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Independent Market Research on Global Optical and Wireless Connectivity Devices Industry

CIG

2025

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For and on behalf of Frost & Sullivan (Beijing) Inc., Shanghai Branch Co.

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Agenda

Overview of Global ICT and Connectivity

Global ICT and Connectivity Overview

The global information and communications technology (ICT) and telecommunications sectors are undergoing continuous development, driven by ongoing digital transformation, infrastructure upgrades, and growing user demand. In 2024, total global ICT investment exceeds USD5 trillion and is projected to surpass USD7 trillion by 2029, representing a CAGR of approximately 7% over the period. The global number of internet users has reached 5.5 billion people in 2024 and is projected to exceed 6 billion people by 2029, reflecting sustained global connectivity growth. These trends signal a strong foundation for the continued expansion of digital services and the increased deployment of advanced ICT infrastructure.

Meanwhile, AI technologies are accelerating the upgrade of ICT industry, unlocking new development opportunities across a wide range of sectors. AI demands massive computing power, high-speed connectivity, and low-latency data processing, which in turn is accelerating the upgrade and expansion of ICT infrastructure. This includes advancements in data centers, communication networks and data transmission systems, all of which are becoming more intelligent, efficient and scalable to support AI workloads. The AI market is projected to exceed USD3,000 billion by 2029, with a CAGR of 37.8% from 2024. Major global tech companies are expected to invest more than USD400 billion over the next three years in developing AI infrastructure, including compute power, storage systems, and data center capacity. As a result, the number of global data center racks, critical for supporting AI workloads, is forecasted to reach 139.8 million units by 2029, growing at a CAGR of 32.8% from 2024. The rapid development of AI technologies is not only transforming end-user applications but also fundamentally reshaping the ICT industry.

In addition, as bandwidth demands surge across sectors, from cloud computing and video streaming to industrial automation and smart cities, there is growing demand for high-performance connectivity equipment capable of supporting large-scale, real-time data transmission. This need is further intensified by the rise of edge computing, 5G networks, and the widespread adoption of data-intensive applications across various sectors. Advanced connectivity solutions have become fundamental components of modern infrastructure, enabling efficient communication between devices, users, and platforms. Meanwhile, the rapid proliferation of intelligent applications is fueled by the continued expansion of the Internet of Things (IoT), which serves as a key bridge between the physical and digital worlds in areas such as smart manufacturing, intelligent transportation, and energy management. The number of global IoT connections is projected to reach 71.8 billion by 2029, with a CAGR of 30.8% from 2024. As end-user devices become more intelligent and interconnected, demand continues to rise for faster, more robust connectivity to support high-frequency interaction and real-time responsiveness.

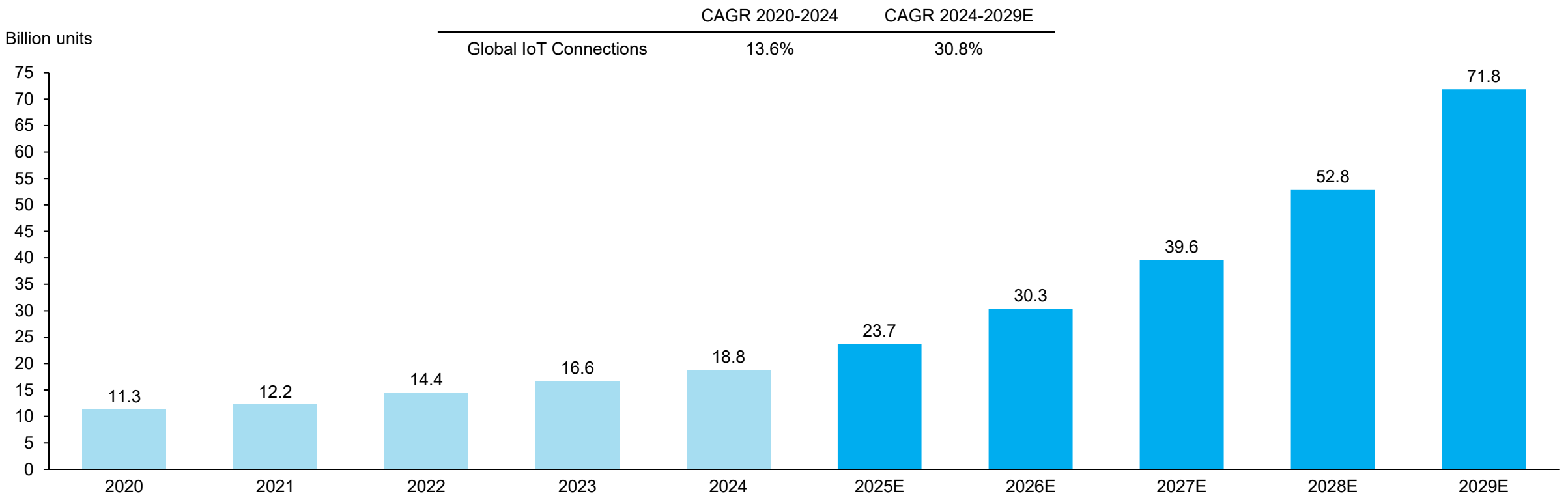
In this context, the development of wired broadband and wireless access products will be critical to supporting the increasingly data-driven and intelligent global economy. The convergence of ICT infrastructure upgrades, growing network traffic, AI workloads, and IoT expansion is creating strong momentum for high-performance connectivity technologies, reinforcing their strategic role in the next stage of digital and industrial transformation.

Source: Frost & Sullivan

Overview of Global ICT and Connectivity

Global Relevant Macro Data (1/6)

Number of IoT Connections (Global), 2020-2029E



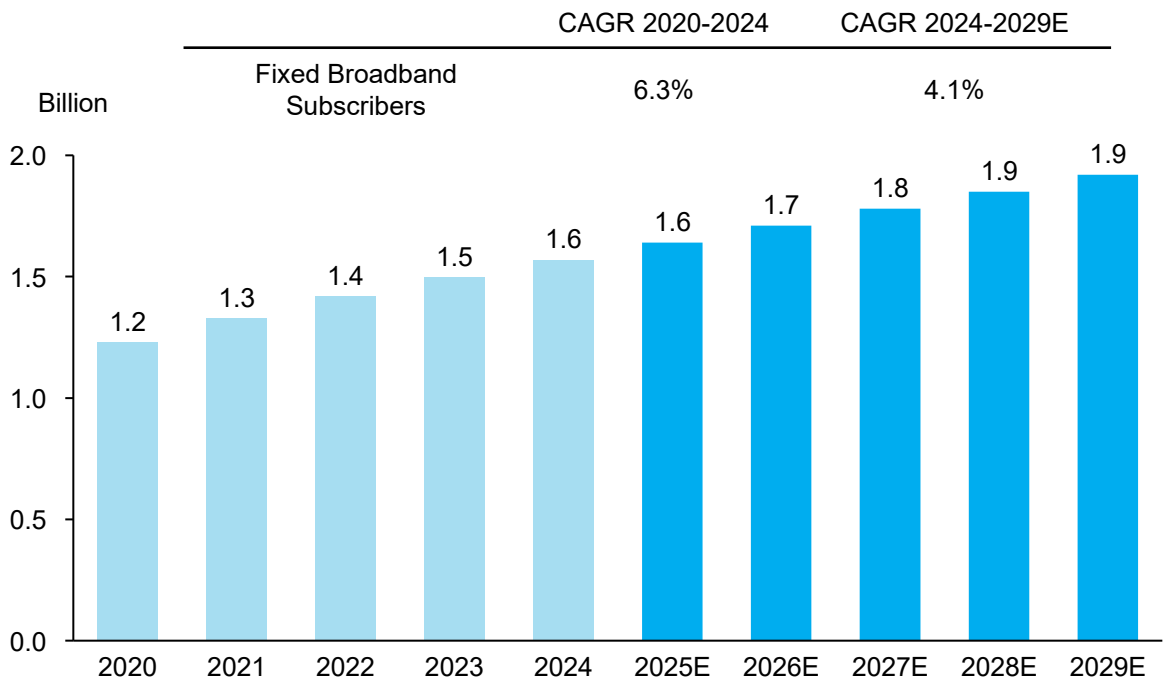
- The global number of IoT connections is growing rapidly, driven by expanding market demand and increasingly diverse industry applications. IoT is gradually becoming a key pillar of digital transformation. This trend is primarily fueled by several factors, including advancements in 5G and communication technologies that enhance connectivity and data transmission efficiency for IoT devices, as well as the widespread adoption of smart devices and sensors, which lower the access barrier for users. The number of global IoT connections grew from 11.3 billion units in 2020 to 18.8 billion units in 2024, with a CAGR of 13.6%. With the ongoing development of 5G, big data, artificial intelligence, cloud computing and other technologies, the connectivity, data processing capacity and intelligence of IoT devices are expected to increase significantly. It is projected that the number of global IoT connections will reach 71.8 billion units by 2029, with a CAGR of 30.8% from 2024.

Source: IOT, Frost & Sullivan

Overview of Global ICT and Connectivity

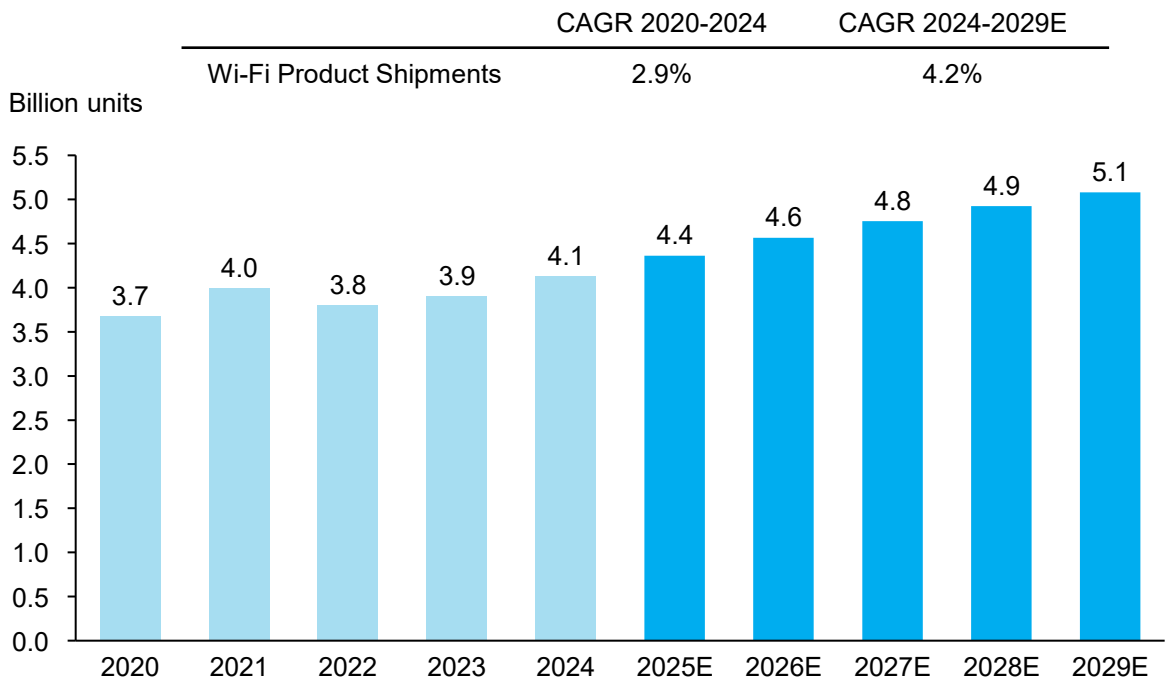
Global Relevant Macro Data (2/6)

Number of Fixed Broadband Subscribers (Global), 2020-2029E



- Fixed broadband remains the primary method of global internet connectivity, particularly in home and business environments. The number of global fixed broadband subscribers grows from 1.2 billion in 2020 to approximately 1.6 billion in 2024, representing a CAGR of 6.3%. The number of fixed broadband subscribers will continue to grow in the coming years, reaching 1.9 billion in 2029, with a CAGR of 4.1% from 2024, especially in developing countries where fiber-to-the-home (FTTH) penetration is increasing.

Number of Wi-Fi Product Shipments (Global), 2020-2029E



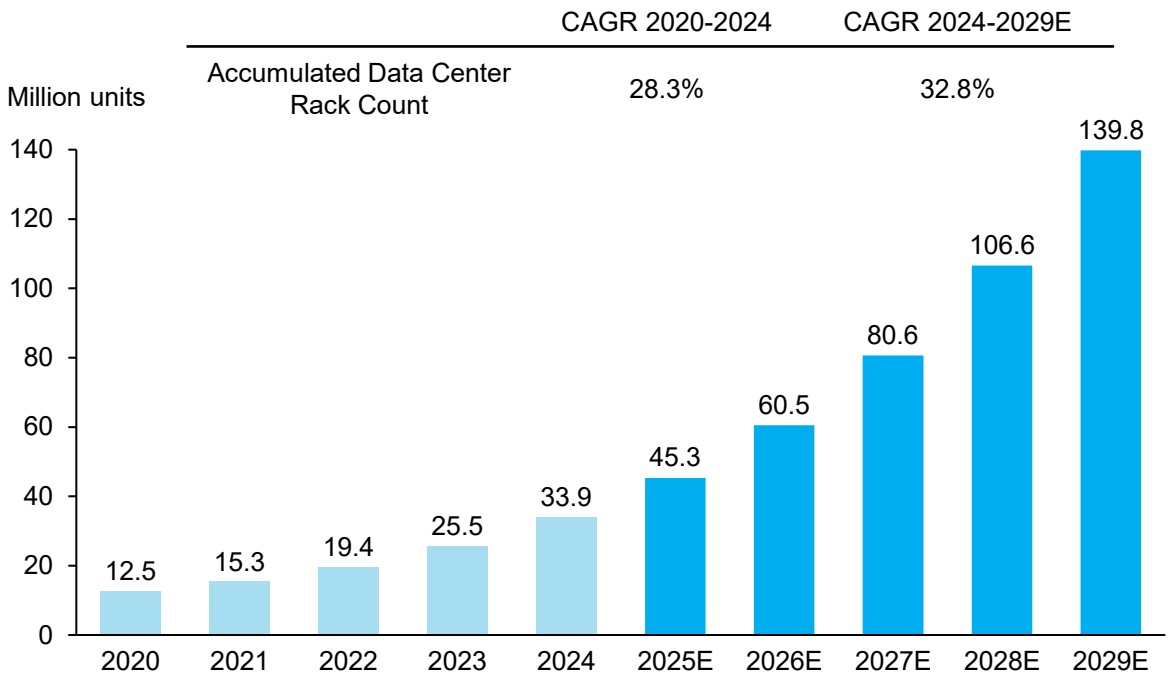
- Wi-Fi has become one of the most important wireless access technologies worldwide. With the development of new technologies such as Wi-Fi 6 and Wi-Fi 7, the application of Wi-Fi in enterprise and industrial IoT sectors is expected to expand further. In 2024, global Wi-Fi product shipments reached 4.1 billion units, with a CAGR of 2.9% from 2020. In the coming years, global Wi-Fi product shipments are expected to reach 5.1 billion units in 2029, driven in part by the widespread adoption of IoT devices and AI technology, which is expected to accelerate the Wi-Fi market's growth.

Source: ITU, IDC, Frost & Sullivan

Overview of Global ICT and Connectivity

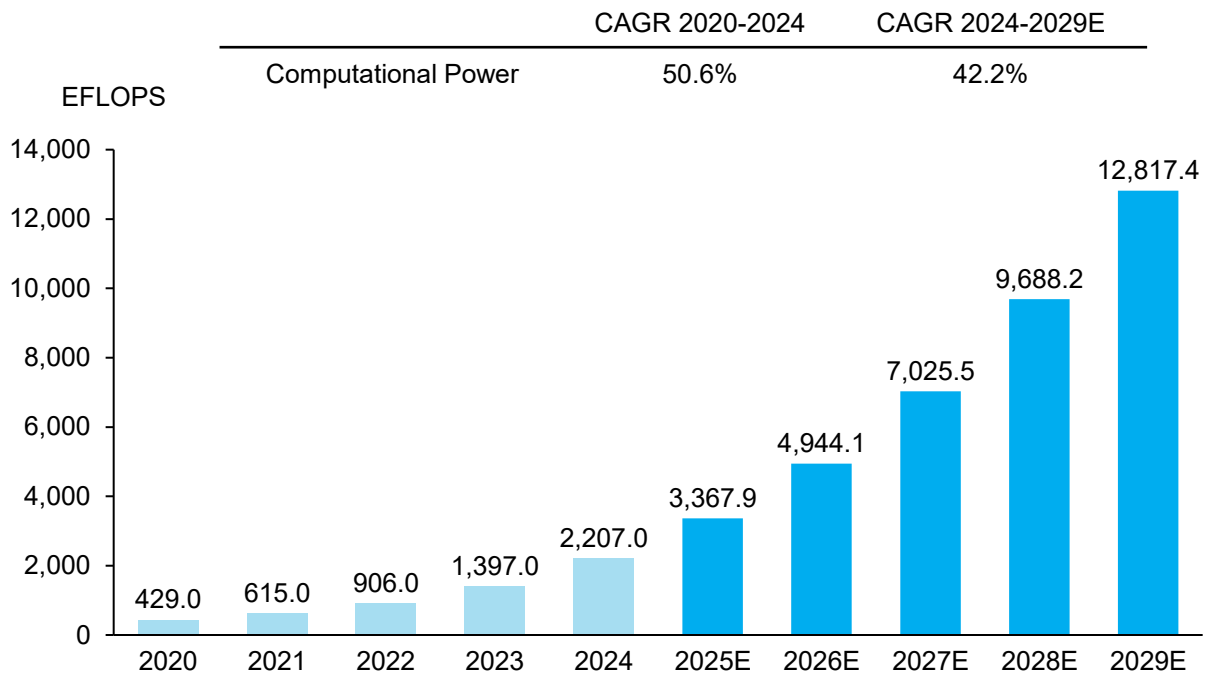
Global Relevant Macro Data (3/6)

Number of Accumulated Data Center Rack (Global), 2020-2029E



- With the emergence of high-performance computing, AI and cloud services, the demand for efficient and scalable data center infrastructure has surged. The number of global data center racks increased from 12.5 million units in 2020 to 33.9 million units in 2024, representing a CAGR of 28.3%. Driven by factors such as the increasing need for AI computing and the ongoing expansion of cloud computing, the global data center market is expected to continue expanding at a CAGR of 32.8% from 2024 to 2029, with the number of global data center racks reaching 139.8 million units in 2029.

Computational Power Scale (Global), 2020-2029E



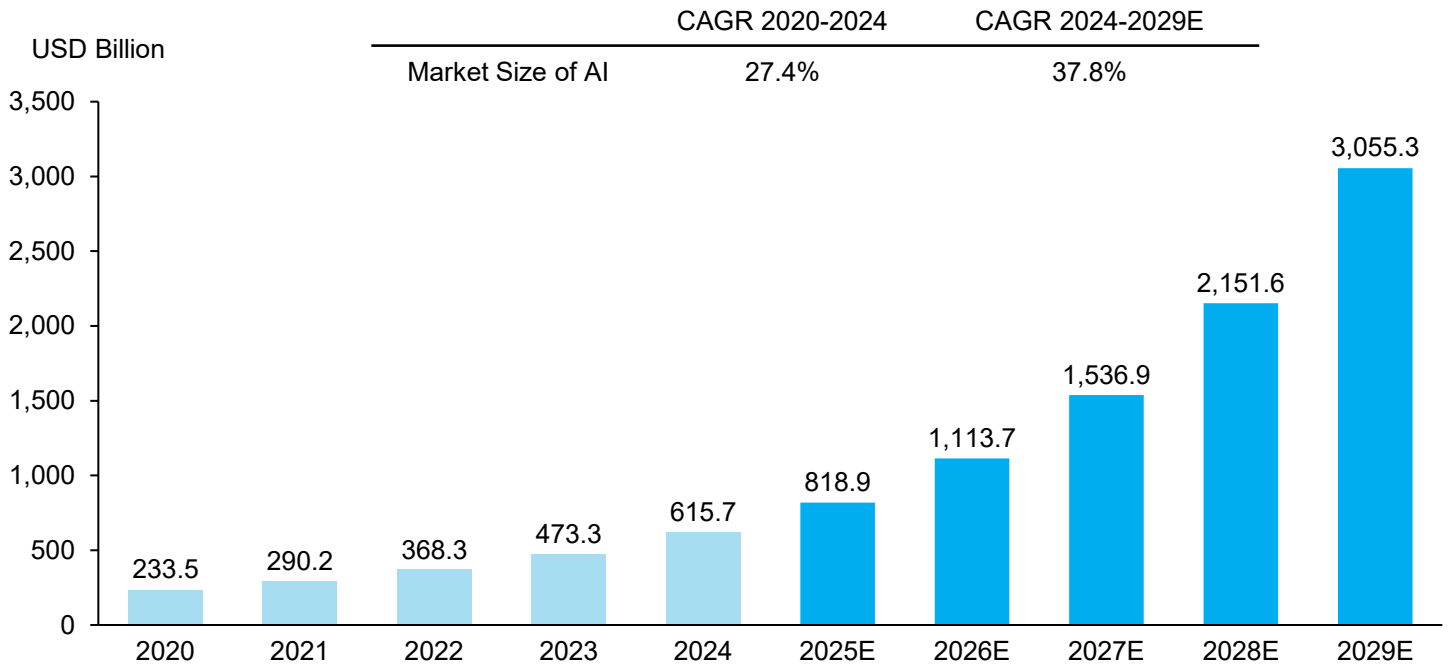
- The rapid development of artificial intelligence is being driven by the increasing demand for computational power. The acceleration of digitalization and the high-end, intelligent transformation of various industries are fueling both development and competition, while the global computing scale is expanding at a rapid pace. The global computational power scale increased from 429.0 EFLOPS in 2020 to 2,207.0 EFLOPS in 2024, with a CAGR of 50.6%. In the future, as the popularization of AI technology, big data analytics and meta-universe, it is expected that the global computational power scale will further reach approximately 12,817.4 EFLOPS in 2029.

Source: CAICT, Frost & Sullivan.

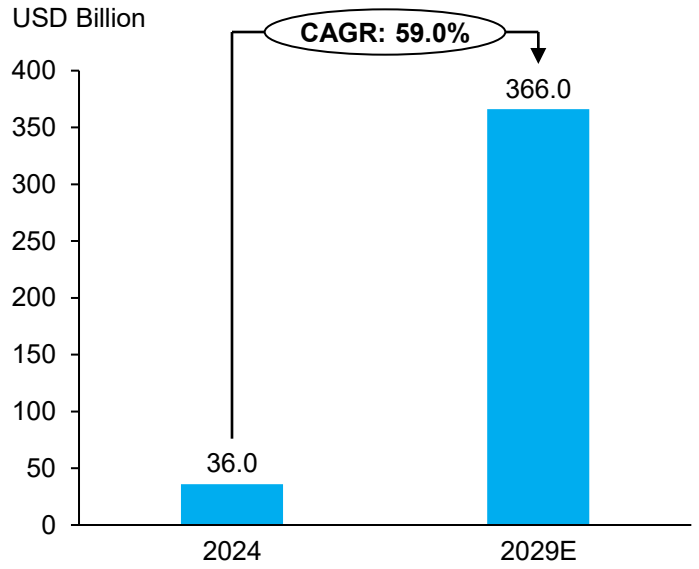
Overview of Global ICT and Connectivity

Global Relevant Macro Data (4/6)

Market Size of AI (Global), 2020-2029E



Market Size of Generative AI, 2024 and 2029E



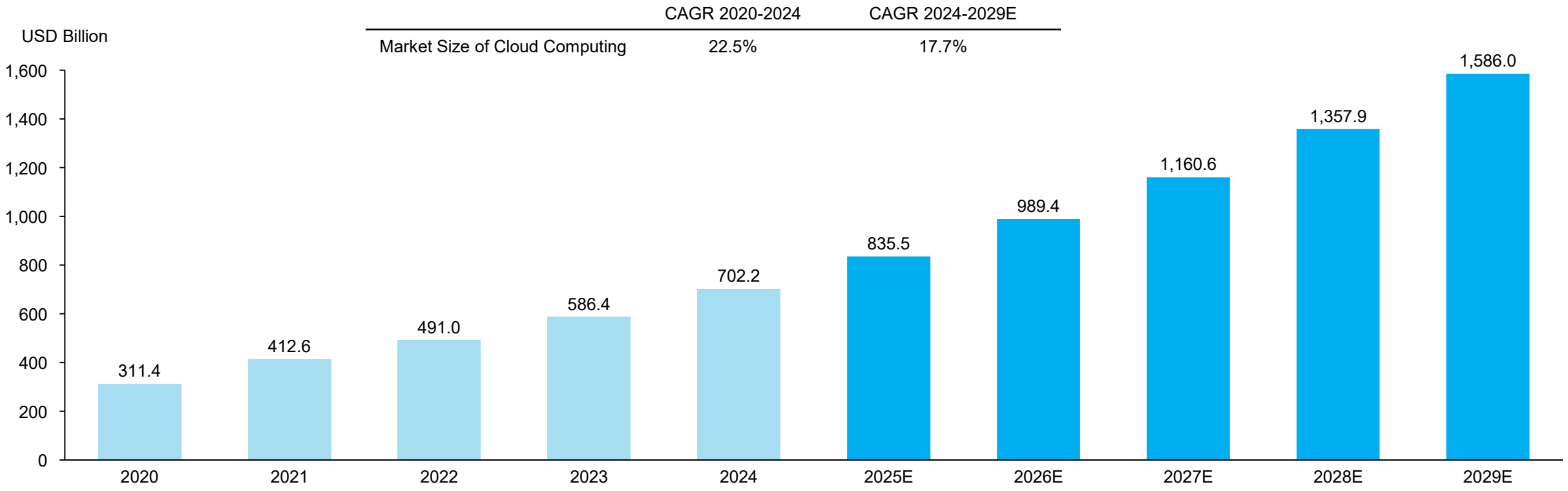
- Driven by technological breakthrough, the global AI market has entered a high growth phase, growing from USD233.5 billion in 2020 to USD615.7 billion in 2024, with a CAGR of 27.4%. AI technology is currently widely applied across various fields and is deeply integrated with technologies such as cloud computing, big data and the IoT. Looking forward, the global AI market is expected to exceed USD3,000 billion in 2029, with a CAGR of 37.8% from 2024 to 2029.
- Generative AI has emerged as one of the most significant breakthroughs in recent years. Powered by the development of pretrained large language models, generative AI can autonomously create content across various formats, including text, images, videos, music and code. The global generative AI market reached approximately USD36.0 billion in 2024, and is expected to grow to USD366.0 billion in 2029, representing a CAGR of 59.0% from 2024.

Source: Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Global ICT and Connectivity

Global Relevant Macro Data (5/6)

Market Size of Cloud Computing (Global), 2020-2029E



- The new generation of AI technology is accelerating the development of cloud computing and the integration of AI with cloud services is poised to significantly influence the growth trajectory and development model of the cloud computing industry. The global cloud computing market grew from USD311.4 billion in 2020 to USD702.2 billion in 2024, representing a CAGR of 22.5%. Cloud services are increasingly extending beyond the Internet sector, with governments, public administrations and enterprises across various industries embracing cloud solutions. Many are transitioning from traditional self-built IT infrastructures to public or hybrid cloud services. The market is expected to continue its steady growth, driven by the rising demand for large models, computational power and other factors, with the global cloud computing market projected to reach USD1,586.0 billion in 2029.

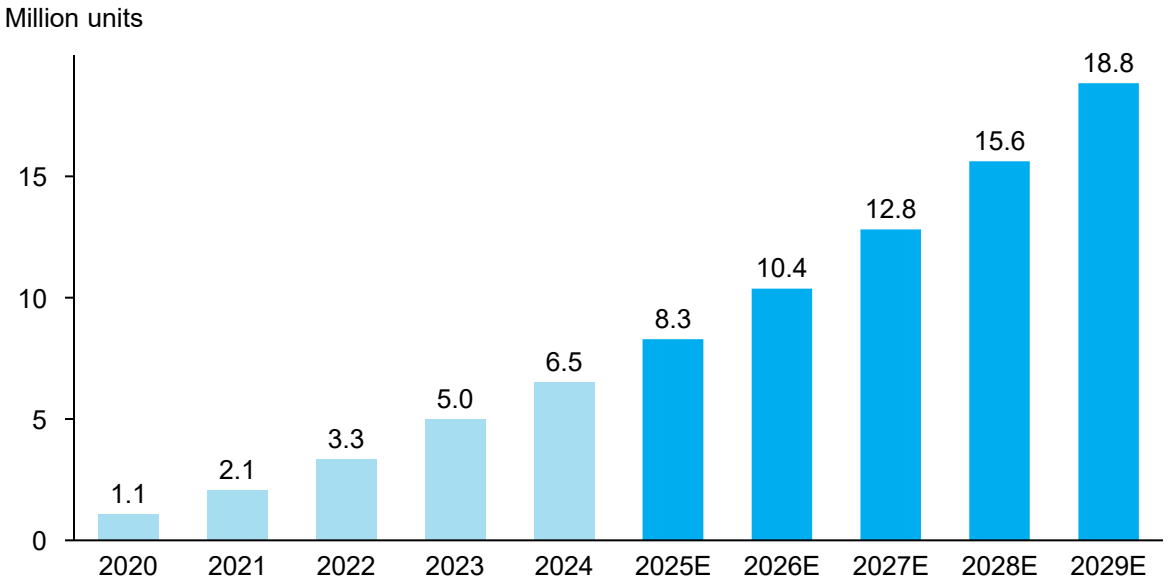
Source: CAICT&Gartner, Frost & Sullivan

Overview of Global ICT and Connectivity

Global Relevant Macro Data (6/6)

Number of 5G base station (Global), 2020-2029E

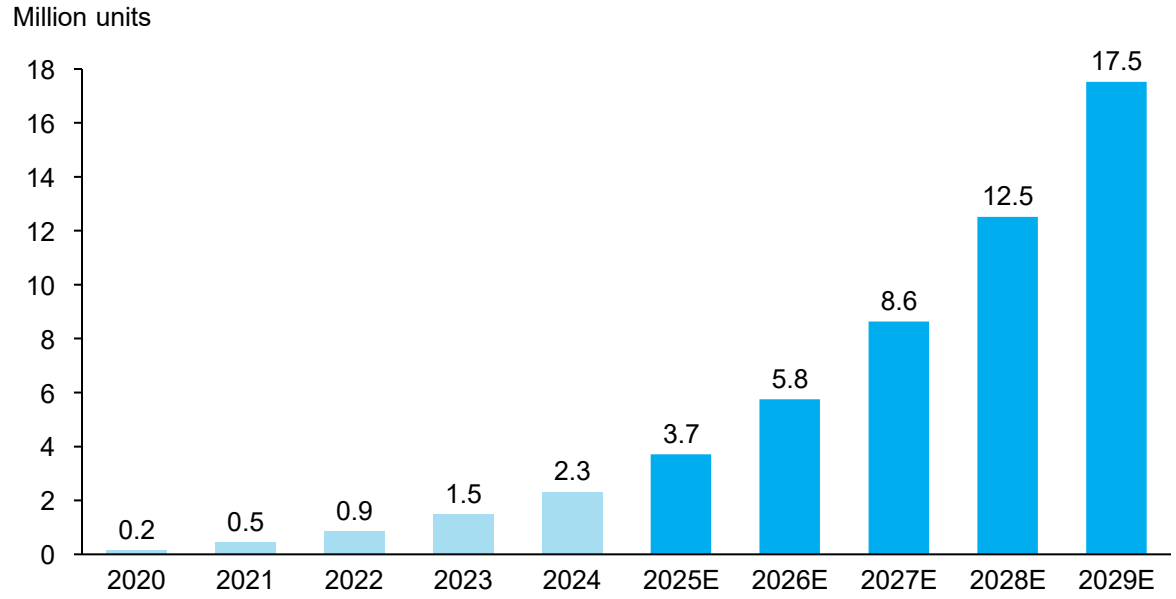
	CAGR 2020-2024	CAGR 2024-2029E
5G Base Station	56.5%	23.6%



- 5G base station is the core equipment of 5G network, with the rapid development of 5G technology, countries accelerate the construction and deployment of 5G base station to achieve the large-scale application of 5G network. In 2020, the number of 5G base station was 1.1 million units. By the end of 2024, the amount of global 5G base station reached 6.5 million units, representing a CAGR of 56.5% from 2020 to 2024. In the future, the total number of 5G base stations is expected to maintain a steady increase, reaching 18.8 million units in 2029, covering a wider area and providing more stable network connectivity.

Number of 5G small base station (Global), 2020-2029E

	CAGR 2020-2024	CAGR 2024-2029E
5G Small Base Station	98.3%	49.8%



- 5G small base station is an important part of 5G networks, especially suitable for high-density population areas, with low power consumption, flexible deployment, high bandwidth and low latency, which can optimize the indoor coverage of 5G networks and reduce the load of macro base stations. The number of 5G small base station increased from 0.2 million units in 2020 to 2.3 million units in 2024, with a CAGR of approximately 98.3%. It is expected that in 2029, the number of small base station deployments will exceed 17.5 million units, becoming an important supplement to 5G networks.

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Source: BAIINFO, Interviews with Industry Experts by Frost & Sullivan, Frost & Sullivan

Agenda

Overview of Global Optical and Wireless Connectivity Devices Industry

Overview of Optical and Wireless Connectivity Devices (OWCD) Industry

Overview of OWCD Industry

- OWCDs refer to a comprehensive suite of devices supporting critical stages across the optical communication and wireless networking industry, which mainly include 1) photonic (optical transceivers/ optical modules), 2) wired broadband access devices, and 3) wireless network access devices. OWCDs enable high-speed, low-latency and high-bandwidth transmission of data and computing power, playing a pivotal role in supporting the broader ICT ecosystem. OWCDs ensure reliable connectivity across core networks, edge nodes, and end-user environments. As AI technologies become increasingly integrated into the ICT ecosystem, OWCDs play a foundational role in AI infrastructure, facilitating the efficient distribution and exchange of computing power and data within and between computational clusters, as well as from computational clusters to end users, thereby driving industry innovation and transformation through enhanced connectivity and communication capabilities..

- Integrated OWCD companies are companies that specialize in the production of at least two sectors within the OWCD category. Their comprehensive product portfolios are designed to meet the needs of downstream customers, such as ICT equipment providers, communication service providers, technology companies and IoT solutions providers. The products from these companies are primarily integrated into the solutions delivered by their customers to the end-users, or directly incorporated into their own data communication infrastructure, such as data centers. Integrated OWCD companies mainly collaborate with their customers through ODM (Original Design Manufacturer) and/or JDM (Joint Design Manufacturer) models, ensuring tailored solutions that align with specific customer requirements.

- Integrated OWCD companies are becoming more common in the industry, leveraging the synergy between photonic and wired broadband access devices (for optical communication) and wireless network access devices (for wireless communication), which are essential and closely interconnected components of modern communication networks. Most integrated OWCD companies operate across two of these three segments. In 2024, the market size of integrated OWCD companies as a percentage of the overall OWCD industry reached 22.6%.

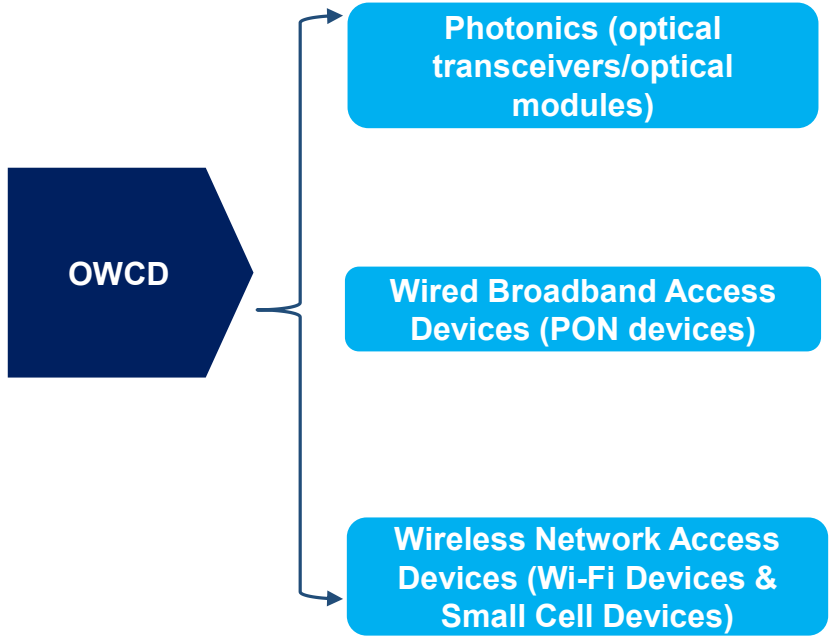
- Integrated OWCD companies with full-sector coverage are those engaged across all three sectors within the OWCD category. Only a few companies meet this criterion, setting themselves apart with uniquely comprehensive portfolios. Their broad capabilities position them to deliver highly customized solutions tailored to the diverse and evolving needs of downstream customers. In 2024, the market size of full-sector coverage integrated OWCD companies as a percentage of the overall OWCD industry was below 10.0%.

Source: Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Overview of Optical and Wireless Connectivity Devices (OWCD) Industry

Introduction of Optical and Wireless Connectivity Devices



Photonics are optoelectronic devices that realize the conversion between optical and electrical signals, enabling high-level fiber optic data transmission, which is crucial for connecting switches, routers and servers within data centers and telecommunication networks. As AI continues to evolve, the increasing data processing and network requirements make photonics indispensable for ensuring seamless data flow and connectivity between internal systems and external networks

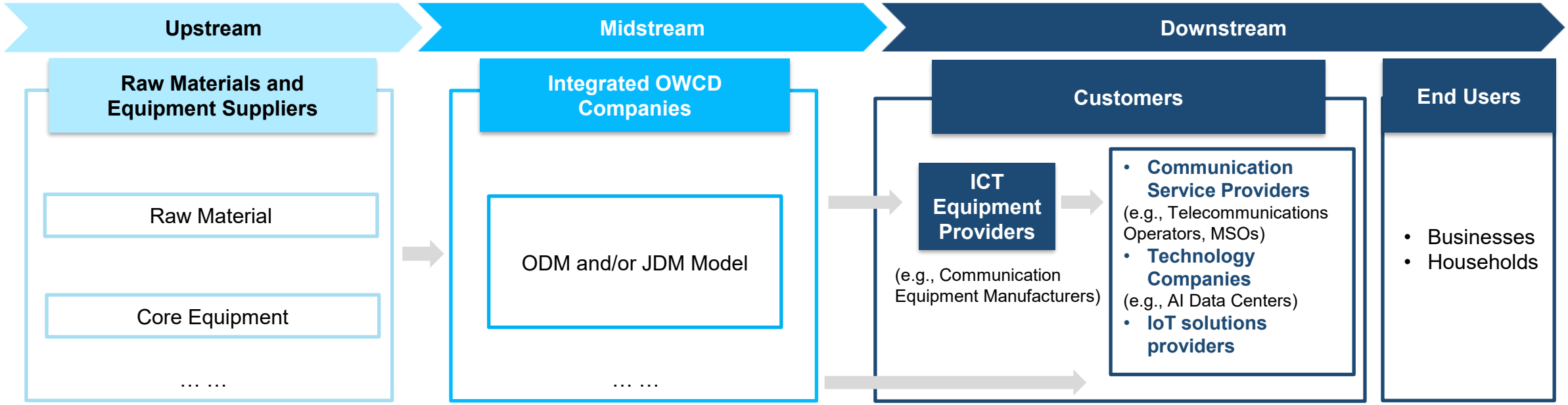
PON devices provide efficient broadband access and stable connections, offering a reliable network infrastructure essential for supporting AI-driven applications. A PON device, which uses a point-to-multipoint architecture where a single optical fiber serves multiple locations through passive, unpowered optical splitters, ensures seamless operation of AI technologies by delivering high-quality, uninterrupted connectivity to residential, commercial and industrial premises

Wi-Fi devices provide broader network coverage, helping enterprises and individuals globally connect to computational clusters. They enhance high-speed interconnection and wide coverage, both between the computational clusters and end users, as well as within the user premises. Small cell devices are essential for enabling AI applications in high-density areas by offering low-latency and high-bandwidth network support. They facilitate real-time data transmission and processing for critical applications such as smart city, autonomous driving and industrial IoT, etc

Source: Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Value Chain Analysis



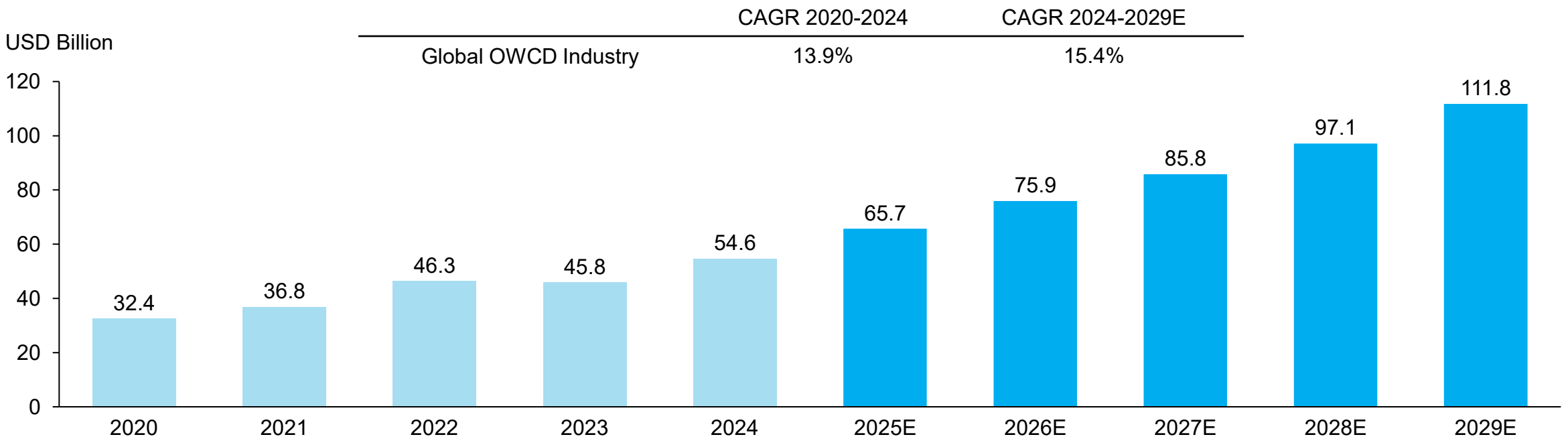
- The integrated OWCD industry chain includes upstream suppliers of key raw materials (e.g., optical devices, integrated circuit chips, structural components, PCBs) and specialized equipment (e.g., coating machines and inspection tools) crucial for manufacturing photonics and network access devices. Midstream, integrated OWCD companies produce a variety of products across multiple categories, often through ODM or JDM models, to meet the customized needs of customers. Downstream players then incorporate these products into their solutions or data communication infrastructures, ultimately enhancing communication experiences for business and household end-users.

Source: Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Market Size of OWCD Industry

Sales Revenue of OWCD Industry (Global), 2020-2029E



- From 2020 to 2024, the global sales revenue of OWCD industry has increased from USD32.4 billion to USD54.6 billion with a CAGR of 13.9%. The accelerating trend and intelligent transformation, coupled with favorable policies from various countries, have led the OWCD industry to undergo technological innovation and industrial upgrade. Thus, due to the accelerated iteration and evolving frontier technologies, the global sales revenue of OWCD industry is expected to reach USD111.8 billion in 2029, representing a CAGR of 15.4% from 2024.

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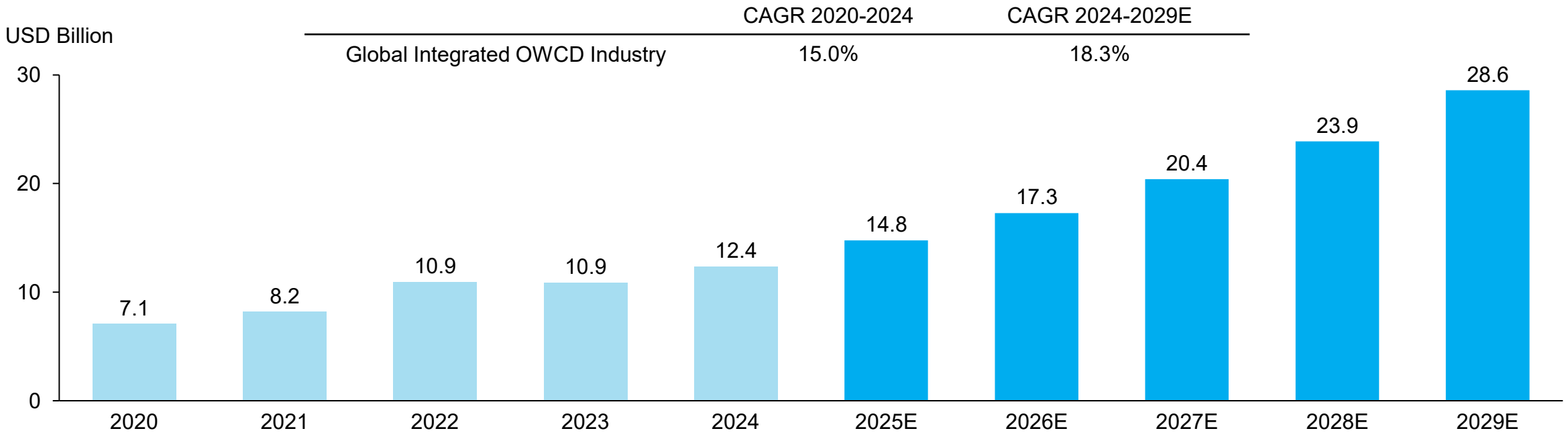
Source: Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Market Size of Integrated OWCD Industry

Sales Revenue of Integrated OWCD Industry (Global), 2020-2029E



- From 2020 to 2024, the global sales revenue of integrated OWCD industry has increased from USD7.1 billion to USD12.4 billion with a CAGR of 15.0%. Leading companies in the OWCD industry are well-positioned to drive market expansion by offering a comprehensive portfolio of advanced photonic components, PON devices, and wireless network access equipment. This diversified offering supports the rapid development of the global integrated OWCD industry. As customer demand grows for one-stop, composite suppliers, integrated OWCD providers are expected to become increasingly attractive to customers in the future. The global sales revenue of integrated OWCD industry is expected to reach USD28.6 billion in 2029, representing a CAGR of 18.3% from 2024, surpassing that of global OWCD industry in the same period.

Source: Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Market Drivers and Developing Trends Analysis (1/3)

Digital Transformation

- The rapid rise in demand for high-bandwidth, low-latency networks in both enterprise and residential settings is driving increased deployment density and performance upgrades of wired broadband access and wireless network access devices. As enterprises accelerate digital transformation, industrial parks and office buildings are placing higher demands on efficient access and stable multi-device connectivity. On the residential side, the proliferation of HD video conferencing, online education, 4K/8K streaming, AR/VR applications, and smart home devices is reshaping network infrastructure needs, challenging the concurrent processing capabilities of access devices. The boom of AIGC and other AI technologies is rapidly advancing the AI industry. Meanwhile, the increasing adoption of AI-driven applications such as AIGC is further amplifying the demand for robust and responsive network environments. In January 2025, a China-based AI LLM company launched an open-source lightweight AI large model, significantly enhancing the accessibility of AI technologies, thereby promoting the widespread adoption of AI technology. With major AI models in China and the United States reaching tens of millions of daily active users and global computational power projected to grow at a CAGR of 42.2% from 2024 to 2029, higher-performance, more reliable OWCDs are becoming key to ensuring wide coverage, stable connectivity and real-time data transmission in increasingly complex usage scenarios.

Continuous FTTx Deployment

- The number of fixed broadband subscribers worldwide has increased from 1.2 billion households in 2020 to approximately 1.6 billion households in 2024, representing a CAGR of 6.3%. As major countries and regions around the world prioritize broadband infrastructure as a key area of strategic investment, the construction of FTTx networks continues to gain momentum, significantly driving the demand for PON devices. For example, China is actively advancing the “Gigabit Optical Network” initiative and the “Eastern Data, Western Computing” project, aiming to achieve universal gigabit access capabilities by 2025. In addition, in January 2025, the Ministry of Industry and Information Technology (MIIT) issued a notice on launching 10G optical network pilot programs, focusing on scenarios such as residential communities, factories, and industrial parks. These pilots will enable the deployment of advanced optical network technologies such as 50G-PON ultra-broadband access and FTTH (Fiber to the Home)/FTTR (Fiber to the Room). In the United States, the Infrastructure Investment and Jobs Act passed in 2021 allocated USD1.2 trillion for various infrastructure projects, including USD65 billion specifically for improving broadband access and quality. Similarly, in 2021, the European Union released the “2030 Digital Compass: the European way for the Digital Decade” plan, aiming to ensure gigabit network coverage for all households by 2030. Under the strong policy push across the globe, telecom operators are expected to continue expanding the coverage of PON networks, thereby generating sustained demand for the procurement and replacement of PON devices. The number of fixed broadband subscribers worldwide is expected to reach 1.9 billion households by 2029.

Source: U.S. Government, National Development and Reform Commission, Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Market Drivers and Developing Trends Analysis (2/3)

Advanced PON Technologies

- With the acceleration of global digital transformation and the development of emerging technologies, advanced PON technology meets the urgent need for higher bandwidth and lower latency in the market. 10G PON technology has become the mainstream solution for telecommunications operators to deploy gigabit networks and meet the growing demand for broadband. At the same time, with the accelerated application of emerging technologies such as digitalization, AI and IoT, the industry's demand for higher bandwidth and greater data processing capabilities has increased significantly, driving the emergence of 25G/50G PON technology. Compared with 10G PON, 25G/50G PON can provide higher bandwidth, lower latency and stronger network scalability, better meeting the high-speed data transmission needs of scenarios such as data centers, cloud computing and intelligent manufacturing. It is expected that with the continuous maturity of technology and the gradual release of market demand, 25G/50G PON products will achieve larger-scale deployment in the near term, with 100G PON and beyond emerging as longer-term trends.

Upgrade of Wireless Network Technology

- With the emergence of Wi-Fi 7 (IEEE 802.11be), the communication device industry will experience a new round of revolution in wireless connection technology. Wi-Fi 7 offers higher data transmission rates, lower latency and improved spectrum efficiency, making it better suited to support data-intensive applications. In both enterprise and home environments, Wi-Fi 7 deployment will significantly enhance the stability, speed and coverage of wireless networks, enabling multiple devices to connect simultaneously without compromising performance. Wi-Fi 7 ensures a smoother user experience, addressing the need for high concurrency, low latency and high bandwidth. In addition, with the rise of emerging technologies such as 5G, edge computing and AI, the demands on wireless networks are becoming more complex and varied. The introduction of Wi-Fi 7 will not only meet these evolving needs but also accelerate the widespread adoption and expansion of wireless connectivity technology. Meanwhile, advanced research into Wi-Fi 8 is already underway, aiming to further push the limits of wireless performance in the future.

Proliferation of data centers fueling accelerated iteration of high-speed photonics demand

- Governments worldwide are introducing policies to support data center development. In the United States, the Stargate Project announced in January 2025 plans to invest USD500 billion over four years in new AI infrastructure. Similarly, China has issued policies such as the "Guidance on the Construction of National Data Infrastructure" to accelerate the construction of data infrastructure. With the rapid development of cloud computing, global data centers are entering a stage of large-scale commercialization. The cumulative volume of data center racks is projected to reach 139.8 million units by 2029 at a CAGR of 32.8% from 2024. Thus, the photonics industry is undergoing rapid technological advancement and product iteration. High-speed photonics — such as 400G, 800G — offer greater bandwidth, lower latency, and higher efficiency, making them critical for interconnecting devices in and across data centers. Meanwhile, the next generation of 1.6T high-speed photonics is also undergoing accelerated research and development, with an expected mass production around 2026. As data demands grow, high-speed photonics will see increasing adoption in datacom applications, driving the accelerated iteration in the OWCD industry.

Source: U.S. Government, National Development and Reform Commission, Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Market Drivers and Developing Trends Analysis (3/3)

Evolving of Frontier Technologies in Photonics

- Driven by downstream demand, companies in the photonics industry are actively strengthening the R&D of new technologies. Below introduce the leading frontier technologies in the photonics industry:
- Silicon photonics technology uses existing CMOS processes to develop and integrate optical devices and photonics. Photonics integrating silicon photonic elements are expected to occupy a mainstream position in the future due to their advantages of high integration and low power consumption.
- Innovative packaging technologies such as LPO (Linear-drive Pluggable Optics), by removing the DSP (Digital Signal Processor), can significantly optimize the power consumption of photonics. CPO (Co-Packaged Optics) technology, by co-packaging optical engine and switching chip on the same motherboard, can effectively reduce energy consumption and improve electrical signal transmission efficiency.
- Liquid-cooled photonics technology, through a unique liquid-cooled heat dissipation design, effectively improves heat dissipation efficiency and module stability.

Source: U.S. Government, National Development and Reform Commission, Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Market Model Analysis (1/2)

Integrated OWCD companies mainly collaborate with their customers through ODM and/or JDM models. In terms of manufacturing, contract manufacturing (CM) and co-location manufacturing model are two models primarily adopted by these companies in addition to in-house manufacturing. The following are analyses of the major business models:

JDM vs. ODM

- Different from ODM model, JDM emphasizes collaboration at each stage from product concept to final manufacture, allowing for high customization and innovation. It requires significant collaboration and close communication, particularly in design and development while ODM operates with more independent, streamlined approach, where integrated OWCD companies handles most of the design, development and manufacturing. Thus, JDM is resource-intensive and demands significant financial and operational capabilities as it involves extensive collaboration and customization, where companies with multiple large-scale customers are able to afford to make such investments. The table below represents the comparison between JDM and ODM models as follows:

	JDM		ODM	
Stage	**Customer Involvement**	**Description**	**Customer Involvement**	**Description**
Software Development		Joint involvement of customers: Collaborative design and development with the customer		No material involvement of customers: Integrated OWCD company handles software design independently
Hardware Development		Joint involvement of customers: Collaborative efforts with the customer to design hardware		No material involvement of customers: Integrated OWCD company handles hardware development independently
New Production Introduction /Prototype /Testing		Joint involvement of customers: Joint efforts in prototyping, testing and ensuring quality		No material involvement of customers: Integrated OWCD company independently creates prototypes and conducts testing
Manufacture		Joint involvement of customers: Manufacturing occurs in close collaboration with the customer		No material involvement of customers: Manufacturing is handled independently by the integrated OWCD company
Sales		Full involvement of customers: Customer is leading the sales and marketing activities		Customer is leading sales and marketing activities of the customized products, while integrated OWCD company may promote the standard products under separate branding

Source: Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Market Model Analysis (2/2)

- The CM model is typically more focused on large-scale contract manufacturing. Compared with CM model, co-location manufacturing offers a flexible, integrated approach, which has become a manufacturing model commonly used in the industry. Under this model, companies typically retain control over core elements such as product design, key materials, key equipment, and overall management, while local partners are responsible for manufacturing operations, labor, and compliance with local regulations. This model supports consistent global quality standards, enhances supply chain responsiveness, and improves cost efficiency. By leveraging local expertise, it also helps mitigate geopolitical risks and facilitates agile capacity deployment with relatively low capital investment, making it a widely adopted option among integrated OWCD companies. The table below represents the comparison between CM and co-location manufacturing models as follows:

Contract Manufacturing (CM） vs. Co-location Manufacturing Model

Criteria	CM	Co-location Manufacturing
Process Design	Developed and owned by the manufacturing partner	Developed and owned by integrated OWCD company, transferred to its manufacturing partner
Manufacturing and Testing Process Intellectual Property	Belongs to the manufacturing partner	Belongs to integrated OWCD company
Production, Labor and Facilities	Handled by the manufacturing partner	Handled by the manufacturing partner in compliance with established procedures and protocols of integrated OWCD company
Raw Material Procurement	Procured by the manufacturing partner	Integrated OWCD company provides core raw materials
Equipment	Provided by the manufacturing partner	Integrated OWCD company provides core equipment
Production Quality Control	Supervised and managed by the manufacturing partner	Supervised and managed by personnel assigned by integrated OWCD company

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Source: Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Policies and Regulations

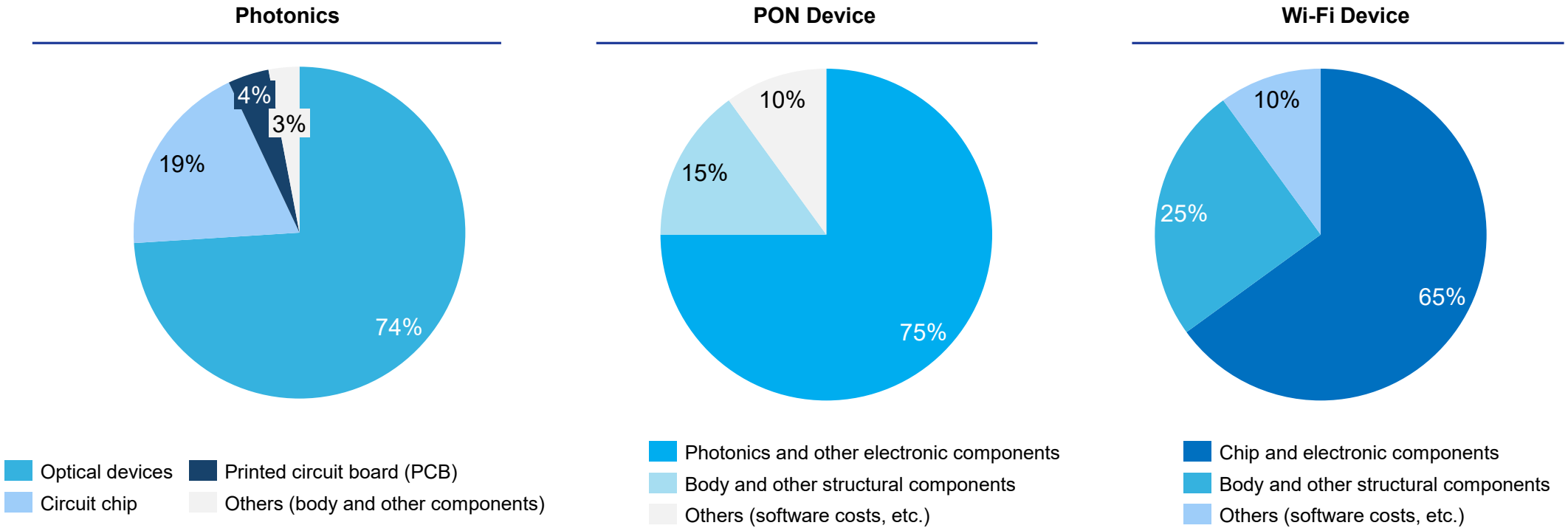
Policies / Plans	Release Date	Issuing Agency / Country	Content
The Stargate Project	2025.1	The U.S.	The Stargate Project is a new company which intends to invest USD500 billion over the next four years building new AI infrastructure for OpenAI in the U.S.. The country plans to deploy USD100 billion. This infrastructure will secure American leadership in AI, create hundreds of thousands of American jobs and generate massive economic benefit for the entire world. This project will not only support the re-industrialization of the U.S. but also provide a strategic capability to protect the national security of America and its allies.
Bipartisan House Task Force Report on AI	2024.12	The 118th Congress	This report enforces to promote AI Innovation, specifies the US federal government leadership in responsible use of AI, sector-specific policies, etc. This report make recommendations on multiple tasks including taking an information and systems-level approach to the use of AI in the federal government, support flexible governance of AI industry, requiring that agencies provide notification of AI's role in governmental functions, facilitating and adopting AI standards for federal government use, supporting NIST in developing guidelines for federal AI systems, strengthening the understanding of the federal government's AI workforce needs, and supporting different pathways into federal service for AI talent.
Guidance on the Construction of National Data Infrastructure	2024.12	NDRC, National Data Administration, MIIT	The guidance mentions that network infrastructure and computing power infrastructure should adapt to the needs of data value release, upgrading and developing towards high-speed data transmission and efficient computing power supply. It is necessary to accelerate the green development and organic synergy of diverse heterogeneous computing power, such as general-purpose computing power, intelligent computing power, and supercomputing power. Further, it is essential to facilitate 400G/800G high-bandwidth all-optical connections between national hub nodes and demand locations, guide telecommunications operators and others to enhance the efficiency of 'public transmission channels,' and advance the deep integration of computing and network.
Guideline for the Establishment of the National Comprehensive Standardization System for the AI Industry (2024 Version)	2024.6	MIIT and other three ministries	The guideline indicates that by 2026, the linkage between standards and industrial technological innovation will continue to improve. Over 50 new national and industry standards will be formulated, accelerating the formation of a standard system that leads the high-quality development of the AI industry. More than 1,000 enterprises will participate in standard dissemination and implementation promotion, further highlighting the effectiveness of standards serving enterprise innovation and development. Participation in the formulation of over 20 international standards will promote the globalization of the AI industry.
Implementation Opinions of Seven Ministries Including the MIIT on Promoting the Innovative Development of Future Industries	2024.1	MIIT and other six ministries	This opinion strengthens new infrastructure, thus deeply advancing the construction of 5G, computing power infrastructure, the industrial internet, IoE, the internet of vehicles (IoV), and gigabit optical networks. Further, this opinion guides major scientific and technological infrastructure to serve future industries, deepens the sharing of facilities, equipment, and data, and accelerates the transformation and application of cutting-edge technologies.

Source: The U.S. Congress, MIIT, NDRC, Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Cost Structure Analysis

Cost Structure Analysis of Photonics, PON Device and Wi-Fi Device (Global), 2024



- The raw materials of photonics mainly include optical devices (e.g., TOSA, ROSA and other optical devices), circuit chip, printed circuit board (PCB) and others (body and other components). Optical devices account for approximately 74% of the total cost of photonics. Among the optical devices include the TOSA, ROSA and other optical devices including optical filter, pigtail and other components. Meanwhile, different technologies adopted in photonics can impact the cost structure of various optical devices. For PON device, cost of photonics and other electronic components account for the major sector with 75% of the total cost. Body and other structural components and others (software costs, etc.) account for the rest 25%. Similarly, chip and electronic components account for 65% of the total cost for Wi-Fi device, the rest 35% includes the cost of body and other structural components and others (software costs, etc.).

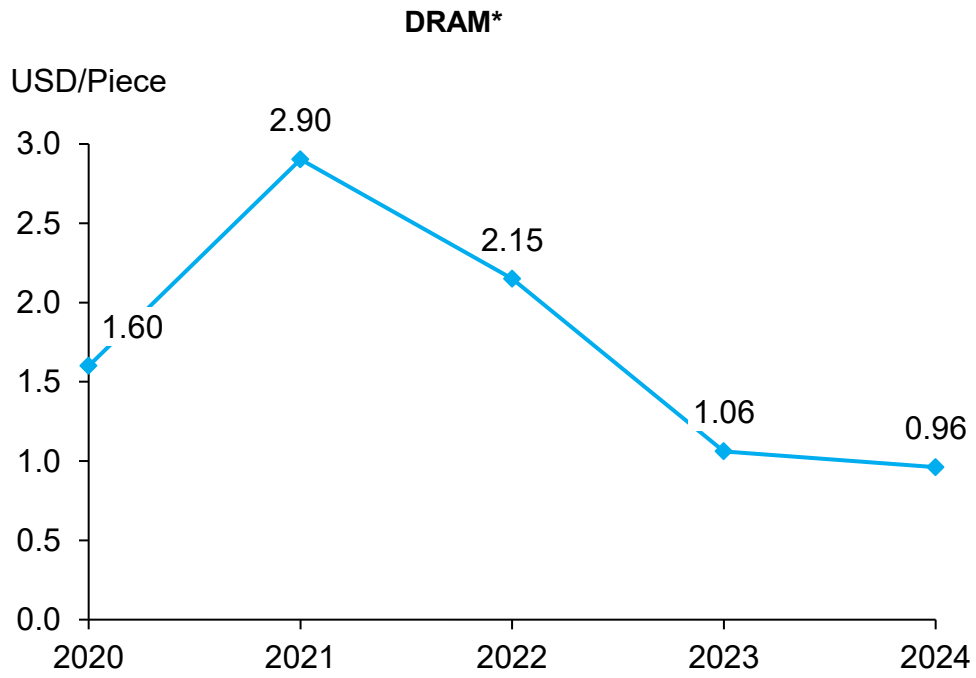
Notes: 1. TOSA and ROSA refers to receiver optical sub-assembly and transmitter optical sub-assembly, respectively.

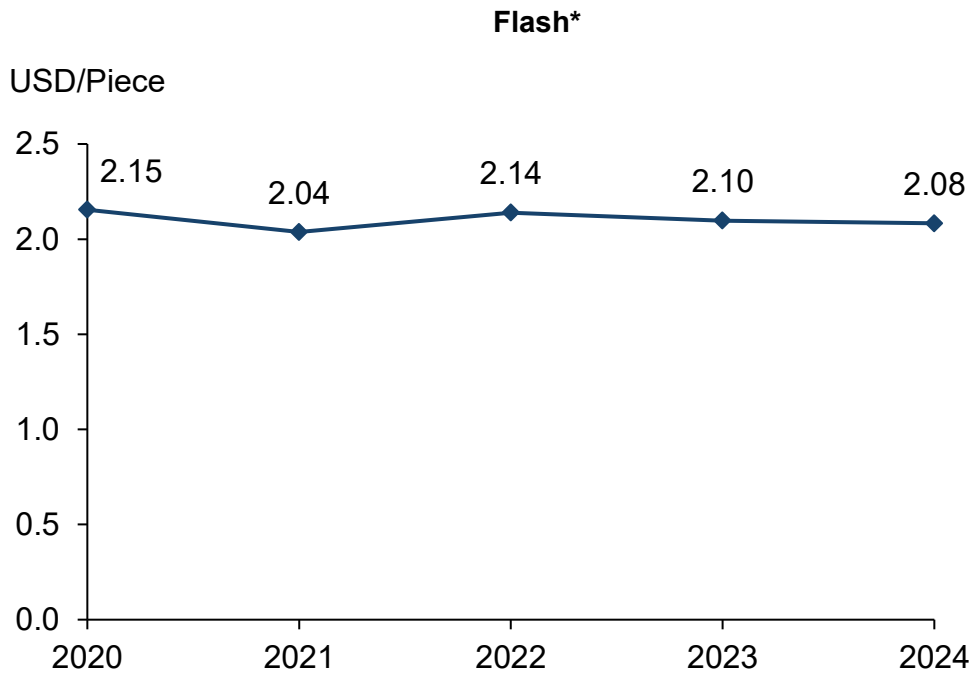
Source: Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Raw Material Price Analysis

Average Price of Flash and DRAM Chip (Global), 2020-2024





- Different types of chips are the major raw materials in the OWCD industry. The chart below illustrates the price trends of two representative chip types. DRAM chips are widely used in PON devices and Wi-Fi devices, while Flash chips are commonly applied in photonics. DRAM chip prices experienced a significant increase in 2021, mainly driven by strong demand from remote education and work-from-home scenarios during the pandemic, which led to a surge in consumption of DRAM-intensive products such as smartphones and laptops. Flash chip prices have remained relatively stable over the past few years, with limited volatility due to more balanced supply and demand dynamics in their application markets. Looking ahead, both DRAM and Flash chip prices are expected to remain relatively stable in the short term, assuming no major disruptions in global supply chains or end-market demand.

**Notes: Refer to NAND Flash(32Gb 4Gx8 MLC) and DRAM:DDR3(4Gb(512Mx8),1600MHz); Due to the price variations among different chip models and types, the selected chip prices above do not represent the industry average.*

Source: WIND, Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Industry Barrier Analysis of Optical and Wireless Connectivity Devices Industry (1/2)

1 Technology Development Barrier

- The OWCD market is highly technical with significant entry barriers, especially in areas like photonics, PON devices, and wireless access equipment. Developing advanced technologies such as silicon photonics and high-speed, low-power devices requires deep expertise in materials, optics, and microelectronics, along with strong R&D and sustained investment. Leading players leverage cutting-edge innovation and smart manufacturing to stay ahead, while those lacking resources and integration capabilities face major challenges entering the market.

2 Customization Capability Barrier

- As demand for efficient, personalized solutions rises, customization has become a key competitive edge. Integrated OWCD companies must tailor products for specific needs like data centers, AI and IoT, requiring both standardized offerings and flexible, responsive design and manufacturing. For new entrants, this poses a high barrier due to the significant investment needed to support such adaptability.

3 Product Comprehensiveness Barrier

- Leading companies in the integrated OWCD industry typically offer a broad product portfolio—covering photonics, PON devices, and wireless access equipment—with advanced technologies in each area. For example, photonics involves silicon and high-speed photonics, while PON devices are advancing toward 25G/50G to meet rising bandwidth needs. Strong players excel across multiple products and provide integrated solutions, creating synergy and raising entry barriers for new entrants.

Source: Frost & Sullivan

Overview of Global End-to-end Optical Communication Core Device Solution Industry

Industry Barrier Analysis of Optical and Wireless Connectivity Devices Industry (2/2)

4 Customer Barrier

- Integrated OWCD customers mainly include ICT equipment providers, telecom operators, and tech companies such as data center and cloud service providers, all of whom demand high standards in quality, performance, reliability, and service. Due to large volumes and long procurement cycles, they rely heavily on trusted suppliers. New entrants must invest considerable time and resources to meet these standards and build trust, especially under deeply integrated models like JDM. Such close partnerships enhance customer loyalty and raise the entry barrier for newcomers.

5 Supply Chain Barrier

- To reduce supplier concentration risk and enhance supply chain resilience, integrated OWCD companies increasingly adopt multi-supplier strategies, ensuring stable access to key components and minimizing disruption risks. However, new entrants often lack the resources to build reliable, diversified supplier networks, creating a significant entry barrier to market competitiveness.

6 Globalization Barrier

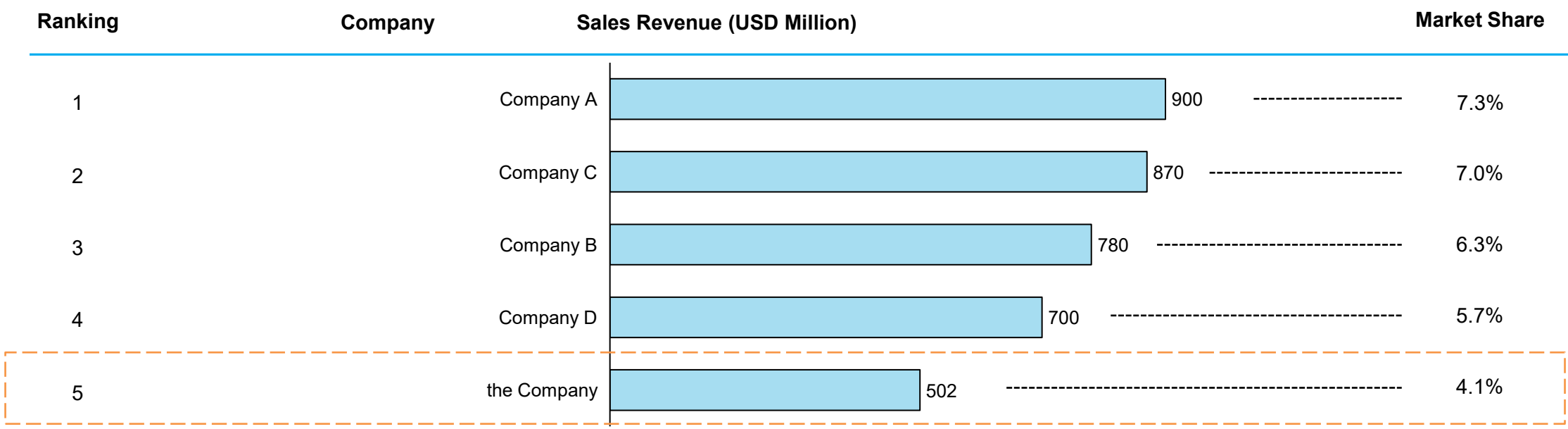
- Companies in the OWCD industry often need to establish a global presence spanning R&D, manufacturing, and sales operations. In particular, building globally distributed manufacturing and operational capabilities is critical to meeting the demands of fast-growing sectors such as AI, data centers, and IoT. This requires not only significant financial investment, but also strong global supply chain management, localized market strategies, and the ability to navigate complex regulatory and logistical environments. For new entrants, replicating this level of global integration and operational excellence poses a major barrier, demanding substantial resources and highly coordinated international strategies.

Source: Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Competitive Landscape of Integrated OWCD Industry

Top Five Companies of Integrated OWCD Industry by Sales Revenue (Global), 2024



- The global integrated OWCD industry is relatively competitive with total market size of USD12.4 billion in 2024. The top five players had an aggregate of 30.4% of the market share in the industry in terms of sales revenue. The Company ranked fifth among all players, achieving sales revenue of USD502 million with a market share of 4.1% in global integrated OWCD industry.

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Source: Annual Reports of Listed Companies, Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Competitive Landscape of Integrated OWCD Industry

Notes:

1. *Company A is a listed company on the Taiwan Stock Exchange established in 1992, primarily engaging in businesses of PON devices and wireless network access devices. The company is headquartered in Taipei, with its market presence spanning North America, Europe, China and the Asia-Pacific region.*
2. *Company B is a listed company on the Taiwan Stock Exchange established in 2003, primarily engaging in providing wired broadband access devices, wireless network access devices and multimedia products. The company is headquartered in Hsinchu, with its markets mainly in Americas, Europe and Asia.*
3. *Company C is a listed company on the Shanghai Stock Exchange established in 1998, primarily engaging in businesses of PON devices and wireless network access devices. The company is headquartered in Shenzhen, with market presence mainly in China, Americas and Europe.*
4. *Company D is an unlisted company established in 2003, primarily engaging in businesses of photonics, PON devices and wireless network access devices. The company is headquartered in Qingdao, and its products are primarily sold to Asia, North America and Europe.*

Source: Annual Reports of Listed Companies, Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Global Optical and Wireless Connectivity Devices Industry

Competitive Landscape of Integrated OWCD Industry

Product Coverage of Global Top Five Companies in Integrated OWCD Industry, 2023

	Photonics	PON Devices	Wireless Network Access Devices
Company A	✗	✓	✓
Company B	✗	✓	✓
Company C	✗	✓	✓
Company D	✓	✓	✓
The Company	✓	✓	✓

- Among the integrated OWCD industry, market participants with all three sectors covered, including photonics, PON devices and wireless network access devices, have the capability to provide end-to-end solutions. The company is one of the few market participants in the global integrated OWCD industry with all sectors covered in 2024.

Source: Annual Reports of Listed Companies, Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

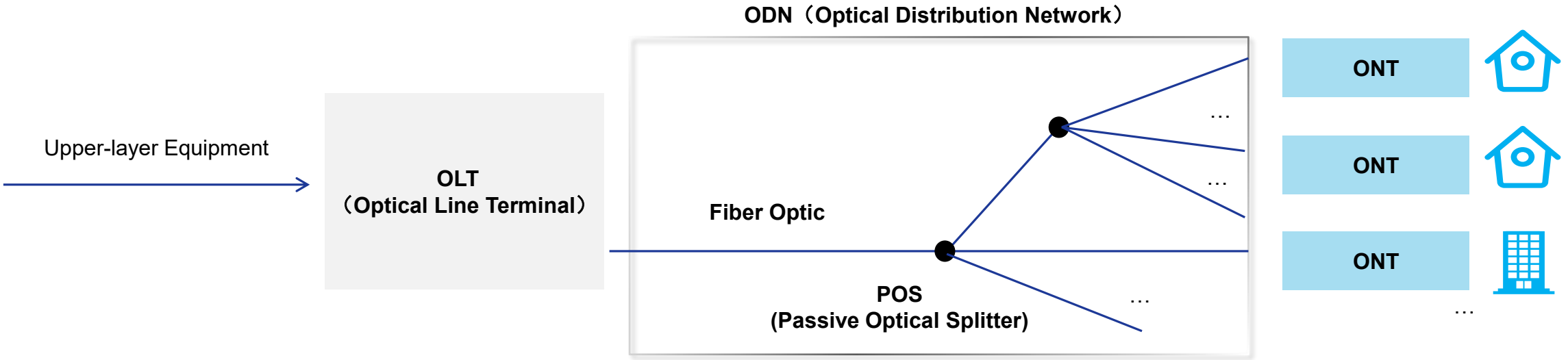
Agenda

Overview of Major Core Device——Global Wired Broadband Access Device Industry

Overview of Global Wired Broadband Access Device Industry

- Wired broadband access devices refer to hardware used to connect user terminal devices to broadband networks via wired connections. Passive Optical Network (PON) devices serve as the core components of wired broadband access, providing reliable connectivity through a point-to-multipoint architecture.

Overview of PON Network Architecture



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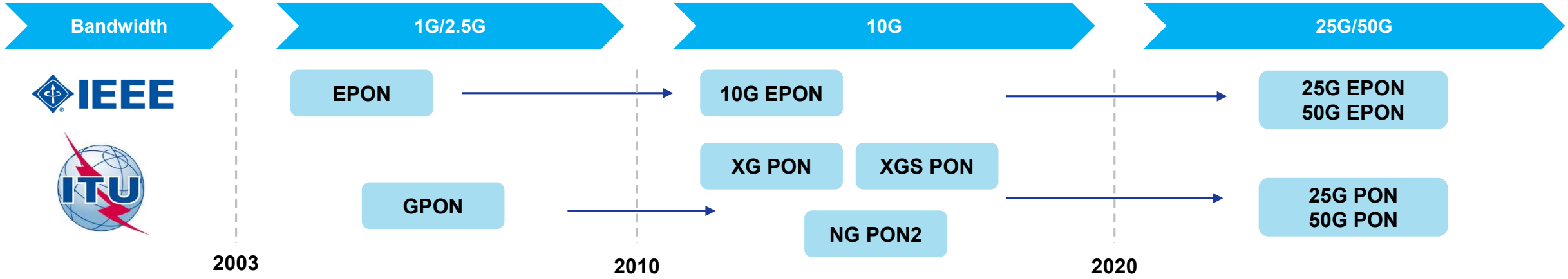
Source: Frost & Sullivan

Overview of Major Core Device——Global Wired Broadband Access Device Industry

Overview of PON Technology Evolution



GPON Technology

GPON (Gigabit Passive Optical Network) technology began its standardization process in 2003 and was commercially deployed in 2007. It has since become a widely adopted mainstream technology, especially in Fiber to the Home (FTTH) applications. The key features of GPON technology include support for downstream speeds of 2.5 Gbps and upstream speeds of 1.25 Gbps.

EPON Technology

EPON (Ethernet Passive Optical Network) technology commenced its standardization in 2004 and was commercially introduced in 2008. The primary feature of EPON is its use of Ethernet protocols, with support for downstream speeds of 1 Gbps and upstream speeds of 1 Gbps.

10G PON includes two main variants: 10G EPON and 10G GPON, with 10G GPON further divided into XG PON (asymmetric) and XGS PON (symmetric).

10G EPON

- Asymmetric: 10 Gbps downstream, 1 Gbps upstream; Symmetric: 10 Gbps for both downstream and upstream;
- Standardized in 2009 (IEEE 802.3av);
- Commercialized in the PRC in 2012 and driven by China Telecom and China Mobile, 10G EPON has been mainly adopted in Asia but is less prevalent in Europe and North America.

10G GPON

- XG PON (asymmetric): 10 Gbps downstream, 2.5 Gbps upstream; available since 2014;
- XGS PON (symmetric): 10 Gbps for both downstream and upstream; standardized in 2016;
- XG-PON is primarily used in the PRC, while XGS-PON dominates in Europe and North America, particularly in the U.S. **XGS-PON represents the latest generation of technology among the mainstream 10G PON solutions in the broadband sector.**

25G PON offers a downstream rate of 25Gbps and an upstream rate of 10Gbps, making it ideal for ultra-high-speed internet access and high-density user scenarios.

50G PON supports a downstream rate of 50Gbps and an upstream rate of 25Gbps, addressing the needs of large-scale data centers, 5G networks and the upcoming 6G networks.

With the growing demand for higher bandwidth, especially in data centers and large-scale applications, 25G PON and 50G PON technologies entered research and pilot phases in the early 2020s. **25G/50G PON is expected to be promoted in the coming years, and is expected to become the next-generation mainstream PON device in the broadband sector.**

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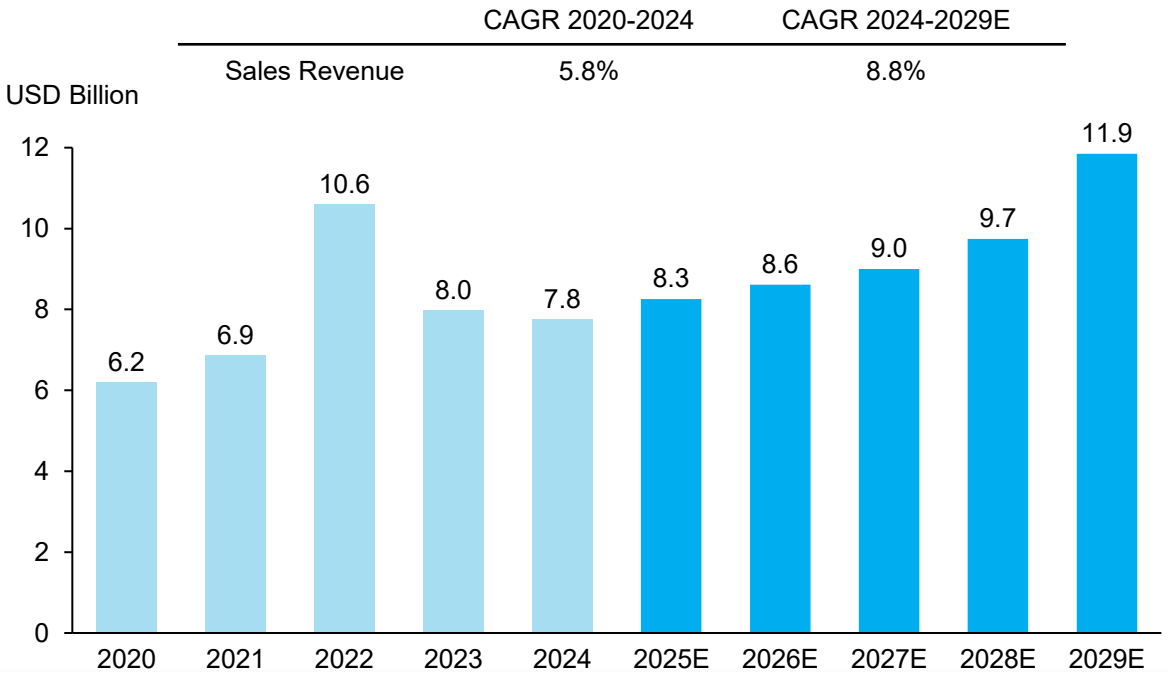
Source: Frost & Sullivan

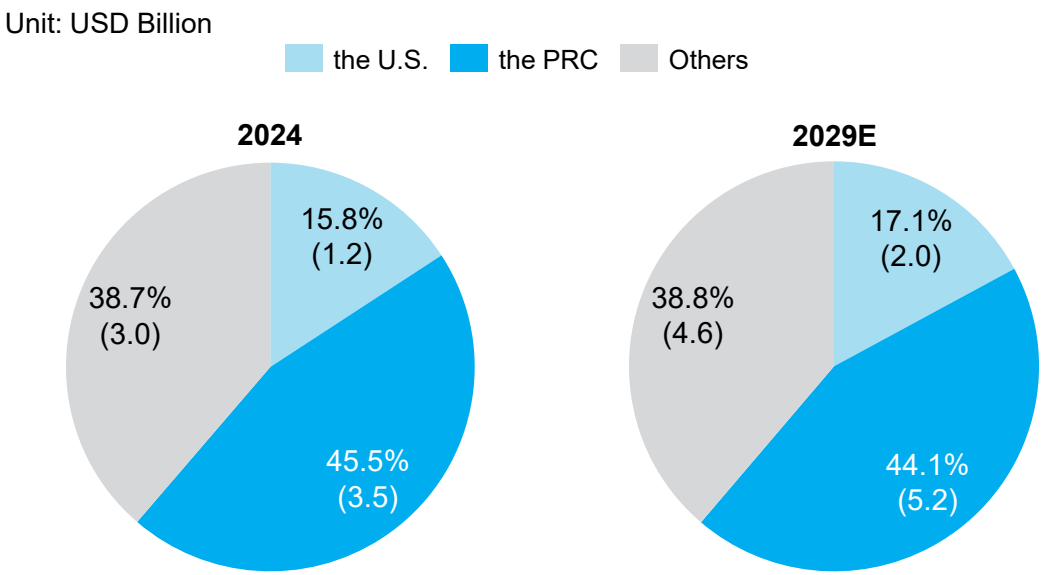
Overview of Major Core Device——Global Wired Broadband Access Device Industry

Market Size of PON Device Industry (1/3)

Sales Revenue of PON Devices (Global), 2020-2029E



Sales Revenue of PON Devices by Major Countries, 2024 and 2029E



- PON devices are essential network components that enable fiber-optic communication. They play a crucial role in modern communication networks by delivering high-speed wired broadband access. The market size of global PON device industry by sales revenue increased from USD6.2 billion in 2020 to USD7.8 billion in 2024, with a CAGR of 5.8%. The decline in the global PON equipment market in 2023 and 2024 was mainly attributed to cyclical factors of the industry, including inventory adjustments and reduced capital expenditures by telecommunications operators. However, driven by the increasing demand for global 5G small cells and data centers, the market size of global PON device industry is projected to further increase, reaching USD11.9 billion in 2029, with a CAGR of approximately 8.8% from 2024.
- In 2024, the market size in the U.S. reached USD1.2 billion, accounting for 15.8% of the global PON device industry, while the PRC is anticipated to generate USD3.5 billion, making up 45.5% of the total market. In 2029, the market size of PON device industry in the U.S. is projected to reach USD2.0 billion, representing 17.1% of the global market, and the PRC's market is expected to reach USD5.2 billion, accounting for 44.1% of the global market. As more developing countries vigorously develop optical fiber broadband networks, the PON equipment market in other regions of the world is expected to gradually grow.

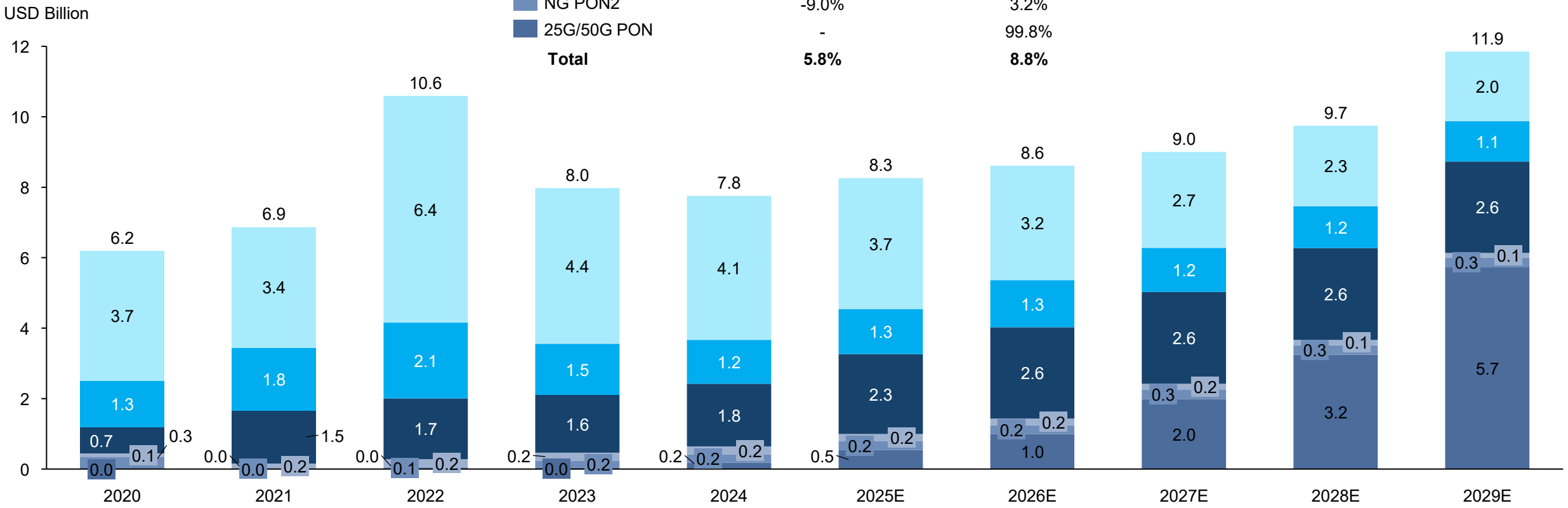
Source: LightCounting, Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Major Core Device——Global Wired Broadband Access Device Industry

Market Size of PON Device Industry (2/3)

Sales Revenue of PON Device by Rate (Global), 2020-2029E

	CAGR 2020-2024	CAGR 2024-2029E
1G/2.5G PON	2.6%	-13.5%
XG PON	-1.3%	-1.7%
XGS PON	24.3%	7.9%
10G EPON	22.4%	-10.5%
NG PON2	-9.0%	3.2%
25G/50G PON	-	99.8%
Total	**5.8%**	**8.8%**



Source: LightCounting, Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Major Core Device——Global Wired Broadband Access Device Industry

Market Size of PON Device Industry (3/3)

- EPON and GPON, standardized in the early 2000s by IEEE and ITU-T, laid the groundwork for high-speed broadband access. GPON (2.5 Gbps down/1.25 Gbps up) became the mainstream FTTH solution since 2007, while EPON (1 Gbps symmetrical), launched in 2008, offers a cost-effective Ethernet-based alternative. Together, 1G/2.5G PON devices generated USD3.7 billion in revenue in 2020, accounting approximately 60% of the total PON market.
- 10GPON is currently the mainstream technology in the wired broadband access sector. 10GPON technologies, including 10GEPON, XG-PON, and XGS-PON, represent major upgrades. Among them, XGS-PON is favored in Europe and the United States for its symmetrical bandwidth, especially in cloud and HD video scenarios. In 2024, the market size of XGS-PON devices accounted for over 50% of the global 10GPON segment. XGS-PON is projected to lead the 10GPON market, with its market size expected to reach USD1.8 billion in 2024 and grow to USD2.6 billion in 2029, capturing 21.9% of the total market share in 2029. NG-PON2, offering up to 40 Gb/s via WDM, remains underutilized due to high costs.
- Looking ahead, 25G and 50G PON technologies are emerging to meet rising demand from data centers and 5G/6G networks. With downstream speeds of 25–50 Gbps, these technologies are entering early deployment phases. The combined market is projected to reach USD5.7 billion by 2029, representing a CAGR of 99.8% from 2024, becoming core enablers of next-generation broadband infrastructure.

Source: Omdia, Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Major Core Device——Global Wired Broadband Access Device Industry

Competitive Landscape of PON Device Industry

- The global PON device market is relatively competitive, with a few players leading the industry while numerous regional and specialized companies also contribute to the landscape. Major companies compete on the basis of technology innovation, product quality and scalability. Key factors driving competition include the ongoing demand for faster internet speeds, the expansion of fiber networks and the shift towards next-generation PON technologies. As a result, companies are increasingly investing in R&D to enhance their product offerings and differentiate themselves in a rapidly evolving market.

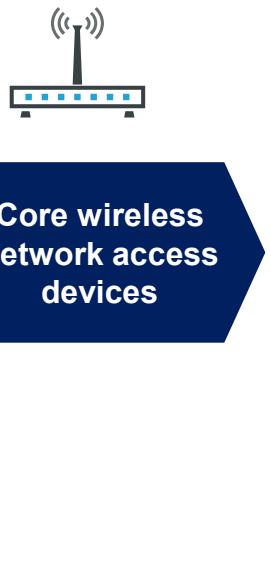
Source: Frost & Sullivan

Agenda

Overview of Major Core Device——Global Wi-Fi Device Industry

Overview of Wi-Fi Devices

- As key wireless network access devices, Wi-Fi devices refer to hardware used to connect user terminal devices to a computer network via wireless signals. These devices use radio waves to transmit data, providing convenient network access services. Wi-Fi devices are commonly used in homes, offices, public places, etc., supporting network access and data exchange for mobile devices. Wi-fi devices mainly include wireless routers and access points (APs), etc.



Name of Core Device	Introduction of Core Device
Wireless Router	In home or enterprise environments, wireless routers are commonly used to connect to the internet and distribute the connection to multiple devices within the local area network via Wi-Fi. These routers typically integrate various functions such as routing, NAT (Network Address Translation), DHCP (Dynamic Host Configuration Protocol), wireless access points and firewalls, providing both wired and wireless connectivity.
Wireless Access Point (AP)	An AP is a device used to extend the wireless coverage of a wired network. The AP connects to a router or switch and extends the network access point over a wider area through Wi-Fi signals, allowing wireless terminal devices to connect to the network within a specific range.
Smart Home Gateway	A smart home gateway is an integrated device, often used as a hub for numerous smart devices in a home. It communicates with smart devices and provides remote control, automated management and device interconnectivity through the internet or home local area network.

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Source: Frost & Sullivan

Overview of Major Core Device——Global Wi-Fi Device Industry

Overview of Wi-Fi Technology Evolution

Wi-Fi 1 (802.11b) - Released in 1999

- **Max Speed:** 11 Mbps
- **Frequency Band:** 2.4 GHz
- **Key Features:** Wi-Fi 1 was one of the earliest standards, offering relatively low speeds and higher interference, but it laid the foundation for the widespread adoption of wireless networks.

Wi-Fi 2 (802.11a) - Released in 1999

- **Max Speed:** 54 Mbps
- **Frequency Band:** 5 GHz
- **Key Features:** Wi-Fi 2 offered higher speeds and lower interference, but the higher frequency resulted in poorer signal penetration and coverage.

Wi-Fi 3 (802.11g) - Released in 2003

- **Max Speed:** 54 Mbps
- **Frequency Band:** 2.4 GHz
- **Key Features:** Wi-Fi 3 combined the long range of Wi-Fi 1 with the higher speeds of Wi-Fi 2, making it widely used for home and office networks.

Wi-Fi 4 (802.11n) - Released in 2009

- **Max Speed:** 600 Mbps
- **Frequency Band:** 2.4 GHz and 5 GHz
- **Key Features:** Wi-Fi 4 introduced MIMO (Multiple Input Multiple Output) technology, improving throughput and stability. It enhanced coverage and became the standard for both home and enterprise networks.

Wi-Fi 5 (802.11ac) - Released in 2013

- **Max Speed:** 3.5 Gbps
- **Frequency Band:** 5 GHz
- **Key Features:** Wi-Fi 5 offered much higher speeds, especially for HD streaming, online gaming and high-speed internet access. It introduced wider channels and MU-MIMO technology, supporting more devices simultaneously.

Wi-Fi 6 (802.11ax) - Released in 2019

- **Max Speed:** 9.6 Gbps
- **Frequency Band:** 2.4 GHz and 5 GHz
- **Key Features:** Wi-Fi 6 brought significant improvements, especially in environments with many devices. Key technologies include OFDMA (Orthogonal Frequency Division Multiple Access), extended MU-MIMO and TWT (Target Wake Time), which improve efficiency and reduce latency, making it ideal for IoT devices and smart homes.

Wi-Fi 7 (802.11be) - Released in 2022

- **Max Speed:** 30 Gbps
- **Frequency Band:** 2.4 GHz, 5 GHz and 6 GHz
- **Key Features:** Wi-Fi 7 will offer even higher bandwidth, lower latency and improved concurrent device connections. It will support wider channels (up to 320 MHz) and higher modulation schemes (4096-QAM), significantly improving throughput for high-demand applications such as 4K/8K video streaming and augmented/virtual reality.

Wi-Fi 8 (802.11bn UHR) - Expected in 2028

- **Max Speed:** Expected to exceed 50 Gbps
- **Frequency Band:** 6 GHz and above
- **Key Features:** Wi-Fi 8 will focus on Ultra High Reliability (UHR), making it suitable for applications that require ultra-low latency and high stability, such as autonomous driving and industrial IoT.

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Source: Wi-Fi Alliance, Frost & Sullivan

Overview of Major Core Device——Global Wi-Fi Device Industry

Analysis of Wi-Fi Technology

Comparison Analysis of Wi-Fi 7 vs. Wi-Fi 6

Metric	Wi-Fi 6	Wi-Fi 7
Max Speed	9.6 Gbps	30 Gbps
Frequency Band	2.4 GHz and 5 GHz	2.4 GHz, 5 GHz and 6 GHz
Max Channel Bandwidth	160 MHz	320 MHz
Modulation Technology	1024-QAM (Quadrature Amplitude Modulation)	4096-QAM, improving data encoding efficiency and transmitting more data
Multi-Link Operation	Does not support	A unique feature allowing devices to communicate simultaneously across different frequency bands or multiple links, reducing latency and increasing stability.
Multi-Resource Units (MRU) & More Efficient Resource Allocation	Provides standard resource allocation but lacks advanced resource management	Optimizes resource allocation, increasing spectrum resource utilization and supporting more complex network environments
MIMO Technology	Supports 8x8 MU-MIMO (Multi-User, Multiple Input, Multiple Output)	Supports more advanced CMU-MIMO, with up to 16 data streams, greatly enhancing concurrent connection performance
Standards & Technical Specifications	Based on the IEEE 802.11ax standard	Based on the more advanced IEEE 802.11be standard

Analysis of Global Wi-Fi Device Technology Development Differences

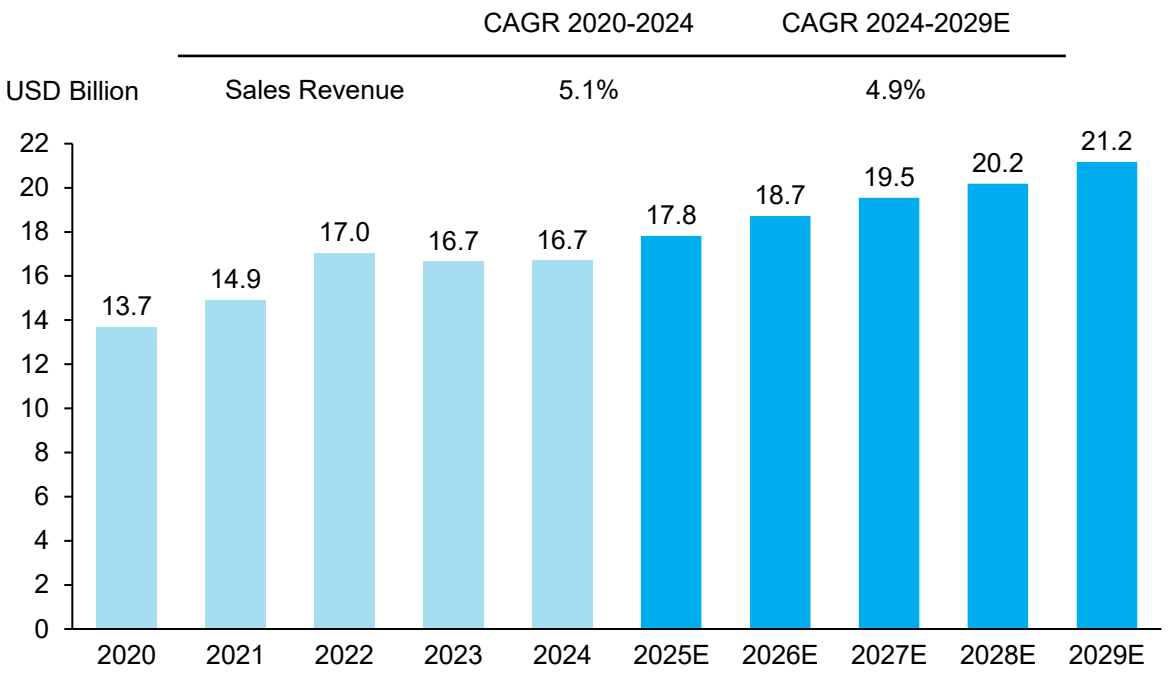
- The development and adoption of Wi-Fi technology varies significantly across regions, influenced by factors such as infrastructure, market demand, economic conditions and regulatory frameworks. In North America, Wi-Fi 6 is widely adopted, with the U.S. and Canada leading the deployment of Wi-Fi 6E, supported by regulatory bodies like the FCC. The Middle East, particularly the UAE and Saudi Arabia, also exhibits rapid Wi-Fi adoption, benefiting from advanced infrastructure and a strong embrace of Wi-Fi 6E. Europe has a well-established Wi-Fi infrastructure, but the adoption of Wi-Fi 6E has been slower in some countries due to regulatory delays.
- In East Asia, countries such as the PRC, Japan and South Korea, are at the forefront of adopting the latest Wi-Fi standards, with Wi-Fi 6E already deployed in major cities. However, India lags behind due to infrastructure challenges. Africa, in contrast, is slower to adopt Wi-Fi, with many regions still relying on older Wi-Fi standards and facing significant broadband infrastructure challenges, particularly in rural areas. Nevertheless, countries like South Africa, Kenya and Nigeria are making progress in expanding Wi-Fi access in urban areas.
- Looking ahead, North America, Europe and the Middle East are expected to maintain their leadership in Wi-Fi 6E and Wi-Fi 7 deployment, while regions such as Africa and parts of Asia, including India, will gradually catch up as investments in infrastructure increase and market demand for high-speed connectivity rises.

Source: Wi-Fi Alliance, Frost & Sullivan

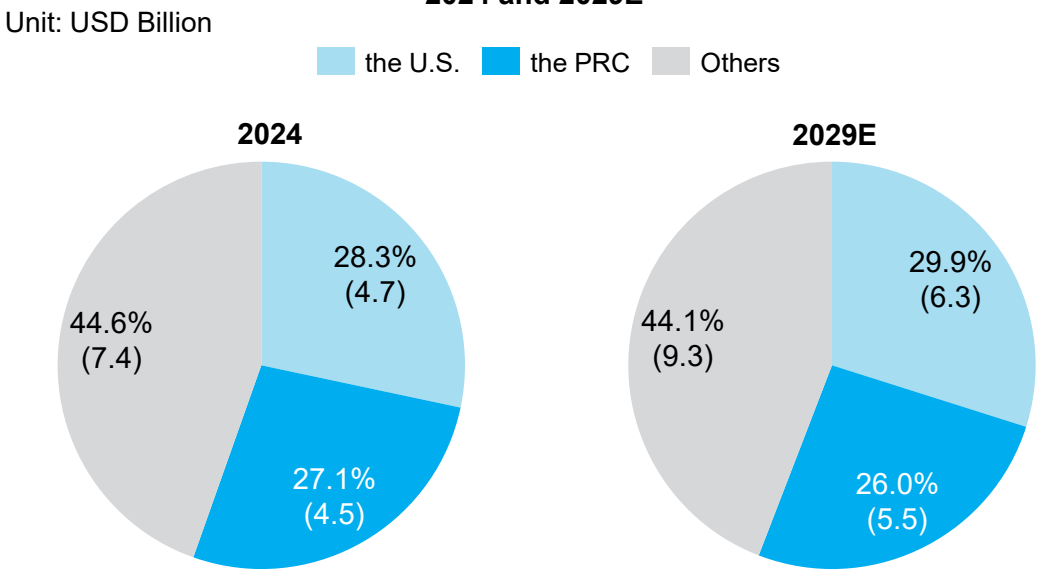
Overview of Major Core Device——Global Wi-Fi Device Industry

Market Size of Wi-Fi Device Industry (1/3)

Sales Revenue of Wi-Fi Devices (Global), 2020-2029E



Sales Revenue of Wi-Fi Devices by Major Countries, 2024 and 2029E



- The Wi-Fi device industry has seen significant growth and transformation due to the increasing demand for faster and more reliable internet connections across the globe. These devices, which include routers, APs, gateways and other wireless communication equipment, are essential for enabling wireless connectivity in homes, businesses, public spaces and industrial applications. From 2020 to 2024, the global sales revenue of Wi-Fi device increased from USD13.7 billion to approximately USD16.7 billion with a CAGR of approximately 5.1%. The PRC is experiencing rapid growth in the demand for high-speed wireless networks, fueled by technological advancements in 5G, IoT and the development of smart cities. Meanwhile, the U.S. remains a leader in the wireless network access device market, benefiting from early adoption of advanced Wi-Fi standards and strong consumer demand for high-speed internet connectivity. Looking forward, the global wireless network access device industry is expected to continue its growth, driven by technological advancements in Wi-Fi standards, the continuous rollout of 5G networks and the increasing demand for connected devices. In 2029, the proportion of the sales revenue in the PRC and the U.S. is expected to reach 26.0% and 29.9%, respectively.

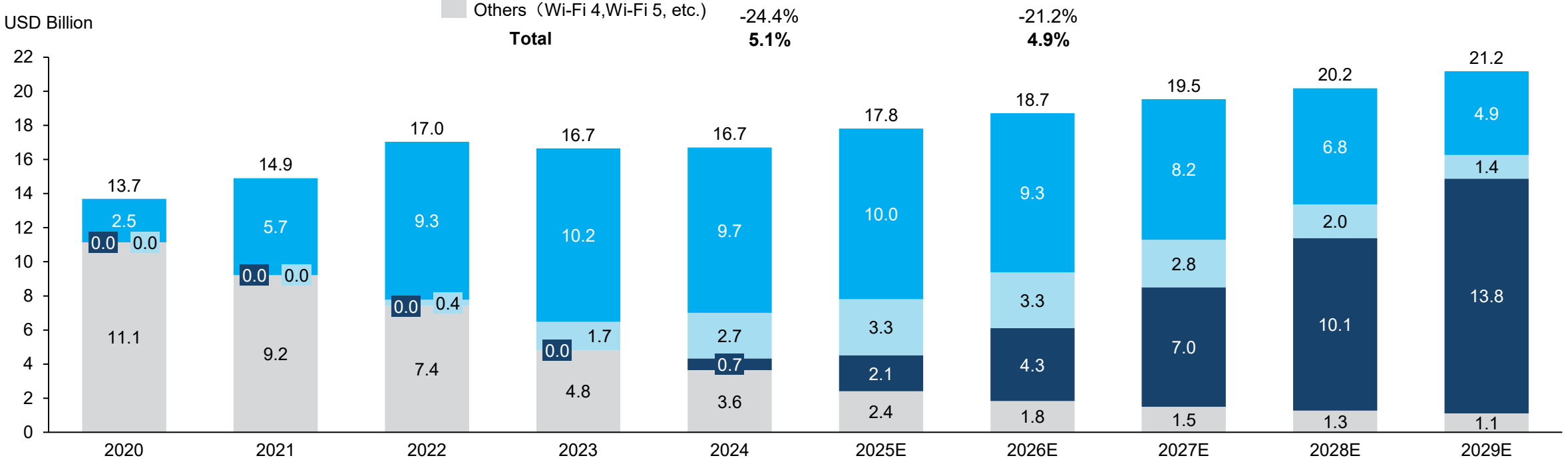
Source: IDC, Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Major Core Device——Global Wi-Fi Device Industry

Market Size of Wi-Fi Device Industry (3/3)

Sales Revenue of Wi-Fi Devices by Technology (Global), 2020-2029E

	CAGR 2020-2024	CAGR 2024-2029E
Wi-Fi 6	39.8%	-12.7%
Wi-Fi 6E	N/A	-12.4%
Wi-Fi 7	N/A	82.2%
Others（Wi-Fi 4,Wi-Fi 5, etc.)	-24.4%	-21.2%
Total	**5.1%**	**4.9%**



- Wi-Fi technology has evolved from Wi-Fi 1 (802.11) in 1997 to today's Wi-Fi 6 and 6E, significantly improving transmission speed, coverage, and device capacity. Wi-Fi 6 and Wi-Fi 6E currently dominate the market, generating USD9.7 billion and USD2.7 billion in sales revenue respectively in 2024. Looking ahead, Wi-Fi 7 is set to become a key enabler for high-speed, low-latency connectivity in smart homes, gaming, IoT, telemedicine, and intelligent vehicles. Global Wi-Fi 7 device sales are projected to reach USD13.8 billion by 2029, representing a CAGR of 82.2% from 2024.

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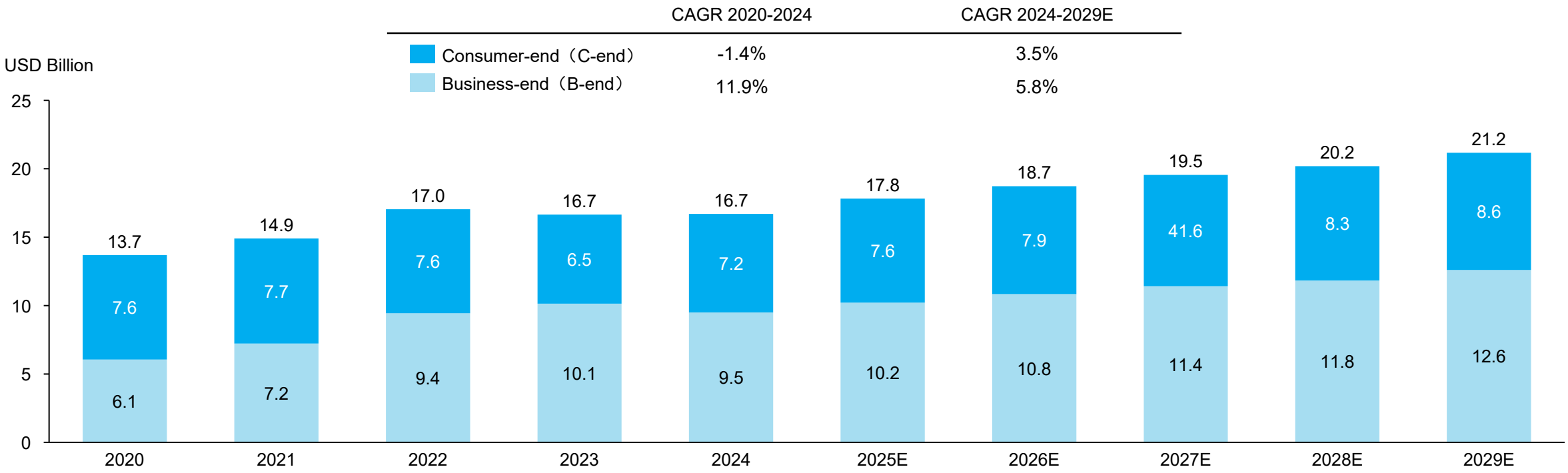
Source: IDC, Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Major Core Device——Global Wi-Fi Device Industry

Market Size of Wi-Fi Device Industry (2/3)

Sales Revenue of Wi-Fi Devices by Application Segment (Global), 2020-2029E



- Both the global C-end and B-end Wi-Fi device markets are experiencing rapid growth, fueled by evolving consumer demands and the expansion of smart technologies. The B-end market is driven by complex, high-performance requirements, while the C-end market focuses on cost-effective, consumer-oriented solutions. The widespread adoption of Wi-Fi 6, alongside the growing proliferation of IoT and smart home devices, are key trends shaping both markets, laying the foundation for continued innovation and development in the wireless network access device sector. It is expected that the global sales revenue of C-end and B-end Wi-Fi devices will increase from approximately USD7.2 billion and USD9.5 billion in 2024 to USD8.6 billion and USD12.6 billion in 2029, representing CAGRs of 3.5% and 5.8%, respectively.

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Source: IDC, Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Major Core Device——Global Wi-Fi Device Industry

Competitive Landscape of Wi-Fi Device Industry

- The global Wi-Fi device market is relatively concentrated, with leading companies firmly holding market dominance through technological advantages, strong brand presence, and deeply established sales channels. In the future, industry competition will revolve around the development of next-generation wireless technologies (e.g., Wi-Fi 7), AI-powered capabilities, cloud-based management, and enhanced network security across multiple dimensions.

Source: Frost & Sullivan

Agenda

Overview of Major Core Device——Global Optical Transceiver Industry

Definition and Classification of Optical Transceivers

- Photonics (optical transceivers/optical modules) are optoelectronic devices that convert optical and electrical signals, enabling data transmission essential for connecting data center infrastructure and telecommunication networks. They typically include a transmitter (TOSA with lasers), a receiver (ROSA with photodetectors), functional circuits, and optical/electrical interfaces.

- Transmission rate, measured in Gbps, is a key performance metric. Currently, 800G is the most advanced in mass production, while 1.6T represents the next-generation technology under development. Photonics are mainly used in datacom and telecom. In datacom, they connect servers, switches, and storage in data centers. In telecom, they support Metropolitan Area Networks (MANs), Wide Area Networks (WANs) and PONs, enabling efficient long-distance, high-capacity communication.

Classification by transmission rate

Low-speed photonics

e.g., 1-10G

High-speed photonics

e.g., 25G, 40G, 50G, 100G, 200G, 400G, 800G, 1.6T, etc.

Classification by application segment

Datacom

Photonics are critical components in data centers, connecting essential infrastructure such as servers, switches and storage devices to support high-speed data transmission, satisfy the demands of massively parallel computing and data storage and improve overall network performance.

Telecom

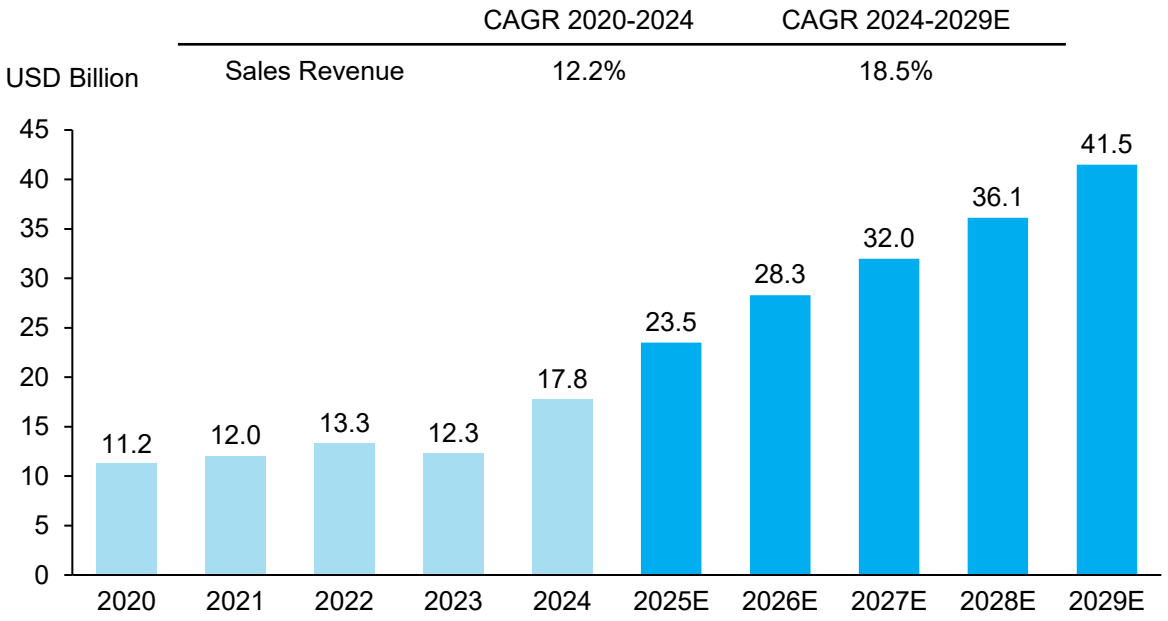
Photonics are essential in Metropolitan Area Networks (MANs), Wide Area Networks (WANs) and Passive Optical Networks (PONs).They are responsible for transmitting and receiving optical signals, ensuring efficient long-distance communication and high-capacity data transmission.

Source: Frost & Sullivan

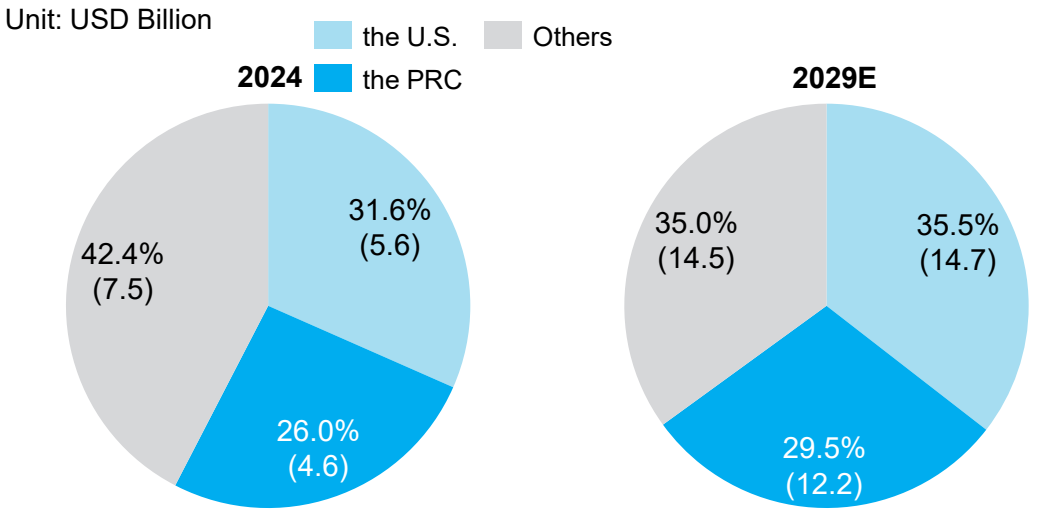
Overview of Major Core Device——Global Photonics Industry

Market Size of Photonics Industry (1/4)

Sales Revenue of Photonics (Global), 2020-2029E



Sales Revenue of Photonics by Major Countries, 2024 and 2029E



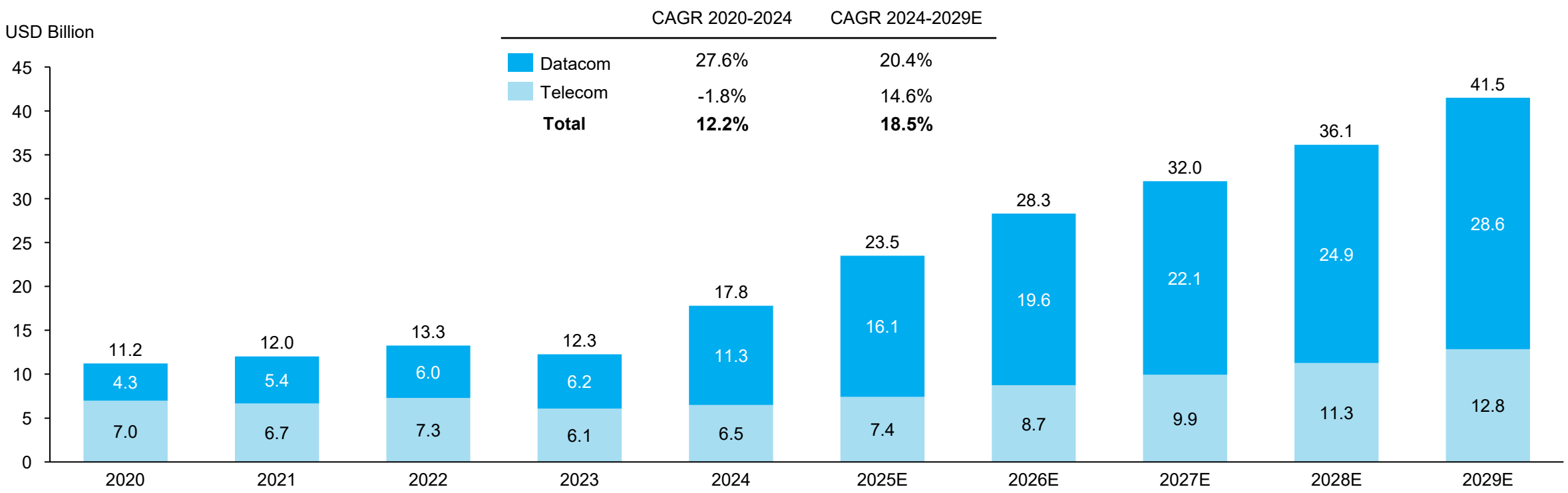
- The photonics market has experienced a steady growth over the past few years, driven by the rising global demand for high-speed data transmission and the expansion of data-intensive applications such as AI, cloud computing and 5G networks. From 2020 to 2024, the global sales revenue of photonics increased from USD11.2 billion in 2020 to approximately USD17.8 billion in 2024 with a CAGR of approximately 12.2%. In 2023, the photonics market declined due to global economic uncertainties, supply chain disruptions, slower cloud investment and cyclical fluctuations of the industry. However, the role of photonics in enabling the digital and intelligent transformation remains indispensable, laying the foundation for sustained growth in the coming years. Looking forward, it is expected that the sales revenue of global photonics industry will reach USD41.5 billion in 2029 with a CAGR of 18.5% from 2024.
- In terms of global market share, both the U.S. and the PRC have seen notable increases. In 2024, the U.S. market was valued at approximately USD5.6 billion, accounting for 31.6% of the global market, while the PRC's market was valued at approximately USD4.6 billion, representing 26.0%. In 2029, the U.S. market is expected to reach USD14.7 billion, capturing 35.5% of the global market, while the PRC's market is anticipated to reach USD12.2 billion, with its share rising to 29.5%.

Source: LightCounting, Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Major Core Device——Global Photonics Industry

Market Size of Photonics Industry (2/4)

Sales Revenue of Photonics by Application Segment (Global), 2020-2029E



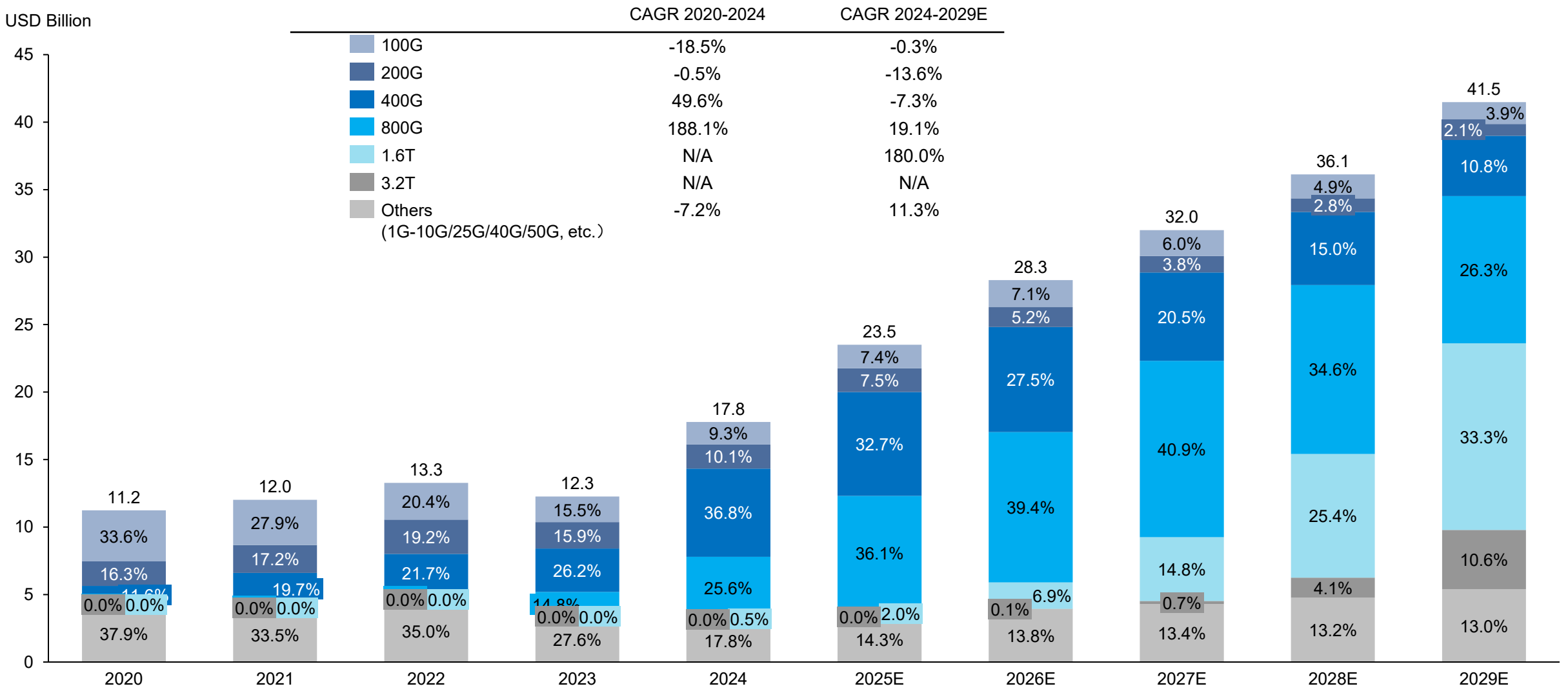
- In 2024, datacom photonics sales reached approximately USD11.3 billion, fueled by data center growth and AI advancements. This segment is projected to grow to USD28.6 billion by 2029, with a CAGR of 20.4% from 2024. While telecom photonics declined slightly in recent years, it is expected to rebound, driven by 5G and new network infrastructure, reaching USD12.8 billion in 2029 with a CAGR of 14.6% from 2024.

Source: LightCounting, Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Major Core Device——Global Photonics Industry

Market Size of Photonics Industry (3/4)

Sales Revenue of Photonics by Rate (Global), 2020-2029E



Source: LightCounting, Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Major Core Device——Global Photonics Industry

Market Size of Photonics Industry (4/4)

Sales Revenue of Photonics by Rate (Global), 2020-2029E

- Driven by the rapid growth of data centers and cloud computing, high-speed photonics — especially 800G and above — are expanding quickly. As the most advanced mass-produced technology, 800G photonics saw a CAGR of 188.1% from 2020 to 2024 and is projected to grow at 19.1% from 2024 to 2029. The R&D of 800G photonics began around 2020 -2021, and leading manufacturers are now capable of large-scale shipments. Meanwhile, 1.6T photonics, representing next-generation pre-production tech, is expected to surge with a 180.0% CAGR from 2024 to 2029, fueled by rising demand for higher bandwidth, lower power consumption, and AI-driven data processing. The R&D of 1.6T photonics started mainly in 2022 -2023, with some leading manufacturers having entered the sample testing phase. As hyperscale infrastructure expands, 1.6T is set to go mainstream, with 3.2T photonics on the horizon.

Source: LightCounting, Interviews with industry experts by Frost & Sullivan, Frost & Sullivan

Overview of Major Core Device——Global Photonics Industry

Competitive Landscape of Photonics Industry

- The global photonics market is relatively competitive, driven by the increasing demand for high-speed data transmission in telecommunications, data centers and cloud computing. Key players include established companies from the United States, China, and Japan, each vying for market share through technological advancements and scaling production capabilities. Companies in China have made significant progress in recent years, benefiting from lower production costs and strong R&D capabilities. The market is also shaped by rapid developments in AI, 5G and IoT, driving further competition among these players.

Source: Frost & Sullivan

Agenda

Supporting Statement

- Relatively high inventory and accounts receivable levels are generally in line with industry norms for OWCD companies due to the global economic uncertainty and the ongoing technological upgrades.
- In the OWCD industry, companies may have overlapping customers and suppliers, which aligns with industry norms. In addition, some major customers often designate specific suppliers — sometimes their affiliates — for certain key components or raw materials. OWCD companies are then required to procure these designated materials, perform manufacturing, and deliver the final products back to the customer. This model ensures consistency in product performance and compatibility, and reflects a typical supply chain collaboration pattern between large customers and OWCD companies in the industry.

Supporting Statement

The data presented in the “Industry Overview” section has taken into account the potential impact of trade restrictions and tariffs, based on several key assumptions that support the industry’s resilience and sustained growth trajectory:

Sustained Global Demand： It is assumed that global demand for OWCDs will continue its steady upward trend. This growth is underpinned by the ongoing digital transformation across sectors, rapid expansion of cloud computing and AI workloads, and increasing internet penetration in emerging markets. The proliferation of 5G networks, IoT deployments, and data center construction further reinforces the demand for high-performance data transmission infrastructure. Given these long-term drivers, the demand for OWCDs is expected to remain robust.

Resilient Global Supply： It is assumed that global OWCD supply will remain stable despite potential trade barriers. Major leading industry participants have implemented proactive strategies to mitigate risks, including shifting production to overseas manufacturing sites and expanding overseas capacity. These measures are expected to effectively reduce the impact of trade restrictions and tariffs on the overall supply landscape.

Technological Innovation as a Growth Catalyst： The continued advancement of core technologies, such as high-speed photonics (e.g., 800G/1.6T), 25G/50G PON, and Wi-Fi 7, is unlocking new application scenarios and driving structural upgrades in demand. These innovations are expanding the addressable market for OWCDs and improving the performance of these products, which in turn drives broader adoption across downstream customers. The pace of technological iteration is expected to remain a key enabler of long-term industry growth.

Globalization Trend： To diversify markets and mitigate geopolitical risks, many OWCD companies are accelerating overseas expansion through joint ventures, local R&D and production facilities, and regional ecosystem partnerships. Emerging markets such as ASEAN countries, India and the Middle East are attracting investment with growing infrastructure demand and supportive policies. This global expansion is expected to serve as a key driver of long-term growth for the OWCD industry tapping into emerging market potential.

Source: Frost & Sullivan

Research Methodologies

- Frost & Sullivan is an independent global consulting firm, which was founded in 1961 in New York. It offers industry research and market strategies and provides growth consulting and corporate training. Its industry coverage includes automotive and transportation, chemicals, materials and food, commercial aviation, consumer products, energy and power systems, environment and building technologies, healthcare, industrial automation and electronics, industrial and machinery, and technology, media and telecom.
- The Frost & Sullivan's report includes information on global optical and wireless connectivity devices industry.
- Frost & Sullivan has conducted detailed primary research which involved discussing the status of the industry with certain leading industry participants and conducting interviews with relevant parties. Frost & Sullivan has also conducted secondary research which involved reviewing company reports, independent research reports and data based on its own research database. Frost & Sullivan has obtained the figures for the estimated total market size from historical data analysis plotted against macroeconomic data as well as considered the above-mentioned industry key drivers.
- Frost & Sullivan's Market Engineering Forecasting Methodology integrates several forecasting techniques with the Market Engineering Measurement-based System. It relies on the expertise of the analyst team in integrating the critical market elements investigated during the research phase of the project. These elements include:
  - ✓ Expert-opinion forecasting methodology
  - ✓ Integration of market drivers and restraints
  - ✓ Integration with the market challenges
  - ✓ Integration of the Market Engineering Measurement trends
  - ✓ Integration of econometric variables
- In compiling and preparing the Report, Frost & Sullivan has adopted the following assumptions:
  - ✓ The social, economic and political environment of the world and China is likely to remain stable in the forecast period
  - ✓ Related industry key drivers are likely to drive the market in the forecast period