)	(169.25)	(193.41)	6.89	104.60	322.08

Source: Company data, Bloomberg, CMBIGM estimates

Contents

Investment thesis

Global automotive LiDAR market is expected to deliver robust growth with 38% 23-29E CAGR

Primary downstream markets for LiDAR applications include ADAS, AM, robotics, and the industrial market. At the current stage, the automotive market is the largest downstream market, as LiDAR plays a vital role in facilitating the rapid development of diverse levels of autonomous driving. Over the long-run, more use cases in robotics and industrial markets should propel further TAM expansion for LiDAR products, in our view.

Auto industry service provider Gasgoo expects global LiDAR delivery volume to reach 5.3mn units in 2027, of which 4.5mn units will be used in the automotive market. Yole Intelligence estimated that global automotive LiDAR market to reach US$3.63bn in terms of revenue in 2029 with a 2023-2029E CAGR of 38%, of which the size of PC&LCV/robotaxi LiDAR markets is expected to reach US$2.99bn/638mn in 2029, respectively, with 2023-2029E CAGRs of 39%/31%. Over the long-run, with evolving lifestyles around the world and higher requirement for efficiency, robotics is poised to be another large downstream market for LiDAR applications, for which Frost & Sullivan expected the market size to total US$16.7bn in 2030E, demonstrating a 2021-2030E CAGR of 71.5%.

HSAI: Global leader in LiDAR sensor solutions with clear competitive edges

Per Yole, HSAI took the lead in both the global and China LiDAR solutions markets. In 2023, HSAI ranked the first with 37% market share in terms of revenue generation in the global LiDAR market. Specifically, it ranked first in both PC&LCV market and robotaxi market, with a market share of 26% and 74%, respectively. With 37.3% market share in terms of installation volume, HSAI also held a leading position in China LiDAR solutions market in 2023.

In our view, HSAI's ability to maintain its leading position among fierce industry competition is due to the following edges: 1) continuous cost optimization capability driven by in-house development of application-specific integrated circuit (ASIC) chips through a leading technological strength platform; 2) self-owned factories and highly automated production supporting its leading mass production capacity; and 3) robust customer relationships and market penetration.

Stable and continuously enhanced ties with downstream customers aiding business expansion

HSAI has established stable partnerships with downstream customers both domestically and globally, and its reliable performance continuously wins recognition from both existing and new customers. As of 3Q24, the company had secured ADAS design wins with 20 OEMs globally across 75 vehicle models. In the international ADAS market, the company has currently reached cooperation agreements directly or indirectly via China joint ventures (JVs) of leading OEMs, including Audi, GM, and Volkswagen. In the domain of autonomous mobility, HSAI's clients encompass Baidu, DiDi, WeRide and a lot of other leading players; in the domain of service robotics, HSAI's clients includes Nuro, Meituan and so on. The stable and continuously enhanced ties with downstream customers in our view lay a solid foundation for long-term business development.

Industry-leading financial performance with more to expect

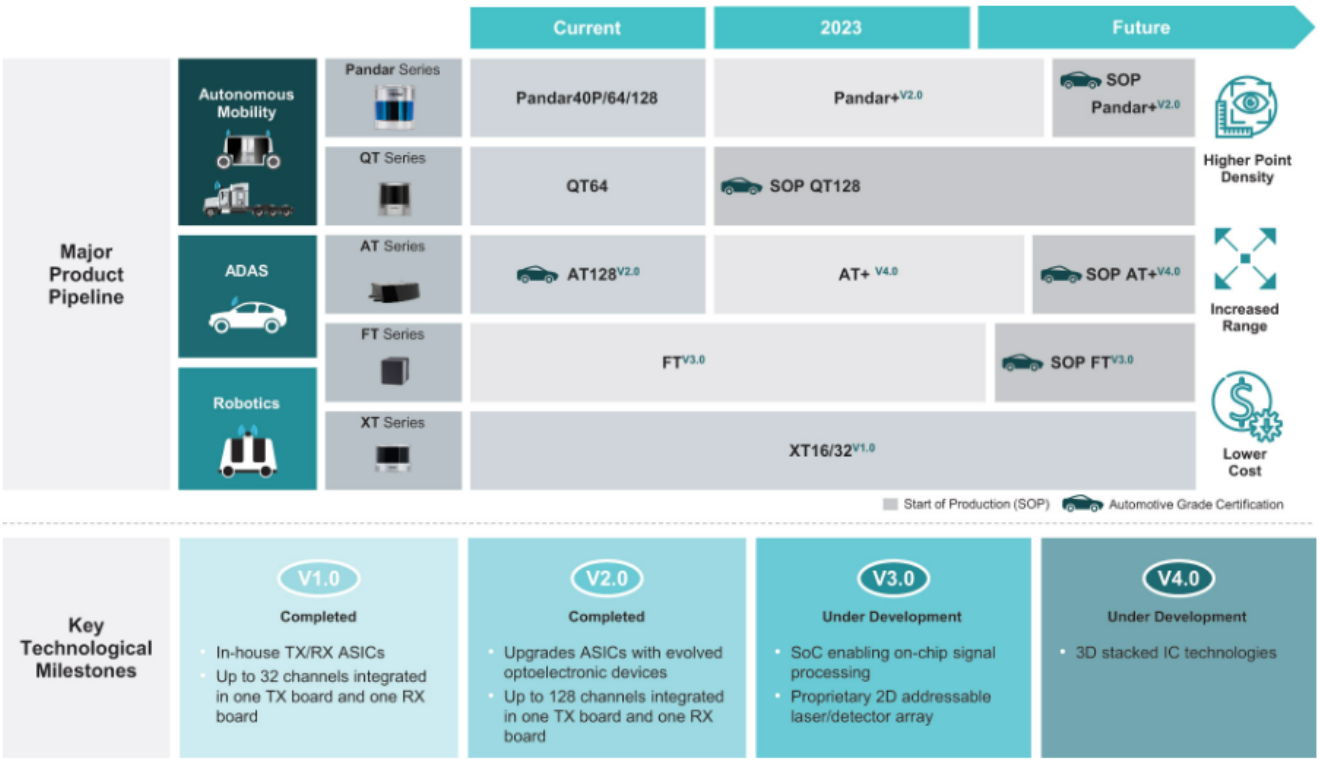
Backed by strong technical capability and continuously enhanced ties with customers, HSAI is the first in the LiDAR industry to achieve positive OCF. Management estimates a

GAAP profit of US$20mn in 4Q24 and full-year profitability on non-GAAP basis, positioning HSAI as the first profitable listed LiDAR company globally. Robust revenue growth driven by rapid growth of LiDAR product shipments should help unleash operating leverage for HSAI, in our view. We estimate HSAI to turn around from non-GAAP net loss of RMB241mn in 2023 to net profit of RMB9mn in 2024E, with net profit to further grow to RMB141mn in 2025E, and the implied non-GAAP NPM may turn around from -12.9% in 2023 to 0.5%/4.2% in 2024E/2025E.

HSAI: one of the global leaders in three-dimensional LiDAR

HSAI is one of the global leaders in three-dimensional LiDAR solutions. Founded in 2014, HSAI initially focused on high-performance laser sensors for natural gas and other industries and shifted to LiDAR products in 2016. Its LiDAR products now enable a broad spectrum of applications across ADAS, AM and robotics markets. The company has developed a robust portfolio encompassing the Pandar and QT series designed for autonomous mobility (AM), the AT128 and FT120 models designed for ADAS in passenger or commercial vehicles, and the XT series designed for service robotics markets.

Figure 1: HSAI: product overview



Source: Company prospectus, CMBIGM

HSAI's LiDAR products cater to short-, medium-, and long-range applications, with industry-leading detection range, resolution, interference rejection technology, and reliability.

Figure 2: HSAI: product specifications

	Pandar128	QT128	XT32	AT128	FT120[1]
					
Application	Autonomous Mobility – long-range detection	Autonomous Mobility – blind-spot detection	Robotics	ADAS	ADAS – blind spot detection
Operating principle	Time of Flight (ToF)	ToF	ToF	ToF	ToF
Scanning method (vertical)	Electronic scanning	Electronic scanning	Electronic scanning	Electronic scanning	Electronic scanning
Scanning method (horizontal)	Mechanical rotation	Mechanical rotation	Mechanical rotation	Scanning mirror	Electronic scanning
Channel	128	128	32	128	120
Range	up to 200 m at 10% reflectivity[2]	up to 20 m at 10% reflectivity	up to 80 m at 10% reflectivity	up to 200 m at 10% reflectivity	up to 30 m at 10% reflectivity
Data points generated (single return)	3,456,000 points/second	864,000 points/second	640,000 points/second	1,536,000 points/second	192,000 points/second
FOV (vertical)	40°	105.2°	31°	25.4°	75°
FOV (horizontal)	360°	360°	360°	120°	100°
Resolution (vertical)	0.125° finest	0.4° finest	1°	0.2°	0.625°
Resolution (horizontal)	0.1° finest (10 Hz frame rate)	0.4° finest (10 Hz frame rate)	0.18° (10 Hz frame rate)	0.1° (10 Hz frame rate)	0.625°
Interference rejection	Yes	Yes	Yes	Yes	Yes
Power consumption	27 W	10 W	10 W	18 W	<12 W

Source: Company prospectus, CMBIGM
Notes: 1) Specifications of FT120 are subject to changes. 2) Reflectivity refers to the ratio of the energy of the light reflected from a surface to the energy possessed by the light striking the surface.

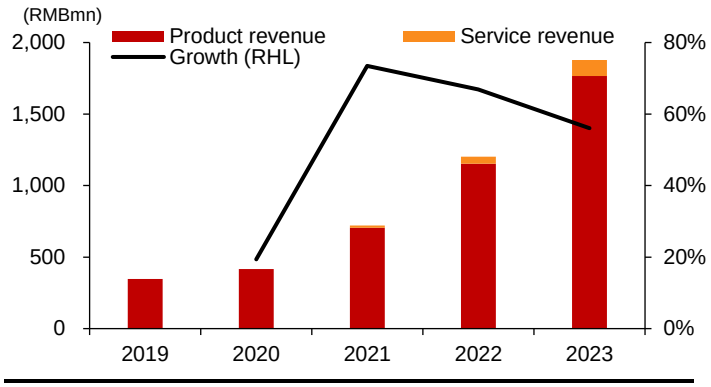
The company integrates LiDAR designs with an in-house manufacturing process, facilitating rapid product development while ensuring high performance and consistent quality. HSAI has established strong relationships with leading automotive OEMs, Tier-1 suppliers, as well as key players in autonomous vehicle and robotics companies worldwide, covering over 40 countries as of December 31, 2023. As of 3Q24, HSAI had secured ADAS design wins with 20 OEMs globally across 75 vehicle models.

Increase in shipment volume of LiDAR products should translate into improving profitability over time

HSAI's revenue is primarily derived from the sales of LiDAR products, with c. 92% of its revenue coming from the sales of LiDAR hardware products in 2023, and the remaining 8% from services which include engineering design, development, and validation service, and solution service.

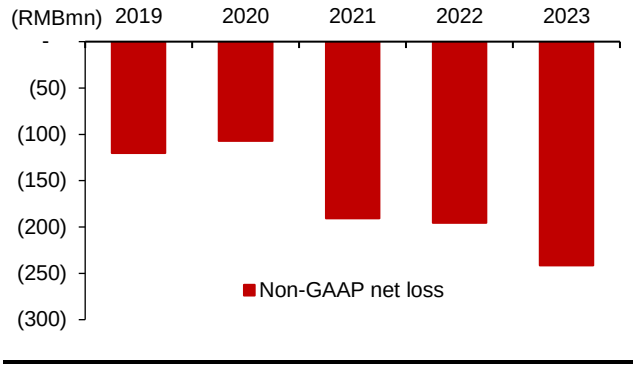
As of 3Q24, HSAI had cumulatively shipped over 580,000 LiDAR units since inception. From 2019 to 2021, its LiDAR shipments were c. 2,900/4,200/14,000 units respectively. Driven by the launch and increased adoption of hybrid solid-state ADAS LiDAR AT128, shipments soared to c. 80,400/222,100 in 2022 and 2023 respectively. As shipment volume rose, HSAI's total revenue increased from RMB348mn in 2019 to RMB1.88bn in 2023, with a CAGR of 52.4%. In 9M24, HSAI shipped 279,835 units of LiDAR products, up 108.2% YoY, and the company expected shipments of over 200,000 units for 4Q24.

Figure 3: HSAI: Revenue structure



Source: Company data, CMBIGM

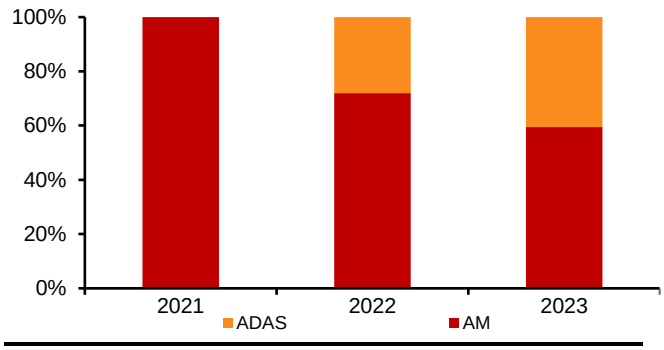
Figure 4: HSAI: non-GAAP net losses



Source: Company data, CMBIGM

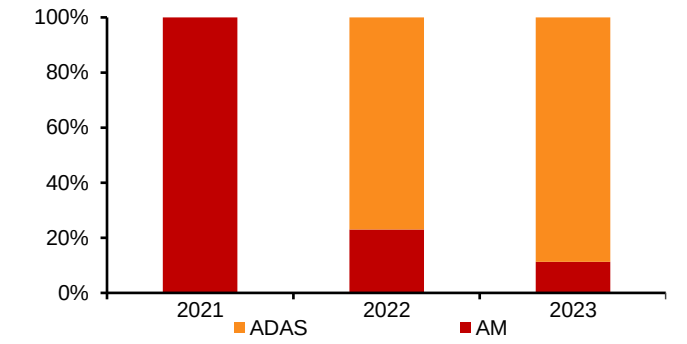
Within LiDAR revenue, revenue generated from AM-related business contributed a large majority initially, but following the large-scale shipments of AT128, the leading automotive-grade product for ADAS, the share of the company's ADAS revenue has witnessed a swift rise. In 2023, revenue contribution from ADAS-related LiDAR products increased to 41% of total LiDAR-related revenue, up from 28% in 2022.

Figure 5: HSAI: breakdown of LiDAR product revenue contribution



Source: Company data, CMBIGM

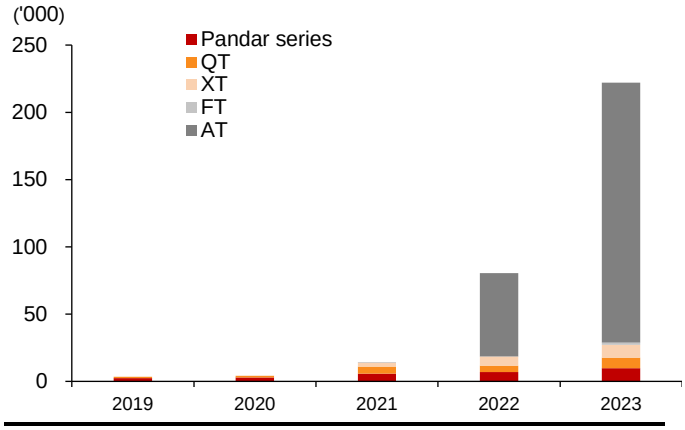
Figure 6: HSAI: breakdown of LiDAR product shipment volume



Source: Company data, CMBIGM

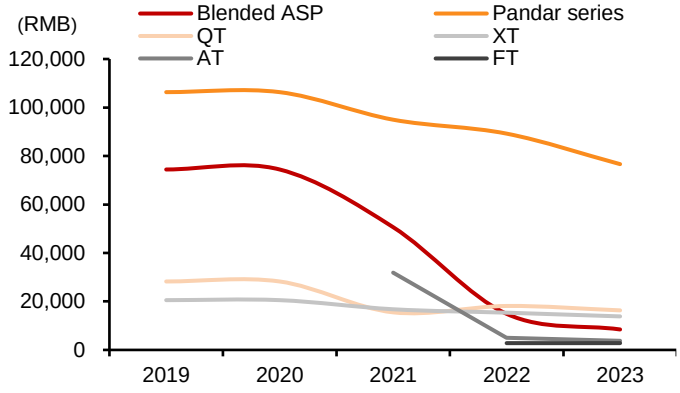
Due to the change in product mix as ADAS related products ramped up in total shipments, the average selling price (ASP) of HSAI's LiDAR units has declined over the years, from c. RMB82,400 in 2020 to RMB7,800 in 2023. However, the decline in ASP is vital to propel wider acceptation of LiDAR products, in our view, and HSAI's strong technical capability could support continuous cost optimization, which enables it to enjoy a broadly stable gross margin for ADAS business amid a declining ASP. Hence, we believe the rapid increase in shipment volume could translate into profitability improvement over time.

Figure 7: HSAI: no. of LiDAR product shipments



Source: Company data, CMBIGM

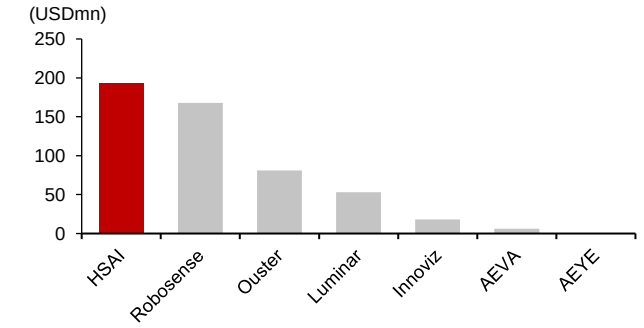
Figure 8: HSAI: ASP of LiDAR products



Source: Company data, CMBIGM

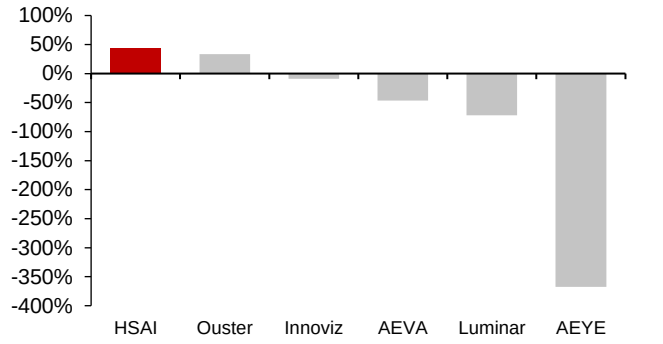
HSAI is the first in the LiDAR industry to achieve positive OCF. The company has a healthy cash position, with a positive operating cash flow of RMB57mn in 2023 and cash and cash equivalents of RMB3.1bn as of the end of 4Q23, supporting the continuous product and technology development. From 2021 to 2023, the company recorded non-GAAP net losses of RMB191mn, RMB196mn, and RMB241mn. Management anticipates GAAP profit of US$20mn in 4Q24 and full-year profitability for 2024E on non-GAAP basis, positioning HSAI as the first profitable listed LiDAR company.

Figure 9: Industry peers comparison: HSAI has industry-leading revenue generation capability



Source: Company data, Bloomberg, CMBIGM
Note: data as of 9M24

Figure 10: Industry peers comparison: HSAI ranks first in terms of GPM

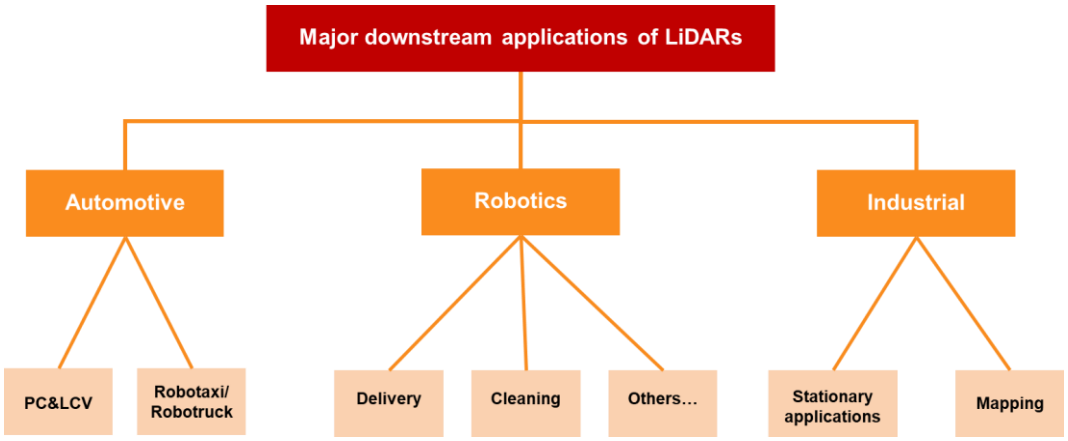


Source: Company data, Bloomberg, CMBIGM
Note: data as of 9M24

LiDAR market: rapid increase in adoption in auto market, with more to expect in other downstream industries

The primary downstream markets for LiDAR applications including ADAS, AM, robotics, and the industrial market. Given that the application of LiDAR by most enterprises in the industrial sector is still at an exploration stage, the total addressable market of LiDAR that we predominantly consider is concentrated in the automotive implications (AM, ADAS) and robotics markets. However, we believe the potential of TAM expansion in industrial market remains large over the long-run, such as the use case of stationary applications and mapping.

Figure 11: Major downstream markets for LiDARs



Source: iResearch, CMBIGM

Gasgoo predicted that global LiDAR delivery volume will reach 5.3 million units in 2027, of which 4.5 million units will be used in the automotive market. Yole Intelligence estimated that global automotive LiDAR market totalled US$538mn in 2023, up 79% YoY, and forecasted it to reach US$3.63bn in 2029 with a CAGR of 38%, of which the size of PC& LCV/robotaxi LiDAR market is expected to reach US$2.99bn/638mn in 2029, respectively, with a 2023-2029E CAGR of 39%/31%.

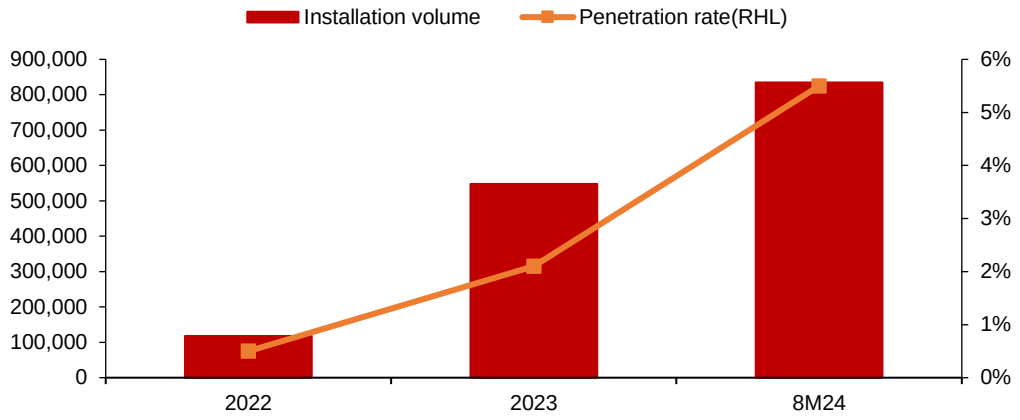
■ Automotive LiDAR market: rapid scale expansion

Benefiting from the steady increase in the penetration rate of intelligent driving in passenger cars (PC) and light commercial vehicles (LCV), the development of higher-level autonomous driving technologies, the continuous decline in ASP of LiDAR aided by technology advancement, global automotive LiDAR market is expected to reach US$3.6bn in 2029E, with a 2023-2029E CAGR of 38%, per estimates made by Yole Intelligence.

LiDAR's large-scale integration into vehicles has been expedited. In 2018, Audi was the sole automaker to equip its high-end vehicles with LiDAR. Since 2021, a number of traditional automakers and emerging EV manufacturers have successively begun to adopt LiDAR. Per Gasgoo, as of 1H24, the number of vehicle models in the Chinese market with standard LiDAR reached 54, and the number of models offering optional LiDAR was 15, both doubling the figures in 2023. In terms of installation volume, the penetration rate of LiDAR in China has rapidly risen from 0.5% in 2022 to 5.5% in 2024. The installation volume from January to August 2024 has reached 830,000 units, an increase of 720,000 units compared to the full year of 2022. Gasgoo forecast that the annual installation volume in 2024 is expected to exceed 1.3 million units. Meanwhile, it predicted that the global

LiDAR delivery volume will reach 5.3 million units in 2027, of which 4.5 million units will be used in the automotive market, and the automotive market is becoming the primary driver for the development of the LiDAR industry.

Figure 12: LiDAR installation volume and penetration rate in China



Note: Penetration rate= Sales of cars equipped with LiDAR/ Total sales of cars
Source: Gasgoo, CMBIGM

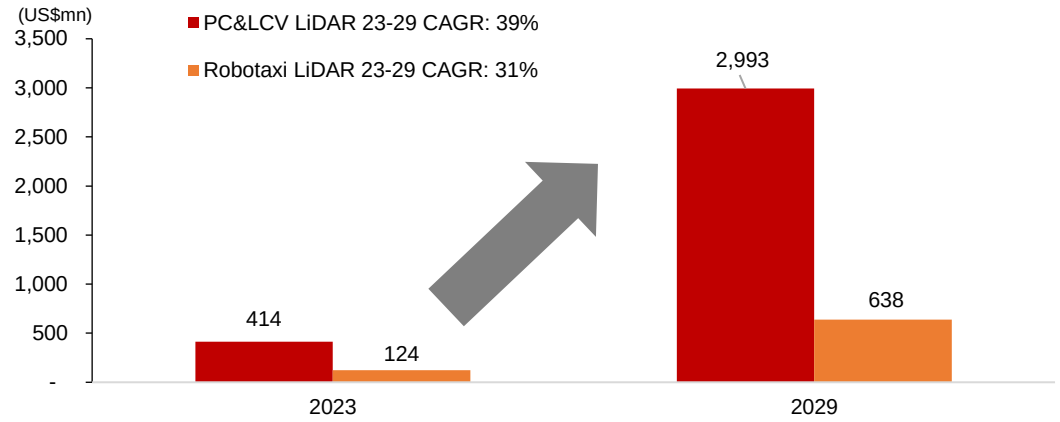
The global automotive LiDAR market is showing robust growth momentum. According to Yole Intelligence, the global automotive LiDAR market was valued at US$538mn in 2023, representing a YoY growth of 79%. It is projected to achieve a CAGR of 38% from 2023 to 2029 and reach US$3.63bn by 2029. Among this: 1) the PC&LCV LiDAR market reached US$414mn in 2023, with a YoY growth rate of nearly 145%, and is expected to expand to US$2.99bn in 2029, with a CAGR of 39%; 2) the robotaxi LiDAR market is anticipated to grow from US$124mn in 2023 to US$638mn in 2029, with a 2023-2029 CAGR of 31%.

Figure 13: Automotive LiDAR market size, 2019-2029

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
PC & LCV market	$20	$25	$44	$169	$414	$767	$1,062	$1,484	$1,926	$2,349	$2,993
Robotaxi market	$111	$87	$99	$130	$124	$177	$236	$298	$422	$512	$638

Source: Yole Intelligence, CMBIGM

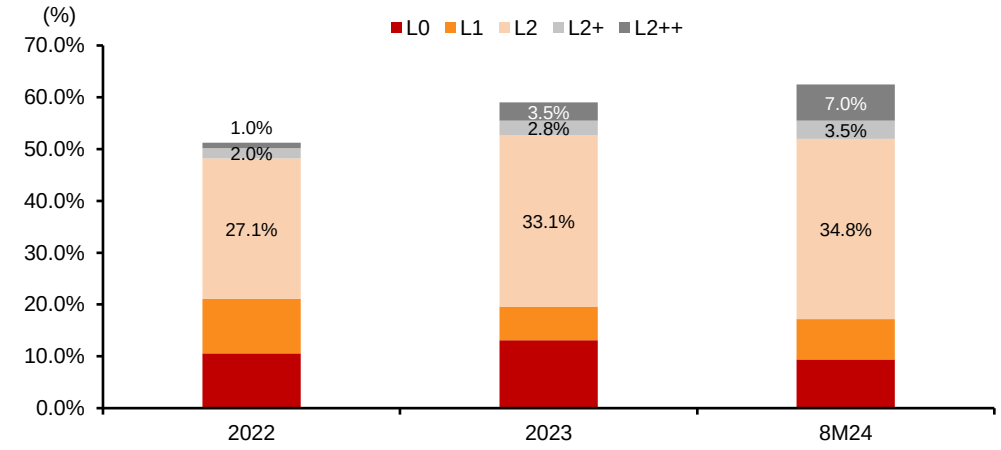
Figure 14: Automotive LiDAR market size is expected to grow rapidly



Source: Yole Intelligence, CMBIGM

The accelerated penetration of high-level intelligent driving has catalysed the increase in the penetration rate and installations of LiDAR. According to Gasgoo, the penetration rate of domestic L2 and above intelligent driving has witnessed a rapid increase, with a 15.1ppts increment in the past three years (from 2022 to 8M24). The automotive LiDAR is regarded as an indispensable sensor for autonomous driving above L3 level. Meanwhile, the multi-sensor fusion solution incorporating LiDAR has furnished ample safety redundancy for L2 level intelligent driving. In 2023, multiple automakers proposed the city Navigate on Autopilot (NOA) expansion plans, expanding the number of cities supporting urban NOA from several to 100 by the end of the year, and even to cover the entire national urban roads. The complicated urban road environment has expedited the application of LiDAR in vehicles. Currently, most vehicle models supporting urban NOA are equipped with LiDAR to cope with more scenarios and irregular obstacles, manifesting a relatively high value of LiDAR in achieving a better urban NOA experience (featuring fewer takeover times and more human-like driving). It is expected that with the continuous enhancement of the automation and intelligence level of automobiles, the growth of installations of LiDAR will be further accelerated.

Figure 15: Penetration trend of different levels of intelligent assisted driving



Note: L0: Vehicle provides brief warning and vehicle control; L1: Vehicle realizes lateral or longitudinal control; L2+: Vehicle realizes both lateral and longitudinal control based on L2; L2++: Vehicle is equipped with navigation assistance function;
Source: Gasgoo, CMBIGM

With the maturation of LiDAR technology and the scale effect brought by the improvement of enterprises' mass production capabilities, the ASPs of LiDAR are decreasing sharply, thereby unlocking higher potential for their extensive application. Especially in China, where the ASP has currently dropped to the range of US$400-US$500, the application of LiDAR in more vehicle models looks quite likely in the future. Meanwhile, in the overseas markets, the ASP of LiDAR products with similar performance is higher than that in China, with an ASP of US$700-US$800, which offers vast opportunity for overseas expansion of Chinese LiDAR enterprises. The reductions in ASP are expected to persist as production volumes continue to expand, and manufacturers optimize their production cost aided by technology enhancement.

Figure 16: Global LiDAR ASP for PC&LCV and Robotaxi

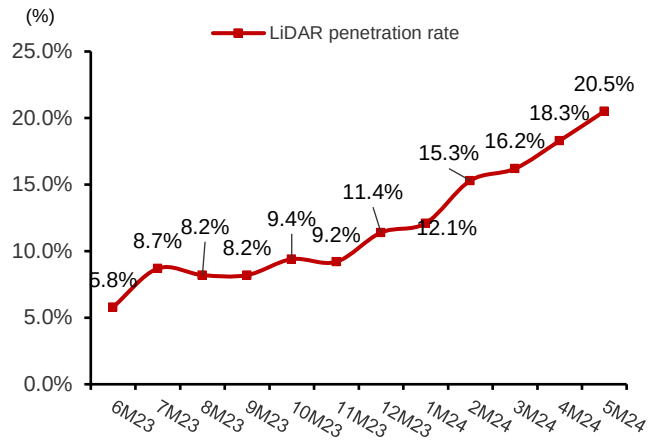
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
PC&LCV Long-range	$600	$603	$652	$760	$545	$474	$413	$371	$323	$291	$276
PC&LCV short-range	$-	$-	$350	$315	$300	$261	$227	$204	$184	$166	$149
Robotaxi Long-range	$12,100	$10,431	$8,550	$7,268	$5,451	$4,361	$3,924	$3,532	$3,179	$2,861	$2,575
Robotaxi Short-range	$3,203	$2,860	$2,600	$2,340	$1,755	$1,404	$1,264	$1,137	$1,024	$921	$829

Source: Yole Intelligence, CMBIGM

The automotive sector continues to evolve with the increasing integration of LiDAR technology into intelligent vehicles across a broader spectrum of price ranges. Per Gasgoo, vehicles with prices between RMB200k and RMB300k are currently the principal categories for automotive LiDAR installations. In 1H24, the installation volume hit a remarkable 197k units in China, surging 2338.4% YoY, signalling a trend of decreasing average prices of vehicles that are equipped LiDARs. Looking ahead, as algorithms become more mature and costs are further optimize, the key growth segment for the LiDAR market is expected to be in vehicles with a price under RMB200k, in our view.

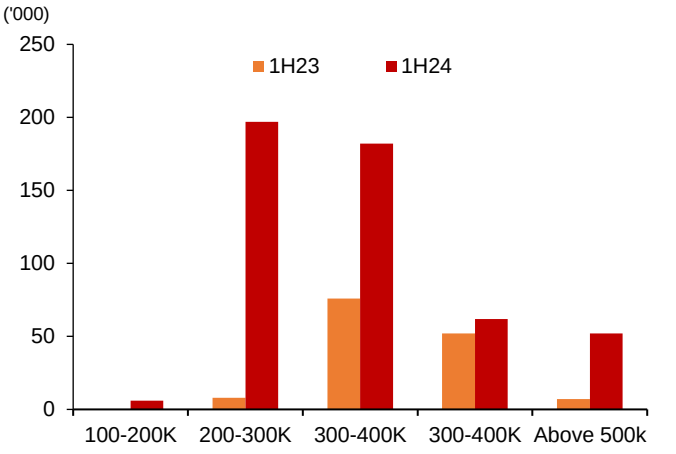
Per our estimate, the intelligent driving system usually takes up 4% of the total vehicle cost, so for a RMB150k vehicle model, its intelligent driving system cost will be about RMB6,000, covering chips, sensors, and software development manpower, and roughly 50% of this, i.e., around RMB3,000, can be reserved for LiDAR. Based on our estimate, with the LiDAR cost now dropping to around US$400 (and is still demonstrating a declining trend) and leading players like HSAI set to realize mass production of the US$200 ATX LiDAR product in late 2025 per their press release, we believe there will be higher potential for RMB150,000 vehicle models to be equipped with LiDARs in the future.

Figure 17: LiDAR penetration rate in EVs with price above RMB150k



Source: Gasgoo, CMBIGM
Note: Penetration rate= Sales of cars equipped with LiDAR/ Total sales of cars

Figure 18: Comparison of LiDAR installation volume by price range, 1H24 vs. 1H23



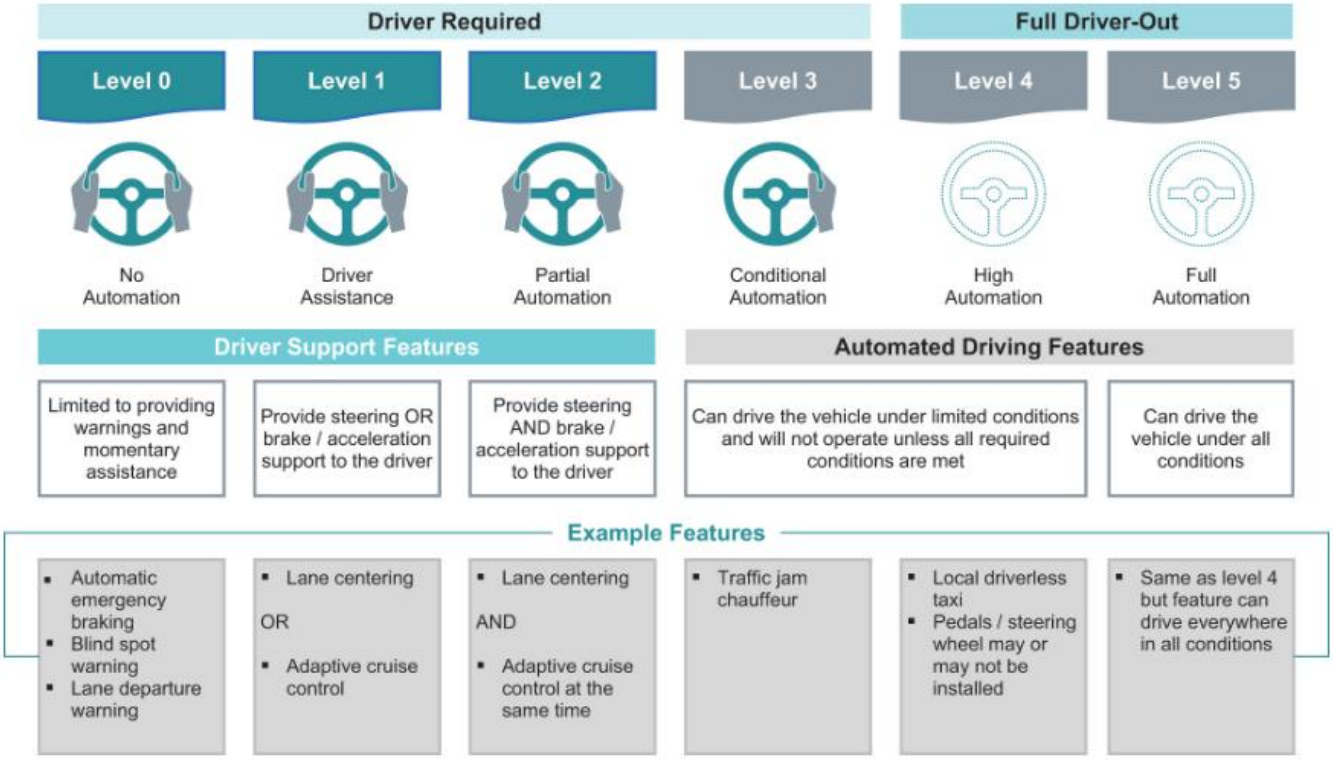
Source: Gasgoo, CMBIGM

■ LiDAR is one of the key elements towards scalable autonomous driving at the current stage

LiDAR plays a vital role in facilitating the rapid development of diverse levels of autonomous driving. Compared to other autonomous driving sensing approaches, LiDAR maintains high accuracy under dark and extreme weather circumstances to offer genuine redundancy and is independent of deep learning algorithms, thereby considerably boosting the reliability and safety of intelligent driving systems.

Driving automation is segmented into six levels based on the human intervention and driving aid scope. In autonomous driving's process of evolution, two main strategies prevail. Key mobility and technology players like Waymo and Baidu aim to build fully autonomous cars (Level 4 from the start) for broader use cases, without human input. Meanwhile, traditional OEMs and new EV players first developed and commercialized lower-level ADASs, focusing on safety alerts like parking sensors, surrounding view, lane departure warnings, etc. As ADASs advance, they have incorporated more features such as adaptive cruise control, emergency brake assists and so on. We expect higher autonomy (Level 3+) will be more common in new vehicles in the future as the ADAS technology marches on.

Figure 19: Levels of driving automation



Source: Company prospectus, Frost & Sullivan, CMBIGM

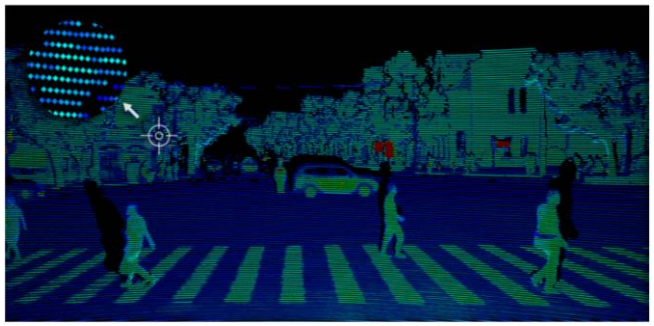
In the rapidly evolving landscape of ADASs and autonomous driving, sensor technologies have emerged as a key impetus for automotive industry innovations. The core of autonomous driving includes three major components: perception, planning, and control. Perception data is collected by a variety of sensing devices, including radar, ultrasonic sensors, and cameras, as well as LiDAR. LiDAR distinguishes itself by leveraging laser-based remote sensing to offer precise mapping capabilities and enhances the accuracy and resolution of the perception results. It is also an answer to the drawbacks of other sensor devices. In contrast to camera solution that highly relies on algorithms, LiDAR directly measures distance and reconstructs surroundings in real time, offering a more reliable and safe way for object recognition and classification especially in dark and extreme conditions.

Figure 20: Comparison of different sensing methods

Source: Company official website, CMBIGM

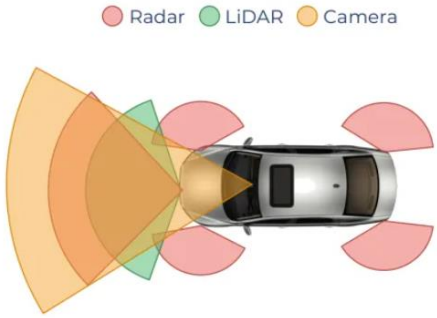
The operational principle of LiDAR involves the generation of a high-energy laser beam by the laser semiconductor at the transmitting end. Once the laser hits surrounding targets and gets reflected back, it is captured by the LiDAR's receiving end for computation to derive the distances and speeds of the targets, ultimately forming the point cloud data of the surrounding environment. When substantial LiDAR data is input into deep learning algorithms, it enables autonomous vehicles to precisely detect and measure object distances. LiDAR offers higher detection precision and identification compared to millimeter-wave radars and cameras, with a detection range often exceeding 200 meters and it can achieve an angular resolution of 0.05°.

Figure 21: Real point cloud data for LiDAR



Source: Company official website, CMBIGM

Figure 22: LiDAR to achieve genuine redundancy

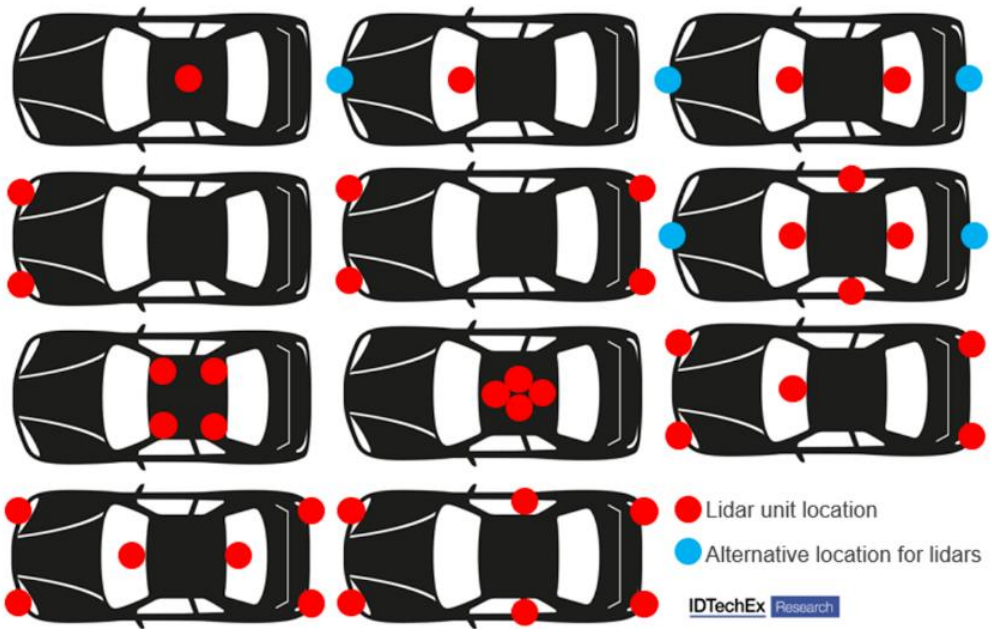


Source: Yole Group, CMBIGM

LiDAR plays a vital role in enabling autonomous driving, especially for Level 3 and above, where LiDAR is an indispensable component of the perception hardware stack, which provides the required detection range and centimetre-level precision for object recognition. For lower autonomy levels below Level 3, the incorporation of LiDAR enhances the vehicle's environmental sensing capabilities, translating into improved ADAS performance, enriched feature sets as well as increased safety. According to the assessment results on the safety performance of LiDAR released by the international insurance giant Swiss Re in 2024, vehicles equipped with LiDAR systems are projected to avoid up to 25% more

collision accidents compared to the same vehicle models without LiDAR, and meanwhile, their ability to mitigate the impact of accidents will be enhanced by as much as 29%.

Figure 23: Examples of LiDAR configurations



Source: IDTechEx, CMBIGM

In our view, the reliability and safety of LiDAR render the LiDAR-backed multi-sensor fusion ADAS perception solution hard to be replaced and set for wide adoption by Chinese vendors (i.e., Xiaomi, Li Auto, etc), and the key to increasing adoption is to offer LiDAR products which are tailored to customer needs and strike a better balance among performance, quality and cost.

The pure vision approach, represented by Tesla, which only uses cameras as the sensing solution, while featuring a low hardware cost, still faces challenges in terms of stability and relies on strong algorithmic capabilities, requiring a huge amount of data and substantial investment for training and iteration. Domestic auto manufacturers, especially emerging EV players, were formed later than Tesla and can hardly support the large-scale data training investment in the early stage. Although the multi-sensor fusion approach has a relatively high hardware cost, it offers better stability. Additionally, according to the Frost & Sullivan report, the cost of LiDAR for the ADAS industry is anticipated to decrease by approximately 9% annually from 2021 to 2030. The general trend of decreasing LiDAR cost is expected to further promote the adoption of LiDAR in the ADAS industry.

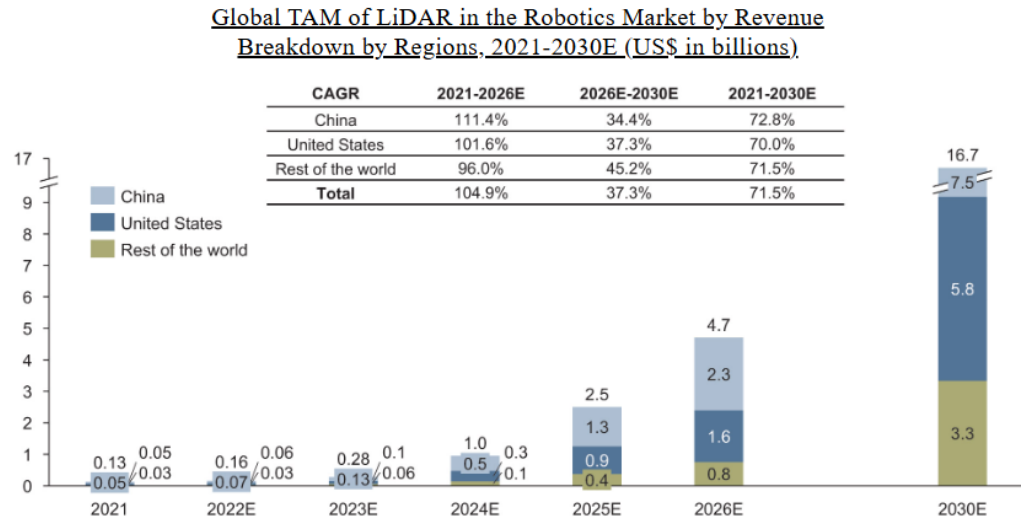
■ **Robotics LiDAR Market: in the initial growth phase but with large potential**

With the evolving global lifestyles and higher requirement for efficiency, global robotics LiDAR market is expected to enjoy rapid growth with the TAM to achieve US$16.7bn in 2030E, representing a 2021-2030E CAGR of 71.5%, per Frost & Sullivan estimates.

The application of LiDAR in the robotics domain is an area that major LiDAR manufacturers are currently actively expanding into, including last-mile delivery robots, street sweeping robots, and logistics robots operating within restricted zones. Although still in the nascent stage, such applications harbor significant growth potential and expansive room for development, and are expected to contribute incremental revenue in the long term.

In the context of the evolving global lifestyles, delivery services, particularly last-mile delivery, offer a convenient and secure experience with a number of choices and enhanced speed. Per the Frost & Sullivan report, the volume of deliveries executed in China amounted to 135bn in 2021. Furthermore, the global count of robotic devices is projected to reach 11.1mn units by 2030, translating into a market demand for over 33.4mn LiDAR units and a TAM of US$16.7bn.

Figure 24: Global TAM of LiDAR in the robotics market by revenue



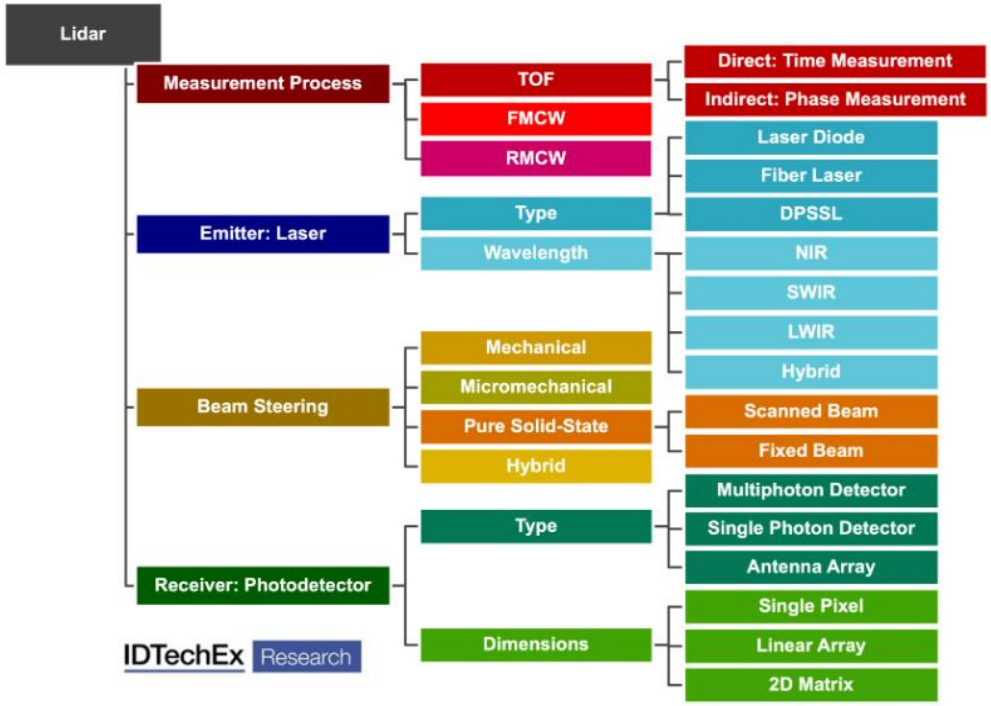
Source: Company prospectus, Frost & Sullivan, CMBIGM

HSAI's LiDAR solution to solve downstream demand triangle effectively

Performance, quality and cost are the demand triangle for downstream customers. In our view, at the current stage, LiDAR manufacturers who leverage high-performance rotating mirror solution and have robust mass production capabilities are poised to benefit from rising demands for LiDAR with high performance, reliability and optimized cost.

LiDAR companies take different approaches in their solutions, and the architecture of LiDARs differs from one another, leading to differences in size, form, performance, and cost. In the short run, the LiDAR industry is expected to maintain a diverse technological landscape. At current stage, the key competitive edge for LiDAR players still lies in their mass production and offering capabilities. Manufacturers with strong mass production capabilities are likely to enhance their strategic partnerships with leading customers.

Figure 25: Different technology choices in designing a 3D LiDAR module



Source: IDTechEx, CMBIGM

Looking ahead, the requirements of LiDAR continue to evolve and customers' key focus will be on high performance with strong reliability as well as cost optimization. In the medium to long term, we expect the manufacturers who leverage reliable rotating mirror tech or have first-mover advantages in solid-state solutions, such as HSAI and Huawei (unlisted), are poised to benefit from rising demands for higher performance and reliability.

Figure 26: Diverse technical solutions in LiDAR market

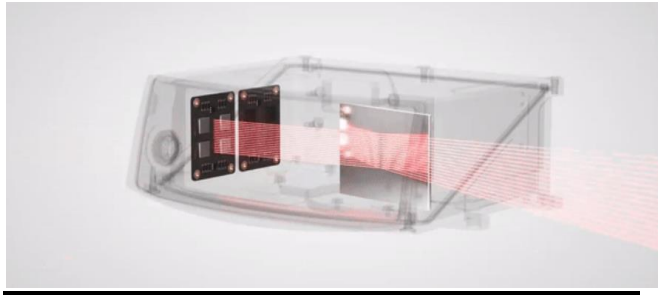
Source: CAICT, CMBIGM

Categorized by beam steering mechanisms, LiDAR can be divided into 3 groups: Mechanical, Hybrid solid-state, and Pure solid-state. In the early 0-1 exploration stage of mobility used LiDAR, mechanical LiDAR was applied in Robotaxi fleets. Since Robotaxi fleets conduct regular professional maintenance on vehicles and have specific requirements for appearance, the relatively large size and short service life of mechanical LiDAR can be tolerated. With the improvements of hybrid solid-state LiDAR in aspects like cost, volume and durability, LiDAR has entered the commercial stage of the passenger vehicle market.

The mechanical LiDAR adopting the traditional discrete design has its optical-mechanical structure relying on motors to achieve overall rotation, resulting in the following issues: 1) relatively large volume with limited space for cost reduction; 2) the discrete structure is easily affected by external environmental factors, thus affecting its temperature stability and service life; and 3) requires complex manual adjustments and has a long assembly cycle, so its application in automotive-grade products is limited. Meanwhile, due to the relatively low maturity of full solid-state LiDAR technology at the current stage, with problems such as low power density and short detection distance, it still cannot meet the performance requirements of the main-view LiDAR. However, the full solid-state LiDAR with a smaller volume and higher stability will continue to be the main direction for the future development. At current stage, the semi-solid LiDAR has become the mainstream choice for scalable production and vehicle installation thanks to its relatively smaller volume, higher precision and lower cost.

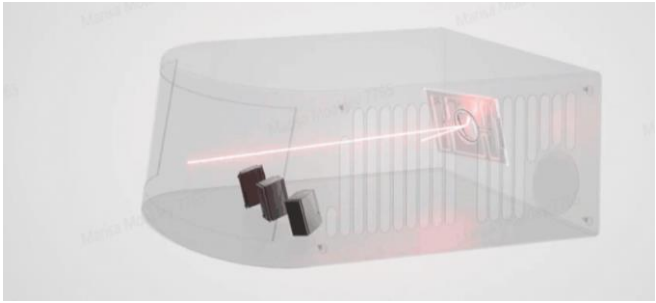
The semi-solid solutions including rotating mirror type and micro-electro-mechanical system (MEMS) micromirror type. For the rotating mirror type, its main moving part is the brushless motor. Since the brushless motor has been widely used in the industry for many years, the stability of its components has been reliably verified and its supply chain is relatively mature. Compared with the rotating mirror type, the MEMS micromirror removes the metal mechanical structural parts, and its moving part is just a miniature reflector (usually with a diameter of 3-7mm) suspended on two torsion bars. The overall structure of the MEMS micromirror is usually made of silicon-based materials, so it has relatively large room for miniaturization and cost reduction. However, due to the nature of the device, the MEMS micromirror has difficulty in achieving optimality simultaneously in terms of large mirror size (affecting measurement distance), maximum deflection angle (affecting field of view), and high scanning frequency (affecting refresh rate). Also, larger-sized micromirror will put pressure on the fatigue durability of the torsion bars, so there is limited room for performance improvement in automotive-grade applications.

Figure 27: Rotating mirror solution to achieve better stability and reliability



Source: Company data, CMBIGM

Figure 28: MEMS solution with limited field of view



Source: Company data, CMBIGM

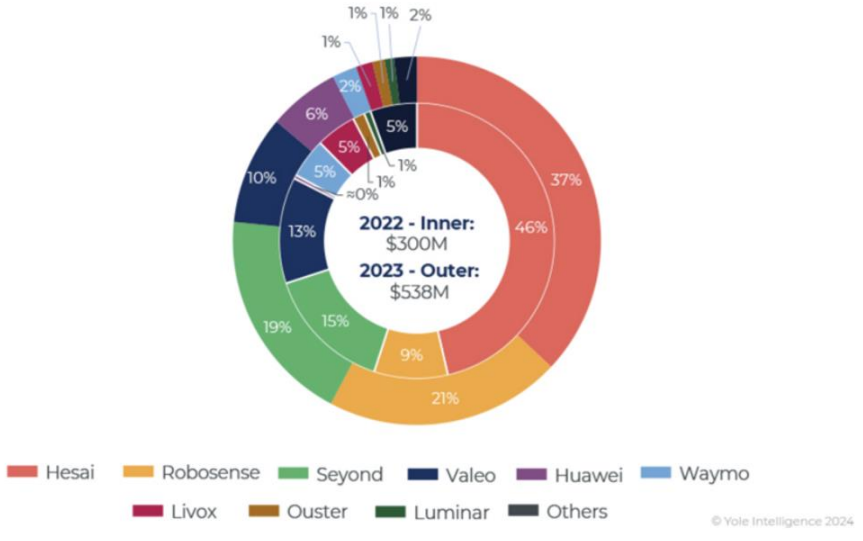
HSAI: Global leader with clear competitive edges

Per Yole, HSAI took a leading position in the LiDAR solutions market both in China and globally. In 2023, HSAI ranked first with 37% market share in terms of revenue generation in global LiDAR market. Specifically, it led in both the PC&LCV market and robotaxi market, with a market share of 26% and 74%, respectively. With 37.3% market share in terms of installation volume, HSAI also took the lead in China LiDAR solutions market in 2023. In our view, HSAI's ability to maintain its leading position among fierce industry competition is due to the following edges: 1) continuous cost optimization capability driven by the in-house development of ASIC chips through a leading technological strength platform; 2) self-owned factories and highly automated production methods supporting a leading mass production capacity; and 3) robust customer relationships and market penetration.

A leading player in LiDAR solutions market

Domestic LiDAR manufacturers have emerged as significant players in the global market. Benefiting from the complete automotive components and optical communication supply chains in China, as well as the booming downstream demands from the intelligent and electric vehicle markets, Chinese LiDAR manufacturers have maintained a leading position globally. According to Yole's report, in terms of the global LiDAR market share by revenue in 2023, HSAI took the lead with a 37% share, followed by 21% for Robosense (21%) and 12% for Seyond (formerly Innovusion). The foreign manufacturer Valeo ranked fourth, accounting for only a 10% market share.

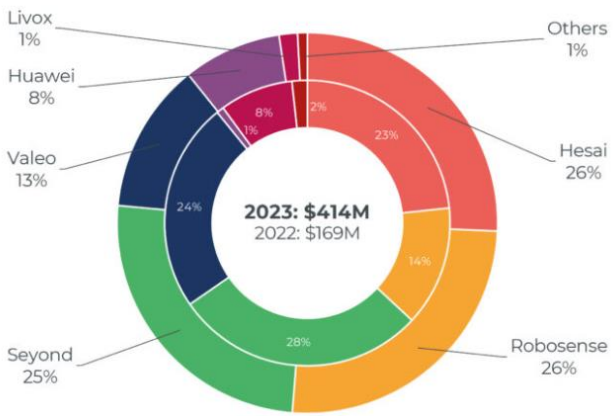
Figure 29: Global LiDAR market share by revenue, 2022-2023



Source: Yole Intelligence, CMBIGM

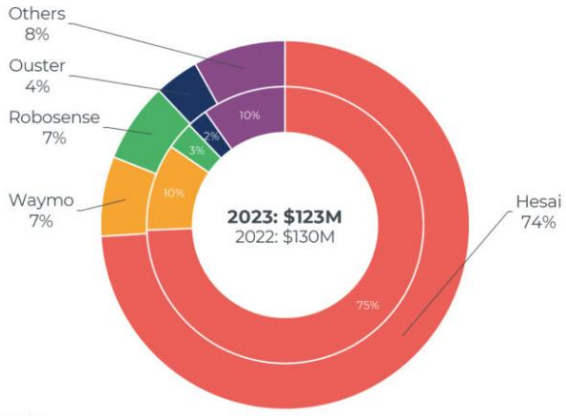
HSAI has been named the top automotive LiDAR company by market share in terms of revenue for the third consecutive year by Yole Group. Specifically, HSAI took the lead in both PC&LCV market and robotaxi market, with a market share of 26% and 74%, respectively, in 2023.

Figure 30: PC&LCV LiDAR market breakdown by revenue, 2022-2023



Source: Yole Intelligence, CMBIGM

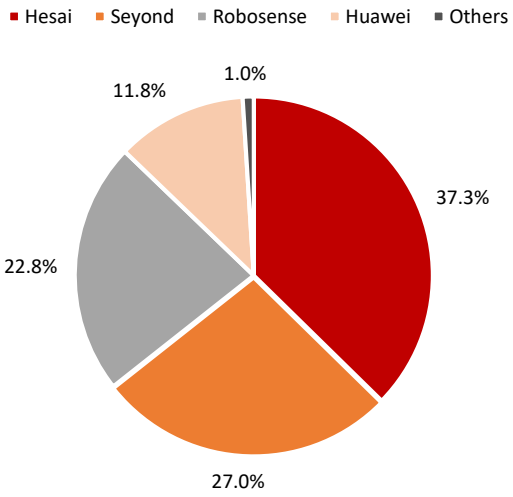
Figure 31: Global robotaxi LiDAR market breakdown by revenue, 2022-2023



Source: Yole Intelligence, CMBIGM

In terms of installation volume in China, the leading-edge effect in the LiDAR market is even more pronounced. According to Gasgoo, in 2023, the installation volumes (excluding imports and optional configurations) of HSAI, Robosense, Seyond and Huawei ranked at the forefront. The combined market share of the top four players reached 99%, while the remaining manufacturers accounted for only 1.00%. HSAI achieved the highest position in terms of LiDAR installation volume, mainly thanks to the robust demand from prominent Chinese OEMs such as Li Auto.

Figure 32: China LiDAR market breakdown by installation volume, 2023



Source: Gasgoo, CMBIGM
Note: Excludes imports and optional configurations

In our view, HSAI's ability to maintain its leading position amid competition comes from the following edges: 1) Cost reduction driven by the in-house development of ASIC chips through a leading technological strength platform; 2) self-owned factories and highly automated production methods supporting its leading mass production capacity; and 3) robust customer relationships and market penetration.

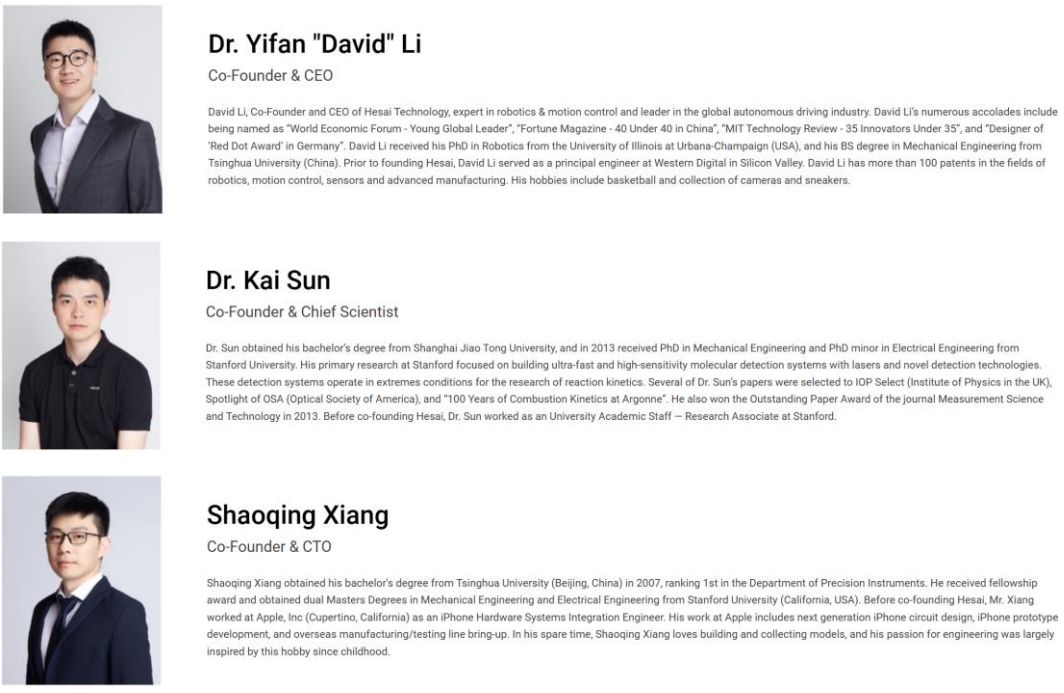
Superior vertical integration technology and in-house manufacturing aid cost optimization and drive better customer adoption

■ Management has strong technical background

HSAI's management team has a strong technical background in robotics, optics and physics, and they all have experience in establishing a global R&D expert team with diverse industry backgrounds, covering ASICs, optical engineering, mechanical engineering, thermal engineering, automotive engineering, electromagnetic compatibility (EMC), manufacturing and software. Also, the skill sets of management compliments with each other, which bodes well for long-term business development.

Li Yifan, HSAI's CEO, graduated from Tsinghua University and holds a Ph.D. from UIUC. He worked as a Principal Engineer at Western Digital. As an expert in the fields of robotics and motion control and a leading figure in the global autonomous driving industry, he has received numerous honours and owns more than 100 patents in the field. Sun Kai, the chief scientist, with a Tsinghua undergraduate and Stanford Ph.D., focused on building advanced molecular measurement systems at Stanford. He was also appointed as a professor at the School of Automotive Studies, Tongji University from 2015 to 2018. Xiang Shaoqing, the CTO, graduated from Tsinghua and holds two Stanford master's degrees. After working at Apple and Samsung's Global Headquarters Research Center, he co-founded HSAI in 2014.

Figure 33: HSAI's management team



Source: Company official website, CMBIGM

The company's commercially validated solutions are backed by superior R&D capabilities across optics, mechanics, electronics, software, and functional safety, among others. A large interdisciplinary team of engineers forms the solid R&D foundation. As of December 31, 2023, HSAI had approximately 730 experienced engineers, mostly in the research and development department, amounting to over 65% of total employees, with 9% of them holding doctor's degrees.

Three divisions collaborate to deliver leading-edge R&D for the company. HSAI's R&D team consists of three departments: HSAI Research Institute, the vertical integration centre, and the R&D centre. HSAI Research Institute undertakes very early-stage research, as well as developing fundamental components. The vertical integration centre with 150 engineers was established in 2017. It is dedicated to the vertical integration technologies to drive the continued evolution of their LiDAR architecture, such as the continuous evolution of their self-developed ASIC chips to realize cost optimization. The R&D centre is responsible for the design and development of the final LiDAR products. They work with the business development team to understand customers' needs and design the LiDAR products according to the desired specifications, and works with the manufacturing team to ensure the manufacturability of LiDARs.

- **Proprietary vertical integration technology aids performance improvement and cost reduction**

Through the in-house development of ASIC chips via a leading technological strength platform for the years, HSAI enables the achievement of high performance and low cost. ASIC upgrade is crucial for reducing the cost and improving the efficiency of LiDAR. The LiDAR products based on ASIC have significantly reduced the number of components, decreased the probability of system failure caused by individual component failures, and enhanced the reliability of the system. Meanwhile, simplifying the entire system into several chips allows for a fully automated assembly process, substantially reducing labour, material, and debugging costs. In addition, HSAI has developed a unique active anti-interference technology for LiDAR, which has become a standard feature in the mass production of HSAI's LiDAR products, solving the problem of possible mutual interference and point cloud noise among different LiDARs.

Figure 34: Key advantages of HSAI's ASICs-based approach

	Legacy approach	Minimum channel approach (MEMS-based)	Minimum channel approach (1550nm Wavelengths-based)	Line-flash ASIC approach	HSAI's approach (AT series as an example)
LiDAR architecture	Discrete architecture — large number of channels using discrete components	Integrated architecture — small number of channels	Integrated architecture — small number of channels	ASIC-based; Integrated architecture — large number of channels integrated at a single circuit board; Firing all lasers at the same time to form a line flash in vertical direction; Using a low-speed scanner in horizontal direction	ASIC-based; Integrated architecture — large number of channels integrated at a single circuit board; Firing lasers at each channel sequentially to form a solid-state electronic scanning in vertical direction; Using a low-speed scanning mirror in horizontal direction
Performance	Difficult to enhance performance for given complexity.	Limited range performance for MEMS due to small apertures; Limited field of view unless using multiple TX/RX systems	High power consumption; Limited point density; Low receiver sensitivity	Low performance in range and point cloud quality since power at each channel is limited; High power consumption; Severe channel crosstalk	High performance in range and point cloud quality; Low power consumption

Quality	Low product consistency due to large number of discrete components	Concerns on reliability as mechanical beam steering system has not been automotive grade proven	Concerns on reliability as high - speed scanning mirror system has not been automotive grade proven; Requires many other non - automotive - grade components	High product consistency as components are integrated on a single circuit board; Automotive grade proven scanning system	High product consistency as components are integrated on a single circuit board; Automotive grade proven scanning system
Cost	Complex manufacturing process; High cost	Multiple TX/RX manufacturing complexity; High cost	High cost of fiber laser	Low manufacturing complexity; Low-cost silicon-based components	Low manufacturing complexity; Low-cost silicon-based components

Source: Company data, Frost & Sullivan, CMBIGM

Figure 35: HSAI's platform-based self-developed chips: each generation evolves toward higher integration

Source: Company data, CMBIGM

■ **Highly automated self-owned factories to support mass production capacity**

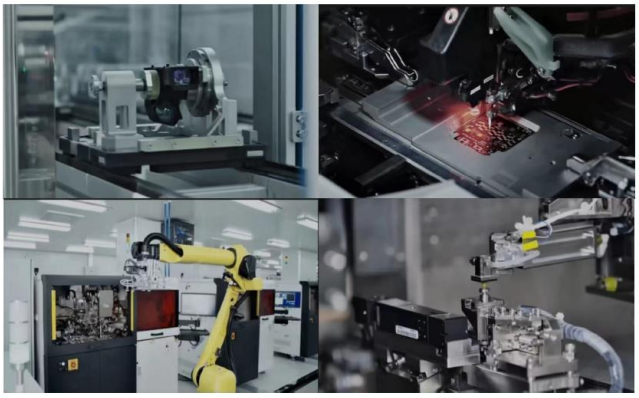
HSAI has been actively engaged in capacity construction by owning and operating its own manufacturing facilities. HSAI's self-owned factory Hangzhou Hertz Manufacturing Center commenced operations in July 2023, and the Shanghai Maxwell Manufacturing Center achieved full-scale operation in November 2023. Collectively, HSAI's annual LiDAR production capacity has exceeded 2mn units.

HSAI has invested significant time in streamlining and automating its production process. Through the establishment of in-house factories, HSAI has encompassed intelligent manufacturing technologies and a state-of-the-art MES central control system for intelligent cloud services, deploying a number of intelligent industrial robots to automate over 100 production procedures, spanning PCB assembly, lens installation, mechanical component fitting, gluing, screwing, welding, electronic testing, and comprehensive unit testing. The aggregate automation rate of the production line has surpassed 90%, enabling the production of a single LiDAR unit within a mere 45 seconds, representing a manifold increase in productivity compared to conventional production modalities. The in-house manufacturing and testing capabilities and strict quality control measures enable HSAI to ensure the high performance and reliability of their products while achieving optimal cost control.

Figure 36: HSAI's Maxwell intelligent factory

Source: Company data, CMBIGM

Figure 37: HSAI's highly automated production line



Source: Company data, CMBIGM

■ Robust customer relationships and market penetration

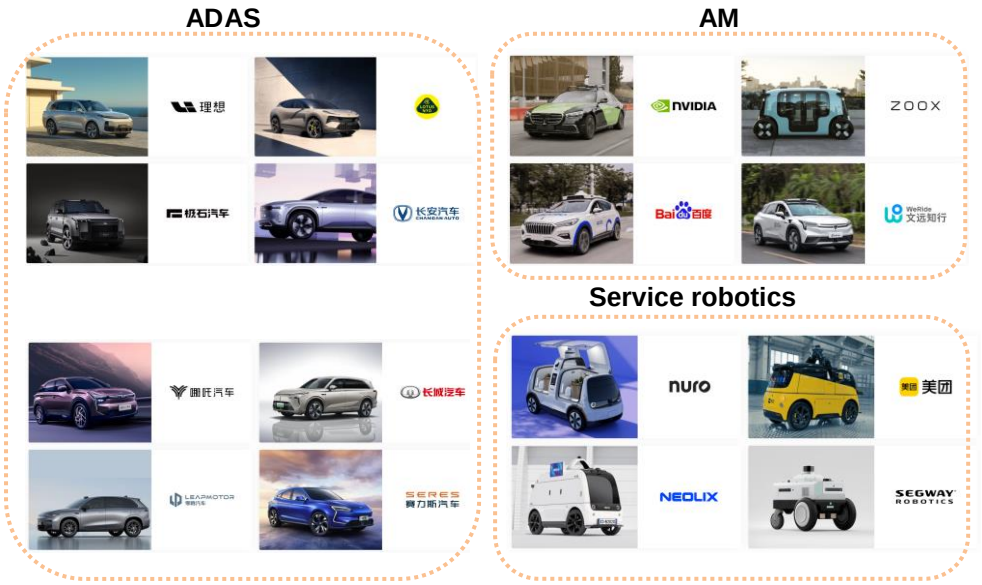
HSAI has established stable partnerships with downstream customers, and its reliable performance continuously wins the recognition of both existing and new customers. In the realm of ADAS, HSAI supplies products to automotive enterprises such as Li Auto, Xiaomi, Lotus, Leapmotor, Changan, and Great Wall Motor. As of 3Q24, the company had secured ADAS design wins with 20 OEMs globally across 75 vehicle models. Since 2023, HSAI has successively reached cooperation agreements with several automakers such as FAW Group, Neta Auto and Leapmotor. In July 2024, HSAI announced a deep strategic cooperation with SAIC. Also, in December, HSAI announced the exclusive series production design win with Great Wall Motor that covers several models across its two brands and the exclusive supply of 1.5mn LiDAR units to Changan over the next few years.

Currently, the company's top-tier partners include Li Auto, Xiaomi, BYD, Zeekr, Great Wall, and Changan. Based on the current vehicle models planning, we estimate that the leading customers are expected to contribute an aggregate demand of over 1mn LiDAR units in 2025.

In the international ADAS market, the company has currently reached cooperation agreements directly or indirectly via China joint ventures of leading OEMs, including Audi, GM, and Volkswagen. The current progress is smooth, and mass production is expected next year, making it the first domestic LiDAR manufacturer to be recognized and expected to reach in-depth cooperation with mainstream automakers in the overseas market.

In the domain of autonomous mobility, HSAI's clients encompass Baidu, DiDi, WeRide and a lot of other leading players; in the domain of service robotics, HSAI's clients include Nuro, Meituan and so on.

Figure 38: HSAI: Strong customer partnerships

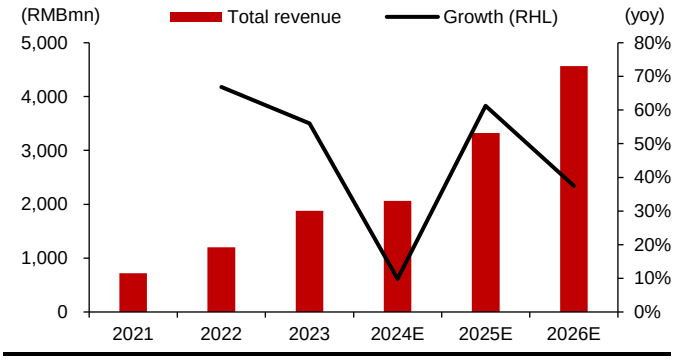


Source: Company official website, CMBIGM

Business segement analysis and financial forecast

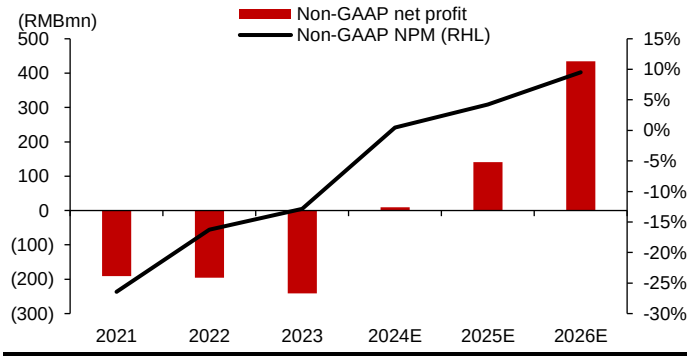
We forecast HSAI's total revenue to grow by 10%/61%/37% YoY to RMB2.1bn/3.3bn/4.6bn in 2024E/2025E/2026E, representing a 23-26E CAGR of 35%, mainly driven by a 90% CAGR in shipment volume of LiDAR, which we see support coming from increased shipments to Li Auto, Xiaomi, BYD, Changan, Leapmoter, etc.. In terms of bottom line, we estimate HSAI to turn around from non-GAAP net loss of RMB241mn in 2023 to net profit of RMB9mn in 2024E, with net profit to further grow to RMB141mn in 2025E, and the implied non-GAAP NPM may turn around from -12.9% in 2023 to 0.5%/4.2% in 2024E/2025E.

Figure 39: HSAI: revenue growth and forecast



Source: Company data, CMBIGM estimates

Figure 40: HSAI: non-GAAP net income and forecast



Source: Company data, CMBIGM estimates

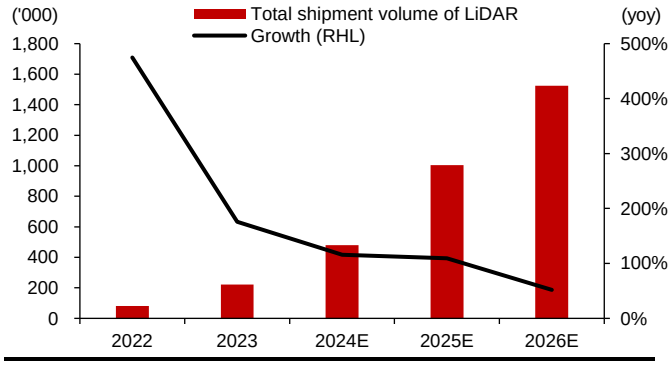
Figure 41: HSAI: key financial forecast

(RMBmn)	2021	2022	2023	2024E	2025E	2026E
Revenue	**721**	**1,203**	**1,877**	**2,062**	**3,324**	**4,570**
Growth - YoY	*73.5%*	*66.9%*	*56.1%*	*9.8%*	*61.2%*	*37.5%*
1. Product revenue	**706**	**1,152**	**1,765**	**1,942**	**3,197**	**4,434**
Growth - YoY		*63.1%*	*53.2%*	*10.0%*	*64.6%*	*38.7%*
a) Revenue from LiDAR products	685	1,122	1,735	1,914	3,169	4,406
Growth - YoY		*63.8%*	*54.6%*	*10.3%*	*65.6%*	*39.0%*
As % of total revenue	*95%*	*93%*	*92%*	*93%*	*95%*	*96%*
b) Revenue from gas detection products and others	21	30	30	28	28	28
Growth - YoY		*42.9%*	*0.0%*	*-5.5%*	*0.0%*	*0.0%*
2. Service revenue	**14.7**	**50.8**	**112.1**	**120.0**	**127.9**	**135.8**
Growth - YoY		*245.6%*	*120.7%*	*7.0%*	*6.6%*	*6.2%*
Gross profit	**382**	**472**	**661**	**921**	**1,339**	**1,818**
GAAP S&M expenses	69	105	149	195	234	257
GAAP G&A expenses	237	201	320	288	303	318
GAAP R&D expenses	368	555	791	830	872	959
Operating profit - GAAP	**(265)**	**(378)**	**(572)**	**(206)**	**(69)**	**285**
Net profit - GAAP	**(2,456)**	**(747)**	**(476)**	**(109)**	**21**	**312**
Net profit - non-GAAP	**(191)**	**(196)**	**(241)**	**9**	**141**	**435**
Margins	**2021**	**2022**	**2023**	**2024E**	**2025E**	**2026E**
GPM	**53.0%**	**39.2%**	**35.2%**	**44.7%**	**40.3%**	**39.8%**
S&M expenses ratio	9.6%	8.7%	7.9%	9.5%	7.0%	5.6%
G&A expenses ratio	32.8%	16.7%	17.1%	14.0%	9.1%	7.0%
R&D expenses ratio	51.1%	46.2%	42.1%	40.3%	26.2%	21.0%
OPM	-36.8%	-31.4%	-30.5%	-10.0%	-2.1%	6.2%
NPM	-340.8%	-62.1%	-25.4%	-5.3%	0.6%	6.8%
Non-GAAP NPM	-26.4%	-16.3%	-12.9%	0.5%	4.2%	9.5%

Source: Company data, CMBIGM estimates

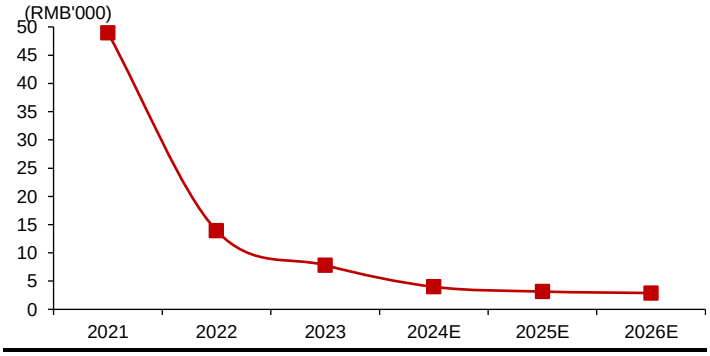
HSAI's revenue generated from LiDAR products reached RMB1.7bn in 2023, up 55% YoY, driven by increased demand for AM and ADAS LiDAR products. HSAI recognized revenue from c.80,400 and 222,100 LiDAR units sold with an ASP of c. US$2,000 and US$1,100 per unit in 2022, and 2023, respectively. The decrease of the unit price per LiDAR sold was owing to a shift of product mix towards lower-priced QT, XT, and AT series LiDAR products.

Figure 42: HSAI: LiDAR shipment volume forecast



Source: Company data, CMBIGM estimates

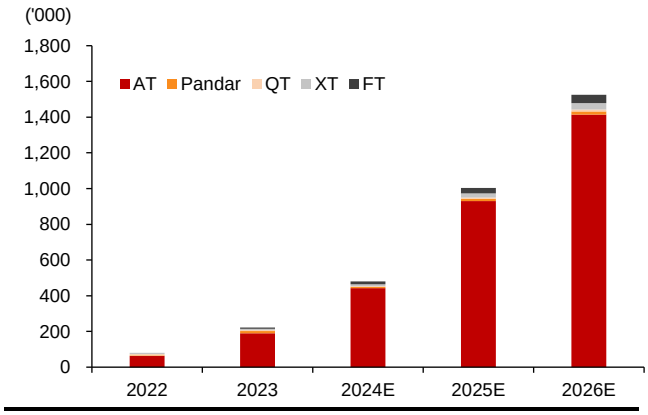
Figure 43: HSAI: blended LiDAR ASP forecast



Source: Company data, CMBIGM estimates

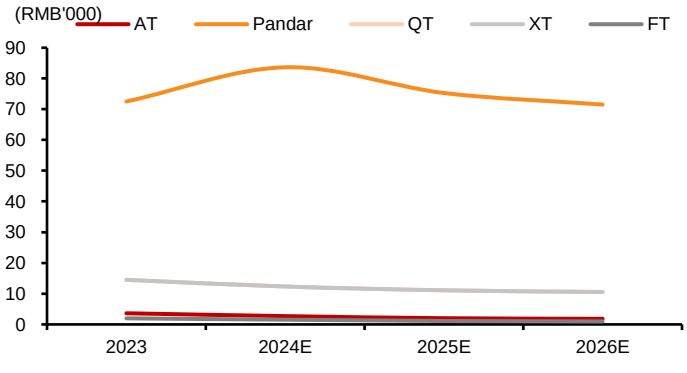
We forecast shipment volume of LiDAR products to achieve a 2023-2026E CAGR of 90%, mainly driven by the AT series, aided by the launch of cost-effective ATX products in 2025E, alongside the increased adoption of existing products. Driven by the product mix shift to relatively lower-price ATX products, as well as the decline in the price of AT products aided by cost optimization, we estimate blended ASP to decline from RMB4.0k in 2024E to RMB3.2k/2.9k in 2025E/2026E. We believe the decline in ASP should propel wider adoption of LiDAR products in the auto industry, while could also aid potential business expansion in other industries such as robotics in the future.

Figure 44: LiDAR shipments by product type



Source: Company data, CMBIGM estimates

Figure 45: HSAI: ASP by product type



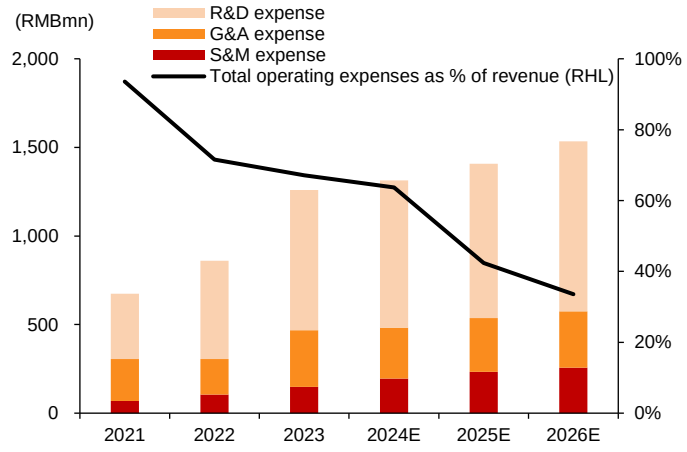
Source: Company data, CMBIGM estimates

OPM to improve alongside robust revenue growth

HSAI's operating expenses totalled RMB1.26bn in 2023, up 46.3% YoY, and accounted for 67.1% of total revenue (2022: 71.6%). We estimate RMB1.3bn/RMB1.4bn of total operating expenses for 2024E/2025E, as large-scale investment phase has passed for HSAI. Robust revenue growth driven by rapid growth of LiDAR product shipment should help unleash the

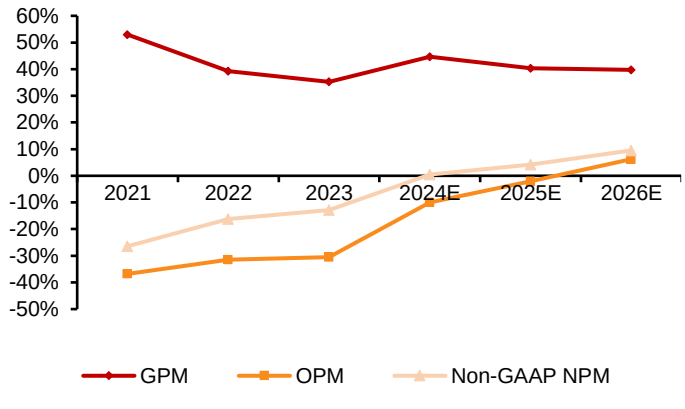
operating leverage for HSAI, in our view. We forecast operating margin to improve from -30.5% in 2023 to -10.0% in 2024E, and to further improve to -2.1%/+6.2% in 2025E/2026E.

Figure 46: HSAI: Opex and expense ratios



Source: Company data, CMBIGM estimates

Figure 47: HSAI: margin trend



Source: Company data, CMBIGM estimates

We estimate HSAI to turn around from non-GAAP net loss of RMB241mn in 2023 to net profit of RMB9mn in 2024E, with net profit to further grow to RMB141mn in 2025E, and the implied non-GAAP NPM will turn around from -12.9% in 2023 to 0.5%/4.2% in 2024E/2025E.

Valuation and risks statement

Target price of US$16.3 per ADS based on 4.8x P/S

We believe P/S is the proper valuation method for HSAI, given that overall LiDAR industry is still in the rapid development phase, and industry profitability is still in the improvement stage. We value HSAI at RMB15.9bn (US$16.3 per ADS) based on 4.8x 2025E PS, 10% above the overall indsutry average at 4.4x (Fig.49), which in our view is justified by: 1) HSAI's industry-leading financial performance, aided by mass production of LiDAR products and backed by its strong techinical capability; 2) potential robust product shipment pipeline in 2025E, thanks to incremental volume contribution from leading auto OEMs inclduing Xiaomi, BYD, Changan and Leapmotor.

Figure 48: HSAI: target valuation

P/S Valuation (RMBmn)	2025E
2025E Revenue	3,324
Target 2025E P/S	4.8x
Equity value	15,945
No. of ADS outstanding (diluted; mn)	135
Target price (US$, per ADS)	**16.3**

Source: Company data, CMBIGM estimates
Note: USD/RMB = 7.25

Figure 49: HSAI: Comps table

Companies	Ticker	Price (Local)	Mkt Cap (US$mn)	Price/Sales (x) 2023A	2024E	2025E	2026E
Luminar	LAZR US Equity	5.2	172.5	2.3	2.5	1.5	0.8
Innoviz	INVZ US Equity	1.7	277.0	16.1	11.4	3.8	1.7
Ouster	OUST US Equity	12.8	637.6	7.7	5.7	4.4	2.9
Mobileye Global	MBLY US Equity	18.9	15361.3	7.4	9.4	7.9	6.4
Robosense	2498 HK Equity	29.1	1685.6	10.9	6.6	4.2	3.1
Average				**8.9**	**7.1**	**4.4**	**3.0**

Source: Bloomberg, CMBIGM
Note: data as of 25 Dec, 2024

Key catalysts for HSAI include: 1) larger-than-expected shipment volume of LiDAR products driven by better-than-expected market adoption; and 2) better-than-expected margin expansion driven by better-than-expected cost saving.

Risks statement

1) Potential product defects, and other routes of technology proven to be more effective than that of LiDAR (such as camera-based system), which may both lead to reducing market adoption of LiDAR solutions;
2) Lower-than-expected pace of penetration of LiDAR/ADAS;
3) Rising competition from other companies developing LiDAR products, as well as a potential price war in LiDAR industry weighing on the blended ASP of HSAI's products;
4) Higher-than-expected operating expenses leading to slower-than-expected margin expansion.

Appendix

Figure 50: HSAI: management profile

Name	Position	Prior experience
Yifan Li	Co-Founder, Director and Chief Executive Officer	Dr. Yifan Li is the co-founder and has served as chief executive officer and director since HSAI's inception. Prior to co-founding HSAI, Dr. Li served as a principal engineer at Western Digital in Silicon Valley from 2013 to 2014. Dr. Li received his bachelor's degree in mechanical engineering from Tsinghua University in 2009, a master's degree in mechanical engineering from University of Illinois at Urbana-Champaign in 2009, and a PhD degree in mechanical engineering from University of Illinois at Urbana-Champaign in 2013. Dr. Li's numerous accolades include being named as Fortune Magazine's "40 Under 40 in China," MIT Technology Review's "2020 Innovators Under 35 of China," and a Young Global Leader of the World Economic Forum for the Class of 2021.
Kai Sun	Co-Founder, Director and Chief Scientist	Dr. Kai Sun is the co-founder and has served as chief scientist and director since HSAI's inception. Dr. Sun received his bachelor's degree in thermal energy and power engineering from Shanghai Jiao Tong University in 2007, a master's degree in mechanical engineering from Stanford University in 2009, and a PhD degree in mechanical engineering and also a PhD minor degree in electrical engineering from Stanford University in 2013. Prior to co-founding HSAI, Dr. Sun worked as a research associate at Stanford University in 2014. Dr. Sun's primary research at Stanford University focused on building ultra-fast and high-sensitivity molecular detection systems with lasers and novel detection technologies. These detection systems operate in extremes conditions for the research of reaction kinetics. Several of Dr. Sun's papers were selected to IOP Select (Institute of Physics in the UK), Spotlight of OSA (Optical Society of America), and "100 Years of Combustion Kinetics at Argonne." Dr. Sun also won the Outstanding Paper Award of the journal Measurement Science and Technology in 2013.
Shaoqing Xiang	Co-Founder, Director and Chief Technology Officer	Mr. Shaoqing Xiang is the co-founder and has served as chief technology officer and director since HSAI's inception. Prior to co-founding HSAI, Mr. Xiang worked at Apple, Inc. as an iPhone hardware systems integration engineer from 2011 to 2014. Mr. Xiang received his bachelor's degree in micro-electromechanical systems from Tsinghua University in 2007. Mr. Xiang received a fellowship award and obtained dual master's degrees in mechanical engineering and electrical engineering from Stanford University in 2009 and 2011, respectively.
Andrew Fan	Director and Chief Financial Officer	Mr. Fan has over 18 years of experience in accounting and corporate financing. From May 2021 to September 2024, Mr. Fan held the position of chief financial officer at a leading automotive technology company. Prior to that, Mr. Fan held senior finance-related roles at listed companies including Hailiang Education Group Inc., Aesthetic Medical International Holdings Group Limited, and Dali Foods Group Company Limited, and various roles at financial institutions including Deutsche Bank, HSBC, and Macquarie. Additionally, Mr. Fan has served as an independent non-executive director of Jiangsu Innovative Ecological New Materials Limited (HKEX: 2116) since 2018. Mr. Fan graduated from Tsinghua University, with bachelor's and master's degrees in accounting in 2004 and 2006, respectively.
Cailian Yang	Director and Vice President of Operations	Ms. Cailian Yang has served as the vice president of operations and director since November 2017. Ms. Yang joined the company in December 2014 as the first employee of HSAI. Prior to joining HSAI, Ms. Yang served as a customer manager in Shanghai Pudong Development Bank from October 2012 to July 2014, and a customer manager in Citibank from September 2014 to December 2014. Ms. Yang received her bachelor's degree in business English from Yancheng Teachers University in 2012.

Source: Company data, CMBIGM

Financial Summary

INCOME STATEMENT	2021A	2022A	2023A	2024E	2025E	2026E
YE 31 Dec (RMB mn)						
Revenue	**721**	**1,203**	**1,877**	**2,062**	**3,324**	**4,570**
Cost of goods sold	(339)	(731)	(1,216)	(1,141)	(1,985)	(2,751)
Others	0	0	0	0	0	0
Gross profit	**382**	**472**	**661**	**921**	**1,339**	**1,818**
Operating expenses	**(647)**	**(850)**	**(1,233)**	**(1,127)**	**(1,408)**	**(1,534)**
Selling expense	(69)	(105)	(149)	(195)	(234)	(257)
SG&A expense	(237)	(201)	(320)	(288)	(303)	(318)
R&D expense	(368)	(555)	(791)	(830)	(872)	(959)
Others	27	11	27	186	0	0
Operating profit	**(265)**	**(378)**	**(572)**	**(206)**	**(69)**	**285**
EBITDA	**(237)**	**(325)**	**(485)**	**(77)**	**99**	**484**
Depreciation	28	54	86	129	168	199
Interest income	33	59	100	110	106	97
Interest expense	0	0	(3)	(13)	(14)	(14)
Net Interest income/(expense)	**33**	**59**	**97**	**97**	**91**	**82**
Foreign exchange gain/loss	(13)	21	(0)	0	0	0
Other income/expense	0	(2)	(0)	0	0	0
Pre-tax profit	**(246)**	**(301)**	**(475)**	**(109)**	**23**	**367**
Income tax	1	0	(1)	(0)	(1)	(55)
Others	(2,211)	(446)	0	0	0	0
Net profit	**(2,456)**	**(747)**	**(476)**	**(109)**	**21**	**312**
Adjusted net profit	**(191)**	**(196)**	**(241)**	**9**	**141**	**435**

BALANCE SHEET	2021A	2022A	2023A	2024E	2025E	2026E
YE 31 Dec (RMB mn)						
Current assets	**3,493**	**3,135**	**4,398**	**4,218**	**4,288**	**4,735**
Cash & equivalents	2,792	1,859	3,141	3,023	2,768	2,738
Account receivables	86	485	525	491	656	901
Inventories	376	647	496	437	598	829
Other current assets	239	144	236	266	266	266
Non-current assets	**322**	**505**	**872**	**1,196**	**1,402**	**1,500**
PP&E	361	589	1,026	1,471	1,835	2,124
Other non-current assets	(40)	(84)	(154)	(275)	(434)	(624)
Total assets	**3,952**	**3,839**	**5,663**	**5,709**	**5,895**	**6,356**
Current liabilities	**892**	**956**	**1,335**	**1,387**	**1,551**	**1,700**
Short-term borrowings	0	0	112	218	218	218
Account payables	77	207	277	222	386	535
Other current liabilities	815	749	947	947	947	947
Non-current liabilities	**10**	**42**	**465**	**456**	**456**	**456**
Long-term borrowings	0	18	286	299	299	299
Other non-current liabilities	10	24	179	157	157	157
Total liabilities	**903**	**998**	**1,800**	**1,843**	**2,008**	**2,157**
Share capital	0	0	7,424	7,537	7,537	7,537
Retained earnings	(2,491)	(3,145)	(3,562)	(3,671)	(3,649)	(3,337)
Other reserves	5,540	5,987	0	0	0	0
Total shareholders equity	**(2,491)**	**(3,145)**	**3,862**	**3,866**	**3,888**	**4,200**
Minority interest	0	0	0	0	0	0
Total equity and liabilities	**3,952**	**3,839**	**5,663**	**5,709**	**5,895**	**6,356**

CASH FLOW	2021A	2022A	2023A	2024E	2025E	2026E
YE 31 Dec (RMB mn)						
Operating						
Profit before taxation	**(2,456)**	**(747)**	**(476)**	**(109)**	**21**	**312**
Depreciation & amortization	28	54	86	129	168	199
Change in working capital	(234)	(540)	181	37	(161)	(327)
Others	2,433	538	266	(51)	0	0
Net cash from operations	**(228)**	**(696)**	**57**	**5**	**28**	**184**
Investing						
Capital expenditure	(282)	(240)	(415)	(355)	(284)	(213)
Acquisition of subsidiaries/ investments	(1,699)	1,360	(622)	0	0	0
Others	0	0	(24)	0	0	0
Net cash from investing	**(1,980)**	**1,120**	**(1,060)**	**(355)**	**(284)**	**(213)**
Financing						
Dividend paid	0	0	0	0	0	0
Net borrowings	1,950	18	377	120	0	0
Share repurchases	454	0	1,225	113	0	0
Others	(1)	(3)	(12)	0	0	0
Net cash from financing	**2,404**	**15**	**1,590**	**232**	**0**	**0**
Net change in cash						

GROWTH	2021A	2022A	2023A	2024E	2025E	2026E
YE 31 Dec						
Revenue	73.5%	66.9%	56.1%	9.8%	61.2%	37.5%
Gross profit	59.8%	23.6%	40.1%	39.3%	45.4%	35.8%
EBITDA	na	na	na	na	na	389.2%
Net profit	na	na	na	na	na	1,351.3%
Adj. net profit	na	na	na	na	1,417.0%	207.9%

PROFITABILITY	2021A	2022A	2023A	2024E	2025E	2026E
YE 31 Dec						
Gross profit margin	53.0%	39.2%	35.2%	44.7%	40.3%	39.8%
Operating margin	(36.8%)	(31.4%)	(30.5%)	(10.0%)	(2.1%)	6.2%
EBITDA margin	(32.9%)	(27.0%)	(25.9%)	(3.7%)	3.0%	10.6%
Adj. net profit margin	(26.4%)	(16.3%)	(12.9%)	0.5%	4.2%	9.5%
Return on equity (ROE)	na	na	(132.7%)	(2.8%)	0.6%	7.7%

GEARING/LIQUIDITY/ACTIVITIES	2021A	2022A	2023A	2024E	2025E	2026E
YE 31 Dec						
Current ratio (x)	3.9	3.3	3.3	3.0	2.8	2.8
Receivable turnover days	36.0	86.6	98.2	87.0	72.0	72.0
Inventory turnover days	283.3	255.5	171.6	140.0	110.0	110.0
Payable turnover days	71.4	70.9	72.6	71.0	71.0	71.0

VALUATION	2021A	2022A	2023A	2024E	2025E	2026E
YE 31 Dec						
P/E	ns	ns	ns	ns	544.8	37.5
P/E (diluted)	ns	ns	ns	ns	589.3	40.6

Source: Company data, CMBIGM estimates. Note: The calculation of net cash includes financial assets.

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