Huawei Investment & Holding Co., Ltd.

2021 ANNUAL REPORT

Building a Fully Connected,
Intelligent World

HUAWEI

Who is Huawei?

Founded in 1987, Huawei is a leading global provider of information and communications technology (ICT) infrastructure and smart devices. We have 195,000 employees and we operate in over 170 countries and regions, serving more than three billion people around the world. We are committed to bringing digital to every person, home and organization for a fully connected, intelligent world.

Together, we're building for tomorrow

Together, we're laying the foundation of the digital economy and helping all industries go digital. Throughout 2021, many countries turned to digital transformation and the digital economy to more effectively fight the pandemic, increase social resilience, and promote economic recovery. This has increased the need for joint effort in areas like industry policy, cross-sector collaboration, and innovation.

At Huawei, we provide a broad range of ICT capabilities to help all industries go digital. Through continuous innovation, we help industries digitalize their supply chains to more effectively cope with challenges caused by the pandemic. We firmly support free trade, open markets, and fair competition – especially the free trade of tech products. We are doing everything we can to drive the healthy development of global supply chains.

Together, we're building a low-carbon world and promoting sustainable development. Climate change has become a formidable roadblock to our ongoing development as a society. Now more than ever, we need to reassess our relationship with nature and move faster towards low-carbon development and green growth models. Carbon neutrality has become a globally recognized mission.

Huawei is doing its part to contribute to a greener and more sustainable digital world. Together with our customers and partners, we use innovative technologies to cut carbon emissions, promote renewable energy, and contribute to a circular economy.

Together, we're addressing new challenges in cyber security and privacy protection. While it's true that digital technology has greatly improved people's lives and fueled economic growth, challenges in cyber security and privacy protection are also on the rise. Addressing these challenges is our top priority. We are working tirelessly to develop secure, trustworthy, and quality products, solutions, and services to help our customers build more resilient networks.

For more than 30 years, we have worked closely with our carrier customers to build over 1,500 networks in more than 170 countries and regions. We are helping millions of companies go digital. Together, we have connected more than three billion people around the world and have maintained a solid track record in security.

Moving forward, Huawei will continue to engage and work with all stakeholders in an open, transparent, and responsible manner. Together, we can more effectively address cyber security and privacy protection challenges through innovative technology, shared standards, certification, and improved governance. We will continue working hard to enhance cyber security and protect personal privacy while people enjoy the benefits of digital technology.

We're working together with people around the world to explore the future. A changing external environment will not cause us to stray from our ideals or aspirations. Global integration and economies of scale will make the whole world more efficient. To benefit from this, we need to work together more openly, sharing both the risks and value created by our efforts. This is the only path to shared progress and prosperity.

As a tech company, one of our greatest social responsibilities is exploring the future. We will spare no effort as we probe the endless frontiers of science and technology. We will join forces with people from around the world to break through engineering bottlenecks and limits in fundamental theories. We are committed to bringing ICT technology to each and every industry, to creating new value by helping them go digital, intelligent, and green, and to helping them cut their energy consumption and go low-carbon. Our ultimate goal is to bring the benefits of technology to everyone.

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Message from the Rotating Chairman

> **Moving forward, Huawei will advance its journey of digitalization, intelligent transformation, and low carbon. We will continuously increase investment in talent, scientific research, and innovation, in an effort to reshape our foundational technologies. Building on this, we will bring together ICT technologies and our global experience to drive digital transformation across different industries, and create greater value for both our customers and society at large.**

Over the past three years, an extremely challenging business environment – not to mention substantial nonmarket factors – have complicated our business operations.

And yet when the storm came, we chose to run headfirst into the rain. We have done everything in our capacity to ensure business continuity, with no interruptions in delivery or service. We have been working day and night to grow the harvest and secure our survival. The pouring rain hasn't extinguished our faith in what the future holds. Quite the opposite: We're more dedicated and innovative than ever.

While many have been watching to see whether Huawei might fall, we've maintained focus on creating value for our customers and working together with our ecosystem partners to foster shared success. We have kept plugging away, improving the quality of our operations and investing in the future.

We could not have achieved any of this without the ongoing trust and support of our customers, partners, and friends from all over the world. You have given us the foothold and the confidence we need to keep climbing. On behalf of everyone at Huawei, thank you for sticking by our side.

Solid financial results, increased operating efficiency, and healthy business development

In 2021, our revenue reached CNY636.8 billion, wrapping up the year in a solid financial position. Overall, our performance was in line with forecast. Our carrier business remained stable, our enterprise business experienced steady growth, and our consumer business quickly expanded into new domains.

In 2021, Huawei generated a net profit of CNY113.7 billion with a net margin of 17.9%. Cash flow from operating activities grew by 69.4%, and we now have plenty of cash on hand. Our liability ratio dropped from 62.3% in 2020 to 57.8% in 2021, further improving our capital structure. By streamlining management and making full use of digital technology, we've made ongoing improvements to operating efficiency, ultimately reducing selling and administrative expenses by CNY9.3 billion.

The harder things get, the more we invest in the future. In 2021, we increased our R&D investment to CNY142.7 billion, representing 22.4% of our total revenue. Both our R&D expenses and R&D expense ratio reached their highest levels in the past ten years. In terms of R&D expenditure, Huawei ranked second in the 2021 EU Industrial R&D Investment Scoreboard.

In 2021, we worked with carriers and partners around the world to create simplified, green, and intelligent ICT infrastructure. Test results show that 5G networks built by Huawei for customers in 13 countries provide the best user experience. To date, we have advanced over 3,000 industrial 5G applications, and have worked with carriers in over 100 countries and regions to build green sites.

In 2021, we launched 11 scenario-based solutions for key sectors such as government, transportation, finance, energy, and manufacturing. We established multiple integrated teams, including a Coal Mine Team, a Smart Road Team, and a Customs & Port Team, to combine resources in a way that more efficiently serves the needs of our customers. Over 700 cities and 267 Fortune Global 500 companies have chosen Huawei as their digital transformation partner, and we now work with more than 6,000 service and operation partners around the world.

Our consumer business zeroed in on consumer wants and needs, further building out the global ecosystem for a smart, all-connected era. We continued to see steady sales growth in smart wearables, smart screens, true wireless stereo (TWS) earbuds, and Huawei Mobile Services (HMS) throughout the year. In total, HarmonyOS was used in over 220 million Huawei devices. We enhanced our brand marketing, channel sales, retail, and service capabilities based on our "1 + 8 + N" Seamless AI Life strategy, which has allowed us to expand into new domains while speeding up our strategic transition.

For Digital Power, we worked with customers and partners worldwide to build low-carbon communities with ongoing innovation in domains like clean power generation, energy digitalization, transportation electrification, green ICT power infrastructure, and integrated smart energy. In total, our digital power solutions helped customers generate 482.9 billion kWh of renewable electricity and save 14.2 billion kWh of electricity. These efforts resulted in a reduction of nearly 230 million tons in CO_2 emissions.

By diving into digitalization, our cloud business made solid progress towards "delivering everything as a service". With Infrastructure as a Service (IaaS), we help enterprises expand their services to all four corners of the earth. With Technology as a Service (TaaS), we provide the fruits of our R&D efforts in the form of cloud services, making innovation easier than ever. With Expertise as a Service (EaaS), we help developers incorporate industry best practices into their own solutions. To date, we have launched more than 50 scenario-based cloud services and provided customers with more than 8,000 scenario-based solutions. To date, more than 2.6 million developers have joined the Huawei Developer Program. Together, we remain committed to providing stable, reliable, secure, trustworthy, and innovative cloud services to our customers.

Our Intelligent Automotive Solution business aims to serve our customers and partners with high-quality products. By the end of 2021, we launched more than 30 intelligent automotive components, bringing new innovation to the industry. We work with car OEMs using models like Huawei HI and Huawei Zhixuan. As always, Huawei does not make cars. We help car OEMs build better cars – and sell more of them.

Over the past year, the competitiveness of Huawei's products has received wide recognition in the industry. At MWC Barcelona 2022, we received major awards for our involvement in multiple projects, including Best Mobile Innovation for the Connected Economy, Best Mobile Innovation for the Connected Human, Best Mobile Innovation for Climate Action, and the 5G Industry Partnership Award. Huawei ranked 9th on Brand Finance's list of the World's Top 10 Most Valuable Brands in 2022, a testament to our brand's sustained recognition and influence in global markets.

Reshaping competitiveness through innovation in systems engineering

The future is built on assumptions, and without the right assumptions we wouldn't be able to find the right way forward. In the absence of a clear direction, our ideas, theories, and strategies would all be led astray.

Our customers expect Huawei to keep providing leading, competitive products well into the future. And that's the direction we'll head. Of course, there's no small number of roadblocks waiting for us along the way, be it patchwork globalization, the politicization of technology, the lingering pandemic, or the bottlenecks in fundamental theories. So if we want to keep meeting our customers' expectations, we can't limit ourselves to traditional, well-worn paths as we move forward.

We will continue investing heavily in R&D to strengthen our innovation in systems engineering and drive fundamental changes in three areas: fundamental theory, architecture, and software. The mission of a system determines how its components are designed, whereas the architecture is what holds everything together for optimal system-level performance. Our goal isn't to make the absolute best components, but to make breakthroughs from a holistic systems perspective. That's where our future competitiveness lies.

Rethinking fundamental theories. We will keep exploring theories and technologies related to next-generation MIMO and wireless AI, which will take us even closer to Shannon's Limit. At the same time, we will dive into new theories like semantic communications, trying to go beyond Shannon's Limit and create new horizons for the development of the communications industry. This plunge into the frontiers of communications theory has already begun to bear fruit. Our MetaAAU, an innovative Massive MIMO product, can add 30% in both uplink and downlink coverage, while delivering a 25% better experience among cell edge users. Compared to a traditional AAU, a MetaAAU is 30% more efficient in energy consumption.

Reshaping architecture. In telecoms, we are using photoelectric fusion and leveraging the synergy between wireless and optics to address core challenges like ultra-high-frequency, ultra-large-bandwidth, and ultra-high-speed data transfer in wireless communications. With these same technologies, we also hope to break through process bottlenecks in future chipmaking. As for computing, we are actively working to address the inability of traditional CPU-centered architectures to keep up with rapidly growing AI and big data applications. In particular, we are developing a peer-to-peer architecture that uses a Unified Bus to enable GPUs, NPUs, and new hardware to more effectively support the explosive growth of AI applications. After we extend this design to computing centers, we estimate that third-generation cluster computing centers will increase performance by a factor of five to ten.

Reinventing software. The explosive growth of AI is significantly driving up demand for computing power while advancements in hardware tend to be slowing down. In response, we have made software a greater priority and streamlined our technology systems for basic software. Moving forward, we will focus on breakthroughs in performance, scalability, integrated storage, and ease of development, through which we aim to maximize the computing potential of diversified hardware with HarmonyOS and openEuler. With our MindSpore framework, we are helping scientists

and engineers significantly improve the efficiency of AI development. We expect reinventing the full software stack around the needs of AI will cultivate a new ecosystem. Through our Software Engineering Capability Enhancement Transformation, we have *doubled* the number of cells and scheduled users for wireless, *quadrupled* the user access performance of Ethernet switches, and cemented the leadership of our optical transmission products. These innovations have enabled us to maintain top-notch product competitiveness despite the challenges we face.

Theoretical breakthroughs, advancements in software, and reshaping architecture will lay solid foundations for our future survival and development. The key to achieving these three goals is to open up, innovate, and embrace global talent.

As always, we remain open to new ideas and collaboration, and are in the process of building out a truly global portfolio of technological capabilities. We work closely with local scientific communities and the world's universities to set up joint labs. We have also opened a number of Spark Cafés near universities. These cafés serve as an openly accessible platform where scientists worldwide can explore, discuss, and drive progress in science and technology. Together, we hope to ignite the sparks that light our way forward as a global community.

We put together the most pressing challenges in our industry and are actively looking to recruit top minds around the globe so that world-class talent can take a crack at world-class problems. We want to attract top minds in great numbers, giving experts a platform to dive headfirst into scientific domains while unleashing their full potential in key business domains. With a large talent pool, we can help remove the industry's most difficult bottlenecks. Huawei ranked 8th on the Forbes list of the World's Best Employers in 2021, and we will keep working hard to make Huawei a place where great people are excited to work.

Serving customers with trustworthy offerings, a reliable value chain, and a thriving ecosystem

Huawei exists to serve our customers and help them solve their commercial problems. Together with our partners, we will continue providing innovative products and quality services to help those who choose to work with Huawei seize new opportunities in digitalization and decarbonization – and ultimately succeed.

Building a secure, reliable, competitive, and healthy value chain. Huawei has a robust end-to-end business continuity management (BCM) system that covers all steps along our value chain: from suppliers and partners, to Huawei itself, and then on to our customers. Optimizing this system is an ongoing effort. We have established backup supply networks at multiple points, along multiple paths, and at multiple levels, to actively respond to supply disruptions caused by the pandemic and other external supply challenges. Needless to say, our supply network has been put to the test in the past few years, and it's managed to stand strong. We will stick to our strategy of maintaining a globalized, diversified supply chain, and will work closely with our suppliers and partners to create a secure, reliable, competitive, and healthy value chain.
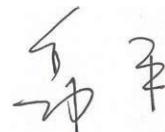
Developing secure and trustworthy products, solutions, and services. Cyber security and privacy protection are and will always remain our top priority. In response to trends like cloudification, the broad use of artificial intelligence, and software-defined everything, we will continue deepening our Software Engineering Capability Enhancement Transformation to ensure that both our results and processes are trustworthy. We will keep making improvements to our end-to-end cyber security assurance systems through management transformation, technological innovation, and open collaboration, in order to embed trust and quality into the very fabric of every product and solution.

Focusing on platform capabilities to cultivate a thriving ecosystem. We will continue developing our business ecosystem based on the principles of open collaboration and shared growth. We will work with our industry partners to build thriving HarmonyOS, openEuler, and MindSpore ecosystems, and create greater value for customers. We encourage a spirit of open innovation, collaboration, and mutual support. To this end, we will keep optimizing operations and monitoring ecosystem health, in order to maximize creativity and value, and achieve multi-win outcomes. Over eight million developers are using our open platforms, open-source software, and a rich variety of development tools to enhance their development efforts. At the moment, more than 70 universities are working with us to develop courseware and broaden their efforts to cultivate new digital talent.

The world we live in is a complicated system, but our philosophy is simplicity itself. Feet planted firmly on the ground, we focus on solving our customers' problems and creating practical value for both industries and society.

An organization can only last when it stays on the right track and actively promotes vitality. Looking ahead, we'll keep pushing the boundaries of our assumptions and probing the very frontiers of technology. In the meantime, we'll keep building up the lifeless mechanisms that ultimately give life to our organization, and use the certainty of rules as a bulwark against uncertainties in the outside world.

We still have plenty of challenges ahead of us. Our fight to survive isn't over yet, but no matter what comes our way, we will keep increasing our strategic investments and working closely with partners across the ecosystem. We firmly believe that, together, the future is better.

Guo Ping
Rotating Chairman

Business Highlights in 2021
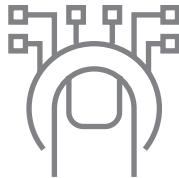
Driving Ubiquitous Connectivity

- We have supported the evolution of innovative 5G services from technical verification to commercial application. Innovative, 5G-powered applications, such as AR, VR, and free-viewpoint video, are already a reality in multiple countries and regions. Our RuralStar series solutions provide high-quality mobile broadband services to remote villages, driving rural digitalization. To date, they have provided connectivity to more than 60 million people in over 70 countries and regions.

- We are committed to making IP on Everything a reality, and have launched an end-to-end Intelligent Cloud-Network Solution. Together with upstream and downstream industry organizations, carriers, and industry customers, we have guided the real-world application of IPv6 and IPv6 Enhanced.

- Huawei Cloud has continued to expand its global data centers and acceleration networks. Through cloud-network collaboration, we strive to connect people, things, and applications, provide a seamless experience on one global network, enable efficient distribution and processing of information streams, and quickly deliver cloud services to where they are needed.

- HarmonyOS has been deployed on more than 220 million Huawei devices. More than 4,500 products from over 1,900 ecosystem partners have joined HarmonyOS Connect. In 2021, over 115 million new HarmonyOS Connect devices were shipped.

Enabling Pervasive Intelligence

- Our Ascend AI platform is empowering the development of new information infrastructure represented by AI computing centers. More than 20 cities in China are planning or building AI computing centers, which are enabling scientific research, innovation, and industrial development. Working with partners, Huawei has launched a wide range of industry-specific solutions, such as Ascend Smart Manufacturing Solution, Ascend Smart Transportation Solution, and Ascend Smart Inspection Solution, enabling the intelligent upgrade of industries.

- We upgraded openEuler as an open source OS that supports digital infrastructure. Huawei and its partners also officially donated openEuler to the OpenAtom Foundation.

- Huawei Cloud released technologies such as the Pangu pre-trained models and the OptVerse AI Solver. By diving into industries and building the intelligent hubs they need, we have amassed considerable know-how related to the application of AI in these industries, and applied this know-how in more than 20 Chinese cities and multiple enterprises that are setting the bar in various fields.

- In the intelligent automotive solution domain, we unveiled five innovative solutions: HarmonyOS Intelligent Cockpit, 4D imaging radar, MDC 810, the Huawei Octopus autonomous driving open platform, and an intelligent thermal management system.

Delivering a Personalized Experience

- Supported by the HarmonyOS and Huawei Mobile Services (HMS) ecosystems, we deliver a Seamless AI Life experience to consumers across five major user scenarios: smart office, fitness & health, smart home, easy travel, and entertainment.

- Following its integration into our wearables and smart screens, HarmonyOS now powers smartphones, tablets, car cockpits, and other Huawei products, further enriching the Seamless AI Life experience for our consumers. HarmonyOS Intelligent Cockpit enables a vehicle's own apps to connect seamlessly to devices such as smartphones and smart home systems, making the fully-connected vehicle a reality.

- We launched HMS Core 6, which provides more advanced open technical capabilities and services, including 69 kits and 21,738 APIs in seven domains (e.g., Graphics, Media, and AI). The HMS mobile app ecosystem, the world's third largest, has continued to thrive. In 2021, the number of HMS apps worldwide jumped by 147% compared to 2020, and there were over 432 billion app downloads worldwide.
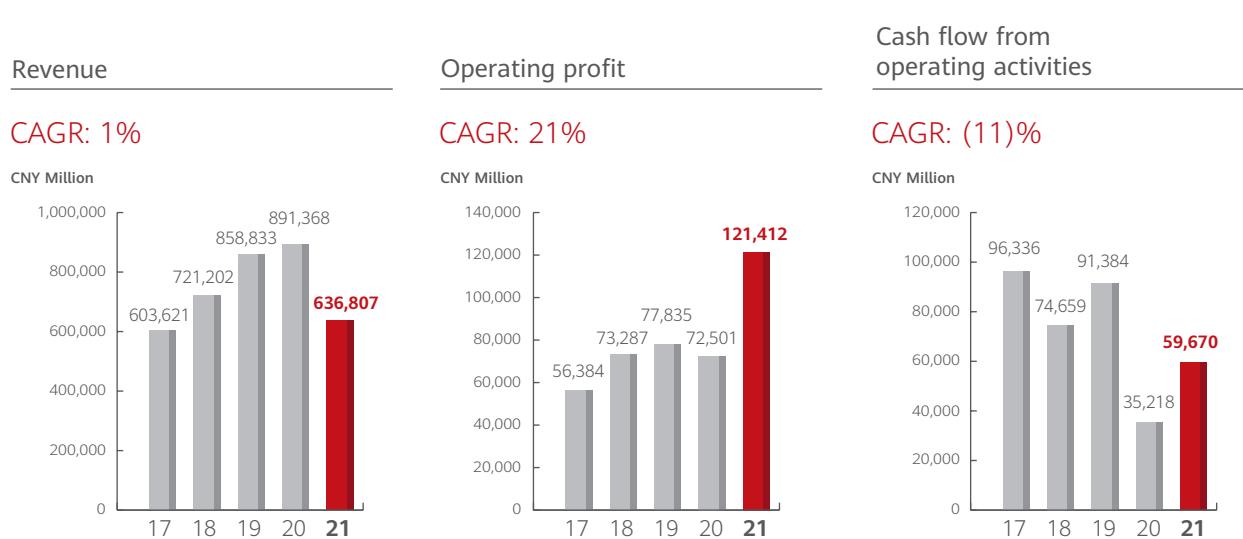
Building a Digital Platform

- Building on our strengths in ICT infrastructure technologies, characterized by device-network-cloud synergy, we have stepped up efforts to create a digital ecosystem where all players create and share value together in order to help industries go digital. Over 700 cities and 267 Fortune Global 500 companies worldwide have chosen Huawei as their partner for digital transformation, while over 30,000 partners are working with us to serve the enterprise market.

- Huawei Cloud is the world's fastest growing major cloud service provider and continues to empower industries. We have launched more than 220 cloud services and 210 solutions, and attracted over 30,000 partners and 2.6 million developers worldwide. More than 6,100 applications are now available on the Huawei Cloud Marketplace.

- Huawei Cloud launched the MacroVerse aPaaS platform. With developers at its core, this one-stop, open platform aggregates the capabilities of partners from across a wide range of industries and offers expertise as a service, empowering scenario-tailored innovation in industries and accelerating industry digitalization.

Five-Year Financial Highlights

	2021		2020	2019	2018	2017
	(USD Million)	(CNY Million)	(CNY Million)			
Revenue	99,887	636,807	891,368	858,833	721,202	603,621
Operating profit	19,044	121,412	72,501	77,835	73,287	56,384
Operating margin	19.1%	19.1%	8.1%	9.1%	10.2%	9.3%
Net profit	17,837	113,718	64,649	62,656	59,345	47,455
Cash flow from operating activities	9,360	59,670	35,218	91,384	74,659	96,336
Cash and short-term investments	65,304	416,334	357,366	371,040	265,857	199,943
Working capital	59,122	376,923	299,062	257,638	170,864	118,503
Total assets	154,184	982,971	876,854	858,661	665,792	505,225
Total borrowings	27,465	175,100	141,811	112,162	69,941	39,925
Equity	65,040	414,652	330,408	295,537	233,065	175,616
Liability ratio	57.8%	57.8%	62.3%	65.6%	65.0%	65.2%

Note: Converted into United States dollars ("USD") using the closing rate at the end of 2021 of USD1.00 = CNY6.3753

Revenue

CAGR: 1%

CNY Million

Year	Value
17	603,621
18	721,202
19	858,833
20	891,368
21	636,807

Operating profit

CAGR: 21%

CNY Million

Year	Value
17	56,384
18	73,287
19	77,835
20	72,501
21	121,412

Cash flow from operating activities

CAGR: (11)%

CNY Million

Year	Value
17	96,336
18	74,659
19	91,384
20	35,218
21	59,670

Message from the Chairman

2022 may prove to be more challenging yet, but we are confident in what the future holds. We will work closely with our global partners to overcome the challenges we face as we seek to pull through and develop as a business. We will also keep increasing investments in the future to create greater value for our customers, the communities where we operate, and the society that we serve. Our goal is to survive – and to do so sustainably.

Pressing ahead for strategic breakthroughs

In 2021, all hands were on deck to face a barrage of new challenges. It was one roadblock after another, but we stood strong and worked hard to achieve our business goals. In the end, our performance was in line with forecast.

I'd like to take a moment to thank our customers, partners, and friends from all over the world for your ongoing trust and support.

Over the past three years, our goal has remained the same – to survive and to do so sustainably. Changes in the external environment have not caused us to stray from our vision or mission. All these challenges and difficulties have only made us stronger.

For one, our business continuity efforts have enabled us to keep serving the customers who have chosen to work with us, and serve them well. For another, our heavy investments in R&D have allowed us to solve a number of technological problems and explore the frontiers of science and technology, which helps lay a solid foundation for our future.

2022 may prove to be more challenging yet, but we are confident in our future development. We will work closely with our global partners to overcome the challenges we face as we seek to survive and develop as a business. We will also keep increasing investments in the future and make strategic breakthroughs to create greater value for our customers, the communities where we operate, and the society that we serve.

Digital and intelligent technologies for low-carbon development and new social value

Enabling industry digitalization for both business and social value. Digital and intelligent technologies have become key drivers of socioeconomic development and are triggering a new round of revolution in industries around the world. At Huawei, we are leveraging these innovative technologies to create new business and social value.

Over the past year, together with our carrier customers and partners, we have enabled digital transformation in more than 20 industries, including ports, manufacturing, coal mining, steel production, and chemicals. To date, together with our carrier customers and partners, we have signed more than 3,000 commercial contracts for industrial 5G applications worldwide.

In ports, 5G has changed the way gantry cranes are operated. In the past, crane operators had to work at great heights, hanging their heads to look down at shipping containers for 10 to 12 hours each day. On top of that, climbing up and down the cranes everyday was difficult, grueling work. With 5G and high-definition video, now crane drivers are able to operate their equipment remotely and work in a much more agreeable environment. It's better for existing crews, and makes the job a lot more appealing to new applicants as well.

In steel mills, 5G makes remote control a reality, boosting productivity and allowing people to escape the furnaces and work in a safer, more comfortable environment.

In the chemical industry, people have to deal with flammable, explosive chemicals and extremely high temperatures. 5G has made robot inspection and mobile monitoring possible, so that data on all aspects of plant operations can be collected by video and analyzed in real time. This can greatly improve a processing plant's ability to predict early signs of danger.

These are just some examples of how digital and intelligent technologies can make a difference. They create business value through productivity gains, while also providing significant social value by enabling safer and more hospitable working environments.

Powering low-carbon development with green ICT. Green development has become a globally recognized mission. And as digital and green technologies converge, digital technology will be key to accelerating decarbonization. Through nonstop innovation, we want to help advance the green and low-carbon agendas for our customers and society at large.

Working in the ICT industry, we have been developing innovative green technologies that make ICT products more energy efficient. We are also working with global carriers to build simplified, green, and intelligent ICT infrastructure. By the end of 2021, we have helped carriers in more than 100 countries and regions deploy green site solutions. These solutions have helped save roughly 84.2 billion kWh of electricity and reduce CO_2 emissions by about 40 million tons. This is part of our greater efforts to promote the green development of the ICT industry as a whole.

We are also enabling other industries to upgrade and achieve green development with ICT. In Switzerland, for example, we are using digital technology to support precision weed management on farms. This has cut herbicide use by 90%, reducing their environmental impact. In China, our smart heating solutions enable on-demand heating, which reduces average energy consumption by 10% in the Daowai District of Harbin, a city in northeast China.

We've also integrated digital, power electronics, energy storage, and heat technologies to more effectively manage watts with bits, helping customers conserve energy and cut emissions. By the end of 2021, our digital power solutions have helped customers generate 482.9 billion kWh of green power and save 14.2 billion kWh of electricity. These efforts have resulted in a reduction of 230 million tons of CO_2 emissions, the equivalent of planting 320 million trees.

Developing digital talent to bridge the digital divide. Digital talent plays a huge role in driving digital transformation and advancing the digital economy. This is why we are working with our partners worldwide to develop a more robust digital talent ecosystem and drive broader digital inclusion through our targeted TECH4ALL program. We want to bring the benefits of digital technology to everyone.

In 2008, we launched a program called Seeds for the Future to support the cultivation of local digital talent in communities around the world. This initiative later branched out into other development programs, including technology competitions, dedicated scholarship programs, the Huawei ICT Academy, Huawei Developers Training, and the Huawei Cloud Developer Institute. So far, we have invested more than US$150 million in these programs, helping more than 1.54 million people from over 150 countries boost their digital skillsets.

In 2021, we launched the Seeds for the Future Program 2.0, which is part of our ongoing efforts to help cultivate broader swaths of digital talent. We will invest US$150 million in this program over the next five years, and we expect these efforts to benefit more than three million more people. Moving forward, we hope more people and organizations will join our TECH4ALL initiative to support more inclusive development of digital talent around the world.

Doubling down on open collaboration, innovation, and globalized operations for shared growth

As a tech company, one of the biggest contributions we can make to humanity is technological innovation.

We are committed to open innovation and working with our partners to make breakthroughs in basic research, and we spare no effort as we probe at the very frontiers of science and technology.

In 2021, our R&D spend was CNY142.7 billion, about 22.4% of the company's annual revenue. Our total R&D investment over the past decade is more than CNY845 billion, and in recent years, more than CNY20 billion of our annual R&D budget has been allocated to basic research.

Now is a critical moment for our company. We will continue to increase investments in research and innovation and create new value for all industries, enabling every person, home, and organization to benefit from advances in digital technology.

We have set up 86 labs that dive deep into fundamental theories and work to build up core technology systems. With greater adoption of AI in all aspects of life, we have put forward a new model for trusted computing, which can run on multiple programming languages and platforms. This model will increase data processing capacity by three orders of magnitude.

We are also working with partners to create thriving open source ecosystems around openEuler and HarmonyOS, as well as open source operating systems that adapt to future computing scenarios. Our purpose is to amp up computing power and data flows, and quickly make computing resources as affordable and accessible as electricity.

As part of our efforts to broaden collaboration, we actively engage with global academic associations and strengthen collaboration with universities and research institutes around the world. We exchange ideas and share the problems we face, and work together to address our industry's toughest challenges, so as to drive technological progress for everyone. We warmly welcome top scientists and the best minds from all around the world to join us in these efforts.

In recent years, Huawei has built Spark Cafés and Nine-Chapters Cafés in Beijing, Shanghai, Shenzhen, and many other cities to provide scientists with a relaxed and undisturbed environment for innovation.

Our goal is to make it easier for scientists to more fully apply themselves to their research projects. This will allow them to explore the future, make it happen, and help make the world a better place.

On the operations side, Huawei is committed to globalized operations and diversifying our supply chains to ensure long-term, continuous, and stable supply, and to lay the foundations for more sustainable development. We work with over 10,000 suppliers and partners around the world and have established solid, long-term partnerships with them. Through open collaboration, we are able to overcome all manner of difficulties and challenges as our business grows.

We firmly believe that collaboration leads to shared success and mutual development, and we are confident in our ability to work with partners from around the world to forge a secure, reliable, competitive, and healthy value chain. This will allow us to continue delivering quality products and services to our customers worldwide.

Enhancing corporate governance and ensuring operational compliance to better serve our customers

A robust corporate governance system is the cornerstone of sustainable development. Huawei stays customer-centric, inspires dedication, and continuously improves its governance structure, organizations, processes, and appraisal systems to sustain its long-term and profitable growth.

In 2021, our Representatives' Commission met twice to review and approve a new series of governance guidelines. One of the resulting documents – *System of the Supervisory Board* – has further defined the positioning, responsibilities, and authority of the Supervisory Board and standardized its operations. There are also guidelines that further delineate the relationship between the company's Board of Directors and subsidiary boards.

Over the past year, we have also established new business management systems and platforms to reinforce digital operations, so that field offices can quickly respond to customer needs in an environment complicated by the pandemic. All of these efforts are aimed at growing the harvest and tilling the soil for future growth.

At Huawei, we believe that legal compliance is a bulwark against the uncertainties of international politics. We conduct business with integrity, adhere to standard business ethics, and observe applicable laws and regulations in the countries and regions where we operate. This is a core guiding principle upheld by our management team. According to company policy, all of our subsidiaries and departments around the world must strictly comply with local laws and regulations. Huawei values and works hard to create a culture of integrity, and requires all employees to comply with its Business Conduct Guidelines (BCGs).

Moving forward, we will continue to communicate openly with the world and embrace transparency so that all customers, partners, and other stakeholders can get to know Huawei better. We welcome all stakeholders – including governments, the media, researchers, and experts – to come and see who we truly are.

The road we're on is certainly a bumpy one, but it's also rewarding. With no way back, success is our only way forward. We will continue on the path of open collaboration and stick to our strategy to ensure our survival and development.

No matter how bumpy the road ahead may be, we will stay the course and remain committed to our vision and mission: To bring digital to every person, home and organization for a fully connected, intelligent world.

Liang Hua
Chairman of the Board

Industry Trends

Exploring the Intelligent World

Over the past three years, Huawei has hosted more than 2,000 seminars, bringing together customers, partners, and academics. Based on these discussions, we have come up with our thoughts on the next decade. We lay out eight directions for exploration, spanning multiple disciplines and domains, to answer questions like: How can ICT help us overcome the problems and challenges that we face? What opportunities will ICT bring to organizations and individuals? For our own industry, we have systematically explored future technologies and lines of progress in domains like communications networks, computing, digital power, intelligent automotive solutions, and smart devices.

We believe that a wonderful intelligent world is fast approaching, and it will benefit every individual, home, organization, and vehicle. Looking ahead to 2030, we hope that the future will bring improved quality of life, more food, and scalable living spaces. We also look forward to the end of traffic congestion, more livable cities, and easy access to renewable energy. We dream of robots that can do repetitive and dangerous work for us. And we want to have secure access to digital services. Driven by these needs, we have set eight directions for exploration.

Healthcare	Making health computable, bettering quality of life

By 2030, we will be able to identify potential health problems by computing and modeling public health and medical data, shifting the focus from treatment to prevention. The growing popularity of fitness wearables and use of technologies such as IoT and AI will make personalized treatments a reality.

Food	Data-driven food production for more bountiful, inclusive, and "green" diets

By 2030, we will be producing multi-dimensional data graphs that will make precision farming possible. The data we collect will enable us to control factors affecting crop growth, such as temperature and humidity, so that we can build vertical farms unaffected by the uncertainties of climate. 3D printing is also introducing the possibility of artificial meat adapted to taste and dietary requirements. We will be relying on firm data rather than the vagaries of the climate for farming.

Living spaces	Personalized spaces with novel interactive experiences

By 2030, we will no longer have to live with clutter. We will manage our possessions with a digital catalog powered by a 10 gigabit network, holograms, and other technologies. Automatic delivery systems will bring household items from shared warehouses to our doors whenever we need them. Intelligent management systems that control our physical surroundings for automatic interactions will mean that the buildings where we live and work may produce net zero carbon. With the next-generation IoT operating systems, multiple intelligent devices will work together, enabling people to live and work in adaptive, intelligent spaces that understand their needs and offering a brand-new interactive experience.

Transportation	Smart, low-carbon transport opens up the mobile third space

By 2030, transport systems will see innovations across many different dimensions. Vehicles using green energy and controlled by autonomous driving technology will provide us with a mobile third space. New autonomous passenger aircraft will make emergency rescue faster, reduce the costs of delivering emergency medical supplies, and may even change how people commute. Mobility solutions will be efficient, customized, and shared, meaning that vehicles will be used much more efficiently and travel will become greener.

Cities	New digital infrastructure makes cities more human and livable

By 2030, the spread of new digital infrastructure will make for better management of the urban environment, with more efficient use of resources and more effective city governance. Cities will be smarter, and citizens will be able to enjoy services that are user-friendly and easier to access. This will make cities more comfortable and livable.

Enterprises	New productivity, new production models, new resilience

By 2030, digital transformation will push enterprises to shift to data-based intelligent operations. They will use new machines, such as collaborative robots and autonomous mobile robots, for increased flexibility in R&D, manufacturing, supply, sales, services, and other activities. New production models will be more people-centric since mass customization will be possible. Companies will become more resilient in the face of dynamic market environments.

Energy	Green, intelligent energy for a better planet

Energy will be greener and more intelligent by 2030. Power plants will be generating electricity from renewable energy sources in lakes and marine areas. Low-carbon data centers and base stations will become a reality. Virtual power plants and energy clouds will be used to build an "energy Internet", with digital technologies connecting generation-grid-load-storage.

Digital trust	Technologies and regulations shape a trusted digital future

By 2030, digital trust will be a basic requirement for our social infrastructure. We will need to combine digital technologies like AI, blockchain, and privacy-enhancing computation with regulations that are designed to ensure data security, cyber security, and personal privacy protection. This will deliver an intelligent world with digital trust.

Intelligent World 2030: Fast-evolving Digital Infrastructure and Smart Devices

	Communications Network 2030: Cubic broadband networks providing ubiquitous intelligent connections

In the next decade, the objects and boundaries of network connectivity will continue to expand. By 2030, as technologies such as XR, naked-eye 3D displays, electronic skin, and electronic noses develop further, next-generation networks, with digital vision, digital touch, and digital smell, will provide immersive and disruptive experiences. As future networks will need to connect hundreds of billions of things, not just billions of people, the focus of network design will be shifted from human-oriented cognition to machine-oriented cognition. Future network infrastructure will be able to enable massive connectivity, support huge amounts of data, and provide multi-level computing power, and we will see computing networks that provide connectivity services. In addition, four types of future networks will gradually become a reality: networks that deliver a consistent experience across homes, offices, and vehicles; satellite broadband Internet; industrial Internet; and cognitive networks.

The communications network of 2030 will be defined by six key features: cubic broadband network; deterministic experience; AI-native; harmonized communication and sensing; security and trustworthiness; and green and low-carbon. Huawei predicts that by 2030, there will be more than 200 billion connections worldwide, and 10 gigabit connectivity will be available to every enterprise, household, and individual.

Computing 2030: Pervasive diversified computing

By 2030, the digital and physical worlds will be seamlessly converged, allowing people and machines to interact perceptually and emotionally. AI will be ubiquitous and will help us transcend human limitations. It will serve as the microscope and telescope for scientists, enhancing our understanding of everything from the tiniest quarks to the largest cosmological phenomena. Industries already making extensive use of digital technology will become more intelligent. Computing energy efficiency will continue to increase, bringing us closer to low-carbon computing. Digital technologies will become a tool for achieving the global goal of carbon neutrality.

Computing is approaching its physical limits, so innovation in software, architecture, and systems will be needed. More importantly, the entire industry needs to jointly explore a new foundation for computing, break through the physical limits of semiconductors, and make computing greener, more secure, and more intelligent. Huawei predicts that by 2030, we will be producing yottabytes of data every year. The amount of general-purpose computing power in use will increase tenfold, and AI computing power will increase by a factor of 500.

Digital Power 2030: Low-carbon, electrified, and intelligent

New renewable energy sources, such as solar and wind, will gradually replace fossil fuels. Power electronics and digital technologies are being deeply integrated so that digital bits will manage electric watts effectively throughout the energy system, and intelligent applications will be running on the "energy cloud". Huawei predicts that by 2030, wind

and solar will become major energy sources, and 50% of electricity generated worldwide will be from renewables. Electricity will represent more than 30% of our power consumption. Over 50% of vehicles sold will be electric. Green energy will power more than 80% of digital infrastructure.

Intelligent Automotive Solution 2030: Bringing digital to every vehicle

In the next decade, electrification and intelligence will be ongoing trends, and ICT will converge with the automotive industry. Huawei predicts that by 2030, over 20% of new vehicles sold in China will be autonomous vehicles; vehicles will come equipped with computing power of over 5,000 TOPS; and in-vehicle network transmission speed per link will exceed 100

Gbit/s. The automotive industry will take great strides in intelligent driving, intelligent spaces, intelligent services, and intelligent operations. To support this progress, Huawei hopes to use its ICT to enable an intelligent automotive industry and help carmakers build better vehicles.

In the next decade, consumer devices will come in a greater variety. Individual devices like mobile phones, PCs, tablets, TVs, and watches will be more intelligent. Collaboration among multiple devices will bring users an extraordinary "super device" experience. These devices will not just serve as personal mobile tools; they will sculpt more intelligent spaces, including at home, at the office, and during travel. Human-computer interaction will be more natural as speech recognition, semantic understanding, and computer vision technologies spread. The physical and digital worlds will further converge, and advanced VR and AR technologies will offer users new immersive experiences. Services will be more intelligent, proactive, and better targeted. Based on a good understanding of user habits, services will be automatically pushed to the right users while privacy is well protected.

Creating the Intelligent World 2030 Together

Our imagination is the only limit on how far we can go, but it is the actions we take now that will determine how quickly we can get there. The best way to predict the future is to create it. There may be ups and downs on our journey towards the intelligent world of 2030, but we will overcome them by working together. We believe that the power of thought is the key driver of social progress. Moving towards the next decade, let's work together to create a better, intelligent world.

Management Discussion and Analysis

Our Vision, Mission, and Strategy

Huawei's mission is to bring digital to every person, home and organization for a fully connected, intelligent world.

To this end, we will:

- Drive ubiquitous connectivity and promote equal access to networks to lay the foundation for the intelligent world

- Provide diversified computing power to deliver ubiquitous cloud and intelligence

- Build powerful digital platforms to help all industries and organizations become more agile, efficient, and dynamic

- Redefine user experience with AI, offering consumers a more personalized and intelligent experience across all scenarios, including home, travel, office, entertainment, and fitness & health

Building a Fully Connected, Intelligent World

Ubiquitous Connectivity	Pervasive Intelligence	Personalized Experience	Digital Platform
Every person has the right to be connected. Connectivity is the foundation for social progress and economic growth. Connections will soon become a natural and ubiquitous resource, provided by networks that proactively sense changes and user needs. These networks will offer intelligent, seamless, and secure connections to people and things whenever and wherever they want. With the advent of 5G, we begin a new chapter in this story.	In the digital economy, computing power is a new driver of production. Data itself is a core asset, and cloud and AI are the new tools of productivity. Moving forward, AI computing will account for more than 80% of a computing center's capacity, providing the muscle for practical AI applications in all areas of life. To deliver ubiquitous cloud and intelligence, we will need to provide the ultimate computing power.	Using AI, cloud, and big data technologies, businesses can better understand their customers' needs and innovate with greater agility to craft a more personalized experience. Coordination and collaboration across industries will drive innovation at scale. With the continuous evolution of smart devices, a seamless experience across all scenarios will become the foundation of an intelligent life.	A new digital wave is sweeping the globe. Digital and AI technologies are helping all governments and businesses become more agile, efficient, and dynamic. Open, secure, flexible, and easy-to-use digital platforms are facilitating innovation and transformation in all industries. They will be the bedrock and the fertile ground for our digital society to flourish.

Ubiquitous Connectivity

Connectivity has extended from people to things and from our homes to the factory floor. Now it's the foundation of everything in an increasingly intelligent world. Huawei is doing what it can to help our customers get ready for the future.

For mobile and home users, Huawei teams up with carriers to provide an ultra-broadband experience across all aspects of everyday life through gigabit 5G, optical, and Wi-Fi networks.

For government and enterprise customers, Huawei works with our partners to enable digital transformation. We provide intelligent connectivity solutions, including ubiquitous ultra-broadband, deterministic experience, and hyper-automation, to support the diverse needs of all enterprises.

We're on a nonstop mission to push connectivity to its limits with products and solutions like 5G, 5G core (one core and cloud-native architecture), best-in-class Wi-Fi 6, intelligent and lossless data center networks, optical cross-connect (OXC), and intelligent optical network terminals (ONTs). And as more industries go digital, we're using AI to enable hyper-automation of network O&M and developing new algorithms to pave the way for truly deterministic IP networks.

We believe that ICT will be pivotal to building a greener world and promoting the sustainable development of society at large. We develop network solutions for green sites, networks, and network operations, as well as more efficient and low-carbon energy solutions. We are also working with our ecosystem partners to deploy more energy-efficient ICT infrastructure. Together, we want to make ubiquitous connectivity a greener possibility.

Pervasive Intelligence

Data has become a valuable raw material these days, and computing power has become the new driver of productivity. The amount of data we produce will explode as more and more of the devices around us become smart, and many industries will need massive, intelligent storage capabilities to handle these new resources. Abundant and affordable computing power will determine the future of the digital economy.

Through nonstop innovation in data storage, diversified computing, and cloud services, Huawei is helping industries go digital by making pervasive intelligence possible. Together we will build a fully intelligent world.

In data storage, Huawei's converged, intelligent, and open data infrastructure is helping break down silos between storage, databases, and big data systems. Huawei's data management engine enables customers to integrate and optimize every step of the data lifecycle, from storage and computing to management and utilization. This helps maximize value per bit and reduce cost per bit to unlock the full potential of data.

In computing, Huawei is constantly developing innovative computing systems and architectures, pushing the boundaries of engineering, and driving synergies between basic software and hardware. We believe open hardware, open source software, partner enablement, and talent cultivation are key to developing the Kunpeng, Ascend, and openEuler ecosystems, which in turn will bring more diversified computing power to the whole world.

In cloud services, Huawei Cloud is working to offer everything as a service. Through this unit, we are translating the company's 30 plus years of ICT know-how into a wide variety of cloud services, including Infrastructure as a Service, Technology as a Service, and Expertise as a Service. These services aim to make the computing power required for AI as easily accessible as water and electricity. To this end, Huawei will continue to innovate in foundational technologies, platforms, and talent. We are also working to make AI more affordable, make it as accessible and available as possible, and help cultivate a new, thriving AI ecosystem.

Personalized Experience

The physical and digital worlds are converging, and the process is speeding up. Mass production is giving way to mass customization, leading to greater business innovation, collaboration across ecosystems, and a richer user experience.

Using new technologies like AI and cloud, businesses can better understand their customers' needs and innovate with greater agility to craft a more personalized experience. Coordination and collaboration across industries will drive innovation at scale.

In our user-centric intelligent world, usage scenarios and experiences are evolving. The boundaries between products and services continue to break down, with many converging scenarios, including home, travel, office, entertainment, and fitness & health. Soon all content and services will travel with users for a completely seamless, holistic experience. Smart collaboration between software and devices will give users an intelligent experience anytime, anywhere. At the same time, developments in natural interaction and machine learning will take the service quality of smart devices to a whole new level. Smart devices will be able to better identify, understand, and respond to users' needs across different scenarios throughout their day, paving the way for a truly personalized experience.

Huawei will continue working closely with partners in its software, service, and hardware ecosystems to systematically integrate existing technologies and innovate to better serve consumers. The company is committed to its Seamless AI Life strategy that focuses on five scenarios: smart office, fitness & health, smart home, easy travel, and entertainment. Through HarmonyOS and Huawei Mobile Services (HMS), Huawei continues empowering its ecosystem partners to provide consumers with a superior intelligent experience across all scenarios.

Digital Platform

Many industries are embracing intelligent upgrade now that digital transformation has reached new levels. From video data and industrial data to personal data and consumption data, all data is coming from more sources and in more forms and is becoming more fragmented. Powerful digital platforms are needed to integrate this data.

New technologies in connectivity, cloud, AI, computing, and industry applications are converging to support comprehensive intelligent connections between people, things, and information at multiple levels. These technologies will help industries expand their traditional boundaries, and enable governments and enterprises to expedite intelligent upgrade. Enterprises will have to adapt their business strategies, organization, processes, marketing, services, manufacturing, and R&D to cope with changes. To do so, enterprises need to synergize cloud, networks, edge, and devices to build an open, powerful digital platform with multi-dimensional perception, all-domain collaboration, accurate judgment, and continuous evolution. With cloud as the foundation and AI at its core, this digital platform helps users accumulate industry know-how, rapidly innovate their core business processes, and quickly iterate to respond to new competition and changes in their business environments.

A digital platform is one of the core engines that drives success in digital transformation. New information technologies can make organizations more efficient through intelligent management of their physical assets like buildings, factories, production lines, and utilities. At the same time, advanced digital technologies in connectivity, cloud, AI, and computing can change the way organizations operate and create new business models. This is the process of digital transformation and intelligent upgrade. An organization's IT systems and the corresponding operational methods combine to form a digital platform.
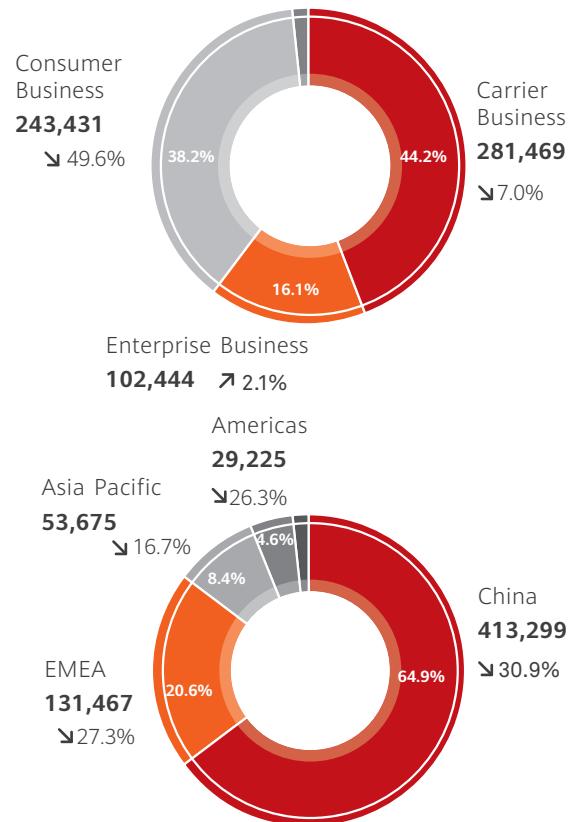
Together with its ecosystem partners, Huawei provides innovative technologies, products, and solutions that help its customers build open, secure, flexible, and easy-to-use digital platforms. With its digital platform, Huawei assists customers in crafting their own intelligent solutions, and enables industries to navigate digital transformation and intelligent upgrade. Huawei's digital platform is injecting new momentum into the digital economy.

2021 Business Review

In 2021, the global economy continued to recover, but uncertainty still plagued the world. Despite this, our employees have continued to overcome challenges and strive to ensure continued equipment supply and secure network operations. Huawei remains committed to using ICT to help industries go digital, intelligent, and green. Ultimately, we want to create more value for industries and allow everyone to benefit from technological advances. In 2021, Huawei's annual revenue reached CNY636,807 million. Our overall performance was in line with forecast.

(CNY Million)	2021	2020	YoY
Carrier Business	**281,469**	302,621	(7.0)%
Enterprise Business	**102,444**	100,339	2.1%
Consumer Business	**243,431**	482,916	(49.6)%
Other	**9,463**	5,492	72.3%
Total	**636,807**	891,368	(28.6)%

(CNY Million)	2021	2020	YoY
China	**413,299**	597,983	(30.9)%
EMEA	**131,467**	180,819	(27.3)%
Asia Pacific	**53,675**	64,466	(16.7)%
Americas	**29,225**	39,664	(26.3)%
Other	**9,141**	8,436	8.4%
Total	**636,807**	891,368	(28.6)%

Consumer Business **243,431** ↘49.6%

Carrier Business **281,469** ↘7.0%

44.2%

38.2%

16.1%

Enterprise Business **102,444** ↗2.1%

Americas **29,225** ↘26.3%

Asia Pacific **53,675** ↘16.7%

China **413,299** ↘30.9%

EMEA **131,467** ↘27.3%

64.9%

20.6%

8.4%

4.6%

- In the Chinese market, our carrier business maintained steady operations thanks to continued 5G rollouts. Our enterprise business saw healthy growth as industries were going digital and intelligent at a faster rate. Our consumer business stuck to its premium quality strategy, stepped up efforts in scenario-based solutions and ecosystem development, and provided superior experiences to consumers. Huawei's revenue from the Chinese market amounted to CNY413,299 million in 2021.

- In Europe, the Middle East, and Africa (EMEA), our carrier business maintained robust performance thanks to the deployment of 5G network infrastructure. Our enterprise business grew rapidly as digital and intelligent transformation accelerated across industries. Our consumer business actively built out the HMS ecosystem and developed converged products. Huawei's revenue from this region reached CNY131,467 million in 2021.

- In the Asia-Pacific Region, our carrier business maintained robust performance alongside

accelerated 5G network rollouts and 5G adoption across industries. Our enterprise business enjoyed healthy growth as companies stepped up efforts to go digital and intelligent. Our consumer business continued to innovate and saw rapid growth in the HMS ecosystem. We achieved solid progress in delivering an intelligent experience across all consumer scenarios. All of these factors resulted in a revenue of CNY53,675 million from this region in 2021.

- In the Americas, our carrier business grew robustly as our customers increased investment and began deploying 5G networks. Our enterprise business grew steadily by leading digital and intelligent transformations in multiple industries. Our consumer business continued to build out its HMS ecosystem, which saw healthy growth, and achieved solid progress in delivering an intelligent experience across all consumer scenarios. In 2021, our revenue from this region was CNY29,225 million.

ICT Infrastructure Business

In the ICT infrastructure business, Huawei focuses on information distribution, interaction, transmission, processing, and storage to provide products and solutions to two types of customers: carrier customers and government/enterprise customers.

From a market perspective, our ICT infrastructure business covers two markets: the carrier market and the government and enterprise market. In these markets, we use our innovative products and solutions to build open ecosystems and serve our carrier, government, and enterprise customers. This allows us to better serve every person, home, and organization.

From an industry perspective, our ICT infrastructure business focuses on connectivity and computing. In terms of connectivity, our wireless network, all-optical network, intelligent IP network, and cloud core network solutions help deliver intelligent connectivity characterized by ubiquitous gigabit, deterministic experience, and hyper-automation. In terms of computing, we focus on diversified computing and data storage and strive to create a flourishing and robust computing ecosystem by adopting an open approach and open source strategy. In addition, we provide services and software to support the digital operations transformation of our carrier, government, and enterprise customers.

Moving forward, digitalization and low carbonization will profoundly impact the future of humanity. They will also serve as two key driving forces behind the innovation and development of ICT infrastructure.

Through ongoing technological innovation, Huawei explores how digital technology can better integrate with business scenarios and industry know-how to address critical business challenges, as well as how to jointly foster an open industry ecosystem with our partners and drive shared success. We aim to accelerate digital transformation across all industries and drive the global digital economy forward.

Huawei firmly believes that digital technologies are essential for green development. We are committed to developing innovative digital technologies to support the low-carbon development of both our customers and society at large. Specifically, we focus on three key initiatives:

1. Investing and innovating in energy-saving technologies to deliver more energy-efficient ICT products for a low-carbon ICT industry;

2. Investing in innovations that combine power electronics and digital technologies to promote clean energy and the digitalization of traditional energy; and

3. Providing digital technology to help all sectors go digital and low-carbon.

With customer needs at the center of everything we do, we will continue investing in connectivity and computing to contribute to digitalization and low-carbon development. Through continuous breakthroughs, we strive to lead innovations in ICT infrastructure and create value for both customers and society as a whole.

Carrier Market

Over the past year, Huawei has placed customers at the heart of everything it does and pursued ongoing innovation. We have supported the stable operations of carrier networks worldwide and helped carriers expand into new business domains and achieve new business growth. By the end of 2021, more than 200 carriers worldwide had deployed commercial 5G networks, serving more than 700 million 5G users, and over 1,200 commercial 5G devices were in use.

We work with carriers and partners around the world to create simplified, green, and intelligent ICT infrastructure, and help carriers deploy leading 5G networks. Third-party test results have shown that 5G networks built by Huawei for customers in 13 countries, including Switzerland, Germany, Finland, the Netherlands, South Korea, and Saudi Arabia, provided the best user experience.

Working with carriers and partners, we have signed more than 3,000 commercial contracts for industrial 5G applications, and gained a wealth of experience in industry applications. Together, we develop innovative XtoB solutions that integrate technologies like 5G, premium private lines, Intelligent Cloud-Network, data centers, and cloud to help carriers tap into the huge opportunities presented by industry digitalization.

By the end of 2021, we had supported the deployment of green site solutions in more than 100 countries and regions, which helped carriers save 84.2 billion kWh of electricity and reduce carbon emissions by approximately 40 million tons. Huawei pursues a green strategy: More Bits, Less Watts. With our full range of green solutions, including green sites, green networks, and green operations, we aim to help carriers achieve green development.

GUIDE to the Future

Digital Telco is the cornerstone of an intelligent world. Huawei has proposed its GUIDE business blueprint, aiming to help carriers lead the future of digital networks by developing five key capabilities: expanding services, innovating efficiently, leveraging resources, competing on value, and contributing to society.

- **G** stands for the Gigaverse Initiative. It means ubiquitous gigabit connectivity and the digitalization of everything, which will enable a new digital life and accelerate industry digitalization.
- **U** stands for Ultra-automation Speed-up, which means accelerating ultra-automation to address uncertainties and creatively boost O&M efficiency.
- **I** is short for Intelligent Computing & Network as a Service. It means new benefits from collaboration by maximizing the utilization of connectivity, computing, and intelligence resources, leveraging resources based on data flows, and maximizing benefits from resource allocation and collaboration between cloud computing power and network capacity.
- **D** stands for Differentiated Experience On-demand. It means diversified experiences and multi-dimensional monetization that compete on value based on on-demand and differentiated monetization of experiences.
- **E** is short for Environmental, Social and Governance (ESG), representing our green strategy of More Bits, Less Watts. It means enabling sustainability through green ICT, contributing more to environmental protection, and better fulfilling our social responsibilities.

Leadership in Innovation: Facilitating Carriers' New Business Growth

In 2021, Huawei continued providing innovative products, technologies, and solutions. Together with carriers worldwide, we provided better services for consumers, home users, and industry customers while facilitating the carriers' new business growth.

Mobile HD video has become the new normal, while XR is maturing. In addition, the demand for ubiquitous gigabit networks is now stronger than ever. In this context, 5G is becoming the preferred choice of many mobile users.

Homes are becoming multi-functional centers, making ubiquitous connectivity and an optimal experience a must. Our fiber to the room (FTTR) all-optical solution extends fibers to every room, enabling gigabit coverage in each room. The solution perfectly meets people's needs for home entertainment and to work or study from home.

Companies are accelerating their digital transformation, and 81% of companies globally are using cloud-based applications. Huawei uses cloud technologies to make carriers' systems more agile and resilient, and uses the Intelligent Cloud-Network Solution to help companies quickly access multiple clouds and help carriers provide reliable ICT infrastructure for industry digitalization.

Radio Access Network: Building Ubiquitous Gigabit Mobile Networks

In the radio access network domain, Huawei helps carriers worldwide build mobile networks that deliver a premium ubiquitous gigabit experience. These networks help carriers develop multiple services at the same time, allowing them to rapidly grow their revenue and achieve business success. We continue to develop innovative solutions to support the diversified wireless network deployment scenarios of carriers worldwide, and maximize the value of sites and spectrum. We also aim to help carriers build green, simplified, and high-performance wireless networks that create ongoing business value.

5G Sees Large-scale Commercial Deployment and Continuously Creates Business Value

The large-scale commercial deployment of 5G started more than two years ago. Since then, the numbers of 5G networks, users, and devices have all grown rapidly. This growing user base is bringing commercial returns to carriers while driving continuous network rollout.

By the end of 2021, 5G user penetration had exceeded 20% in countries such as China, South Korea, Switzerland, and Kuwait, while in some large cities more than 30% of mobile traffic was from 5G networks. The ongoing development of 5G not only brings business value to carriers, but creates social value. The energy efficiency of 5G per bit is more than 10 times that of 4G. This means the more traffic that passes through 5G networks, the greener carrier networks will be.

Huawei helps carriers monetize networks by supporting the evolution of their innovative 5G services from technical verification to commercial application. Innovative, 5G-powered applications, such as AR, VR, and free-viewpoint video, are already a reality in multiple countries and regions, and use cases have been expanded from entertainment and education to domains including culture, tourism, shopping, and sporting events.

In South Korea, carriers are actively developing innovative 5G services such as AR and VR, and more than 40% of their 5G users use AR and VR applications. The AR-based children's library is one of the most popular applications in the country.

In China, new 5G-based video services, such as multi-view video and free-viewpoint video, have been used for many sporting events like athletics and table tennis, bringing users an immersive viewing experience. Similarly, AR maps have been used by shopping malls to deliver an immersive shopping experience to 5G users while creating brand-new business models for carriers, shopping malls, and advertising agencies.

Huawei has helped more than 70 carriers worldwide launch 5G Fixed Wireless Access (FWA) services to better support applications such as HD video and cloud gaming. In 2021, the total number of home users of FWA services exceeded 2 million, increasing the average revenue per user (ARPU) by about 60%. 5G FWA and 5G MBB combine to create more business value for carriers.

5G Brings New Industry Digitalization Opportunities to Carriers

In 2021, 5G saw large-scale commercial deployment in many industries, including manufacturing, mining, steel production, ports, chemicals, cement, power grids, and healthcare. Huawei's 5G solutions for industries have been replicated on a large scale across eight typical application scenarios, such as remote equipment control, data collection, and product quality inspection.

5G-powered free-viewpoint video used in Hunan TV's *Dance Smash* allows users to freely change viewing angles and enjoy an immersive experience.

At Zhunneng Group, a mining company based in Inner Mongolia, China, Huawei helped a carrier deploy 5G base stations that supported mobile operations of mining trucks, and provided network planning services based on precise 3D modeling. This ensured low-latency and reliable network connectivity in complex mining scenarios. Our modular data center solution for mines supported the quick deployment of computing platforms.

Hungary's East-West Gate Intermodal Terminal, a container terminal for freight rails, used Huawei's 5G dual fed and selective receiving solution, guaranteeing a low latency of 20 ms during remote control of unmanned gantry cranes. This significantly improved the work environment and logistics efficiency.

Continuous Innovation in Products and Solutions Delivers Optimal User Experiences

5G Radio Access Network

Huawei's superior hardware enables simplified 5G deployment and optimal total cost of ownership (TCO).

Our full series of active antenna units (AAUs) meet carriers' deployment requirements across different scenarios:

- Our Massive MIMO AAUs have evolved to support efficient network rollout for carriers.

- In Switzerland, our highly-integrated BladeAAU Pro site solution helped drastically simplify network deployment and provide coverage for 2G, 3G, 4G, and 5G on a single antenna, greatly reducing the TCO of sites and maximizing site value.

- Using the extreme-large antenna array (ELAA)

China Unicom Tianjin and Huawei achieved the world's first commercial deployment of MetaAAUs over a contiguous coverage area.

technology, our MetaAAUs maximize energy savings and network coverage, increasing the downlink cell-edge rate by more than 40% and the uplink cell-edge rate by about 60%, and delivering users a better 5G experience.

Our multi-band and multi-antenna solutions for sub-3 GHz bands have continued to evolve. Specifically:

- The 8T8R RRU solution for two mid-bands was commercially deployed on a large scale in Malaysia. It supports smooth evolution to 5G and beamforming, increasing network capacity by about 80%. This greatly reduces traffic congestion and improves user experience.

- Our 4T4R RRUs for three low-bands were commercialized, significantly reducing site OPEX.

- The FDD Massive MIMO solution has helped more than 60 carriers worldwide improve spectrum efficiency, unleash the pent-up demand for data in high-value regions, and meet the demand for higher network capacity and better experience.

Huawei's optimal software algorithms enable a superior 5G experience. Our proprietary adaptive high resolution (AHR) algorithm has evolved to increase the accuracy of beamforming and further improve Massive MIMO performance. In high-density scenarios, the algorithm improves multi-user download speeds and cell capacity by over 20%.

Antennas

Our green antennas use signal direct injection feeding (SDIF) technology to eliminate the need for cables within antennas and significantly improve energy efficiency. In Thailand, our green antennas helped one carrier improve its energy efficiency by about 15%.

Our new Hertz platform antennas support FDD 8T8R. With ultra-precision array technology, the antennas increase cell capacity by about 15%.

Microwave

Our 4-in-1 RF units are highly integrated across all frequency bands, and have seen large-scale commercial deployment in a number of countries including France, Saudi Arabia, Nigeria, and Malaysia. Their energy consumption per bit on towers was reduced by about one third.

We have developed a technology that automatically optimizes system resource scheduling based on traffic awareness and service scenarios. The technology was applied in Romania to reduce the energy consumption of sites by more than 10%.

The transmission range of our long-reach E-band solution has increased by more than 50%. This solution also reduces the number of microwave links to significantly reduce the energy consumption of the entire network. It accelerates the time-to-market of 5G services and slashes TCO by more than 30%.

Cloud Core Network: Enabling Carriers to Build Networks with Rock-solid Reliability

Huawei continues to build fully-converged core networks with rock-solid reliability based on a telco cloud-native foundation. Our core networks help carriers build fully-converged and simplified voice and packet data networks that simultaneously support 2G, 3G, 4G, and 5G. After carriers migrate their core networks to the cloud, they may face challenges in network reliability and fault demarcation and locating. Our core networks help carriers address these challenges by rapidly restoring services and ensuring zero service interruption.

Our kite-like solution for public network integrated non-public networks (PNI-NPN) has helped carriers provide private network, private line, industrial vision, industrial interconnection, remote control, and other solutions to more than a dozen industries, and incubated over 150 new use cases to enable industry digitalization.

We have helped carriers worldwide deploy more than 60 fully-converged core networks, supporting them in different scenarios, such as the coexistence of multiple RATs, the sunset of 2G and 3G, and user migration. We have helped carriers outside China gain 100 million new voice over LTE (VoLTE) users, and have served more than 1 billion VoLTE users worldwide. In China, we have helped the three major carriers deploy the world's largest fully-converged commercial core network, and provided stable and reliable services to more than 400 million 5G users.

Fixed Network: Building Innovative Intelligent Networks for the Digital Economy

Huawei continues to innovate in fixed networks and helps carriers worldwide build ultra-broadband, intelligent, simplified, and green networks that meet the service development requirements in different scenarios involving individuals, homes, and enterprises. We aim to build premium, intelligent connections, and accelerate the digital transformation of all industries.

Giga Home Broadband: Enriching Diversity of Carrier Services

Through continuous innovation in the home broadband domain, Huawei helps carriers develop new and diversified home broadband services. Our fiber to the home (FTTH) solution supports rapid network construction and bandwidth upgrade, and our FTTR solution ensures ubiquitous broadband coverage in every room. In addition, our Home+ solution offers digital and intelligent services that enhance the lives and work of users. These solutions help carriers provide better networking services and experiences to users to increase revenue and improve user loyalty.

Our "CO + AirPON" hybrid network construction solution helps carriers quickly build networks, expand their user base, and achieve quick business success. By the end of 2021, the solution had been adopted by more than 170 carriers worldwide. In the Philippines, the solution helped a carrier reduce its service time-to-market by about 60%, compared with the traditional model.

Our FTTR for Home solution upgrades FTTH to FTTR for ubiquitous gigabit Wi-Fi coverage in every room. The solution has seen large-scale deployment in China, attracting more than 150,000 users. It has also been piloted by more than 20 carriers in the Middle East, Asia Pacific, Latin America, and other regions. In June 2021, a Chinese carrier partnered with Huawei to launch the FTTR for SME solution, which extended

fiber networking to microbusinesses and SMEs, and helped the carrier tap into new business opportunities.

In addition to connectivity and networking solutions, we provide a digital platform based on service experiences to help carriers develop digital and intelligent services that enhance the lives and work of users. In 2021, a Chinese carrier worked with Huawei to expand into diversified home services, including scenario-based broadband services such as education and livestreaming, which helped the carrier increase its revenue.

Premium All-optical Solutions: Building Ubiquitous Optical Connectivity

Huawei's premium OTN all-optical solutions adopt innovative technologies such as ultra-broadband spectrum, ultra-broadband single-wavelengths, and optical cross-connect (OXC) in order to create an all-optical target network that is secure, reliable, green, and low-latency, and drive the digital economy forward. By providing premium private line services with differentiated service level agreements (SLAs), we help carriers monetize network performance, including bandwidth, latency, reliability, and time-to-market, and stimulate new business growth.

All-optical Foundation Network: The network uses OXC to simplify sites, greatly saving on space and energy consumption and achieving green, all-optical coverage. By the end of 2021, Huawei had deployed the OXC solution for more than 40 carriers worldwide. In addition, Saudi Arabian carrier Mobily used Huawei's Super C120 and 800G ultra-broadband technologies to upgrade its single-fiber capacity from 8 Tbit/s to 48 Tbit/s, addressing its core link congestion.

SDH Network Modernization Solution: The solution supports various technologies, such as automatic parsing, intelligent batch processing, and one-stop cutover, to ensure carriers' efficient and secure migration from legacy SDH networks to new OTN networks. The solution helped a carrier in the Middle East improve its service migration efficiency five-fold and release large amounts of idle site resources. The carrier also saved energy, reduced carbon emissions, and cut its TCO by about 23%. The solution was a huge boost to the carrier's development of new services such as 5G.

Premium OTN Private Line Solution: The solution meets the requirements of numerous services, such as live broadcasts of sporting events, data center interconnection, and securities trading, by offering high bandwidth, high reliability, and zero jitter, helping carriers monetize SLAs. To date, Huawei has helped carriers worldwide deploy over 90 premium OTN private line networks.

Intelligent Cloud-Network: Supporting the Operations of Numerous Industries with One Network

Huawei's intelligent IP network solutions help carriers build an automated slicing network that meets the differentiated SLA requirements of services such as home broadband, mobile broadband, and enterprise migration to the cloud. A single network can support the large-scale operations of numerous industries, representing a shift from a converged transport network to an Intelligent Cloud-Network.

Converged Transport Network Solution: Using technologies such as intelligent FlexE slicing, simplified multi-service platform, and ultra-broadband 400G, the solution supports the unified access of B2B, B2H, and B2C services, and drives the rapid development of fixed-mobile convergence (FMC) services. By the end of 2021, the solution had been deployed by more than 70 carriers worldwide.

Cloud-Network Express Solution: The solution helps carriers leverage their strengths in network resources to build differentiated private lines for accessing the cloud, and to provide a superior cloud experience to their users. A carrier in Asia Pacific used this solution to shorten the time required to provision cloud-based healthcare services from two months to about one week, greatly reducing the time-to-market and improving efficiency.

IP Network Automation Solution: The solution addresses the issues of low network resource utilization and inefficient service operations that are encountered when there are a massive number of concurrent users, helping carriers manage network resources more efficiently and deliver an optimal experience to end users. MTN Nigeria used this solution to detect service nodes with traffic congestion in real time and significantly reduce the time required to adjust service paths, improving resource management efficiency.

Service and Software: Accelerating Digital Operations Transformation

To accelerate the digital operations transformation of carriers worldwide, Huawei builds upon its own successful transformation practices and those of its customers in order to help carriers evolve towards autonomous networks and work with partners to create new value and experiences. The transformation paths we pursue include business agility enabled by convergent and intelligent technology, data-driven ultimate experience, predictable intelligent O&M, and smart operations.

In the digital services domain, our FinTech solution has served more than 380 million users in over 20 countries and regions. Through contactless online payments, the solution has reduced transmission during the pandemic. It also helped governments distribute subsidies to tens of millions of citizens and provide financial services, such as microfinance, to people in multiple countries. In the operations domain, our new cloud-native Convergent Billing Solution has maintained healthy growth, with the first public-cloud-based commercial SaaS site deployed in Europe. In addition, the Customer Engagement Center was upgraded, helping carriers seize new business opportunities in industry markets like finance and government.

In the customer experience management domain, the data-driven HUAWEI SmartCare® solution helps carriers achieve leadership in networks, experience, and business development. In 2021, we helped 12 carriers rank top in network performance tests conducted in 13 countries, and helped XL Axiata Indonesia and other carriers build convergent data platforms. By the end of 2021, HUAWEI SmartCare® had been adopted in more than 180 projects worldwide. It won prestigious awards including the Best Implementation of Innovative Technology Solutions Award from TM Forum and the Best Test and Measurement Technology Award at 5G World Summit 2021.

In the O&M domain, our intelligent operations services solution AUTIN™ integrates digital and intelligent technologies into all O&M scenarios and the end-to-end O&M process, helping carriers move towards Zero Service Impact, Zero Touch NOC, and Zero Code Development. This ultimately improves O&M efficiency and quality and accelerates the upskilling of O&M staff. By the end of 2021, AUTIN™ had been adopted in more than 170 projects around the world. Thanks to its iterative automation and intelligence, the solution won an Excellence Award from TM Forum and the Best Digital Transformation Project Award at the 2021 Glotel Awards.

To help carriers address the challenge of upskilling talent, Huawei provides an end-to-end talent development solution that covers consulting, training, and certification. This solution helps improve managers' awareness of transformation, develop employees' digital skills, and address the talent challenges experienced by customers during the upskilling process. To date, Huawei has provided training on digital and intelligent technologies to more than 1.9 million professionals from over 260 carriers around the world.

We continue to provide customers with comprehensive and thoughtful services. In 2021, we helped customers complete more than 820,000 network optimizations, upgrades, and changes worldwide to support continued stable network operations. In addition, we used digital and intelligent technologies to support the successful delivery of over 1 million wireless sites across the globe.

When travel to the Philippines was disrupted by COVID-19, we chartered flights to remote regions where delivery was next to impossible, and hopped between islands on crab boats to complete delivery.

Connectivity + IT: Enabling Carriers to Achieve New Business Growth

Huawei provides reliable, efficient, and intelligent IT infrastructure to support carriers as they go digital and intelligent and look to achieve new growth.

Cloud services: IT infrastructure is migrating to the cloud. To meet the needs of our carrier customers, we have launched distributed cloud-native solutions that feature IT-CT synergy and cloud-network synergy. By the end of 2021, we were working extensively on cloud services with over 120 carriers globally.

Storage: The explosive growth of various types of service data is driving carriers to ramp up efforts to upgrade data infrastructure. Huawei's storage resource pool solutions give carriers the efficiency they need through on-demand resource provisioning, intelligent data management, and multi-cloud convergence. By the end of 2021, we had provided intelligent and efficient data storage services to more than 300 carriers worldwide. Two examples include:

- In Chile, a carrier was dealing with service performance bottlenecks created by data surges in its core systems. To resolve this issue, the carrier turned to Huawei's all-flash storage solution, which cut the carrier's bill run duration by about 66% and improved its service efficiency three-fold.

- In Italy and Germany, a customer faced the challenge of migrating legacy data from nine data centers. We provided this customer with professional data migration services, which ensured zero interruption during the migration of online services and improved the overall project efficiency by about 60%.

Computing: Our Kunpeng hardware supports more than 80% of the network functions virtualization scenarios of carriers. As part of our Ascend computing series solutions, we launched the Ascend Smart Manufacturing Solution, Ascend Smart Transportation Solution, and Ascend Smart Inspection Solution. With these solutions, we have worked with more than 500 Independent Software Vendors (ISVs) to help carriers expand into new industry markets.

Continuously Enabling Carriers' Green Development

Green development is now a global consensus. Huawei has developed a full range of green solutions, including green sites, green networks, and green operations, which support our "More Bits, Less Watts" strategy to help carriers increase network capacity without significantly increasing energy consumption. Through these actions, we aim to support carriers' green and sustainable development, and use ICT technology to help industries increase energy efficiency and accelerate their green development.

A Full Range of Green Solutions for Improved Network Energy Efficiency

Green Sites

Our green site solutions feature innovations in site-level energy saving in the wireless site and data center domains.

In the wireless site domain, we provide systematic optimization solutions in the following areas:

- Simplified site solutions: In the Netherlands, we adopted high-integration RF modules to integrate legacy single-band modules in the existing networks. We also performed installations on towers to decrease feeder loss. This led to a reduction in the energy consumption of equipment by about 20%. In Indonesia, we used integrated outdoor cabinets to modernize sites from indoor to outdoor and eliminate the need for shelters and air conditioners, cutting the energy consumption of auxiliary infrastructure by about 30%.

- Maximizing the use of renewable energy: In southern Poland, we designed the iSolar access solution for sites based on a comprehensive assessment of sunlight resources, site space, and site energy consumption. Up to 30% of all required electricity was supplied by solar systems, and a total of 110 sites were modernized between August 2021 and the end of November 2021. During this period, about 57,000 kWh of electricity was generated from solar systems, which was equivalent to a reduction of about 40 tons of carbon emissions.

- Intelligent management: In the UAE, Huawei's intelligent energy consumption management system enabled a local carrier to dynamically adjust the energy consumption of wireless networks based on traffic. The energy consumption of 5G base stations was cut by about 10%. By the end of 2021, our intelligent management technologies had been used on more than 70 networks around the world, helping carriers improve the energy efficiency of wireless sites.

Green Data Centers

- Green power supply: In Dubai, we built a solar energy and power storage system for data centers, which reduced annual carbon emissions by about 5% through the use of renewable energy.

- Green construction: In Bangladesh, our prefabricated modular construction solution enabled faster service rollout, and reduced water consumption and waste during construction. Upstream and downstream carbon emissions were about 50% less than with the traditional civil work.

- Intelligent full-stack solutions: A carrier in China's Guangxi Province used our solutions to dynamically adjust power usage effectiveness (PUE) by hour, reducing the energy consumption of data centers by 9–15%.

Green Networks

We improve the energy efficiency of networks by drastically optimizing network architecture, and enable green evolution in the following three areas:

- All-optical: We have moved service switching and routing from the traditional electrical layer to the optical layer. In the Philippines, we helped a carrier design a converged network that carries multiple services and extends OXC to the edge. OXC was deployed in more than 300 central office (CO) equipment rooms and at over 2,000 sites. It is estimated that OXC will reduce energy consumption by about 55%.

- Simplified: We have simplified the functions and architecture of networks. For example, we helped a European carrier plan its 5G Massive MIMO networks using 64T64R. This reduced the number of sites by about 25% compared with 32T32R, when the coverage goals were the same. In addition, we reused all existing sites to reduce overall network energy consumption. We also helped an Italian carrier improve energy efficiency by about 60% with our 4-in-1 router solution, which is estimated to save about 1.3 million kWh of electricity every year.

- Intelligent: We have achieved additional efficiency gains by implementing intelligent features in our equipment. For example, the intelligent features in our microwave products enable dynamic hibernation and activation based on service volume. This helped a Romanian carrier reduce energy consumption by 8–10% per site.

Green Operations

To achieve green operations, we use indicator systems to measure and evaluate the carbon emissions and energy efficiency of networks. Through network and user operations, we help carriers optimize their network architecture, upgrade network equipment, and migrate users to more efficient RATs, structurally improving the overall energy efficiency of networks.

Network operations: We have developed the industry's first carbon emissions indicator system to quantify the carbon emissions of networks and accurately identify sites with low energy efficiency. We use this system to help carriers analyze and identify their areas for improvement regarding carbon emissions and energy efficiency. Carriers can then prioritize sites, accurately determine which sites require improvement, select optimal solutions through simulated designs, and make well-informed investment decisions based on multi-dimensional ROI analyses.

User operations: Huawei's user operations platform supports intelligent analysis and provides operations assistance to accelerate new service development and user migration. It also helps carriers worldwide optimize how spectrum resources are used and release high-value spectrum. In South Africa, we customized user migration solutions by using a "one site, one strategy" approach based on multi-dimensional evaluation standards and models. This helped more than 2 million 2G and 3G subscribers quickly migrate to 4G without compromising user experience.

Green ICT for Green Development of Industries

Huawei is committed to bringing digital technologies to every industry and helping them go digital and green. Two examples include:

- In Switzerland, we applied ICT technologies to agriculture to precisely control weed growth, cutting the use of herbicides by about 90%, and reducing the environmental impact of pesticides.

- In China, a smart heating solution powered by Huawei's ICT technologies was adopted in Harbin, Heilongjiang Province. According to Harbin Taiping Heating Co., Ltd., on-demand heating reduced average energy consumption by more than 10%.

Moving forward, Huawei will continue innovating and using ICT products and technologies to facilitate energy conservation and emissions reduction across a wide range of industries, contributing to a greener world.

Enterprise Market

Digital transformation is now in full swing. In the enterprise market, Huawei consistently invests in R&D and innovates digital infrastructure, allowing us to work with customers and partners worldwide to deeply integrate ICT technology with industries. Our goal is to accelerate industry digitalization, boost the digital economy, and create new value together for all industries.

We explore the future of digital transformation across industries by focusing on three areas: scenarios, models, and ecosystems. In 2021, we launched 11 scenario-based solutions for key sectors such as government, transportation, finance, energy, and manufacturing. By the end of 2021, we had developed more than 100 scenario-based solutions for over 10 industries. To better meet customer needs, we have established integrated teams dedicated to specific industries, including a Smart Road Team and a Customs & Port Team. These teams integrate resources to efficiently serve and create value for our customers, and help industries go digital and intelligent.

Our products and solutions, such as Intelligent Cloud-Network, Intelligent OptiX Network, data centers, data storage, 5GtoB, and trusted services have become increasingly competitive, and we have combined a number of cutting-edge products to meet customers' differentiated needs and accelerate the digital and intelligent transformation of industries.

Globally, we are bringing together seven types of partners: sales partners, solution partners, service and operation partners, investment and financing partners, talent alliances, industry organizations, and industry partners. Through this, we are striving to build a business environment that is open, collaborative, and thrives on shared success by helping partners increase profits, simplifying our partner policies, improving partners' capabilities, developing digital toolkits, and building healthy ecosystems.

By the end of 2021, over 700 cities and 267 Fortune Global 500 companies worldwide had chosen Huawei as their partner for digital transformation.

A Wealth of Experience in Helping Governments, Public Utilities, and Enterprises Go Digital

Huawei has always been customer-centric and focused on constantly creating value for customers. We are committed to industry digitalization, working with governments and leading enterprises worldwide to continuously explore and implement best practices for green, low-carbon, secure, and fast digital transformation. To help customers from sectors like government, education, manufacturing, and real estate build campuses and data centers, we continue working with them and our partners to develop secure, intelligent, and green ICT infrastructure and create new value together.

Smart Cities

Huawei's smart city solutions currently serve over 700 cities across more than 40 countries and regions. With the smart city architecture as the foundation, we oversee the coordinated planning and development of multiple technologies (e.g., 5G, cloud, and smart devices), and enable service collaboration. We also work with partners to develop innovative scenario-based solutions for government services, urban governance, ecological civilization, and investment attraction to meet diverse city digitalization requirements and help customers build smart and digital cities.

In 2021, Huawei's smart city solutions used digital management tools to promote unified urban governance in one network and improve urban governance capabilities. This was achieved by collecting and analyzing data, streamlining the service handling process, and driving online and offline collaboration. During this process, we prioritized the use of intelligent technologies and collaboration to ensure efficient service handling.

Huawei's Unified Urban Governance in One Network Solution fully leverages core technologies such as cloud and big data to build the foundation for unified urban governance in one network. The solution can be adopted in more than 1,000 urban governance scenarios, such as the management of dump trucks and end-to-end oversight of hazardous chemicals. With this solution, government customers can launch new services on their systems within just two to four weeks, and reduce the average period required to handle city incidents by around 20%. In addition, about 80% of all work orders can be automatically distributed with the assistance of AI, with up to 88% accuracy.

By the end of 2021, Huawei's smart city solutions had been implemented in more than 50 cities in China, including Wuhan and Changchun. The solutions helped Shanghai, Wuhan, and another 11 cities win World Smart City Awards.

Huawei's converged command solution has helped customers in more than 30 countries build visualized command centers and overcome service barriers. The solution helps these customers receive reports on and handle emergencies 15% to 45% faster, and build a safe urban environment for citizens.

Huawei's Smart Finance Solution draws on Huawei's own practices in sharing financial services worldwide, experience in financial transformation, and strengths in all-cloud technologies to help governments modernize their financial governance systems and capabilities. The solution has been adopted by government customers in Shaanxi, Jiangsu, Hubei, and other provinces in China. By building an integrated budget management system and optimizing the financial data governance system, the solution supports more standardized financial management, well-targeted fund supervision, well-informed decision making, and centralized management of financial information, enabling new smart finance.

In terms of customs, ports, comprehensive bonded zones, and free trade zones, we have worked with Shenzhen Customs to develop innovative solutions covering multiple scenarios, including 5G-enabled intelligent inspection, fighting COVID-19 with technology, and next-generation command systems, to help realize smart customs. We also helped Chongqing Lianglu/Cuntan Free Trade Port Area plan and design solutions and build digital platforms and network infrastructure to significantly improve its operating efficiency. Its operating status has become visualized, incidents can now be efficiently controlled, and services can be effectively managed.

Huawei provides digital solutions for more than 700 cities around the world. We leverage the power of technology to continuously improve the efficiency of public services, make the lives of citizens more convenient, facilitate collaborative governance, and enable well-informed decision making.

Finance

Building on its leading innovative technologies and expertise, Huawei continues to develop advanced solutions for the finance industry through joint innovation and open collaboration with financial institutions and ecosystem partners.

By the end of 2021, we had served over 2,000 financial institutions from more than 60 countries and regions, including 48 of the world's top 100 banks. We have established comprehensive strategic partnerships with more than 80 large banks, insurance companies, and

securities companies around the world, and become a trusted strategic partner for the digital transformation of the finance industry.

In China, we have developed comprehensive digital transformation solutions based on our best practices in digitalization. Our collaborations with banks, insurance companies, securities companies, and asset management companies are constantly deepening, and we have continued expanding our business presence. Huawei has become a mainstream ICT infrastructure provider in China's finance industry.

Outside China, we focus on scenarios such as digital banking, cloud transformation, and inclusive financial services, working with our partners who complement our capabilities to help the finance industry go digital and help banks develop digital capabilities.

Huawei Cloud GaussDB(DWS) helped China Merchants Bank implement its Cloud Data Warehouse Construction and Joint Innovation Project, which won the Innovation Best Practice in Technical FSI Applications Award. The Credit Card Center of China Minsheng Banking Corporation (CMBC) and Huawei combined the extensive big data knowledge of Huawei Cloud FusionInsight and the industry know-how and business scenarios of CMBC's Credit Card Center to establish a big data joint innovation lab. The lab won China's Best AI Innovation Lab Award from *The Asian Banker* for its efforts to explore innovative fintech services and accelerate the digital transformation of credit card services.

For mobile payments, we help financial institutions outside China connect users, merchants, channel partners, and developers. This allows these financial institutions to provide faster and more affordable financial services to the public, bringing the world a step closer to financial inclusion. For example, in Kenya, we worked with NCBA, a leading bank in East Africa, to develop mobile payment and micro finance solutions, which provided local people with flexible and convenient online financial services and boosted the real economy.

After jointly releasing the *Bank of Things White Paper* in 2020, which proposed a brand-new financial services model for "intelligent things", SPD Bank and

Huawei launched the SPDB Finwarehouse Solution, which applies the Bank of Things to manage pledges for movable warehousing properties. This solution uses technology to help financial institutions ensure the trustworthy evaluation and supervision of movable properties, making every object identifiable, every alarm traceable, and every item trustworthy.

In 2021, Huawei and the Shenzhen Branch of the Agricultural Bank of China established an e-CNY joint innovation lab and introduced the industry's first application for cloud-based smart contracts in e-CNY, marking the successful implementation of the first such contracts in the industry. Huawei has signed a global technology partnership agreement with Temenos, a leading global banking software provider, to build and provide cloud-native core banking solutions that are more efficient and secure and help banks' digital transformation. We have also launched new distributed core solutions with Subline, CSII, and DCITS.

Over the past 10-plus years, we have worked with our solution and service partners worldwide to gather a wealth of industry experience and build a comprehensive finance ecosystem. In 2021, Huawei announced its Financial Partner Go Global Program (FPGGP). Through this program, we will collaborate with capable partners who wish to work with Huawei in the finance industry. Drawing on combined experience and expertise in technical innovation, we will work alongside our partners to drive the digital transformation of finance and develop industry-leading solutions.

Transportation

Huawei strives to facilitate safe, reliable, and accessible transportation for both people and goods. We have developed a set of comprehensive solutions for the transportation sector, targeting the digitalization of six industry verticals: smart aviation, smart urban rail, smart roads, smart logistics, smart railways, and smart ports. Our solutions cover all major forms of transportation and logistics, improving the safety, security, efficiency, and experience of the transportation industry and driving its green development. To date, 42 of the world's top 500 transportation companies have partnered with Huawei as they embark on their digital transformation journey.

In the **road** domain, Huawei currently serves more than 30 countries and regions. We have developed scenario-based solutions for the end-to-end process from construction all the way to management, maintenance, operations, and services in order to

facilitate digital and intelligent transformation. More specifically, our work covers the following:

Highways: We worked with Shandong Hi-speed Company Limited to make breakthroughs in key technologies such as radar and video fusion, precise lane positioning, and trajectory restoration, and built the longest open and experimental V2X road section in China. We also worked with Yunnan Communications Investment & Construction Group to build a digital industry platform, based on the company's digital transformation strategy, which helped fully improve the company's service capabilities and create a vibrant ecosystem.

Urban traffic: We worked extensively with Shenzhen Bus Group and Qingdao Chengyun Holding Group to develop the industry's first AI-powered, integrated charging scheduling algorithm. This algorithm boasts over 90% accuracy in charging and power consumption forecasts, reducing charging costs by more than 10%.

Transportation: We worked with Shenzhen Transport Bureau to develop a new transportation management and service model that integrates perception, regulation, and service. This model can serve as a role model for comprehensive safe and convenient urban transportation.

Urban traffic governance: We released the Intelligent Road Network Solution and jointly innovated with customers in major cities like Chongqing to enable real-time and accurate road status detection and all-domain, fine-grained 24/7 governance.

Traffic management: Our AI-powered, ultra-low-light checkpoint solution reduced the light pollution of traffic control equipment in cities. We worked with our partners to develop an innovative, all-optical intersection solution, which doubled the reliability of the signal control system and reduced the total cost of ownership (TCO) of equipment by more than 15%. This solution has been deployed at more than 300 intersections. Our Intelligent Off-site Traffic Law Enforcement Solution helped reduce traffic violations by 60% in Yanbu, Saudi Arabia, ensuring a safer and more efficient traffic environment.

For the **ports** industry, we have worked with our customers and ecosystem partners to build smart ports.

At the **Port** of Ningbo-Zhoushan, Huawei's 5G technology helped the customer remotely control rubber-tired gantry (RTG) cranes to improve productivity and the work environment.

At the Port of Tianjin, our AI-powered, intelligent horizontal transportation system worked with automation equipment including quay cranes, yard cranes, and locking/unlocking stations to optimize overall scheduling, which was 20% more efficient than the operations of traditional ports. We also applied the Huawei Cloud OptVerse AI Solver to enable the Port of Tianjin to develop an intelligent planning platform, cutting the time required to plan the operations of ships from hours to minutes. In addition, the plans were made more reasonable, improving the resource utilization of the port by 15% and container yard utilization by 5%.

At the Port of Tunis, we helped the customer build an intelligent campus, making port management more secure, command and scheduling more efficient, and the flow of people and vehicles faster.

In **aviation**, we are currently serving more than 100 airports and airlines across over 40 countries and regions. We have deeply integrated new ICT technologies with the aviation industry and worked with partners to develop smart aviation solutions. These solutions offer passengers a smooth travel experience, allowing them to complete procedures without realizing it. They also help create an intelligent, efficient, and collaborative operation and control system that supports the unified display of airport operation status on a single screen.

We have deepened our strategic partnership with the Civil Aviation Administration of China (CAAC) to drive the robust development of civil aviation in China. Together, we released the industry's first data standard for smart civil aviation, titled *Technical Guide to Airport Data Infrastructure*.

We have continued innovating with Shenzhen Bao'an International Airport to help it become a smart airport. In 2021, this airport was named a five-star airport by Skytrax, and its smart airport project won the Project Excellence Award of the PMI (China) project management awards.

We have helped numerous airports advance their digitalization, including Beijing Daxing International Airport, Shanghai Airport Authority, Zhejiang Airport Group, Yunnan Airport Group, Dubai International Airport, and Macau International Airport. We have also helped China Southern Airlines and the CAAC Northwest Regional Administration, among many other airlines and air traffic control organizations, go digital.

In **urban rail**, Huawei's smart urban rail solution serves more than 300 urban rail lines in over 70 cities worldwide. We have also developed scenario-based solutions for the planning, construction, O&M, and management of urban rail lines, which include solutions for smart construction, smart passenger transport, smart O&M, and smart stations, as well as an urban rail Intelligent Operation Center (IOC).

Huawei and Wuhan Metro jointly launched the industry's first "3-in-1" smart station solution, which intelligently integrates travel, security checks, and COVID-19 prevention, greatly enhancing passenger experiences.

Shenzhen Metro Line 20 became the first fully-automated commercial line in China. The entire line uses Huawei's train-to-ground Wi-Fi 6 network communications solution. When a train is traveling at a speed of 160 km/h, the train-to-ground bandwidth provided by the solution still reaches up to 1.4 Gbit/s,

The Port of Tianjin has chosen Huawei to support its digital transformation. It aims to constantly improve its levels of automation and intelligence and become a smart, green, and safe port.

In December 2021, the China-Laos Railway, which is more than 1,000 kilometers in length, became fully operational. Huawei's Smart Railway Solution helped provide a private railway communications network for this new line and ensure its intelligent, safe, and efficient operations.

with a latency of just 30 ms, and real-time backhaul of full services is supported. This ensures safe urban rail and higher operating efficiency.

For the **railway** industry, Huawei has served over 130,000 km of railways.

Energy

Huawei has worked with its ecosystem partners to develop more than 30 scenario-based solutions, paving a digital path to carbon neutrality. To date, Huawei has established extensive partnerships with more than 190 electric power companies worldwide, and currently provides digital services to 17 of the world's top 20 oil and gas companies and 17 of the world's top 20 mining companies.

For **energy transition and green and low-carbon development**, we proposed the T³-Cube methodology (net-zero carbon transformation, energy transition, and digital transformation), and released the *White Paper on Global Energy Transition and Zero Carbon Development* based on this methodology. We have also gradually developed capabilities for carbon consulting services in order to help build a green, low-carbon, intelligent, and modern energy system.

We co-authored the *Progress Report on China's Energy Revolution* with the aim of helping to advance China's energy technology revolution. Our innovative practice in the intelligent low-carbon campus domain has helped customers achieve intelligent lean management, efficient multi-energy complementation, low-carbon and green operations, and online carbon-energy trading.

In **electric power**, we have built a "3I" intelligent electricity solution system based on the software-defined electricity system architecture. "3I" incorporates Intelligent power generation, Intelligent grid, and Intelligent services. Specifically, our work covers the following:

Intelligent power generation: Huawei has launched an intelligent power plant solution. We worked with ecosystem partners to build an intelligent infrastructure based on "one network, one AI center, and one platform" for power plants to make them safer and more efficient in their daily operations by eliminating security incidents, reducing carbon emissions, and achieving unattended operations without the need for manual inspections. For example, we worked extensively with Guangdong Energy Group Co., Ltd. to create a digital foundation for power generation enterprises.

Intelligent grid: We leveraged our advanced 5G and edge computing technologies and worked with our partners to develop a central management and control solution for distributed energy scheduling. This solution helped State Grid Shandong implement China's first commercial pilot project for intelligent energy scheduling. In addition, we developed an autonomous intelligent inspection solution for power transmission lines, which helped customers like China Southern Power Grid ensure tower base security and enable video uploading in blind spots of public networks.

Intelligent services: Huawei worked with State Grid Xi'an Electric Power Supply Company to develop an emergency control solution for securing and safeguarding power supply. Building on Huawei's digital operation platform, this solution intelligently secured and safeguarded the power supply for China's 14th National Games in Xi'an. We have also worked extensively with key customers, such as Indonesia's PLN, in the power bandwidth operation domain to explore new business and value models for creating added value from power assets.

In **oil and gas**, Huawei released the Intelligent Oil & Gas Fields Solution, which realized commercial deployment in the Middle East as the first application outside China. The solution provides security warnings and emergency services for oil and gas fields, enabling the digital transformation of oil and gas fields.

We provided consulting services on digital transformation planning for China Oil & Gas Pipeline Network Corporation (PipeChina), which digitalized its business scenarios based on Huawei's operational safety management platform and other solutions. We also launched the Smart Oil & Gas Retail Solution, which creates a converged edge intelligence platform in order to combine ecosystem capabilities and make gas station services, management, and marketing more intelligent.

In **mining**, we established a Mine Team, which is committed to diving deep into the mining industry and identifying the right technologies for the industry through a short-decision-chain model. The team has worked with partners to launch groundbreaking smart mining solutions based on the industrial Internet architecture. These solutions included Mine HarmonyOS, All-Optical Industrial Network for Mining, Converged IP Industrial Network, cloud and digital platforms, intelligent mining campuses, and intelligent operational assistance systems.

The Mine Team aims to deeply integrate leading ICT technologies with OT systems and supporting IT systems in the mining industry to establish an industrial Internet architecture that covers the entire business flow of mining companies. The architecture has been adopted by many Chinese mining companies, including major coal groups and metal and non-metal mining groups.

Manufacturing

Working with partners worldwide, Huawei leverages technologies such as connectivity and cloud to help over 8,000 manufacturing companies achieve digital and intelligent business operations, including R&D, production, and supply, create new value, and shift towards intelligent manufacturing.

In the R&D domain, Huawei's desktop cloud solution has helped companies such as SANY Group build R&D collaboration platforms, establish a unified R&D environment, and create greater synergies among R&D resources. In addition, our full-stack, integrated, and high-performance simulation platform provides efficient and reliable computing power for manufacturing companies such as SAIC Volkswagen.

In the production domain, our Huawei Cloud-based industrial vision solution helped enterprises such as the China FAW Group Corporation implement one-stop, AI-powered quality inspections, with 99% accuracy.

Huawei's operational safety management platform was piloted at PipeChina's liquefied natural gas station in Shenzhen, managing risky operations and serving as a showcase for safe production.

Education

Huawei strives to apply connectivity, cloud, and other ICT technologies to education to help universities and vocational schools cultivate innovative talent, accelerate innovation in teaching and scientific research, and bridge the digital divide. We also actively work to drive equity in basic education.

In **higher education**, we have helped more than 2,800 universities and research institutes in over 80 countries and regions explore the unknown. More than 30 of the QS World University Rankings' top 100 universities have chosen Huawei as their partner for digital transformation, to help them improve education quality, research efficiency, and innovation capabilities. Huawei also builds "vocational schools in the cloud" by focusing on smart campus development and industry-academia integration, aiming to cultivate ICT industry talent for the future intelligent world.

In **basic education**, we have participated in and facilitated the development of demonstration zones for intelligent education in China. During the construction of the Intelligent Education Demonstration Zone in Hexi District, Tianjin, and cloud-based schools in Shenzhen, we used technologies such as cloud and 5G to build smart classrooms on campus, helping customers set regional benchmarks. In addition, we have continued to build ICT infrastructure for education in a number of countries, including Italy, Côte d'Ivoire, and Paraguay, to expand the adoption of digital technologies in local education and drive equity in education.

Healthcare

Huawei's ICT solutions currently serve more than 1,700 hospitals across over 70 countries and regions, including China, Turkey, Indonesia, and Germany.

At the Guangdong Second Provincial General Hospital, we applied cutting-edge technologies, such as cloud, 5G, and Wi-Fi 6, to a number of domains and activities, including diagnosis & treatment, education, research, and management, and helped transform the hospital into one that provides smart services in all scenarios. Results have been published in the *Nature Medicine* journal.

In Germany, Huawei's all-flash storage system helped ensure the efficient and stable operations of core service systems in hospitals and protect medical data throughout its lifecycle. In other countries, such as France and Singapore, Huawei's converged hospital network solution has helped hospitals boost diagnosis and treatment efficiency and improve patient experience.

Internet Service

Huawei has provided connectivity, data center infrastructure, and public cloud solutions to more than 2,200 Internet service providers worldwide, working with partners to accelerate the shift to an all-optical, intelligent Internet service industry.

For **Internet access and enterprise connectivity**, we provide a full portfolio of products and solutions covering access networks, metropolitan area networks, and backbone networks. We also support a joint construction and sharing model to help Internet service providers build ultra-broadband and deterministic networks that support intelligent operations.

In **Internet data center services**, our green, low-carbon data center solutions can be used to build simplified, green, secure, and intelligent data centers that support sustainable business development. We also help managed service providers provide cloud-based network services and storage hosting services.

For **Internet content services**, we develop collaborative and innovative Internet data center infrastructure and Internet public clouds to help customers across various industries, such as e-commerce, audio and video, and gaming, achieve service agility, efficiently utilize resources, and achieve business success. In China, we currently serve more than 80% of the top 50 Internet service providers.

Intelligent Campuses

We integrate new ICT technologies to develop intelligent campus solutions, continue building our competitiveness, and reinforce our partner ecosystem. These solutions have been adopted by more than 600 customers across various sectors, including government, energy, manufacturing, healthcare, and real estate, helping them create secure, intelligent, and green campuses. Our goal is to help build green, low-carbon buildings and campuses. Three examples are:

- We helped the Shenzhen Bay Eco-Technology Park become intelligent by bringing together a large number of low-current systems, services, applications and integrating data. The park's operation status can now be displayed on a single screen, improving security efficiency by about 10%.

- Shanghai Jiushi Group partnered with Huawei to adopt a low-carbon and environmentally-friendly approach to the renovation of Shanghai Stadium. We enabled the unified management of stadium facilities, including lighting, mechanical and electrical facilities, and HVAC, ensuring the facilities would constantly run in their optimal state and extending the service life of equipment by about 25%. Energy efficiency management for the stadium has helped reduce power consumption by around 15%. These improvements have created a world-leading intelligent stadium.

- Based on the ICT product portfolio and intelligent campus operation system, Union Bank of the Philippines partnered with Huawei to build a smart innovation center with visualized campus operation management, unified alarm linkage management of facilities and devices, and convenient access for employees and visitors, improving campus operation efficiency, personnel access, and office experience.

Data Centers

Huawei has proposed a vision of full-stack data centers oriented to the upgrade of enterprise data centers, public service data centers, and leased Internet data centers. We have developed six solutions to renew digital infrastructure, including centralized DC, multi-level DC, light DC, AI computing DC, HPC DC, and national integrated DC. For example:

- We developed a centralized DC solution for the finance and government sectors to help customers build intensive and highly reliable data centers, featuring geographic redundancy with three data centers across two cities, and cross-regional active-active data centers.

- We developed a multi-level DC solution for vertically-managed government organizations and large corporations, which ensures efficient service collaboration between HQ and branches with the support of technical features such as the synchronization of data, algorithms, and applications in minutes.

- Our national integrated DC solution offers technical features such as DC-network synergy and low-carbon facilities, which slash the time needed to provision cross-regional services from days to minutes, and reduce power usage effectiveness (PUE) to less than 1.2.

A Thriving Enterprise Ecosystem and Global Service Capabilities

Expansion of Seven Types of Ecosystem Partners

We consistently implement fair, just, transparent, and simple partner policies, and openly collaborate and share value with our partners. We take a forward-looking approach as we work to develop, cultivate, motivate, and support our partners, and encourage them to complement Huawei's capabilities, not just serve as a means to access markets. We also focus on the development of core partners and improve the willingness of partners to work with Huawei and their capabilities to build an interdependent community with shared interests.

By the end of 2021, over 30,000 partners were working with us worldwide, including more than 20,000 sales partners, 1,800 solution partners, 6,200 service and operation partners, and 2,000 talent alliances.

Moving forward, we will continue helping partners increase profits, simplifying our partner policies, improving partners' capabilities, developing digital toolkits, and building healthy ecosystems. During this process, we will increase our investment in partners, further our efforts in partner development and engagement, and build the cornerstone for our long-term survival and rapid development.

Ongoing Investment into a Flourishing Talent Ecosystem

Huawei shares the experience, technologies, and talent cultivation standards it has gained over years of operations in the ICT industry with stakeholders. We work with educational authorities, educational institutions such as universities, partners, and various other actors to build an education talent ecosystem, public talent ecosystem, and industry talent ecosystem. This can be achieved by establishing talent alliances, integrating talent standards, improving talent capabilities, and communicating the value of talent. We aim to improve digital skills throughout society, drive technological advances and industry prosperity, and promote sustainable social and economic development.

We share comprehensive, cutting-edge ICT technologies with universities worldwide through the Huawei ICT Academy – a partnership project between Huawei and universities that aims to cultivate new ICT talent. We have established ICT academies with 1,971 universities worldwide, and provided over 170,000 certifications to university students.

We have also continuously optimized our certification system, which includes both career certification and professional certification. By the end of 2021, we had presented over 550,000 certifications worldwide, including over 17,000 Huawei Certified ICT Expert (HCIE) certifications. Engineers who pass our certifications are a valuable resource for industry digitalization worldwide.

Working with Partners to Provide Consistent, High-quality Services to Customers

Huawei always remains customer-centric as it constantly innovates in its service models and actively develops service partners. We collaborate with over 6,000 service and operation partners to provide consistent, high-quality services to more than 55,000 customers worldwide, with consistent service content, processes, and quality. We also work tirelessly to develop service capabilities and expand the presence of our offline service teams in order to respond to service requests raised by our customers anytime and anywhere. We aim to help them quickly go digital, continuously improve O&M efficiency and system availability, and ensure business continuity. In 2021, we delivered on more than 130,000 contracts, including over 600 key projects, and supported the secure and stable operations of more than 120,000 customer networks.

We have continuously increased our investments in industry digitalization services, and developed the following service tools and platforms: ServiceTurbo Cloud tool, the Intelligent Maintenance and Operation Center (IMOC) for unified O&M, iDOP operation support platform, and iData intelligent data integration platform. These platforms consolidate service knowledge and assets and enhance service automation and intelligence, providing customers with services throughout all stages of the solution lifecycle, including consulting, design, implementation, and O&M support.

Our training and certification programs serve as a continuous source of high-quality talent for industry digitalization. In addition, we have helped over 400 customers go digital by sharing our years of hands-on experience in digital transformation and providing consulting and top-level planning services on digital architecture.

Members of the Ghana Security Network Phase II Project continued installing sites even when the country was still gripped by the pandemic. They raced to meet the deadline and ensure customer satisfaction, and ultimately won acclaim from the customer.

Connectivity

We are entering the intelligent world at full speed, and the digital transformation of industries is reaching a new stage of intelligent upgrade. Connectivity is permeating all scenarios of our lives, homes, and industries. Instead of just providing best-effort services, connectivity is evolving to deliver differentiated and deterministic services. Bandwidth is growing from hundreds of megabits per second to gigabits per second over any medium, and manual network O&M is being replaced by hyper-automated models. In response to these trends, Huawei has developed the concept of intelligent connectivity, characterized by ubiquitous gigabit, deterministic experience, and hyper-automation.
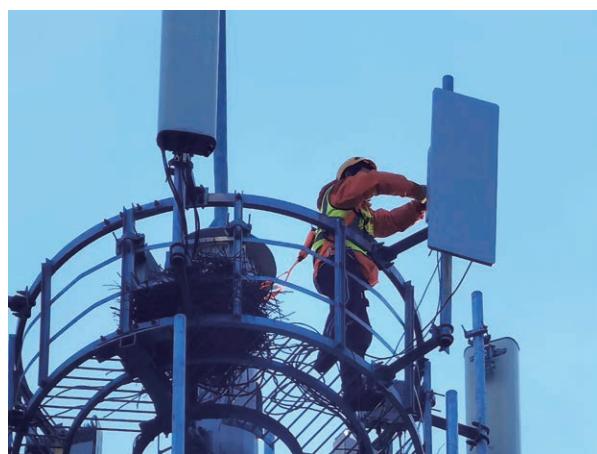
Wireless Networks

- **Huawei collaborates with industry partners to drive robust and coordinated development across the wireless industry.**

  - We have identified 10 wireless industry trends that will define the future of mobile networks in the decade to come. Based on these insights, we are working with industry partners to make the intelligent world of 2030 a reality.

  - We work with industry partners to maintain unified global standards systems. At 3GPP's Project Cooperation Group (PCG) meeting, we supported efforts to create an industry consensus around 5.5G, which officially adopted the name 5G-Advanced. This has helped clarify the requirements for evolution beyond 5G.

  - Huawei proposed 10 technical topics, including XR-Pro, ultra-large uplink network, high-precision positioning, and flexible spectrum usage, all of which were accepted as key research directions for Release 18. These directions are part of the technical framework and key technological directions for 5G-Advanced that were clarified in a 3GPP plenary meeting.

  - GSMA published a joint statement, signed by Ericsson, Huawei, and Nokia, regarding its intention to promote 6 GHz for licensed use. The statement called on governments to make at least 2 GHz of mid-band spectrum available for 5G, so as to deliver on the full potential of the 6 GHz spectrum band and promote the development of the 6 GHz industry.

  - In the *2.3 GHz Band Industry Statement* released together with 13 industry partners, Huawei supports 2.3 GHz as the golden mid-band to promote the development of the 2.3 GHz industry.

  - We are moving towards large-scale replication of 5GtoB solutions, supporting more than 3,000 digital transformation projects in eight industries.

- **Huawei continues to provide innovative solutions for all scenarios and improve solution competitiveness.**

MetaAAU, which delivers high performance with less energy use, helps make the Miyun District of Beijing greener.

  - **Industry-leading 5G Massive MIMO**

    - Our MetaAAU uses an extreme-large antenna array (ELAA) and adaptive high resolution (AHR) beamforming algorithm to improve both network performance and energy efficiency. Compared with traditional AAUs, the MetaAAU improves coverage by 3 dB and user experience by 30% while consuming 30% less energy.

    - Our BladeAAU Pro supports all sub-6 GHz bands with just a single antenna. This can greatly reduce the total cost of ownership for sites and simplify the deployment of Massive MIMO products in all scenarios.

- **Ultra-wideband and multi-antenna technologies to support the evolution of sub-3 GHz bands**

  - Huawei provides the industry's lightest true wideband 4T4R RRU that supports three bands in one box. This product improves user experience by 30% while consuming 30% less energy.

  - We have also launched the high-power, ultra-wideband 8T8R RRU. It can provide three times the capacity, boost coverage by 3 dB, and further reduce energy consumption through energy-efficient Hertz platform antennas.

  - Our FDD Massive MIMO can be used in scenarios requiring large capacity, benefiting both 4G and 5G networks. Specifically, it increases 4G network capacity by 3 times and 5G network capacity by 5 times.

- **Ubiquitous gigabit experience in all scenarios**

  - Huawei has launched the TDD and FDD dual-band EasyMacro 3.0 and Book RRU 3.0 solutions to support on-demand simplified deployment in scenarios like residential areas and urban hotspots.

  - Our distributed Massive MIMO meets fast-growing traffic demands in indoor areas such as subways, railway stations, and stadiums.

- **Microwave products for faster rollout of 5G transmission networks**

  - Our long-reach E-band solution, a leading innovation in the industry, overcomes the limits of high-frequency spectrums that are typically used for transmitting over short distances.

  - Our SuperLink, an innovative multi-band antenna solution, enables simplified deployment with only one antenna, raising the bar for long-distance and large-capacity transmission.

- **IntelligentRAN wireless network architecture** helps carriers build autonomous networks featuring intelligent service operations, optimized experience, and simplified O&M. It will enable carrier networks to bring service wait times to zero, deliver consistent user experience, eliminate network faults, and support optimal user experience and energy efficiency.

- **Huawei helps carriers build high-performance, green wireless networks for 5Gigaverse & 5Green.**

  - We are helping carriers build wireless networks with optimal performance. These networks have proven instrumental to many carriers' best-in-class performance in LTE/5G network assessments. All test results on 5G network experience in large cities rank Huawei's 5G networks No. 1, and Huawei has a substantial lead (of more than 30%) over the vendor ranked second.

  - We are helping carriers build wireless networks with optimal energy efficiency. In 5G equipment energy consumption tests in countries like China and Germany, these networks have been proven to consume 15%-20% less energy than those ranked second.

Optical

Fiber networks, such as gigabit optical networks, deliver high bandwidth and low latency while consuming less energy. They are resistant to inference, and don't take much space. Huawei is committed to developing optical solutions that serve homes, enterprises, and passenger cars, and providing services that offer deterministic experience to various households and industries.

- **Optical transmission**

  - Huawei has worked with global carriers to deploy more than 90 premium OTN private line networks. We have also launched the OTN point-to-multipoint (P2MP) premium private line solution for buildings and SMEs. Combined, these can help carriers expand their user base for premium private lines tenfold.

- We continue to hold a leading share in the 200G optical module market. Our 400G optical modules offer the industry's largest single-fiber capacity. We have completed more than 20 commercial use tests for our 800G optical modules and completed the industry's first single-wavelength 1.6T prototype test in Europe. Our purpose is to help carriers reduce per-bit transmission costs.

- We have launched the OptiX SuperSite solution, which is the industry's first innovative solution to deploy optical transmission and access networks at the same site. This solution makes OTN equipment about 75% smaller.

- We have seen faster adoption of OXC products by global carriers, with more than 2,000 sets of OXC products shipped worldwide. These products can help carriers save about 40 million kWh of electricity each year.

■ **Optical access**

- Huawei has launched the FTTR for Home solution, which provides premium gigabit Wi-Fi experience for homes and micro-, small-, and medium-sized enterprises (MSMEs), and presents new networking opportunities for carriers. So far, we have shipped more than 400,000 units.

- For home users, we have launched FTTR smart ONTs that support HarmonyOS Connect. Using ultra-flexible transparent fibers and the LinkHome Assistant app, carriers can implement fast deployment within two hours and one-click network management.

- For small and micro enterprises, we have launched FTTR for SME series products, which support a maximum of 32 hotspots and 300 concurrent terminals. These products support value-added applications and O&M services such as enterprise VPNs.

- Huawei's AirPON solution has helped more than 170 mobile carriers, multi-system operators (MSOs), and traditional carriers deploy networks efficiently and economically. This solution cuts home pass (HP) costs by about 30% and shortens the time-to-market by more than 50%.

- Huawei Digital QuickODN (DQ ODN) uses all-scenario pre-connection and digital optical iris technologies, reducing unnecessary site visits by about 30%.

- We have also upgraded the intelligent distributed access network solution to bring intelligence to optical line terminals (OLTs), optical distribution networks (ODNs), and optical network terminals (ONTs). This solution has helped carriers greatly improve broadband user satisfaction.

■ **Government & enterprise**

- With our Campus OptiX and FTTM All-Optical Industrial Network solutions, we have helped more than 5,000 customers around the world build green and low-carbon campus networks, extending fiber connections from the campus edge to desktops and machines.

- Our simplified architecture helps customers save 80% of space in weak-current equipment rooms and cut power consumption by about 30%.

- We have launched the Native Hard Pipe (NHP) network solution. This solution is compatible with Synchronous Digital Hierarchy (SDH) and implements end-to-end hard pipes – optical service units – to pass through access networks and WANs, ensuring the security of key production services.

- Huawei has launched its first optical sensing product – OptiXsense EF3000, which has been used in oil and gas pipeline inspections. This product can correctly identify up to 97% of instances when pipelines are threatened by digging or construction.

■ **Optical applications**

- Huawei has launched an Intelligent Automotive Optics Solution, bringing its optical technologies to the automotive industry. Huawei's augmented reality head-up display (AR-HUD) solution can display a 70-inch virtual image 7.5 m in front of the driver. This solution provides AR navigation, environment warnings, points of interest (POI), and other intelligent prompts to improve driving efficiency and safety.

Data Communications

Huawei is committed to making IP on Everything a reality in the data communications field. Huawei has launched an end-to-end Intelligent Cloud-Network Solution that is powered by our AirEngine, CloudEngine, NetEngine, and HiSecEngine data communications products. This solution is enabling digital transformation in various industries.

- Data communications is moving faster towards the IPv6 Enhanced era. Network capabilities will be improved across six dimensions: ubiquitous connectivity, ultra-large bandwidth, automation, deterministic experience, low latency, and security. Led by organizations such as ETSI and the China Expert Committee for Promoting Large-Scale IPv6 Deployment, Huawei has, alongside upstream and downstream industry organizations, carriers, and government and enterprise customers, published a series of white papers to guide the real-world application of IPv6 and IPv6 Enhanced.

- **Campus networks**

  - Huawei has launched the CloudCampus 3.0 solution to enable fully wireless, intelligent campus networks for the cloud era. These networks will center on user experience and connect LANs and WANs from end to end.

  - For digital office scenarios, Huawei helps build simplified, intelligent, and low-carbon campus networks with all-scenario AirEngine Wi-Fi 6 series products, CloudEngine S8700 series switches (next-generation high-density modular switches), fiber/copper hybrid cables, and remote modules.

  - For industrial production scenarios, Huawei has launched the Wi-Fi 6 Advanced technical framework to help build fast, stable, and intelligent fully-wireless production networks.

  - For smart office/home office scenarios, Huawei has launched the AirEngine Wi-Fi 6 Honeybee series, which are all-new wall plate 86 x 86 access points that provide ultra-fast network experience with 3,000 Mbit/s bandwidth.

  - For financial institutions and large enterprises with multiple branches, Huawei's SD-WAN solution uses products such as NetEngine AR8140, a new high-performance converged gateway, to enable one-hop connection of multiple new services to the cloud.

- **Data center networks**

  - As cloud-based services and all-flash storage continue to develop, we are moving towards all-Ethernet data center networks. Huawei has unveiled its CloudFabric 3.0 Hyper-Converged Data Center Network Solution. This solution is ideal for building computing and storage networks with zero packet loss based on an all-Ethernet architecture, and has been designed to unleash 100% of a data center's computing power. In addition, this solution has become the first to support L3.5 autonomous driving network, empowering enterprises' faster intelligent upgrades.

  - In cooperation with industry organizations, analysts, customers, and partners, Huawei has published the *Hyper-converged Data Center Network White Paper* and *Specifications for Rating Hyper-converged Data Center Networks with Lossless Ethernet*, to guide the construction of green, low-carbon data centers.

- **WANs**

  - Huawei has developed new capabilities for the Intelligent Cloud-Network solution for carriers. This solution offers one-hop access to the cloud, one fiber for multiple purposes, one-click navigation, one network to anywhere, and all-in-one security.

  - We have made many major technological innovations in terms of architecture, protocols, algorithms, and 400GE Ethernet interface standards of cluster routers. These innovations are helping carriers develop core digital capabilities.

- For the enterprise market, Huawei has launched the CloudWAN 3.0 solution to help various industries build agile, intelligent, and secure cloud WANs in two scenarios: enterprise cloudification and IP-based production networks. This will accelerate the digital transformation of industries.

- **Cyber security**
  - Huawei has launched the HiSec 3.0 solution, which supports intelligent analysis, dynamic detection, all-round defense, and intrinsic trustworthiness. With this solution, we provide customers with accurate, fast, and stable security defenses, and help them build a resilient security network.

Cloud Core Networks

In the cloud core network field, Huawei continues to contribute to standards and open source organizations and lead the way in the industry. We paved the way for the 5G Slicing Association to become a market representation partner of 3GPP. Huawei has built a fully converged 5G core network solution with rock-solid reliability using telco cloud-native technology. We have also launched a 5GtoB kite-like solution for public network integrated non-public networks (PNI-NPN), which ensures superior user experience and aims to accelerate the development of the 5G industry. Huawei was rated the solo leader in 5G core networks by GlobalData, a world-renowned consulting firm.

- Huawei has adopted the Single Packet Core (SPC) solution to build a fully converged data network that supports 2G, 3G, 4G, NSA 5G, and SA 5G. This solution has applied standalone technology to non-standalone, meeting different requirements for network evolution. We have also used the Single Voice Core (SVC) solution to help carriers build 5-in-1 fully converged voice networks. This solution helps save spectrum resources for carriers, accelerate the retirement of 2G and 3G networks, and ensure smooth network evolution.

- Huawei has developed the Rock-Solid Reliability solution using telco cloud-native technology, stateless design, N-way redundancy, and distributed federated databases. With this solution, carriers can build highly reliable core networks which allow the services for tens of millions of users to be switched over between data centers within just a few minutes. This will also allow carriers to overcome telecom network reliability challenges when networks are migrated to the cloud. In addition, it will support the construction of ultra-large-scale networks.

- Huawei's 5GtoB kite-like solution transforms carrier networks into a PNI-NPN configuration. The central site "flies kites" (communicates with edge sites) through dedicated lines to ensure rock-solid reliability. While ensuring high reliability, high efficiency, and high security, this solution provides S, M, and L tiers to meet differing security requirements of private networks. The solution also provides high-performance, high-reliability 5G networks, which aims to increase the value of 5G for businesses, ultimately unleashing the potential of the digital economy.

- Huawei's Core Network Autonomous Driving Network Solution adopts "one-body and two-wing" architecture. On a network that adopts this solution, data is aggregated and serves as the foundation or "body" of the system, while the workflow orchestration engine and AI engine, which make up the "two wings" of the system, improve automation and intelligence during network planning, construction, maintenance, optimization, and operation. Thanks to the network's high level of automation and intelligence, automatic network-healing can be achieved to ensure a highly stable network, automatic configuration can be realized for efficient network operations, and automatic optimization can be attained to deliver a superior user experience. Through these efforts, this solution greatly helps carriers with their digital transformation.

Computing

With the intelligent world fast approaching, data has become the new primary factor of production and computing power the new productivity. In the intelligent era, we will see a massive explosion in data, ubiquitous computing, and a proliferation of intelligent applications aimed at different scenarios. As these scenarios and data types will come in a greater variety, diversified computing is the way forward. At Huawei, we are committed to open collaboration for shared success. Together with our partners around the world, we are providing diversified computing, ushering in a new era of computing that benefits everyone.

Co-creating a Vibrant Computing Ecosystem for Shared Success in the Digital Age

Focusing on computing architecture innovation, Huawei is committed to providing diversified computing power with Kunpeng and Ascend, and helping the industry thrive through Kunpeng's general-purpose computing capabilities and Ascend's AI computing capabilities. In 2021, Huawei launched its cluster computing solution, which has already been used in AI computing centers, high-performance computing centers, and integrated big data centers, helping customers build efficient public platforms for diversified computing services.

In the past year, we implemented a strategy of "open hardware, open source software, partner enablement, and talent cultivation", and worked with industry partners to drive the industry forward and foster a vibrant ecosystem.

Kunpeng: Upgrading Kunpeng across the full stack so that it's not just usable, but useful

Since Kunpeng's debut in 2019, we have worked with our industry partners to build a complete foundational software and hardware ecosystem and talent development system. Kunpeng has now been used in major scenarios across a broad swathe of sectors, including governments, finance, telecommunications, electric power, and transportation. In 2021, we:

- Upgraded openEuler, an open source OS for digital infrastructure, and openGauss, an enterprise-grade open source database;

- Launched Kunpeng DevKit 2.0, marking a shift in focus from enabling application porting to supporting simplified Kunpeng-native development;

- Launched Kunpeng BoostKit 2.0 to improve application performance, making Kunpeng not just usable, but useful to our partners.

To date, 12 partners have launched PCs and servers based on Kunpeng motherboards. More than 10,000 solutions, developed by over 3,500 partners, have been certified as Kunpeng-compatible. Mainstream OS partners in and outside China have released openEuler-based commercial distributions, and more than 10 partners have launched commercial releases of openGauss. In addition, we have established 24 Kunpeng Ecosystem Innovation Centers in China, and more than 800,000 Kunpeng developers have joined us in working on innovations spanning the full stack, from hardware and foundational software to applications.

Official donation of openEuler to the OpenAtom Foundation: The openEuler community will pool the contributions of global developers more openly and move from open governance to autonomy and prosperity, thus accelerating the development of the OS ecosystem.

In September 2021, Huawei upgraded openEuler as the industry's first open source OS that supports digital infrastructure across all scenarios. openEuler 21.09, the new innovation edition, provides support not just for servers, but for cloud and edge computing devices and embedded devices used in communications technology (CT) and operational technology (OT) settings.

In November, Huawei and its partners officially donated openEuler to the OpenAtom Foundation, marking the transition of openEuler from a founder-led open source project to one that is co-developed by contributors from across the industry and governed by the community itself. To date, the openEuler community has attracted nearly 10,000 contributors and more than 300 companies, research institutes, and universities, and has established nearly 100 special interest groups (SIGs).

openGauss is an enterprise-grade open source database that provides secure, stable, efficient, and intelligent data management capabilities for digital infrastructure. Since going open source in June 2020, the openGauss community has attracted over 100 enterprises and institutions, established 20 SIGs, received technical contributions from 2,500 developers, and seen over 500,000 downloads in 81 countries. In 2021, the community launched its first long term support (LTS) edition – openGauss 2.0 – offering users an enterprise-grade database with higher performance, higher availability, and a higher level of security and intelligence.

Ascend: Diving deep into AI computing to enable industrial intelligent upgrades

Huawei is committed to building a foundational software and hardware platform powered by Ascend's AI capabilities so as to drive the development of both the technical and business ecosystems around AI. Huawei cooperates extensively with universities, research institutes, and partners on Ascend to jointly promote AI technology innovation and build up the AI technology ecosystem. Huawei is also working with partners and customers to enable industrial applications and build an AI business ecosystem together.

The Ascend AI software and hardware platform is continuously upgraded, empowering the development

The Ascend Smart Manufacturing Solution is used by many electronic equipment manufacturers, including Huawei's Southern Factory, PowerLeader, and Yangtze Computing, to improve product quality and efficiency with AI. In the computer, communication and consumer (3C) electronics industry, factories can automatically detect more than 30 types of defects with the help of computer vision algorithms, with a detection rate and accuracy of over 99% for servers and desktop hosts. This solution is helping factories become more digital and intelligent.

of new information infrastructure represented by AI computing centers. Currently, more than 20 cities in China are planning or building AI computing centers and in some cities they are already in use. These centers are enabling scientific research, innovation, and industrial development with inclusive AI computing power.

The abundant computing power provided in these AI computing centers has enabled the development of foundation models and the incubation of new applications. This includes the PCL-L foundation model and the PCL-G gene sequencing model, both of which are based on Peng Cheng Cloud Brain II. The Wuhan AI Computing Center incubated Zidong.Taichu, the world's first multi-modal foundation model (i.e., image, text, and speech), and Wuhan.LuojiaNet, the industry's first dedicated framework for remote sensing. A multi-modal AI industry alliance around Zidong.Taichu and an open source ecosystem alliance for smart remote sensing based on Wuhan.Luojia have been established to accelerate application innovations and enable the intelligent upgrade of industries.

In 2021, MindSpore 1.5 was released, creating a new paradigm with AI for Science. It supports collaboration across all scenarios, automatic parallelism, and simplified processes. To date, the MindSpore community has recorded tens of millions of visits and over one million downloads. It has supported more

than 5,000 enterprises and attracted more than 4,000 individual contributors and the ModelZoo hosts more than 300 models. In addition, the community has been recognized as the industry's first trustworthy community for open source AI.

Currently, more than 600,000 AI developers are using Ascend and more than 100 universities are teaching Ascend-specific AI courses. More than 600 solutions have been developed by over 500 partners from various industries, and the Ascend AI ecosystem is taking shape. In cooperation with around 40 partners, Huawei has already launched a wide range of industry-specific solutions, such as Ascend Smart Manufacturing Solution, Ascend Smart Transportation Solution, and Ascend Smart Inspection Solution, covering manufacturing, smart city, transportation, energy, and more.

Aggregating talent by industries, for industries

Huawei continued with the Intelligent Center model to foster industry-academia cooperation on talent cultivation and opened the first batch of Kunpeng & Ascend Intelligent Centers in universities. This past year has seen Ascend and Kunpeng reach more universities. By the end of 2021, 72 partner universities had delivered these courses to more than 1,300 classes, and over 2,500 instructors had completed related training, benefiting over 200,000 students. Tsinghua University Press and Higher Education Press published 18 textbooks under this program. We also teamed up with the MOOC Alliance for Computer Education in Chinese Universities which established a dedicated expert group on MOOC development. So far, 12 online courses are already available.

In collaboration with Chinese Ministry of Education and 11 universities, Huawei launched the Kunpeng and Ascend OpenMind Program. The program came with more than 2,000 tasks and a reward fund of over CNY100 million, aiming to pool the wisdom and strengths of the industry to accelerate foundational software innovation. Teaming up with ecosystem partners, we also launched the Kunpeng and Ascend Talent Intern Program which provided internship opportunities for 600 outstanding students, helping them forge connections with enterprises.

Unlocking the Value of Data and Navigating the Yottabyte Era with Innovative Data Infrastructure

OceanStor data storage: Providing a more secure, reliable, and efficient data foundation for government and enterprise customers

Huawei works with industry partners to build all-flash data centers featuring data acceleration, data security, energy conservation, and multi-cloud convergence, accelerating the evolution from mass unstructured data analytics towards data-intensive high-performance data analytics (HPDA). Huawei has developed an all-scenario data protection solution that is highly converged and intelligently implements comprehensive disaster recovery of hot data, rapid backup and restoration of warm data, and warm archiving of cold data. We have also developed agile, efficient, simplified, and hyper converged data infrastructure. This is how Huawei contributes to a flourishing digital economy.

A common challenge facing conventional storage is that storing large troves of small files can lead to performance deterioration. Huawei's latest OceanStor Dorado All-Flash Storage overcomes this problem and is particularly suitable for financial data exchange platforms, carrier charging data records (CDRs), and semiconductor electric design automation (EDA) simulation, serving as a high-performance and reliable data foundation. The dedicated backup storage solution OceanProtect, with comprehensive ransomware protection capabilities, provides the last line of defense for data protection.

China's Industrial Bank is using Huawei OceanStor Storage to build all-flash data centers which consume less energy and emit less carbon dioxide, helping the bank become greener.

West China Hospital of Sichuan University and Huawei jointly launched a genome sequencing solution, which slashes the time for human genomic analysis from 24 hours to 7 minutes, making precision medicine a reality.

Huawei's OceanStor Pacific series – a suite of distributed storage systems – supports hybrid workloads. This means a single OceanStor Pacific system can be used for high-performance data analytics, big data, video, backup, and archiving applications at the same time, increasing customers' storage utilization by 30% or even more in some cases. These systems can be used to drive digital transformation in many domains such as life sciences, energy exploration, autonomous vehicles, weather forecasts, smart city, and smart transportation. Huawei OceanStor Pacific series won Best of Show Award Grand Prize in the Server & Storage Division at Japan's largest ICT exhibition, Interop Tokyo 2021 and topped the IO500 list for commercial systems.

For data centers, Huawei launched the FusionCube hyper-converged infrastructure+ (HCI+) along with related products. Featuring hyper convergence ("Efficiency+, Green+, and Application+"), FusionCube increases virtual machine/container density by about 20% and energy efficiency by about 15%, and can be used in all scenarios from large data centers to enterprise branches.

HUAWEI IdeaHub: A Lightweight Telepresence System Enabling Innovation and Contributing to a More Vibrant Digital Office Ecosystem

Built on the powerful audio and video capabilities of Huawei's video conferencing systems and vibrant cloud service ecosystem, IdeaHub is changing how work is done and is enabling smart offices. In addition, Huawei opened its SDK capabilities to industry partners to encourage joint innovation. A variety of solutions are now used by major customers across many industries such as energy, manufacturing, healthcare, finance, and education.

Cloud Computing

Huawei Cloud: Building the Cloud Foundation for an Intelligent World with Everything as a Service

The future is all about intelligence, and digitalization is the path for enterprises to get there. The key to successful digitalization is to think cloud native, act cloud native. Here at Huawei Cloud, our approach is all digital, all cloud, AI-driven, and providing everything as a service. Huawei Cloud works with customers, partners, and developers, always innovating and bringing reality to our vision of building the cloud foundation for an intelligent world with ubiquitous cloud and pervasive intelligence.

■ **Infrastructure as a Service for Global Accessibility:** Huawei continues to expand its global data centers and acceleration networks. Through cloud-network collaboration, we strive to connect people, things, and applications, provide a seamless experience on one global network, enable efficient distribution and processing of information streams, and quickly deliver cloud services to where they are needed. Huawei Cloud launched four new Regions in 2021, bringing the total to 27. Huawei Cloud and its partners currently operate 65 availability zones (AZs) worldwide, covering more than 170 countries and regions.

■ **Technology as a Service for Easy Innovation:** Huawei employs more than 100,000 R&D engineers and spends more than US$10 billion on R&D annually. The fruits of our R&D efforts, including cloud-native technologies, AI, big data, database, audio and video, and collaborative office, are all available to Huawei Cloud customers, partners, and developers in different industries in the form of cloud services. We have built four development pipelines: MetaStudio, ModelArts, DevCloud, and data governance, to facilitate software development for various industries. This helps make Software as a Service (SaaS) easier and faster and creates greater value on the cloud.

- **Expertise as a Service for Shared Excellence:**
  In September 2021, Huawei Cloud released MacroVerse aPaaS. It distills the best practices of Huawei and partners in digital transformation across various industries and categorizes and integrates industry know-how into API services that are readily accessible to enterprises and developers. Developers no longer need to reinvent the wheel; they can focus on innovation for specific industry scenarios. MacroVerse aPaaS provides five digital engines for payment, search, browsing, maps, and advertisement. We have fully opened over 50 scenario-specific cloud services, 128 Kits, and more than 20,000 API services for nine vertical industries, including the manufacturing, automotive, travel, retail, healthcare, interactive media, and news industries.

Cloud-Cloud Collaboration: Capturing New Value on the Cloud

In 2021, Huawei Cloud introduced the idea of Cloud-Cloud Collaboration to deepen the synergy between Huawei Cloud infrastructure and the mobile application ecosystem of Huawei Mobile Services, providing developers and partners with unified services and experience. This collaboration covers unified account, payment, audio, and video capabilities, and a unified development platform, application platform, and operation services, benefiting the audiovisual, finance, industrial Internet, healthcare, and education industries.

Huawei provides a horizontal cloud platform that integrates technologies such as cloud computing, AI, big data, and connectivity, and a vertical enablement platform that streamlines production, deployment, consumption, and operations. Through its global premium channels, the top three mobile app ecosystems, and technological innovation, Huawei helps Internet companies improve their ability to distribute content globally, allowing them to bring high-quality content to Huawei's vast user base. There are over 730 million monthly active users of Huawei devices around the world. Our cloud services also provide a reliable foundation for exploring innovative application scenarios, enhancing user experience, and improving operation quality. They also allow our partners to focus on their core business, develop more good products, and build a high-quality content ecosystem to better serve end users around the world.

Enabling Industries while Growing Rapidly

In 2021, Huawei Cloud maintained rapid growth while continuing to innovate and make technology more inclusive. It continued to improve cloud service capabilities and market share, enabling digital and intelligent upgrades across a wide range of industries.

According to Gartner's *Market Share: IT Services, Worldwide 2020*, published in April 2021, Huawei Cloud had risen to become the fifth largest IaaS vendor in the world.

Huawei Cloud has launched more than 220 cloud services and 210 solutions, and attracted over 30,000 partners and 2.6 million developers worldwide. More than 6,100 applications are now available on the Huawei Cloud Marketplace.

In China, Huawei Cloud has served more than 600 e-Government clouds, helping more than 35 cities make the switch to cloud-native services. Huawei Cloud has also worked with financial institutions including China's six major banks, all of the 12 joint-stock commercial banks, and top 5 insurance institutions; transportation sector customers including more than 30 smart airports, 30 urban rails, and 29 provincial highways; and more than 30 carmakers; as well as at least 15 top household appliance manufacturers. Huawei Cloud has built more than 40 industrial Internet innovation centers, helping 17,000 manufacturers with their digital transformation, and also serves 80% of China's top 50 Internet customers.

In Asia Pacific, Huawei Cloud is the fastest growing mainstream public cloud provider and has become a digital transformation partner for enterprises. In Latin America, Huawei Cloud is the cloud service provider with the largest number of nodes. In Africa, Huawei Cloud has a node in South Africa, serving customers in more than 30 countries. In the Middle East, Huawei Cloud has become a powerful facilitator of digital transformation, working with local partners to help large enterprises migrate to the cloud and build AI and big data capabilities.

Enabling Faster Digital and Intelligent Transformation Through Constant Innovation

Huawei Cloud continues to improve its product competitiveness and has been recognized by a number of leading research firms. It was named in the Leaders quadrant in eight technical fields, ranked first in 10 market segments, and listed in Gartner's Magic Quadrant for cloud databases, EiPaaS, and network firewall.

Cloud Native 2.0: Enabling all businesses to become new cloud natives

- Huawei Cloud released Cloud Native 2.0 services and solutions to help governments and enterprises achieve high-quality and efficient digital transformation. In particular, the industry's first distributed ubiquitous cloud-native service (UCS) provides a consistent experience in cloud-native application deployment, management, and ecosystem development. With Huawei Cloud UCS, enterprises can use cloud-native apps without being constrained by geographical, cross-cloud, or traffic limitations. UCS aims to bring cloud-native capabilities to every service scenario and accelerate the adoption of cloud-native apps in all industries.

- Based on Cloud Native 2.0, Huawei Cloud has supported customers in the finance, Internet, automotive, logistics, retail, and energy industries, among others, helping them undergo cloud-native transformation and further unlock the value of digital transformation.

  - GF Securities has embraced Cloud Native 2.0 as it seeks to upgrade its IT system architecture. This has allowed the customer to create diversified containerized workloads, improve O&M efficiency by over 40% through features like fault self-healing, monitoring log collection, and automatic and flexible scaling, and enhance the lifecycle management of applications and automatic scaling mechanisms. The new architecture also supports composable development. As a result, GF Securities can now provide hundreds of services per month, up from just a few before.

  - Singapore's Nestia has migrated all its services and applications to Huawei Cloud. Cloud-native technologies such as containers and big data enable Nestia to conduct agile development and deployment. This makes development and provisioning of new versions and applications faster while improving performance by about 20% and reducing costs by about 30%.

In September 2021, the Gui'an Data Center, Huawei Cloud's largest data center, was put into commercial use, serving Huawei Cloud customers in Guizhou, Chongqing, Guangxi, Guangdong, Yunnan, Sichuan, and more. The data center introduces green and intelligent technologies, bringing the power usage effectiveness (PUE) to 1.12. When the data center runs at full capacity, it is estimated that it will, annually, consume 1.01 billion less kWh of power and produce 810,000 less tons of carbon emissions, which is equivalent to planting 35.67 million trees.

AI services: Constant innovation in foundational technologies for easier AI development

- ModelArts, the one-stop AI development platform on Huawei Cloud, has been continually evolving, and now offers ultra-large soft clustering for training with up to 32 EFLOPS computing capacity. In 2021, Huawei Cloud released Pangu pre-trained models, the OptVerse AI Solver, and a knowledge computing solution.

  - One Pangu model can adapt to different scenarios to support flexible AI development at scale.

  - OptVerse AI Solver deeply integrates solver, AI, and operation optimization to optimize global decision making in complex scenarios.

  - Our knowledge computing solution, the first of its kind in the industry, is driven by knowledge and data and injects knowledge into the computing process for industry problem modeling and solving. In addition, industry knowledge is combined with AI to extend AI to core production systems.

- Huawei Cloud has long been committed to accelerating AI adoption and value creation in industries, and has extensive experience in about a dozen domains, including smart city, finance, healthcare, manufacturing, and transportation. From diving into these industries and building the intelligent hub they need, we have amassed considerable know-how related to the application of AI in these industries. We are applying this know-how in more than 20 Chinese cities and multiple enterprises that are setting the bar in various fields.

  - Medicine: Professor Liu Bing of Imperial College London designed a new broad-spectrum antimicrobial drug by using the Huawei Cloud Pangu drug molecule model. This drug is expected to save 700,000 lives each year in the future.

  - Oil & gas: Changqing Oilfield and Dagang Oilfield have built a cognitive computing platform based on Huawei Cloud's knowledge computing solution. This solution has shortened the well logging time for gas layer identification by about 70% and improved the accuracy of gas layer identification to over 90%, and allows customers to more accurately calculate the water content of oil reservoirs.

  - Internet: Singapore's online car marketplace UCARS has used Huawei Cloud ModelArts to build the first AI vehicle valuation tool in Southeast Asia. After deployment, UCARS is able to complete vehicle valuation in seconds, greatly improving user experience.

Data services: Combing AI and data to build a data foundation for digital transformation

- Huawei Cloud FusionInsight provides a big data and analytics cloud service portfolio that features cloud native, lakehouse, and decoupled compute-storage, as well as convergence with machine learning, accelerating the digital transformation of customers in the finance, telecommunications, and Internet industries, among others. Huawei Cloud GaussDB(for openGauss) is already commercially available. With a distributed architecture, it supports more than 1,000 nodes and provides a solid foundation for data processing that features financial-grade high availability with 2-site-3-DC disaster recovery and AI-native autonomous management. Huawei Cloud GaussDB(DWS), an all-scenario data warehouse, seamlessly integrates the online analytical processing (OLAP) engine, time sequence engine, and complex event processing (CEP) engine to support batch, interactive, and real-time analysis. It also simplifies the architecture of all-domain data and makes data analysis simpler and more autonomous.

- The e-commerce platform Mengxiang Group has migrated its entire big data and analytics system to Huawei Cloud. Thanks to the decoupling of storage and computing units, this Group has cut its total cost of ownership (TCO) by about 30%. In addition, the fully-managed, serverless environment that comes with the cloud-native architecture allows flexible resource scaling to be completed in seconds. This is important for ensuring the stable operations of the online platform when user traffic surges during large promotions.

By integrating AI, big data, and content delivery network (CDN) with cloud services, Huawei Cloud is enabling the e-commerce platform Xinsheng Selected to conduct real-time analysis of its operation data. Through this, the platform is able to quickly understand consumption trends and user profiles, analyze product categories, and forecast sales volumes. This allows more consumers to enjoy the convenience of next-day delivery, even in rural areas. In addition, it has helped expand the market for rural agricultural products. In Hunan province, the platform has helped more than 400,000 rural households earn an impressive income of CNY8 billion.

Huawei is also supporting the construction of big data and analytics systems for multiple financial customers, such as ICBC and China Merchants Bank. Huawei helps them gradually migrate key services such as risk control, marketing, and profit and loss query to big data platforms, ensuring rolling updates of big datasets and zero service interruption. We are also helping them go cloud native and adopt lakehouse for their financial big data and analytic platforms. ICBC has used Huawei Cloud Stack to achieve the in-depth integration of big data and cloud computing, making cloud-native big data a reality. Based on HetuEngine's convergent analysis for the lakehouse, the bank is able to make its real-time business intelligence analysis 50 times more efficient across the board. Huawei Cloud GaussDB has been named in the *Magic Quadrant for Cloud Database Management Systems* reports for two consecutive years and is widely used by more than 1,500 major customers.

Media services: Powerful media infrastructure for appealing digital content

- Huawei Cloud's media service portfolio includes SparkRTC, MetaStudio, ultra-low latency livestreaming, and webinars, all of which are designed to supercharge the future cloud-native digital content, real-time interaction, and content production in both virtual and real worlds.

  – SparkRTC, powered by a media network that connects 2,500 Huawei Cloud sites worldwide, delivers 99.99% high availability and reduces latency to 200 ms. It also provides real-time communication (RTC) for efficient media production, distribution, and application.

  – Using MetaStudio, a digital content pipeline, Huawei Cloud has created Sara, Huawei's first virtual employee. Sara is a symbol of Huawei's relentless efforts to further refine digital content production processes.

- Huawei Cloud media services span over 1.5 million organizations and Internet platforms worldwide. The live streaming service is used by China's top 5 live streaming platforms, and in 2021 supported major events such as the Grand Finals of the League of Legends World Championship, allowing viewers to enjoy stable, high-quality streaming.

  Through the Huawei Cloud Audio & Video Industry Innovation Center, we are working with customers and campus partners of the Malanshan (Changsha) Video, Cultural, and Creative Industrial Park to build China's V Valley and create a thriving digital content ecosystem.

  Based on Malanshan Audio & Video Industrial Cloud, Huawei Cloud MetaStudio is supporting the Key Laboratory of 5G High Format and New Concept Video Multi-Scene Application (Hunan Broadcasting System, SARFT). The lab is co-developed by the National Radio and Television Administration and Hunan Mango XR Tech Ltd. Using Huawei MetaStudio, they have developed a digital host called Young, who has already featured in a popular variety show.

Huawei Cloud Stack: Diving into industries to build a cloud that better understands enterprises

- Huawei unveiled Huawei Cloud Stack 8.1 and 23 scenario-based solutions for seven industries in September 2021. With multiple advanced services, such as IoT and Application Performance Management (APM), added to more than 80 cloud services across 12 categories, Huawei Cloud can now offer a more diverse portfolio of solutions than its competitors. Huawei Cloud Stack has continued its work to create a flourishing ecosystem, and this year rolled out the Featured Products Mall, which sells over 70 products developed jointly with partners.

- Huawei Cloud Stack serves over 4,800 government and enterprise customers. It has been used in more than 600 e-Government clouds. For example, the Financial Department of Shaanxi Province has used Huawei Cloud Stack to build a centralized, one-stop, service-oriented provincial cloud platform, supporting 148 financial regions across the province, over 30,000 budget units, and over 80,000 users. In the financial sector, five large banks and seven joint-stock commercial banks have chosen the new distributed core and converged data lake solutions powered by Huawei Cloud Stack, helping them go digital faster. In addition, Huawei Cloud Stack has facilitated the digital transformation of 29 provincial smart highways, more than 30 smart airports, PipeChina, and State Grid, among others.

A Cloud Ecosystem by All, of All, for All

In the cloud service domain, Huawei aims to create and share value for greater success. We bring together developers worldwide and empower our partners to address the pain points that customers face during digital transformation.

In April 2021, Huawei announced its Huawei Cloud Developer Program targeting SaaS and independent software vendor (ISV) partners. Through this program, Huawei plans to invest US$100 million in the form of cloud resources, technical support, and business promotion in six fields: container/microservice, SaaS, big data, AI, video, and intelligent edge.

At the inaugural HUAWEI CLOUD Spark Founders Summit in August 2021, Huawei Cloud launched four initiatives to better support startups worldwide – cloud-cloud collaboration, continuous technological innovation, global localization services, and high-quality business ecosystem – and released the Cloud-Cloud Collaboration Innovation Plan.

In September 2021, Huawei Cloud announced its four-pronged ecosystem strategy: serving tens of millions of developers, building MacroVerse aPaaS for open innovation, pooling together SaaS partners, and investing in the cloud marketplace for application distribution. Huawei plans to invest US$100 million in 2022 to expand the Huawei Cloud Developer Program and bring more services and benefits to developers.

The Huawei Cloud Developer Program has attracted 2.6 million developers so far, 70,000 of whom have obtained Huawei Cloud Career Certifications. More than 30,000 partners worldwide have joined hands with Huawei Cloud and, together with solution partners, we have already developed over 8,000 solutions. In terms of talent cultivation, we have developed over 200 Huawei Cloud courses through partnerships with more than 70 leading Chinese universities.

Digital Power

Carbon neutrality has become a globally acknowledged mission. It will drive an extensive and profound transformation in society and the economy. It will also trigger a revolution in energy production and consumption, presenting an opportunity for all industries to upgrade. Over the next 30 to 40 years, we will continue to see intelligence and low carbon gain traction.

- Intelligence will soon be in our grasp, and it will affect every individual, family, and organization, as well as society as a whole. Smartphones, smart homes, smart manufacturing, and autonomous vehicles have already become part of our work and life, but there are still more intelligent applications to come.

- Low carbon in the energy industry means clean power generation, electrification of energy consumption, and intelligent power scheduling. It also means gradually replacing traditional fossil fuels with a power system based on renewable energy, starting us down the path towards full decarbonization.

We believe that the global energy industry will transition from being resource-dependent to technology-driven. Fossil fuels have caused numerous environmental problems and sustainability challenges. Clean power enabled by technology is a sustainable alternative that will drive new economic growth the world over.

Huawei Digital Power is committed to integrating digital and power electronics technologies, developing clean power, and enabling energy digitalization to drive energy revolution for a better, greener future. We pursue innovations in clean power generation, energy digitalization, transportation electrification, green ICT power infrastructure, and integrated smart energy, and we are working with our customers and partners around the world to develop the digital power industry, and build low-carbon households, buildings, factories, campuses, villages, and cities. This will ultimately support the shift from a low-carbon world to a carbon-neutral world.
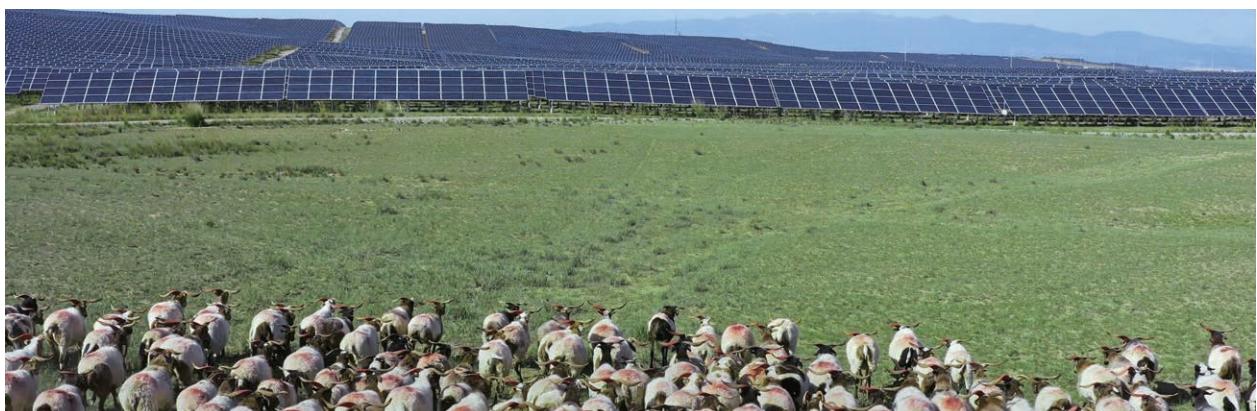
Integrating and innovating on digital and power electronics technologies to drive the digital power industry forward

Huawei Digital Power integrates and innovates on digital, power electronics, and heat technologies to manage watts with bits and help customers conserve energy and cut emissions. By the end of 2021, Huawei Digital Power has helped customers generate 482.9 billion kWh of green power and save about 14.2 billion kWh of electricity. These efforts have resulted in a reduction of nearly 230 million tons in CO_2 emissions, equivalent to planting 320 million trees.

Clean power generation: Combining PV and energy storage to accelerate the adoption of green and smart PV as a primary energy source for every home and organization

By integrating digital and power electronics technologies, we have launched five smart PV & storage solutions that address three application scenarios: power generation, energy storage, and energy consumption. The five solutions are: Smart PV&ESS Generator, Smart String Energy Storage

In Qinghai province, China, we helped Huanghe Hydropower Development, a subsidiary of China's State Power Investment Corporation (SPIC), build the world's largest renewable energy base using wind, solar, and hydropower. The base hosts a 2.2 GW PV plant that produces nearly 5 billion kWh of clean electricity each year. This plant covers 56 km² and has more than 7 million PV modules. Each string of modules is precisely managed with intelligent, digital technologies. This improves energy yields by over 2% and O&M efficiency by over 50%, while reducing the LCOE. This project has also greatly improved the local ecosystem. Now, sheep can be found grazing under the rows of solar panels, and an oasis has reappeared in the desert.

In Indonesia, Huawei has provided its smart PV solution to Green School Bali, the "Greenest School on Earth", helping supply the campus with solar energy. This solution can reduce the school's CO_2 emissions by about 3.5 tons each month.

System, C&I Smart PV Solution, Residential Smart PV Solution, and Smart Micro-grid Solution. These solutions are designed to quickly bring down the levelized cost of electricity (LCOE) over the lifecycle of PV plants, and provide stronger support for power grids, helping build a new power system based on renewable energy.

We have published two white papers on our own – the *Smart String Energy Storage Solution White Paper* and *White Paper on Designing Inverters with Large-size Silicon Wafers*, as well as one in cooperation with the China General Certification Center – *White Paper on Electrical Safety Design for Inverters with PV Arrays: Smart String-Level Disconnect*. All these efforts have contributed to the healthy development of the smart PV sector.

The Red Sea Project, a key part of Saudi Vision 2030, is the world's largest microgrid energy storage project. Huawei is providing PV and storage solutions for this project, including a 1,300 MWh energy storage system and a 400 MWp PV system. This project will see the construction of the world's first city to be powered solely by PV with energy storage, which will supply power to one million people.

Transportation electrification: Redefining EV travel experience and safety for greener transport

In the intelligent electric mobility domain, our full-stack power domain solution DriveONE is redefining travel experience in terms of range, charging, and safety by integrating digital and power electronics technologies.

- Range: DriveONE improves ePowertrain efficiency through high-speed motors, as well as intelligent oil cooling and AI-driven control technologies, and uses multiple converged algorithms to improve the available capacity of batteries. These features combined boost range by 8.5%.

- Charging: We have launched the industry's first full-stack high-voltage platform solution for power domains. This solution delivers 200 kilometers-worth of power after just a 10-minute charge, greatly improving charging experience for users.

- Battery safety: Our DriveONE-Cloud, powered by AI, can provide early warnings about battery thermal runaway 24 hours before it occurs, making vehicles safer.

We believe collaboration leads to shared success. In April 2021, we set up an industry development group for high-voltage fast charging, together with 22 partners, including industry organizations, carmakers, and charging point operators. This group aims to promote the coordinated development across the kilovolt-level fast charging ecosystem, and foster shared success while accelerating the electrification of the transportation sector.

Green ICT power infrastructure: Helping build green and low-carbon data centers and communications networks to enable more connections and computing power per watt

- **Data center facility**

  We focus on reshaping four areas: architecture, power supply, cooling, and O&M. Through technology integration and innovation, we have iterated and upgraded our solutions, and released a series of low-carbon, intelligent products and solutions. We want to help build low-carbon and intelligent data centers and lead the development of the data center industry.

  – Our FusionDC prefabricated modular data center solution presents a new model for building data centers.

  – Our FusionPower PowerPod solution sets the trend for high-density and high-efficiency power supply and distribution systems.

  – Our FusionCol indirect evaporation cooling solution maximizes natural cooling sources for better power usage effectiveness (PUE).

  Huawei has also worked with third-party organizations to publish several white papers, including the *Next-Generation Prefabricated Modular Data Center White Paper* and *White Paper on Intelligent Converged Power Modules for Next-Generation Data Centers*. We have also promoted the implementation of technical standards for lithium-ion batteries used in data centers. All these efforts are aimed at driving the data center industry forward.

  Our SmartDC low-carbon smart data center solution has been deployed in various sectors, including government, telecommunications, Internet data centers (IDC), finance, education, healthcare, transportation, and energy.

In partnership with Huawei, Moro Hub, a subsidiary of Digital DEWA, has built the largest 100% solar-powered data center in the Middle East and Africa, with a total installed capacity of 18 MW, including 1.8 MW in the first phase. Huawei's prefabricated modular data center solution was used in the first phase to complete installation within 5.5 days. This has set a new benchmark for data center construction in the Middle East.

China Transport Telecommunications & Information Center (CTTIC) CLOUD uses Huawei's FusionPower PowerPod solution. Compared with those in a conventional solution, the power supply and distribution systems used in the new solution take up 40% less space, allowing the customer to deploy 350 more IT cabinets and save more than 16,000 meters of power cables. In addition, products were prefabricated in the factory, ensuring faster onsite delivery in two weeks. AI technology is also used to implement predictive maintenance, making the power supply system safer and more reliable.

■ Site power facility

As 5G networks are deployed, 5G sites consume more energy, produce more emissions, and drive up OPEX. To address these challenges, we have launched low-carbon site power solutions for all scenarios and full lifecycle of sites, covering low-carbon network construction, low-carbon operations, and low-carbon maintenance. These solutions help carriers deploy green 5G networks without additional energy OPEX, while minimizing CAPEX. Our ultimate purpose regarding site power facility is to build a low-carbon energy target network.

In terms of sites, these solutions can improve site energy efficiency from 60% to 97% by changing sites from rooms to cabinets and from cabinets to poles, minimizing physical footprints and rental costs.

We are also modernizing existing equipment rooms with precise cooling and power boosts. This can improve energy efficiency up to 80% while also negating the need for new equipment rooms, changing cables, or air conditioners. The solutions use cabinets instead of equipment rooms to deploy new sites, raising energy efficiency from 60% to 90%.

For communications sites with no mains supply or unstable supply, our simplified hybrid power solution maximizes the use of solar power while eliminating the need for diesel generators, to provide green and affordable power supply.

Integrated smart energy: Focusing on low-carbon buildings and campuses to help build green, low-carbon cities faster

In cities, the shift to low carbon is accelerating. Huawei Digital Power works with customers and partners to build low-carbon buildings and campuses, and ultimately low-carbon cities, through top-level carbon consulting services, integration of power generation, grids, loads, and storage, as well as the Dual-carbon Co-Mind. Huawei's integrated smart energy solutions leverage energy infrastructure such as smart PV & storage, charging networks, smart lighting, and smart cooling to achieve optimal system performance. According to the best practices, they deliver nearly 20% gain in energy efficiency, slash energy use costs by about 10%, and shorten the payback period by about 25%. In addition, Huawei has actively participated in the formulation of ultra-low-energy building standards and related policies, and launched pilot projects in support of Shenzhen's efforts to establish zones with near zero carbon footprint.

Huawei built an iSitePower showcase in 2021 together with China Mobile Hangzhou and the China Mobile Design Institute in Hangzhou, Zhejiang province. This site has combined six cabinets into one cabinet, reducing its physical footprint by 80% and allowing for the installation of a Huawei iPV power generation system. Compared with a traditional PV power generation system, Huawei's iPV solar-energy system delivers 20% higher energy yield and saves CNY13,000 in electricity costs per site per year – equivalent to a reduction of 8 tons in annual carbon emissions per site.

With Huawei's integrated smart energy solutions, the Futian District Government in Shenzhen has identified the timetable, roadmap, and blueprint for carbon peak and neutrality, aiming to build a near zero carbon benchmark for downtown areas of major cities. The Futian District Government, together with Huawei, has created low-carbon buildings, campuses, exhibition halls, hospitals, schools, and other typical pilot projects.

The Shenzhen International Low Carbon City (ILCC) Convention and Exhibition Center is using Huawei's Dual-carbon Co-Mind and smart PV & storage solutions to build China's first near zero energy exhibition hall. It has installed a 1.1 MW PV system, a 2 MWh energy storage system, and an integrated smart campus management system. Once put into operation, this center is expected to produce about 1.27 million kWh of green electricity every year, saving about 606 tons in annual carbon emissions.

Huawei Digital Power's new AntoHill campus in Shenzhen is currently under construction, and is expected to open in 2022. This campus will have nearly zero carbon footprint that combines PV generation, energy storage, direct current distribution, and flexible electricity use. Once up and running, this campus will generate approximately 1.5 million kWh of green power each year. Energy saving technology and integrated energy management will cut annual electricity consumption and carbon emissions by 51% and 63% respectively.

Working together to build an open and symbiotic digital power ecosystem for shared success

Digital power is an open and ecosystem-centric business. Huawei Digital Power is implementing an open ecosystem strategy that opens up hardware and software, and promotes multi-layer collaboration across the industry. We are working with like-minded partners to upgrade the energy industry, and create an open and symbiotic digital power ecosystem that thrives on shared success.

- Opening up hardware: As part of our greater Inside strategy, we provide core hardware products and modules to our partners in multiple ways, such as through original design manufacturers (ODMs), secondary development, and integration. We also enable partners to achieve business success and advance the energy industries in their regions.

- Opening up software: We build an open, secure, and reliable DigiPowerCloud, which enables more industry partners to develop more energy applications, and implement integrated smart energy management in different scenarios.

- Multi-level collaboration across the industry: We actively participate in industry organizations to develop industry standards and alliance ecosystems, and work with global standards organizations, institutions, and think tanks to promote the formulation and implementation of relevant standards and industry policies. This will drive the healthy development of the digital power industry.

Device Business

In 2021, Huawei's Consumer BG continued its mission to build a global ecosystem for the smart, all-connected era, and to deliver a Seamless AI Life experience, focusing all of its work firmly on consumers.

Our innovation has been non-stop. The HUAWEI P50 Pocket has ushered in a new era of foldable phones, while our new HUAWEI MateBook laptops have created a brand-new PC experience with their multi-screen collaboration feature and the Huawei Mobile App Engine. HUAWEI Vision smart screens have injected new vitality into the entertainment domain. The HUAWEI WATCH D and HUAWEI WATCH GT Runner have pushed the boundaries of fitness and health services. And with its intuitive interface, the HUAWEI PixLab X1 printer has made printing more convenient than ever.

In 2021, more Huawei products were integrated with HarmonyOS, further enriching the Seamless AI Life experience for our consumers. Following its integration into our wearables and smart screens, HarmonyOS now powers smartphones, tablets, and even car cockpits. This is a significant step forward towards a future where all things are intelligently connected. By the end of 2021, HarmonyOS had been deployed on more than 220 million Huawei devices, making it the world's fastest-growing mobile device operating system.

We also launched HMS Core 6, which supports developers worldwide so that they can focus on app innovation. The Huawei Mobile Services (HMS) mobile app ecosystem, the world's third largest, has continued to thrive. By the end of 2021, the number of monthly active users of Huawei devices around the world had topped 730 million.

Wider Use of HarmonyOS, Strong Growth for the HarmonyOS and HMS Ecosystems

In 2021, we launched many new products powered by HarmonyOS 2, including the HUAWEI MatePad Pro and HUAWEI WATCH 3 Series.

Based on the open source project OpenHarmony 2.0, HarmonyOS 2 is a commercial distribution developed by Huawei to support a diverse range of smart devices and scenarios. In terms of its UX design, cross-scenario experience, performance, and security, HarmonyOS 2 gives users a brand-new experience. Nearly 100 Huawei smartphones, tablets, and other devices have been upgraded to run HarmonyOS 2.

In addition, HarmonyOS for car cockpits saw its first official launch. The AITO M5, an intelligent luxury SUV, benefited from Huawei's deep expertise in ICT and became the first vehicle to feature HarmonyOS Intelligent Cockpit. HarmonyOS enables a vehicle's own apps to connect seamlessly to devices such as smartphones and smart home systems, making the fully-connected vehicle a reality.

For IoT devices, Huawei upgraded the HUAWEI HiLink and Powered by HarmonyOS connectivity systems to HarmonyOS Connect, a new technology brand supporting the HarmonyOS ecosystem. This brand brings new possibilities to intelligent hardware innovation.

The HarmonyOS 3 Developer Preview offers developers an advanced development platform and toolset. Huawei has donated HarmonyOS's basic functions as open source to the OpenAtom Foundation. This has created the OpenHarmony project, which will provide many industries with an open digital foundation.

Based on its core strengths in distributed capabilities, Huawei offers technologies to intelligent hardware partners that enable them to develop high-quality products, enjoy higher product sales, and achieve effective commercial operations. Products that support HarmonyOS Connect can all be connected to Super Device, which provides seamless connections, service widgets, simplified interaction, and hardware collaboration for a smooth and interactive experience. The more devices collaborate, the more intelligent they will become, so Super Device gives consumers easy access to the benefits of smart devices. By the end of 2021, more than 4,500 products from over 1,900 vendors had joined HarmonyOS Connect. In 2021, over 115 million new HarmonyOS Connect devices were shipped.

HarmonyOS itself continued to improve, and now offers more advanced development platforms and tools to developers. At the Huawei Developer Conference 2021, Huawei released the HarmonyOS 3 Developer Preview. This latest release of HarmonyOS includes a new visual tool for automated elastic deployment, and innovative heterogeneous networking technology. The upgraded HarmonyOS development suite includes the Harmony Design System, ArkUI 3.0, and ArkCompiler 3.0. With these innovative tools, the HarmonyOS 3 Developer Preview helps developers create cross-device HarmonyOS apps and services more efficiently to create greater value.

The HarmonyOS ecosystem needs more than just diverse devices, apps, and services. Its success also depends on a steady supply of trained software engineers. Huawei is providing HarmonyOS courses for students at 17 of China's most prestigious universities, including Peking University and Tsinghua University. On top of this, Huawei's Shining-Star Program has offered incentive awards to more than 10,000 innovative HarmonyOS apps. Moreover, Huawei provides a full ladder of HarmonyOS certifications to encourage software engineers to develop their careers.

HMS app ecosystem: HMS is available not just for smartphone apps. Mobile services can also be intelligently and seamlessly shared across devices such as tablets, PCs, smart screens, smart watches, AR/VR devices, and head units. In 2021, there were over 432 billion app downloads worldwide, demonstrating the success of our dual-engine strategy (HMS app ecosystem and "1 + 8 + N" hardware ecosystem).

We launched HMS Core 6, which provides more advanced open technical capabilities and services across different devices, OSs, and scenarios. This release contains 69 kits (including 13 with cross-OS capabilities) and 21,738 APIs in seven domains (e.g.,

Graphics, Media, and AI). These capabilities and services are secure, reliable, distributed globally, and can be accurately delivered to users worldwide with one-step access. This frees up developers to focus on creating innovative apps, without worrying about the back end.

More than 5.4 million developers worldwide have registered to join Huawei's developer alliance, and over 187,000 apps have been integrated with HMS Core. In 2021, the number of HMS apps worldwide jumped by 147% compared to 2020. The rich pool of premium apps has attracted more and more consumers from around the world. By the end of 2021, the number of monthly active users of AppGallery worldwide had increased to 580 million. In addition, the number of monthly active users on the HUAWEI Account Kit and Quick App had exceeded 400 million and 160 million, respectively.

The HUAWEI Mobile Cloud, HUAWEI Browser, HUAWEI Wallet, HUAWEI Video, HUAWEI Music, HUAWEI Books, HUAWEI Themes, HUAWEI Ads, Petal Search, Petal Maps, and other mobile apps continue to deliver a superior, intelligent experience to consumers, regardless of how they access these services. For example, Petal Search covers over 20 vertical domains, supporting online access to more than 700 million stock keeping units (SKUs) of products. Petal Maps is available in more than 160 countries and regions outside China, and supports over 70 languages. With these innovative technologies, HMS has grown to become the world's third-largest mobile app ecosystem, and continues to thrive and deliver a Seamless AI Life experience to consumers.

"1 + 8 + N" Seamless AI Life Strategy: Continuous Innovation in Five Scenarios

Huawei has consistently pursued a "1 + 8 + N" Seamless AI Life strategy for several years now. This strategy is centered on smartphones: "1" represents mobile phones; "8" represents tablets, PCs, VR devices, wearables, smart screens, smart audio, smart speakers, and head units; and "N" represents ubiquitous IoT devices. Supported by the HarmonyOS and HMS ecosystems, this strategy helps us deliver a Seamless AI Life experience to consumers across five major user scenarios: smart office, fitness & health, smart home, easy travel, and entertainment.

Huawei has seen significant successes in the smartphone domain. Total shipments of the HUAWEI P Series have hit the 100-million-unit mark, and the number of HUAWEI nova users has topped 190 million worldwide.

We have also made new R&D breakthroughs in many smartphone technologies, especially in imaging technology. The HUAWEI P50 Pro delivers the perfect balance of form and function with its all-new Dual-Matrix Camera system, which produces true-to-life imagery with extreme clarity and high dynamic range. Building on the solid camera technology of previous HUAWEI P Series devices, the Ultra Spectrum Camera Matrix that comes with the HUAWEI P50 Pocket enables the phone to capture even more nuanced details and produce even clearer images. The phone also introduced the unique sunscreen detection feature.

Foldable screens are driving a revolution in the form factor of smartphones. In 2021, Huawei embraced the new foldable era with two new foldable phones:

- HUAWEI Mate X2: Featuring both an inner and outer display, the phone delivers a superior large screen experience. An intricate Multi-Dimensional Hinge with an interlocking mechanism allows the device to fold perfectly with a near imperceptible gap, and minimizes the crease on the screen when the device is unfolded.

- HUAWEI P50 Pocket: The next-generation Multi-Dimensional Hinge and Huawei's unique Multi-Dimensional Lifting design allow the smartphone to achieve a perfectly symmetric, seamless fold.

In addition to innovations in the hardware, Huawei designed the foldable form factor from the ground up to support a smart immersive experience unlike any other. Back in 2019, Huawei partnered with the Software Green Alliance to establish the first foldable screen ecosystem alliance, which aims to deliver optimal experiences to users across all their phone use scenarios.

Smart office: Huawei continues to lead innovation in this area, with a focus on multi-device collaboration and ecosystem integration. We are bringing consumers brand-new smart office experiences characterized by easy connections, smooth data sharing, cross-device operations, and task continuity. Through these offerings, we enable free creation and boundless communication, and help consumers fully unleash their creativity and maximize communication efficiency.

Smart features such as OneHop file sharing, Multi-screen Collaboration, and Super Device link Huawei devices and ensure that they work efficiently together and share capabilities. The Huawei Mobile App Engine integrates computer and mobile apps, allowing users to use mobile apps directly on their

Photo taken with the HUAWEI P50 Pro. XD Fusion Pro, an improved solution that incorporates a new Super Color Filter System, True-Chroma Image Engine, and Super HDR technology, significantly improves detail, color, and dynamic range.

PCs. The engine already offers more than 4,200 apps, bringing consumers a new kind of computer experience.

The HUAWEI MateBook X Pro 2022, Huawei's new flagship smart laptop, supports Super Device, meaning it can effortlessly connect to Huawei phones, tablets, monitors, and smart screens, making PCs a new portal to the fully connected world. The HUAWEI MatePad Pro is the first tablet powered by HarmonyOS; combined with the HUAWEI M-Pencil, it is the perfect tool for unlocking user creativity. Petal Clip provides professional video editing functions and a smooth editing experience. The HUAWEI Mobile Cloud has become a secure and easy-to-use smart data steward in the cloud. AppGallery is now available for PCs, allowing users to access a whole host of popular apps on their computer.

In 2021, Huawei further expanded its smart office product range. In addition to the MatePad tablet series and the MateBook laptop series, we launched our MateStation desktop series, MateView monitor series, PixLab printer series, and supporting peripherals and solutions. This comprehensive smart office line-up can support the diverse requirements of smart offices in any office scenario.

Fitness & health: Huawei has built a complete ecosystem supporting seamless collaboration between hardware, software, and services. In 2021, Huawei comprehensively upgraded its strategy in the fitness and health domain, integrating its strengths in sensors, software algorithms, and comprehensive digital health services. Under this upgraded strategy, we will continue working with our ecosystem partners to build an intelligent digital ecosystem for fitness and health.

The HUAWEI WATCH D can measure blood pressure with medical grade precision. The HUAWEI WATCH GT Runner comes with a groundbreaking floating antenna, which provides 135% better GPS performance than traditional designs. Together with other wearables like the HUAWEI WATCH GT 3, HUAWEI WATCH KIDS 4 Pro, and HUAWEI Band 6, our wearables provide consumers with a wide range of options across all scenarios. With functions including monitoring of heart rates, SpO2, blood pressure, and stress, as well as sleep tracking and ECG, our wearables allow users to track their health in real time.

In Q3 2021, Huawei led the world in shipments of smart watches and bands. By the end of 2021, Huawei had cumulatively shipped more than 100 million units of wearables. In total, Huawei health and fitness products have served more than 320 million users worldwide. The HUAWEI Health app provides users with comprehensive data, science-based exercise advice, and targeted health management services, and has attracted 83 million monthly active users worldwide.

Huawei has accelerated its partnerships with medical institutions to explore solutions like chronic disease management and disease screening outside of hospital settings. This has improved the effectiveness of disease screening outside hospitals, and helped users promptly identify their health risks. Based on the HUAWEI Research platform, Huawei is working with more than 60 institutions on health research that covers a range of topics, such as heart health, sleep apnea, respiratory health, and blood pressure health.

Six research findings from the Huawei Heart Study were published at the annual European Society of Cardiology (ESC) 2021 conference, and were recognized by global medical authorities and organizations. By the end of 2021, 3.8 million users had participated in our Heart Study, during which more than 15,000 people were identified as suspected cases of atrial fibrillation, with an accuracy rate of 94%.

Huawei continues increasing investment in the R&D of fitness and health technologies. In 2021, Huawei opened its Health Lab in Songshan Lake, Dongguan, China. It will be a world-class center for technology innovation in fitness and health, dedicated to product R&D, new standards development, testing & certification, exhibitions, and industry incubation activities.

Smart home: Huawei launched multiple new next-generation products in its HUAWEI Vision V series of smart screens, including the V75 Super and V98.

The HUAWEI Vision V75 Super uses Huawei's proprietary SuperMiniLED backlight technology. The 46,080 MiniLED dots have revolutionized display technology, creating 2,880 backlight zones and achieving an ultra-high HDR peak brightness of 3,000 nits. This makes it possible to vividly restore true-to-life colors. The 20-unit audio system, jointly designed with Devialet, turns living rooms into home theaters.

We have expanded the uses of Huawei's smart screens with HarmonyOS and functions like MeeTime calls and karaoke. Looking ahead, Huawei's smart screens will offer an even greater variety of functions and experiences through continuous system upgrades, to ensure our consumers are always up to date with the latest trends.

The HUAWEI SmartHome Solution, featuring a "1-2-N" architecture (1 stands for the SmartHome Computer, 2 stands for Connection and Interaction, and N stands for N subsystems), brings the intelligent experience at home to a whole new level. It places today's consumers in the homes of the future, enabling them to live happier lives.

As the central control system, the SmartHome Computer serves as the "brain" of the whole house, capable of learning, computing, and decision making, and provides AI and connectivity throughout the house. Intelligent and interactive hardware is ubiquitous, and software supports multiple forms of intuitive interaction. These combine to form intelligent core interactions at home. In addition, a powerful home network connects a broad array of scalable subsystems throughout the house over high-speed Wi-Fi and a high-reliability power line communication (PLC) network.

In 2021, Huawei Smart Home Authorized Experience Stores opened in many Chinese cities, including Beijing, Shanghai, Shenzhen, and Chengdu. We also partnered with leading real estate developers including Vanke, Greenland, China Overseas Property, Jinmao, and Shimao to optimize and implement the HUAWEI SmartHome Solution. Our goal is to build at least one store and one showcase project in every major city.

Easy travel: The cars of the future will be electric, intelligent, and connected. We provide leading intelligent automotive solutions, backed by our powerful ICT technologies, to help car manufacturers build better vehicles. In addition, we leverage our branding and marketing experience in the consumer electronics industry to help them sell such vehicles through our retail sales channels.

In 2021, Huawei started selling two new extended-range electric SUVs, the SERES SF5, a high-performance SUV coupe, and the AITO M5, an intelligent luxury SUV, through its retail network, giving customers a smarter travel experience.
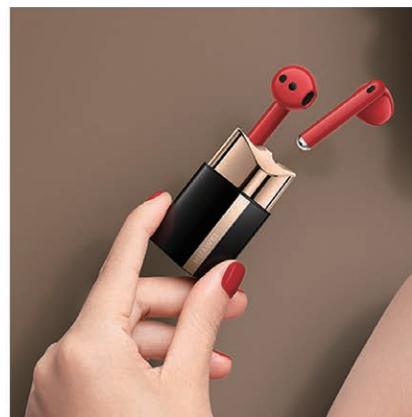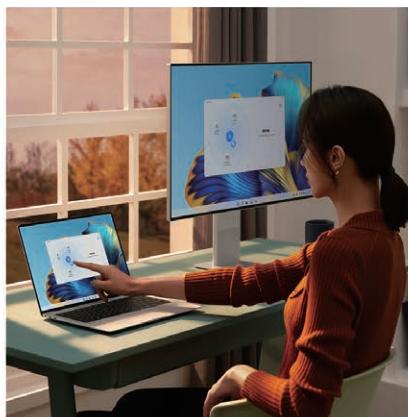
Many customers' main concerns about electric vehicles are range and difficulty to recharge. In response, the AITO M5 includes an extended range ePowertrain platform that not only reduces range anxiety, but also delivers world-class driving performance. It also offers flexibility that allows users to shift between a pure electric mode that meets the needs of urban commuters, and an extended range mode for long distance travel. The AITO M5 boasts a minimalist, stylish design as well as excellent performance thanks to the HUAWEI DriveONE all-in-one electric drive system. It comes equipped with HarmonyOS Intelligent Cockpit, which delivers an intelligent, intuitive experience to the driver and passengers. The HUAWEI SOUND® system provides immersive audio and video experiences. The AITO M5 marks a historic shift from electric vehicles to intelligent vehicles. It is also a key part of Huawei's fully-connected ecosystem initiative.

The HUAWEI HiCar solution has established partnerships with more than 30 mainstream carmakers, and has been fully integrated into the platforms of several car brands. In 2021, the HUAWEI HiCar supported more than 100 car models, and was integrated with more than 30 industry platforms. It is currently in use in more than 10 million vehicles. We have also teamed up with vendors to provide users with in-vehicle services through HMS for Car by pre-installing cloud services into head units. HMS for Car has launched services with car manufacturers like Volvo, with further collaborations to be rolled out soon.

Entertainment: The distributed capabilities of HarmonyOS mean that Huawei's TWS earbuds, smart eyewear, smart speakers, smart screens, smartphones, PCs, and tablets can connect to each other. The system provides intelligent pairing prompts, dual device connectivity, and Super Device, so that users can experience intelligent entertainment, however they enjoy their media.

Huawei has continued innovating in audio technologies. HUAWEI FreeBuds 4 uses adaptive ear-matching technology for active noise cancelation even with open-fit buds. The trend-setting HUAWEI FreeBuds Lipstick, featuring a groundbreaking form factor, perfectly integrates luxury design with cutting-edge technology. HUAWEI FreeBuds products such as the FreeBuds 4 and FreeBuds Pro have received a Smart Green Medal from SGS, an internationally recognized certifier. These products meet SGS level-1 standards in the following five categories: material safety, hearing safety, wearing

Huawei provides consumers with a Seamless AI Life experience across five major user scenarios: smart office, fitness & health, smart home, easy travel, and entertainment.

safety, radiation safety, and battery safety. Powered by HarmonyOS, HUAWEI Eyeware brings users a more efficient lifestyle and improves their work efficiency.

The upgraded HUAWEI Sound X smart speaker features a separate design for tweeters, mid-range speakers, and woofers. This new design ensures that the speakers work independently to deliver better audio quality. As the first smart speaker powered by HarmonyOS, the HUAWEI Sound X also offers easier interactivity, including auto-discovery of nearby devices, OneHop Audio Sharing, and Super Device.

In addition to great devices, Huawei provides users with rich music and video services and experiences. HUAWEI Music provides online music services that offer over 50 million songs across more than 170 countries and regions. HUAWEI Video enables users to watch content from multiple video platforms collected in one convenient place. Nearly 1,000 movies in 4K, HDR, and 5.1 surround sound formats are also available in the AiMax Cinema zone.

Upgraded Brand Image in Retail and Service Stores

In 2021, we continued to explore and develop premium retail and service models to improve Huawei's brand image and optimize customer experience at retail and service stores. By the end of 2021, we had more than 56,000 retail stores, display zones, and display counters worldwide, including over 5,500 experience stores.

Huawei Global Flagship Stores have become landmarks in their cities, serving as social spaces for engagement and relaxation. At the stores, customers can relax, meet up with friends, and participate in free

Huawei Global Flagship Store in Qingdao is a spacious, two-story building covering a total area of 1,296 square meters. There are three showcase areas on the lower floor: Easy Travel, Smart Office, and Fitness & Health. The upper floor is divided into four areas: Smart Home, Entertainment, Service Center, and HUAWEI TALK.

courses delivered daily through the HUAWEI TALK program. These courses cover areas like photography, videography, and fitness & health. Customers can also hear talks by experts in sectors like art, painting,

This large space at Beijing Yintai in01 is Huawei's first new concept store in China. Covering an area of 470 square meters, it was designed around HarmonyOS to showcase exactly how people can interact with their cars and homes.

or travel. By the end of 2021, more than 6,000 educational sessions had been delivered at Global Flagship Stores as part of HUAWEI TALK, attracting more than 30,000 customers.

We have continued to enhance our core strengths in delivering technical expertise and thoughtful services to improve customer experience. In 2021, global customer satisfaction with Huawei's services increased by 5 percentage points over 2020. We also used AI technologies to shift towards intelligent automated services, which are currently available in eight different languages across 12 countries. In 2021, we handled over 17 million consumer inquiries through robots.

By the end of 2021, we had approximately 3,000 physical service centers in more than 100 countries and regions, providing convenient and fast services to customers around the world. We also organized targeted service campaigns such as Service Day, the Service Carnival, and Thanksgiving Season, which generated more than 500 million consumer interactions.

More than 1,000 consumer suggestions and requests directly led us to take action to improve our products and services. This is an important part of our efforts to continuously improve consumer experiences. In May 2021, we launched a hotline dedicated to supporting customers using accessibility features on their devices,

and began providing in-store services to address these customers' needs.

Enriching Life with Technology as an Active, Responsible Corporate Citizen

Huawei believes that no one should be left behind in the digital world. We see providing equal access to technology to everyone worldwide as our corporate mission and responsibility.

We always consider the needs and experiences of each and every user and integrate accessibility into the design of our operating systems in order to provide thoughtful services for disabled users. Every month, more than 4.47 million visually impaired users use Huawei's Screen Reader feature, and approximately 840,000 users use Huawei's AI subtitling feature. A Huawei phone received a 5-star rating at an Elderly Friendliness Evaluation for smart mobile devices conducted by the China Telecommunication Technology Labs (CTTL), part of the China Academy of Information and Communications Technology (CAICT).

Huawei has followed the vision of "Tech for a Better Planet". We are working to protect the planet with our technology and to contribute to a sustainable world. Specifically, we focus on three areas: Reducing carbon emissions, promoting renewable energy, and contributing to a circular economy.

Huawei is an active partner in environmental protection programs. In 2021, we officially launched a campaign to plant poplar trees in Gansu Province. Members of the public donated more than CNY1.5 million to this campaign by the end of the year, and the first batch of 62,439 poplar seedlings are now growing in the desert in Jinta County, northern Gansu. These trees will create windbreaks and help with sand fixation, and are expected to protect an area of 7.44 square kilometers, equivalent to around 1,042 standard soccer pitches.

For example, we use recyclable paper and paper materials from Forest Stewardship Council (FSC) certified forests, which uphold rigorous sustainable development standards. Our latest eco-friendly materials have passed an international compostability certification, meaning that they are biodegradable as part of industrial composting. Huawei uses 100% biodegradable soy ink made from soybean oil on product packaging. Our new flagship smartphones, the HUAWEI P50 Series, use less than 1% of plastic in their packaging, an 89% reduction in the use of plastic compared with the previous series.

One of the most effective ways to conserve resources is to manufacture durable products that do not need to be constantly replaced. That's why we conduct stringent reliability tests on our products before they are sold to the public, and provide ongoing system updates and convenient, affordable repair services. This allows us to extend the lifespans of our products, reduce the consumption of new resources, and work with customers to make tangible contributions to the circular economy. In 2021, we provided repair services for more than 20 million users.

We constantly work to protect user privacy through innovative technologies. We have adopted industry-leading security technologies to ensure that user data is fully protected. For example, we have built a Trusted Execution Environment (TEE) OS that supports hardware isolation. Sensitive user data such as fingerprints, facial biometrics, and lock screen passwords are all encrypted, verified, and stored in the TEE OS to prevent privacy leaks. The microkernel of TEE OS has obtained CC EAL5+ certification, the highest security certification level available for a commercial OS kernel. This helps eliminate underlying system vulnerabilities and enhance security.

We have established a robust system for protecting and managing personal data, and we are a global leader in terms of personal data security management, transparency, and privacy compliance. For example, AppGallery manages the security of apps with a unique four-layer system – malicious behavior detection, security vulnerability scanning, privacy leak checks, and app reassessments by human evaluators. This system ensures that only secure apps are available to download from AppGallery. The HUAWEI Mobile Cloud encrypts all data stored and transmitted through device-cloud channels to provide end-to-end protection for user data.

In 2022, we will continue to focus everything we do in the consumer business on our consumers, and continue to create new technologies so that the Huawei brand is synonymous with convenient and thoughtful services. We will make Huawei the world's most trusted smart device brand, and make Huawei our users' first choice. Working with our partners worldwide, we will redouble our efforts to build thriving ecosystems around HarmonyOS and HMS and continue delivering a Seamless AI Life experience for our consumers.

Huawei protects privacy with innovative technologies

Four proposals

- Top-down organizational and process assurance
- An airtight privacy and security framework
- A security verification framework developed with leading industry organizations
- Sharing security and privacy expertise with ecosystem partners

Three commitments

- Treating privacy as a fundamental user right
- Encrypting all user data
- Giving users complete control over their data

In 2021, Huawei published four proposals and three commitments for security and privacy in the consumer business. The company applies its years of experience in security and privacy to the design of Huawei products, and also shares its expertise with its app and device partners, so that the Seamless AI Life experience is protected by strong security and trustworthiness.

Intelligent Automotive Solution Business

At Huawei, we strive to become the world's preferred provider of new components for intelligent connected vehicles, and aim to help the automotive industry go electric, connected, and intelligent. Ultimately, we want to help car OEMs build better vehicles.

Industry Development Trends

- **The global automotive industry is going electric far faster than expected, and this trend is irreversible.**

  Technology and user experience are the two key drivers that have led the global new energy vehicle (NEV) market into a golden age of growth. NEVs have reached as high as 20% of monthly vehicle sales in China and Europe, far exceeding market expectations. According to the China Passenger Car Association, China alone saw its annual penetration rate for new energy passenger cars reach 14.7% in 2021, far higher than 2020's 5.8%.

  Carmakers worldwide have been rapidly expanding their presence in the NEV market, and many are making ambitious plans to go electric. Huawei's Global Industry Vision report estimates that fully electric vehicles will account for more than half of global vehicle sales by 2030.

- **Intelligent functions like intelligent driving and intelligent cockpits have become key factors in consumer purchasing decisions.**

  The key differentiators for vehicles are changing from mechanical specifications to intelligent functions such as intelligent driving and intelligent cockpits. And intelligent components – such as high-performance computing platforms, lidars, large displays, and multiple displays – have become unique selling points for car OEMs. 2021 marked the first year of mass production for lidars, which have become a standard component in top car models. Vehicles with three or even four lidar units have begun to hit the market.

Major Achievements in 2021

- **Business development**

  We are continuing to increase investment in intelligent automotive components, as they represent long-term strategic opportunities for Huawei. In 2021, our investment in intelligent automotive solutions reached US$1 billion and our intelligent automotive solution R&D team reached 5,000 people.

We are already providing customers and partners with high-quality products, including the 30-plus innovative intelligent automotive components we have already launched. At Auto Shanghai 2021, Huawei unveiled five innovative solutions: HarmonyOS Intelligent Cockpit, 4D imaging radar, Mobile Data Center (MDC) 810, the Huawei Octopus autonomous driving open platform, and an intelligent thermal management system.

We are working with car OEMs using models like Huawei HI and Huawei Zhixuan. Huawei does not make cars. Instead, we have established in-depth partnerships with many car OEMs, such as Beijing Automotive Industry Corporation (BAIC), Changan Automobile, Guangzhou Automobile Group, and SERES, to help them build better vehicles and achieve business success. Two Huawei HI cars – the BAIC ARCFOX Alpha S HI model and the Changan Avatar 11 – and one Huawei Zhixuan car – the AITO M5 – will gradually begin mass production and delivery in 2022.

- **Ecosystem development**

  As part of Huawei's broader "Platform + Ecosystem" strategy, we have opened up our intelligent digital vehicle platform (iDVP), intelligent driving computing platform MDC, and HarmonyOS Intelligent Cockpit platform to provide a digital foundation and development tools for creating intelligent vehicles. Over the past year, more than 300 upstream and downstream partners from across the industry have joined us on these three platforms.

  - iDVP has been pre-integrated with 20 equipment models from 10 vendors.

  - The MDC ecosystem has more than 70 partners who are helping drive pilots and commercial applications of the MDC platform in intelligent driving scenarios such as passenger cars, ports, mining trucks, and campuses.

  - Through the HarmonyOS Intelligent Cockpit platform, we have established partnerships with over 150 hardware and software providers, providing consumers with intelligent personalized and diversified service experiences.

Huawei has also been deeply involved in the SparkLink Alliance, which is committed to driving innovation and creating an industry ecosystem for next-generation short-distance wireless communications technology. To date, the alliance has attracted more than 140 members across the value chain.

- **Safety and security certifications**

  Huawei pursues a zero-defect quality system to ensure safety and security for its customers and users. We invest heavily in R&D, testing, manufacturing, supply, processes, and more to quickly build up end-to-end and systematic capabilities.

  – Our intelligent driving operating system AOS, intelligent vehicle control operating system (VOS), MDC, advanced driving solution (ADS), advanced intelligent sensing (AIS), intelligent electric power, and other related products have all passed ASIL-D – the highest certification for functional safety assessment.

  – For HD maps, Huawei has been granted Class-A qualification for surveying and mapping in China.

  – Huawei Intelligent Automotive Solution Business Unit has received ISO/SAE 21434 certification for automotive cyber security.

– Our Intelligent Vehicle Cloud Service has received the Automotive Software Process Improvement and Capability Determination (ASPICE) certification and meets all Volkswagen KGAS (Group Basic Software Requirements).

- **Awards**

  – June 2021: Huawei ADS made it onto the top 30 finalist list of the Super Artificial Intelligence Leader (SAIL) Award at the World Artificial Intelligence Conference.

  – September 2021: Huawei's high-resolution mmWave radar with a large antenna array and its AI algorithm-based cloud warning technology for battery thermal runaway both won the Global NEV Cutting-edge and Innovative Technologies Award.

  – October 2021: Huawei's AR-HUD won the VR/AR Innovation Award at the World Conference on VR Industry.

  – October 2021: Huawei AOS and VOS won the China Automotive Supply Chain Innovation Achievement Award.

Research and Innovation

Digitalization and carbon neutrality are two of the world's most important current topics. They are both making a deep and lasting impact on the ICT industry. The global digital economy is growing rapidly, and the demand for digital products and services has outstripped expectations. However, supply is struggling to catch up, because both Shannon's theorem and the von Neumann architecture have run into severe bottlenecks. In 2021, Huawei invested even more in research and innovation, as part of our greater efforts to sustain development in the future. We are sparing no efforts as we explore the endless frontiers of science and technology. We are also devoting efforts to identifying the needs of different industries and overcoming global challenges. Guided by our vision of a fully connected, intelligent world, we will work openly with the global scientific community to explore new theories, architectures, and technologies, which will support the ongoing development of the industry.

Basic Research

In 2021, Huawei ramped up investment in basic research into fundamental theories about communications, computing, AI, and many other fields.

- We continued to make advances in the fundamental theories on wireless communications, pushing our algorithms ever closer to the theoretical Shannon limit. Our innovations in the theory and algorithms of sparse superposition codes have enabled us to derive the Shannon limit for a fast-changing coding matrix, helping us to substantially simplify the design of transceivers.

- We published our 6G vision, defining new services, use cases, and technological trends for the future, as part of the industry-wide efforts to create a consensus around 6G.

- We created a new, trustworthy architecture that combines full-spectrum wireless communications and sensing with native AI, incorporating the New Radio (NR) framework, ultra-dense satellite networks, and terrestrial cellular networks. This new architecture will support intelligent 6G connectivity.
- We continued to research new architectures and new components for wireless transmission, reshaping conventional cellular network designs, and proposed a capacity-centric architecture for future wireless networks. We were able to calculate the theoretical maximum network capacity and defined the capacity changes to help increase the coverage and capacity of future wireless networks combining both high- and low-frequency resources, setting the wireless network industry on a stable footing for the future.

- We advanced optical communications with new approaches to non-linear waveform designs, making important progress on the industry-wide problem of non-linearity in fiber and significantly extending transmission distances.
- We created a precision network traffic prediction model and refined the actuarial theory for network service level agreements (SLAs), enabling traffic models to make a leap in levels of precision, from the millisecond level to the microsecond level. This has made network performance much more predictable and boosted resource utilization.

- We continued our research into storage coding technologies. We were the first to develop divide-and-conquer mapping and vertical horizontal recursion coding, which allowed us to achieve breakthroughs in low-complexity, incremental error correction coding, and increase the throughput of distributed storage under typical load distributions.

- We have made new progress in AI image encoding and decoding technologies, and supported the launch of the JPEG AI project (ISO/IEC JTC 1/SC29) to develop the next generation of image standards.
- Our AI-powered mixed audio codec architecture has been approved by the China Ultra-HD Video Industry Alliance (CUVA) and Audio Video Coding Standard (AVS), China's working group on audio and video codec standards, and will provide the technical foundation for their spatial audio codec standards.
- Our dynamic HDR core technologies are helping the HDR Vivid industry standard achieve widespread acceptance in the industry. Over 10,000 hours of video content has now been delivered using HDR Vivid.

Left picture: Laurent Lafforgue is a world-renowned mathematician. Born in 1966, he won his first silver medal at an International Mathematical Olympiad (IMO) when he was just 18. At the age of 35, he received the Fields Medal, the mathematics equivalent of a Nobel Prize, for his outstanding contributions to number theory and algebraic geometry. In 2021, Lafforgue joined Huawei's Paris Research Center. The topos theory he works on is a highly abstract mathematical proposition that may point the way to new worlds of communications, computing, and AI. The company also set up a Lagrange Mathematics and Computing Research Center in Paris, France in 2020. This center aims to attract top-tier academics to be part of Huawei's research programs and to nurture young researchers.

Right pictures: The Lagrange Mathematics and Computing Research Center

Focus, Persevere, Break Through

Huawei has spent decades investing heavily in R&D. In 2021, we once again witnessed how our "Focus, Persevere, Break Through" strategy drove innovation and rapid advances across the industry.

Optical Networks

In this area:

- We made breakthroughs in optical network technologies, such as new coding, signal processing, and optoelectronic components, supporting our evolution towards higher bit rate per wavelength over long haul.

- We have a good grasp on key materials and manufacturing techniques for optical amplification, and verified the feasibility of ultra-wide spectrum transmission technology. We have also recast the optical backplane architecture and developed new technologies to address engineering challenges like high-precision, high-density optical connections in the C + L bands. These efforts have doubled transmission capacity per fiber.

- We generated groundbreaking results in key technologies like high-power light source pooling and silicon photonics. This supports N x 100G, low-cost, high-density optical interconnection within data centers and maximizes the computing performance of their networks.

- We made innovations in optical fiber sensing, spectrum detection, and micro-electro-mechanical system (MEMS) sensing algorithms and architectures, and promoted the adoption of optical networks to help vertical industries, including oil and gas, coal mining, and ports, go digital.

Carrier and Enterprise Networks

- We made innovations in Ethernet technology. Specifically, this year we defined a simplified, low-latency data center network technology stack. When converged with Unified Bus (UB), a computing-native interconnections technology, this will make a UB-over-Ethernet (UBoE) solution possible, creating large-scale computing networks, each with more than 300,000 nodes, a switching element capacity of over 100 Tbit/s, and a static latency of less than 130 nanoseconds.

- The interconnection of heterogeneous networks (ManyNets) is an ongoing and irreversible trend. In 2021, we continued our own research into new network protocols and a distributed forwarding architecture. We also expanded our collaboration with carriers, industry customers, and partners, and carried out cutting-edge pilot projects in new industrial Internet, IoT network access, smart cities, smart campuses, and more. All of these efforts are aimed at providing a deterministic connectivity experience to our customers, underpinned by intrinsic security and ultra-low power consumption.

Intelligent O&M

- Autonomous Driving Networks (ADNs) aim to achieve automation, self-healing, self-optimization, and autonomy, and their four most prominent features are advanced intelligent sensing, digital mapping, self-learning, and adaptive decision making.

- Supported by our new algorithms, wireless networks can learn and predict variations in network load, and orchestrate the use of multiple energy sources to maximize the use of green energy, while also reducing electricity costs by at least 10% compared with human-controlled networks.

- We made breakthroughs in network knowledge graph technologies, accumulated 1.1 million pieces of network O&M knowledge across 15 products, and created AI inference tools that provide solutions in seconds.

AI

- As part of our full-stack AI portfolio, we launched the dense foundation model Pangu-Alpha, which was the industry's first to be trained with 200 billion parameters. We also invented an adder neural network which can replace convolution operations for deep learning, significantly reducing required floating-point multiplication and increasing energy efficiency by 30% to 50%.

- We took significant steps forward in parallel model training, deployment and scheduling algorithms, and communications technologies for ultra-large-scale deployment of AI models, honing our competitive edge in power consumption, performance, and cost.

- Our groundbreaking work in optimized compilation, automated deployment, and efficient execution in heterogeneous distributed compute clusters has helped halve the cost of computing for AI and search.

- We made huge leaps in high-bandwidth algorithms for medium detection, error correction codes for high-performance memory, and in the theory and algorithms for low-redundancy erasure coding. These advances helped boost the reliability of our computing and storage functions.

Smartphone Media

- With sustained innovation in computational photography, computational optics, and the True-Chroma Image Engine, Huawei remains a leader in digital photography. We are continuing to work nonstop to deliver a better image and video experience for our users.

- Our groundbreaking work in core technologies such as spatial computing, spatial video, and 3D reconstruction is helping create immersive augmented reality experiences.

- The adaptive noise reduction technology in our open-fit earphones takes noise cancellation to new heights.

- Our ultra-HD, low-latency video processing technology supports easy multi-screen collaboration, delivering a better viewing experience for users.

Physical Engineering

- We were the first to use a phone form factor that features a wedged shape and multi-dimensional hinge design. This allows the two screens to fold in snugly against each other, preventing dust or grit from getting in and scratching the screens or obstructing the hinge. These innovations have been applied in multiple Huawei foldable phone models and helped us lead in this sector.

- We developed an eight-channel, high-performance, high-sensitivity photoplethysmography (PPG) module and an intelligent algorithm to minimize interference when a smart watch is monitoring a wearer's heart rate in sports mode. In more than 40 different sports scenarios, our heart rate monitor delivers the most accurate results in the industry.

Basic Software

- We have continued to research and innovate in this area. Our innovations in software architecture and full-stack systems optimization have substantially improved the utilization of hardware resources and sharpened our competitive edge.

- In terms of operating systems, we achieved breakthroughs in technologies like deterministic scheduling and flexible resource isolation. This helps us meet demands for low latency in embedded applications, and has doubled resource utilization in typical cloud scenarios.

- Thanks to great progress in multi-core parallelism and automated vectorization technologies, our BiSheng compiler deeply synchronizes software and hardware, helping our proprietary chips lead the industry in diversified computing performance.

- We've also made substantial headway in core technologies for GaussDB, such as fully parallel, multi-core processing and AI-assisted self-optimization. This has honed our edge in high performance, high availability, and autonomous O&M, helping us expand our presence in seven key industries.

- We are committed to open source and openness in software ecosystems. Our multiple-pillar technology architecture helps us build technologies and ecosystems in key segments like finance, public services, and enterprise solutions. The openEuler and HarmonyOS ecosystems are developing rapidly and more than 220 million Huawei devices now run on HarmonyOS.

- We provide technologies to support app porting, including connectivity, rendering, AI, maps, search, data management, Kit frameworks, and our AR Engine. More than 3,000 apps have now been ported to Huawei operating systems to date and over 600 million active devices are using Huawei Mobile Services (HMS).

Trustworthiness

- We have made sustained investments in research into trustworthy theories, technologies, and engineering practices.

- Huawei works with industry peers to develop theories, standards, and specifications for trustworthy technology, and is a major contributor to trustworthiness-related working groups in the International Organization for Standardization (ISO), Telecommunication Standardization Sector of the International Telecommunication Union (ITU-T), 3rd Generation Partnership Project (3GPP), European Telecommunications Standards Institute (ETSI), Internet Engineering Task Force (IETF), and other standards organizations.

- We are dedicated to enhancing our own software engineering capabilities and the trustworthiness of open source software. To this end, we are researching trustworthy programming languages and developing new engineering capabilities. Huawei is also one of the five founding members of the Rust Foundation.

- We research technologies for vulnerability management and open source to help more accurately and efficiently find open source vulnerabilities and ensure that code comes from trustworthy sources.

- We are exploring cutting-edge technologies, including cryptography, AI trustworthiness, systems security, and privacy-enhancing computation, and applying the results of our research to our ongoing engineering practice to enhance product security and resilience.

- We are studying engineering technologies like functional security and human factor engineering, bringing ICT technologies to all walks of life.

Every year, Huawei invests over 10% of its sales revenue into R&D.

In 2021, our total R&D expenditure amounted to **CNY142.7 billion**, equaling **22.4%** of the company's total revenue.

Over the past decade, Huawei's total R&D investment surpassed **CNY845 billion**.

In 2021, **107,000** employees, representing **54.8%** of Huawei's total workforce, worked in R&D.

Huawei has one of the largest patent portfolios in the world.

By the end of 2021, Huawei held a total of **110,000+** active patents, across **45,000+** patent families.

In terms of the number of patents granted in 2021, Huawei ranked **No. 1** at both the China National Intellectual Property Administration and the European Patent Office, and **No. 5** at the United States Patent and Trademark Office.

The patents held by Huawei are broadly recognized across the industry.

Patent panorama reports published by independent third parties show that Huawei is an **industry leader** in the fields of **5G, Wi-Fi 6, and H.266**.

More vendors are signing agreements with Huawei to **use our patented technologies**, expanding from the communications industry to intelligent vehicles, smart homes, and IoT.

Improving the Management System

Our global management system supports the company-wide promotion of our corporate culture and the effective management of our business. Ultimately, we aim to:

- Stay customer-centric, build an ecosystem for shared success, and continue creating more value for customers by meeting their needs and pursuing technological innovation
- Effectively manage risks, and ensure operational compliance and business continuity
- Guarantee the trustworthiness of both processes and results, and provide trustworthy, quality products
- Pursue corporate social responsibility (CSR) initiatives and promote sustainable development

Quality and Customer Satisfaction

Quality is key to Huawei's survival and success. The more difficult our environment gets, the more attention we pay to quality. That means implementing higher quality requirements and stricter management systems. Huawei intends to make its name synonymous with high quality in the ICT industry. To achieve this, we have doubled down on efforts to strengthen our ISO 9000-based total quality management system. Therefore, we have implemented a strategy-driven, all-hands, full-process quality management system across our entire value chain in alignment with customer needs. We are also rolling out a broader quality management system across the company, continuously implementing new system requirements, and building a data-driven quality awareness and measurement platform. This will ensure our quality management system constantly improves along the value creation stream while staying customer-centric.

- We are working to increase the quality awareness and capabilities of **all employees** so the company can win with quality:

  - We regularly host quality training sessions for managers and quality conferences, and work to increase our quality leadership. The Huawei Quality Awards, Quality Star awards, and internal and external audit and assessment programs are all part of our efforts to create a quality-first culture and instill a sense of responsibility and honor among all employees in the pursuit of high quality.

  - We also help employees reach their full potential and encourage them to participate in a wide array of improvement initiatives, honing quality engineering capabilities in areas such as Six Sigma, lean manufacturing, theory of inventive problem solving (TRIZ), Taguchi methods, failure mode and effects analysis (FMEA), and Quality Control Circle (QCC).

- We are working to manage quality and embed quality requirements into **all of our processes**.

  - Through our complete, three-level process architecture, including operational, enablement, and supporting processes, we have embedded requirements for compliance; trustworthiness;

One-piece flow: Automated, lean production line of on-board chargers (OBCs) for intelligent electric power

Huawei has equipped itself with essential techniques and technical capabilities, including lean manufacturing processes, to manufacture intelligent automotive components. While creating a culture of craftsmanship, Huawei is learning from the experience and expertise that guide the automotive industry. The company has been evaluated by multiple industry authorities and customers, receiving certification in IATF 16949, VDA 6.3, TISAX, and ISO 26262. Building on these efforts and Huawei's strong ICT expertise, we are making smart manufacturing possible, bringing digital to every vehicle and helping car OEMs build better vehicles.

Tuanbowa intelligent manufacturing campus for Huawei's device business

Huawei's Tuanbowa campus uses a three-flow, one-cloud intelligent manufacturing architecture that covers all levels of production, including its production lines, workshops, factories, and larger campus area. 5GtoB applications and digital safety management initiatives within this campus provide campus-wide 5G coverage, quality warnings enabled by big data, preventative maintenance tools, digital work stations, AI-assisted quality inspections at 5G edge, AI-assisted behavior analysis at 5G edge, and intelligent scheduling for automated guided vehicle (AGV) clusters.

quality; internal controls; cyber security and privacy protection; information security; business continuity; Environment, Health, and Safety (EHS); CSR; and sustainable development into multiple domains. These domains include sales, marketing, R&D, delivery and services, supply chain, procurement, and manufacturing.

- We have also streamlined these processes from end to end, and worked to constantly hone our competitiveness and prevent major quality risks.

■ With a focus on value and experience, we encourage efforts to extend quality management to **every link of our value chain**:

- Previously, our quality management system focused on our products and services. Today, it has been adopted by multiple business domains within the company and has become an integral part of every link of our industry value chain.

- With quality as our foundation, we continue to pursue operational compliance and place cyber security and privacy protection at the top of the company's agenda.

- To deliver Real-time, On-demand, All-online, DIY, and Social (ROADS) user experiences, we strive to build the best digital operations platform. This platform will make operations simpler, more prompt, and more accurate, and raise the overall quality of our routine work and results.

- Huawei actively works to capture the Voice of the Customer (VOC) through a wide array of channels to identify and consolidate key areas for improvement and continuously improve customer satisfaction.

- We constantly push customer requirements and expectations up the industry value chain to align quality strategies and encourage further collaboration for coordinated development across the value chain. We also call on suppliers to build their own Business Continuity Management (BCM) systems and lead our value chain in the pursuit of high quality.

All aspects of Huawei's ISO 9000-based total quality management and other relevant management systems have been certified by leading industry organizations, winning extensive recognition from customers.

■ The company has been evaluated and certified by numerous independent third parties, receiving the following certifications:

- ISO 9001 (quality management)
- TL 9000 (quality management for the ICT industry)
- IATF 16949 (quality management for the automotive industry)
- ISO 14001 (environmental management)
- ISO 14064-1 (quantification and reporting of greenhouse gas emissions and removals)
- ISO 45001 (occupational health and safety management)
- IECQ QC 080000 (hazardous substance process management)
- ISO 50001 (energy management)
- ISO 22301 (BCM)
- ISO 28000 (supply chain security management)
- ISO/IEC 20000-1 (IT service management)
- ISO/IEC 27001 (information security management)
- ISO/IEC 27017 (cloud security management)
- ISO/IEC 27034 (application security)
- ISO/IEC 27018 (protection of personally identifiable information in public clouds)
- ISO/IEC 27701 (privacy information management)

- ISO/IEC 29151 (protection of personally identifiable information)
- CSA STAR (cloud security management)
- PCI DSS and PCI 3DS (payment card industry data security)
- SOC 1, 2, and 3 (system and organization controls)
- ISO 27799 (health information security)
- ISO 26262 (road vehicles – functional safety)
- ISO/SAE 21434 (road vehicles – cyber security engineering)
- ASPICE (Automotive Software Performance Improvement and Capability Determination)
- TISAX (information security and trusted information exchange in the automotive industry)
- NIST CSF (cyber security framework)

■ Huawei has passed comprehensive audits, regular reviews, and stringent assessments, all of which were conducted by the world's top carriers, as well as major enterprise and industry customers.

- Audited domains cover financial robustness, quality management, risk management, delivery and services, supply chain management, knowledge management, project management, trustworthiness and software engineering, cyber security and privacy protection, information security, EHS, CSR, sustainable development, and BCM.

- We strive to become a strategic partner for our customers that can assist them in future-oriented transformations.

Improving the BCM System

In today's highly globalized and highly specialized world, Huawei's operations rely heavily on third parties. This makes business continuity management (BCM) critical. Through years of sustained investment, Huawei has established a BCM system for domains such as R&D, procurement, manufacturing, logistics, and global technical services. This system covers our end-to-end processes, from suppliers to Huawei and on to our customers. As part of this system, we have developed and established effective measures to drive BCM and emergency response upskilling across organizations, allowing them to manage risks that arise during their daily work. Specifically, we have built up management organizations, processes, and IT platforms, embedded key BCM elements into our product designs, prepared business continuity plans and emergency management plans, and organized BCM training and drills for employees.

Key Initiatives for BCM in R&D and Procurement

■ Supply chain diversity: Huawei will always pursue globalized supply and supply chain diversity. When designing a product, we strive to source raw materials, boards, and products from more than one supplier, actively expand the pool of supply resources, and prioritize the supply diversity of raw materials. We prefer suppliers that have multiple manufacturing sites and avoid relying on any single supplier or region to safeguard supply availability.

■ Scenario-specific stockpiles: During mass production, we prepare safety stock of high-risk raw materials, semi-finished products, and finished products. This allows us to better address customer requirements and uncertainties from various sources, including supply availability, trade conflicts, and natural disasters like the COVID-19 pandemic.

■ Supply and demand visibility: Huawei works closely with suppliers to ensure that demand forecasts, purchase orders, and supplier inventory are all visible through IT systems. This ensures that we receive timely demand information and have adequate supply.

Key Initiatives for BCM in Manufacturing and Spare Parts Supply

■ Manufacturing and supply resource backups: Huawei considers in-house manufacturing and outsourcing capabilities to be of equal importance. We have established long-term strategic partnerships with multiple electronics manufacturing service (EMS) suppliers. Board manufacturing and supply capabilities are shared between Huawei and EMS suppliers, and between multiple EMS suppliers, to ensure we always have a backup. We have also established supply centers in Shenzhen, Europe, Latin America, and Dubai, which serve as integrated equipment backups for each other.

- **Spare part reserves to support full-lifecycle operations:** Huawei reserves spare parts according to market demand and historical usage before a product reaches its end of life (EOL). After a product reaches its EOL, we reserve enough spare parts to cover the full lifecycle of all remaining products. This prevents any impact on the operational continuity of live customer networks.

Over the past decade, we have weathered many crises, from natural, political, economic, and trade-related conflicts, to even armed conflicts in some regions. Despite the lasting effects of COVID-19, Huawei continued to ensure supply continuity and timely delivery to our customers. This shows that Huawei's BCM system – as part of our overall management system – is functioning as intended. Huawei is a global company that works in the network infrastructure, IT infrastructure, cloud services, and smart device domains. We have worked with over 10,000 suppliers and partners, and fostered sound, long-term partnerships with them.

As a staunch advocate of globalization, we will continue to pursue supply chain diversity. We aim to develop sustainable and stable supply capabilities to prevent dependency on any single supplier, country, or region. Based on the principles of collaboration for shared success and mutual development, Huawei is confident in its ability to work with partners around the world to forge a secure, reliable, competitive, and healthy value chain. We will continue to deliver quality products, solutions, and services to our customers worldwide.

Regulatory Compliance

Huawei works hard to conduct its business with integrity and conform to business ethics standards and all applicable laws and regulations. This key principle is upheld by our highest levels of management. We have worked for years to build a compliance management system that aligns with industry best practices and embed compliance management into every aspect of our business activities and processes, and these efforts continue to this day. Huawei emphasizes a culture of integrity and invests heavily to make it a reality. As such, every Huawei employee is required to strictly adhere to its *Business Conduct Guidelines* (BCGs).

- Our Chief Compliance Officer (CCO) manages the company's operational compliance, and reports to the Board of Directors (BOD). Every one of our company's business departments and subsidiaries has also established its own compliance team,

taking responsibility for the management of their own operational compliance.

- We identify and assess risk according to applicable laws and regulations and business scenarios. In addition, we have formulated control measures that have been incorporated into our business activities and processes. This guarantees effective compliance management during operations. Huawei also continuously optimizes its management system through root cause analysis and targeted corrective action.

- We attach great importance to and continuously enhance the compliance awareness of our employees. Through publicity, training, exams, disciplinary action, and other related actions, we push employees to fully understand the company's and their own obligations, in order to ensure compliance and incorporate this understanding into their behavior.

- With an open mind, we proactively work with customers, partners, regulators, and other stakeholders on compliance, and communicate our compliance principles and practices to them to constantly enhance mutual understanding and trust.

Compliance Management by Domain

As always, Huawei is dedicated to ensuring better compliance across multiple domains, including but not limited to trade compliance, financial compliance, anti-bribery compliance, intellectual property (IP) and trade secret protection, and cyber security and privacy protection. These compliance requirements are embedded into our policies, systems, and business processes.

Trade Compliance

Huawei complies with applicable laws and regulations of the countries and regions in which it operates. These include applicable export control and sanction laws and regulations of the UN, China, the US, and the EU. We have invested immense effort over the years to establish a mature and sustainable internal system for trade compliance, in line with industry standard practices, and worked tirelessly to constantly improve this system.

We have also established an integrated trade compliance management organization within the company. This organization manages trade compliance across both group functions and field offices. In addition, we have established specialist teams in our

global offices that monitor changes to local laws and regulations, integrate trade compliance into the company's rules and processes, and manage and oversee trade compliance in each link of our business operations, ranging from procurement, R&D, and sales, to supply and services.

Huawei continuously pushes employees to further their own trade compliance awareness. Employees must sign Huawei's BCGs each year, which include commitments to observing applicable export control laws and regulations. Huawei provides training sessions on trade compliance to managers and employees across the company, with training taking various forms across different sessions. These efforts, combined with targeted training for specific business scenarios, ensure employees fully understand their own responsibilities and obligations, as well as those of the company, regarding export control.

Financial Compliance

Huawei earnestly fulfills its legal obligations and social responsibilities. As always, we are dedicated to complying with applicable financial laws and regulations, and attach great importance to the management of financial compliance risks. With appropriate organizations in place, we continuously invest resources into financial compliance and have established a management and control system that remains in line with industry standard practices. We achieve end-to-end financial compliance by considering factors such as regions, transaction objects, and funding paths; setting key control points for our sales, procurement, and treasury processes; and constantly working to improve our IT control tools. For years, Huawei has endeavored to create a culture that promotes financial compliance by raising employee awareness and instilling respect for regulatory compliance within our employees.

Anti-Bribery Compliance

Huawei has a zero tolerance policy towards corruption and bribery. We will continue to strengthen our anti-bribery compliance system at both the group and subsidiary levels by continuing to support the following: a culture of compliance, governance and oversight, compliance risk assessment and prevention-discovery-response techniques, and continuous operations. We identify risks and drive the optimization of relevant business processes. We are also working to build a culture of compliance, and increase employee compliance awareness, internal compliance training, and external third party compliance management. The combination of these efforts allows us to effectively control anti-bribery compliance risks across the company.

IP and Trade Secret Protection

Respecting and protecting IP: Huawei is dedicated to its long-term investments into R&D and continuously enriching its IP portfolio. Huawei is one of the world's largest patent holders, and the company believes that respecting and protecting IP is the bedrock of innovation. As a follower, practitioner, and contributor of IP rules, as well as an innovator, Huawei invests heavily in IP protection and respects the IP of others. Huawei has reached cross-license agreements with major ICT companies around the world, and works tirelessly to improve the environment for protecting innovation and IP in the industry and across countries and regions.

Respecting and protecting the trade secrets of others: Huawei is committed to protecting its own IP and trade secrets, while respecting those of others. We explicitly prohibit our employees from improperly acquiring, disclosing, using, or disposing of the trade secrets of others.

The key measures Huawei has taken to protect the trade secrets of others include:

- Issuing our *Regulations on Respecting and Protecting Third Party Trade Secrets*, which set out clear rules that employees must follow to respect and protect the trade secrets of others during business activities and ensure that employees carry out business activities legally and in accordance with our contracts

- Embedding trade secret protection requirements into business processes such as R&D, sales, procurement, and HR, conducting regular reviews, and continuously improving management mechanisms by taking away lessons and case studies from day-to-day operations

- Organizing publicity, training, and exams on trade secret protection for all employees, so that they are fully aware of their obligations and responsibilities regarding trade secret protection compliance

- Conducting supervision, including checks and audits, to examine efforts aimed at protecting the trade secrets of others and thus ensure effective implementation of policies, rules, and processes

- Establishing an accountability system based on official corporate policies such as the *Accountability Protocol for Infringements of Other Parties' Trade Secrets* and the *Accountability Rating Criteria for Information Security Violations* to hold violators accountable for any trade secret violations

Regional Compliance Management

Huawei has appointed compliance board directors to every country and region where it operates. These directors manage and supervise the compliance of subsidiaries through the following key measures:

- Fully identifying and assessing risk under the ever-changing international business environment, and taking measures to effectively manage and prevent compliance risks, especially those from new businesses and the digital domain.

- Formulating subsidiary compliance management policies and rules based on the company's unified compliance requirements and in accordance with local laws and regulations. This allows them to internalize external regulations and continuously refine subsidiaries' basic rules and compliance incident management systems, thereby ensuring their compliance.

- Making compliance part of the key performance indicators (KPIs) of all business departments. Through ongoing efforts to strengthen our compliance management team and carry out compliance training, subsidiaries have built a strong culture of compliance.

Management Transformations

The overall goal of transformations at Huawei is to "grow the harvest and increase soil fertility". Huawei is developing new business systems and digital platforms to better address internal and external pressures, such as those presented by the pandemic, and leveraging various digital technologies to safeguard our business continuity.

- **Ensuring business continuity through digitalization:**

  - Over the last year, the company has improved its business rules regarding data protection and identified new risks pertaining to data security, data control, and legal and regulatory compliance. We have established a Data Strategy Center that structurally manages 16 corporate-level security strategies for internal data, and centrally manages key objects. This makes internal data secure and visible at every link, and helps the company's oversight organizations identify risks and implement oversight initiatives.

  - Huawei effectively supports a low-cost governance structure for multiple businesses and multiple subsidiaries through flexible expansion of the data architecture for multi-tenant management and sharing of common capabilities.

    - We use a unified foundational data platform to create data architectures for multiple businesses, including our original equipment manufacturer (OEM) component, Huawei Cloud, and Intelligent Automotive Solution (IAS) businesses. These architectures encompass business objects for each business and can guarantee both consistency and security, supporting flexible expansion for multiple-tenant and multiple-object scenarios.

    - For general business objects, we keep developing common capabilities to address common management requirements.

  - Thanks to ultra-large-scope, multi-BoM-level, and ultra-fast data connectivity, the company has been able to build a graph model with more than 22 billion instance-level relationships to serve various business continuity scenarios, including product quality backtracking, supply quality isolation, and geographic blocks caused by earthquakes, typhoons, airway congestion, or other incidents. This proactive approach to risk treatment guarantees business continuity.

  - The company has also shortened the time taken to locate defected materials from over 20 hours to less than an hour through faster analysis and isolation for off-standard components. This is successfully minimizing the risk of quality incidents that may affect our customers.

- **Continuing to develop new business systems and digital platforms to reinforce digital operations and address the new situation in 2021:**

  - **Carrier business:** This unit stepped up efforts to go digital while securing a buy-in from all its employees regarding the importance of digital operations in 2021.

- Over the past year, this unit hosted over 500 customer executives in virtual exhibitions and online conferences supported by the Three Clouds platform and its events were held via global live streams in its green-screen exhibition halls. Together, this unit constructed 80 of these exhibition halls and deepened relationship with customers through more frequent engagements.

- Another 75 accounts have moved to the unit's Customer Collaboration Online (CCO) platform, ensuring uninterrupted transactions and improving the customer digital transaction experience.

- **Enterprise business:** Digitalization of this unit has focused on helping industries go digital and ensuring business continuity.

  - In 2021, this unit created a competency partner map and tools for the non-named-account market, and developed a mechanism for coordinating the manufacturing and sales teams. This increased both its percentage of zero-touch transactions and systems connected with customers' despite the ongoing pandemic.

  - This unit has also released a series of digital tools, such as a software annual license fee performance channel, and developed a joint operational assurance system to advance digitalization, support partners and employees, and boost customer and partner satisfaction.

- **Device business:** The transformation and digitalization of this unit focus on all-in-one smart homes to support new business development.

  - It has continually improved the key capabilities of its brick and mortar stores, increasing their overall sales ability and operating efficiency by bringing online services to offline storefronts and digitalizing store user management, pre-sales management, distribution, and consignment.

  - Guided by its Seamless AI Life and ecosystem development strategies, this unit is constantly working to optimize the value stream of the intelligent hardware ecosystem. By increasing the number of potential certification channels three times

over, the unit has also added more than 4,500 products to HarmonyOS Connect and over 1,900 certified partners to this ecosystem.

- **Supply chain:**

  - This team has continued to iterate its algorithms, models, and service-oriented capabilities for key, cross-process scenarios: simplifying supply, increasing the resilience of the supply network, and integrating research, manufacturing, and sales. Intelligent operations have also been introduced to refactor business models and processes, boosting the operational efficiency.

  - The unit has increased the digitalization of precision parts and components manufacturing. This will help bring digital design and manufacturing to all new ICT infrastructure and device products.

  - The procurement team has also steadily advanced digitalization. In 2021, they developed a procurement operations platform and a unified procurement collaboration platform for suppliers. To date, the vast majority of our suppliers, including all our mainstream suppliers, are connected to the collaboration platform. These two agile and automated platforms have significantly improved procurement operations and collaboration.

- ■ **In 2021, Huawei continued to roll out the Transformation Program for Software Engineering Capability Enhancement, improving company-wide software engineering capabilities and creating trustworthy and quality products. To date, almost all our vanguard products and common platforms have delivered trustworthy results.**

  - **Building trustworthiness into management systems:** In 2021, we released the Huawei Trustworthiness Framework 2.0, covering 110 sub-capabilities across 10 capability categories. This framework allows all products within the program to achieve preset objectives, self-evaluation, and self-improvement. By building trustworthy capabilities into the Integrated Product Development (IPD) process, we guarantee the lasting effects of transformation.

- **Employee upskilling:** To date, 80% of eligible employees have passed our trustworthy software certification. Multiple software coaches have been assigned to key positions related to major products and platforms.

- **Culture and awareness:** By the end of 2021, corporate organizations had been established to handle trustworthiness theories and technologies, as well as engineering; security protection and verification; vulnerability management; open source management; software integrity management; R&D digital IT toolkits; and software certification. Both black box and white box testing results have been used to inform the performance appraisals of all our software professionals, while a culture of trustworthiness in software has started taking shape.

- **Trustworthy products:**

  - **Trustworthy processes:** The key to trustworthy processes lies in software integrity and process traceability. At Huawei, we work to realize trustworthy process objectives by adopting the same approach to digitalizing operations. This way, we can also improve the R&D efficiency and experience while working to achieve these objectives. So far, the common capabilities defined in the Huawei Trustworthiness Framework 2.0 have been applied to almost all products under the program.

  - **Trustworthy results:** In 2021, we analyzed new scenarios related to trustworthiness for different businesses, identified related threats and risks, and developed subsequent mitigation measures. 77.1% of the trustworthiness requests we received have been addressed within the predefined timeframe, and more than 190 of our products have been credited as trustworthy by third parties.

- **Refactoring:** The company has also built new architectures and platforms for more than 80 products and refactored 70% of our previous code.

- **AI Business Intent and Governance Principles:** AI is driving technological changes that greatly improve efficiency, productivity, quality of life, and societal well-being. At the same time, it also presents a fair share of ethical and governance challenges. Our company has done a significant amount of engagement and research to understand these challenges. As for implementation, we have established a company-wide set of rules, which include our AI business intent and six AI governance principles, to instruct related business domains in their research, planning, deployment, and adoption of AI. We have a dedicated task force to ensure that AI technologies are being designed, developed, deployed, and used properly. Their goal is to drive responsible and sustainable innovation in our AI business.

Organizational Vitality

Despite changes to our internal and external environment, the company has stayed true to its corporate culture and core values. We have pooled resources to make our operations more agile and continued efforts to develop multi-business organizations and mechanisms. We have also rolled out transformations related to organizations and talent to improve our organizational capabilities and efficiency. Despite many challenges, our employees have kept their confidence and our organization has remained dynamic.

In 2021, initiatives for boosting organizational vitality focused on the following key areas:

- **Performing integrated operations, enhancing expertise, adapting organizational formations to business, pooling resources, and steadily advancing transformation for business success:** The company has continued to refine its organizational formations to better support a multi-business landscape, particularly one that integrates ICT infrastructure, devices, digital power, cloud, intelligent automotive solutions, and chips. We rolled out the Representative Office Full Autonomy Program globally in 2021 as scheduled, strengthening our representative offices and simplifying HQ teams. Our ultimate goal with this program is to transform our organization into one of multiple elite teams supported by a big platform. We explored new operations models for our integrated teams. By shortening the management chain, we can now meet customer requirements faster to better serve customers. We went beyond organizational boundaries to synchronize R&D efforts. By pooling expert resources from numerous global industries and directing them towards the same goal, we will be able to make breakthroughs regarding key business and technical issues.

- **Selecting and developing managers with proven track records, and forging a management team with keen insights and solid expertise:** We unified thoughts of and requirements for managers across the company, boosting manager confidence. We continued equipping managers at all levels with better expertise and leadership skills. We optimized the leadership management system, reinforced the development of the manager term of office and managerial pipeline systems, created more opportunities for the vertical promotion of managers based outside China, and inspired passion among all our managers. We continued to select and develop managers that possessed successful experience and proactively identified outstanding high-potential talent from key projects. We offered such talent more opportunities and bold deployments to key positions. This will encourage outstanding talent to shine in greater numbers.

- **Continuing to actively source outstanding talent from around the world, unleash the potential of current employees, and maintain the dynamics of teams across the company:** We have continued bringing in talent from around the world, regardless of background or seniority. Top minds and scientists have joined us in droves, upgrading our workforce. We have adopted a talent supply strategy tailored to our organizations and are working to create a diverse talent mix. We have steadily advanced an orderly mobility system for employees and a training and practice system through the Strategic Reserve to upskill and reskill employees. This will help the company fully utilize its talent. We continued to roll out the Professional Staff Transformation Program in 2021 to create a stable specialist team. We pushed ahead with our strategy to recruit, train, and develop local talent, enabling them to maximize their value and serve as a stronghold for local operations. With a focus on both performance and capabilities, we redoubled efforts to improve competency and qualifications (C&Q) management. We are also optimizing the way profession committees work and unleashing the value of experts. All these efforts combined aim to boost team effectiveness.

- **Continuing implementation of the Contribute and Share system based on responsibility fulfillment results and developing a differentiated incentive mechanism:** The company is developing an incentive mechanism that varies by business, development stage, and employee group, so as to help organizations and employees deliver greater value. We have placed greater emphasis on the alignment of employee personal grades and remuneration with their abilities and contributions. We have encouraged outstanding employees to make more contributions and motivated employees to take up positions within our business teams that are highly challenging or urgently need to be filled, creating even more value for our customers.

- **Staying customer-centric and inspiring dedication:** Huawei has and will always live its core values of customer centricity, dedication, perseverance, and growth by reflection. On this basis, we are making every effort to create a dedicated and enterprising organizational climate in line with our diversified business portfolio and talent mix. We care deeply about our employees and will continue to ensure their physical and mental health by constantly improving their work and living environments and organizing various wellness activities.

Cyber Security and Privacy Protection

Cyber security and privacy protection challenges and opportunities

We live in a highly interconnected world, where the physical and digital realms are converging and network boundaries are increasingly blurred. Cyber security and privacy protection are ever more important. Over the past year, a succession of critical vulnerabilities, supply chain attacks, and advanced persistent threats (APTs) emerged. Cyber security threats have become ubiquitous, arising in products, services, operations, internal IT systems, supply chains, code, and personnel. Governments around the world are paying greater attention to cyber security and privacy protection, and have adopted laws and regulations to strengthen the governance of cyberspace and protect personal data. With the rising role and importance of data in all parts of our lives, data protection and compliant data use are becoming a basic requirement.

As digital transformation accelerates across industries, the application of new technologies – such as cloud computing, artificial intelligence (AI), 5G, and big data – brings with it opportunities, but also risks. We need to consider how to meet the increasingly strict compliance requirements of regulators, and how to provide secure and trustworthy products and services that fulfill our commitments to customers. We also need to embrace a defense-in-depth approach to provide better security, ensure business continuity, and improve efficiency and customer experience while all the time protecting user privacy.

Over the past three decades, we have built more than 1,500 networks together with carriers, and helped millions of enterprises with their digital transformation. During this time, we have connected over three billion people around the world and maintained a solid track record in security. With digital transformation picking up pace, we are acutely aware that cyber security will become a cornerstone of the future digital world. Business success will not be achieved without security, trustworthiness, and privacy protection. We continue to place cyber security and privacy protection as a top priority. We are committed to confronting cyber security and privacy challenges and opportunities through management transformation, technological innovation, and open collaboration. We want to foster a better life for all in the future digital world by offering secure and trustworthy products, solutions, and services where personal data is lawfully used and always protected.

Building secure and trustworthy products, solutions, and services to help customers strengthen cyber resilience

We continuously optimize our end-to-end cyber security and privacy protection assurance system, making sure that each domain is constantly refined and up-to-date:

- **Deepening trustworthiness transformation to enhance software engineering capabilities and cyber resilience, and building secure, trustworthy, and quality products and solutions**

  In 2021, we improved our internal off-the-shelf components of trustworthy technologies and product design platforms, and implemented the clean code mechanism to continuously improve code quality and reduce vulnerabilities. We also enhanced threat analysis and trustworthy design, bringing improvements to the security and resilience capabilities of products and solutions. We incorporated the software engineering capability enhancements into the Integrated Product Development Lifecycle (IPD 12.0).

  In terms of organizational changes, we strengthened the integration and continuous development of common security capabilities. We set up a corporate-level vulnerability management center based on the Product Security Incident Response Team (PSIRT) to enhance common vulnerability management capabilities. We also integrated the Trustworthiness Enabling Department and IT Equipment Department at the product line level to help implement software engineering capabilities through IT systems.

- **Consolidating privacy governance to respect and protect user privacy**

  We comply with privacy protection laws and regulations in the countries and regions in which we operate. In 2016, we established a unified privacy governance framework in accordance with the General Data Protection Regulation (GDPR). With successive personal data protection laws – such as China's Personal Information Protection Law – being enacted and cross-border data transfer requirements being imposed in different regions and countries, we have continuously improved our governance architecture and technical capabilities, and incorporated privacy protection and cross-border data transfer requirements into

R&D, services, operations, and other aspects. Based on the governance architecture and processes, we developed a series of IT tools and platforms to improve compliance effectiveness and management maturity, and provided transparent and clear compliance processes and results. We handled over 20,000 data subject requests in a timely and effective manner, protecting the rights of data subjects. We conducted 30 internal and external audits in different countries across business domains, and multiple subsidiaries have obtained internationally recognized privacy protection certifications, ensuring that our privacy policies are effectively implemented and independently validated.

- **Helping customers manage security risks through technological innovation**

We continue to research, explore, and implement cutting-edge fundamental technologies, such as cryptography, AI trustworthiness, confidential computing, and differential privacy. Furthermore, we accelerate the application of security technology solutions to products, and continue to introduce vulnerability mitigation, advanced threat detection, data protection, and other technologies into ICT products, improving security and resilience.

Take 5G base stations as an example. We deploy a wide range of functions – including software integrity check in the boot state, runtime software integrity measurement, and one-click security configuration check – providing security verification, hardening, and detection capabilities. We also build intrinsic security for 5G to enable a more efficient integrated security protection system. In this way, we have significantly enhanced cyber resilience.

Additionally, we introduced application behavior detection and other functions under device-cloud synergy to mobile phones, further enhancing privacy protection capabilities. We released the AI situational awareness technology, which improves the attack detection and audit capabilities of AI models and protects AI model assets.

- **Ensuring privacy and security of HarmonyOS users**

HarmonyOS is a next-generation operating system that can run on a wide range of smart devices. It enables different smart devices to speak the same language, facilitating better connection and collaboration, and bringing a simple, smooth, continuous, secure, and reliable interaction experience in all scenarios.

At the outset, we emphasized the fundamental importance of consumer privacy and security and implemented a system security architecture and ecosystem management and control framework, in order to explicitly address these issues. With HarmonyOS, we have built a security architecture for the Super Device. It implements hierarchical device security management, trusted device connections, distributed access control, and a security collaboration platform, protecting the security of consumers.

Furthermore, we have built a HarmonyOS application management and control framework to ensure that applications are protected throughout the lifecycle, including the development, commissioning, release, installation, and running phases. In this way, we protect users from malicious applications and effectively ensure their privacy and security.

- **Continuously enhancing secure and trustworthy service operations**

We continue to invest in the development of IT-based capabilities for trustworthy operations and digitally ensure transparent and traceable network operations. We set up an operations trustworthiness lab to strengthen interconnection with global standards organizations and cutting-edge research and we continued to develop capabilities to address emerging cyber security challenges. Our data security management system for carrier service support passed the external System and Organization Controls 2 (SOC 2) audit, demonstrating effective lifecycle management of such data. At the same time, we continued with the Network Safety Day campaign to increase cyber security awareness and risk control, working together with our customers to enhance cyber resilience.

- **Steadily boosting awareness and professional capabilities among all employees**

We encourage employees' continued participation in external professional cyber security and privacy protection certification programs. To date, more than 1,200 employees have obtained industry-recognized certifications, such as Certified Information Systems Security Professional (CISSP), Certified Information Privacy Professional (CIPP) from the International Association of Privacy Professionals (IAPP), and Certificate of Cloud Security Knowledge (CCSK). We have established a Cyber Security & Privacy Protection Knowledge Center and released more than 200 Massive Open

Online Courses (MOOCs), facilitating rapid sharing and transfer of knowledge within the organization.

In order to continuously improve cyber security and privacy protection awareness among all employees, we held the Cyber Security Awareness Month campaign, engaging about 150,000 employees online and offline through different activities. Such activities included messages from top-level management, expert lectures, knowledge quizzes, Capture the Flag competition, a cyber security technology conference, and a verification conference.

- **Continuously strengthening cyber security risk management and capability building of the supply chain**

We have established a comprehensive ISO 28000 compliant supply chain security management system to identify and control security risks in the end-to-end process from incoming materials to manufacturing and delivery to customers. We have developed industry-leading material security and trustworthiness specifications, security sourcing test standards, and supplier security and trustworthiness maturity standards. Suppliers must pass the security system certification and test before they are admitted.

In 2021, we conducted cyber security risk assessments of more than 4,000 suppliers worldwide, and recorded, tracked, and rectified the issues identified. We signed data processing or protection agreements with more than 5,000 suppliers and implemented privacy protection management requirements for suppliers to ensure compliance. We also optimized the security baselines and verification processes for manufacturing and supply availability, and implemented them in the production and delivery processes of new products.

Given the great importance we attach to supply chain security requirements around the world, we have now obtained 35 Authorized Economic Operator (AEO) certificates in 28 countries and regions across five continents. We continue to build a thriving security ecosystem together with our partners, and 25 of our logistics service providers around the world have obtained Transported Asset Protection Association (TAPA) certificates. We continue to optimize our supply chain tracking system, which is capable of tracing software and hardware from incoming materials to customer

delivery within hours, effectively supporting rapid rectification and risk mitigation.

- **Increasing investment in third-party independent verification**

We continue our cooperation with industry-recognized certification bodies to test our cyber security capabilities against international standards and best practices, providing customers with internationally recognized security assurance. In 2021, we obtained more than 70 cyber security certificates. For example, our 5G base station was the first to pass the NESAS/SCAS 2.0 evaluation in the industry; HarmonyOS obtained high-level Common Criteria certification; the Intelligent Automotive Solution Business Unit (IAS BU) was the world's first to obtain ISO/SAE 21434 certification for automotive cyber security; and digital power products obtained the IEC 62443 certificate.

Shared responsibility, joint capability building, and collaboration for shared success

Cyber security and privacy are a common challenge, one that all stakeholders – including governments, industry and standards organizations, enterprises, technology suppliers, and consumers – have a shared responsibility to confront. We reiterate our commitment to communicating and collaborating with all stakeholders in an open, transparent, and responsible manner so that we can jointly improve cyber security and privacy capabilities and address the challenges through technological innovation, knowledge sharing, standards development, verification, and other measures. We strive to continually improve cyber security and personal privacy, enabling everyone to enjoy all of the benefits brought by technological advances. In 2021, we made the following key achievements in external cooperation:

- In the mobile communications field, we submitted more than 400 cyber security proposals to 3GPP and GSMA, maintaining our longstanding industry-leading position. We also submitted proposals on remote attestation security architecture, interaction models, YANG data models, and campus IoT device access security to international standards organizations, such as ETSI, IETF, ITU-T, and CCS. These are just a few examples of our many continuous contributions to the development of industry security standards.

- China Mobile and Huawei set up a joint innovation center on 5G security in Zhejiang Province. To address typical cyber security requirements of industries, such as manufacturing and power grids, this center incubates different security solutions, including network element security risk detection, multi-access control over terminals, slice security isolation, and mobile edge computing security services. In this way, the center aims to continuously enhance the security capabilities of 5G networks, safeguarding digital transformation of industries. One of the center's key innovation achievements – 5G service-based security capability safeguards to support digital transformation in manufacturing – won first prize in the application security final of China's 4th Blossom Cup 5G Application Contest. This center was selected by the Ministry of Industry and Information Technology as the 2021 innovation demonstration center for 5G application security.

- We became a member of the Organisation of the Islamic Cooperation-Computer Emergency Response Team (OIC-CERT), the world's third largest computer emergency response organization, and actively participated in the OIC-CERT 5G Security Working Group to develop a 5G cyber security framework for risk assessment and management, aiming to help member states improve their 5G cyber security management capabilities.

- In Indonesia, we renewed the Memorandum of Understanding (MoU) on cyber security cooperation with the National Cyber and Crypto Agency (BSSN), reaffirming our commitment to the sharing of cyber security knowledge, and supporting Indonesia's plan to develop cyber security and digital transformation professionals.

- In Germany, Huawei supported the Federal Office for Information Security (BSI) in the release of the AI Cloud Service Compliance Criteria Catalogue (AI C4) by providing relevant suggestions based on a use case pilot project. AI C4 is the industry's first security standard for AI cloud services. In December 2021, Huawei Cloud OCR service officially passed the AI C4 attestation conducted by an independent agency.

- In Malaysia, we worked with the national cyber security specialist agency CyberSecurity Malaysia (CSM) and mobile telecommunications provider Celcom to build a Cyber Security Test Lab (My5G), helping Malaysia improve cyber security capabilities and set the stage for 5G deployment. At the Cyber Security Malaysia Awards, Conference & Exhibition (CSM-ACE) in December, the Ministry of Communications and Multimedia Malaysia released

My5G, and Huawei was awarded "Cyber Security Innovation of the Year" by CSM.

- In Thailand, we worked with the National Cyber Security Agency (NCSA) to organize the participation of more than 600 professionals in the Cyber Top Talent competition, helping identify and select local cyber security talent. As part of the partnership with the NCSA, we will assist them in building a dedicated e-lab to provide in-depth training on cyber security technologies and standards for local organizations and talent.

- In Singapore, we joined the SG Cyber Safe Partnership Programme launched by the Cyber Security Agency (CSA) as an "Advocate" partner. We will deepen our cooperation with the CSA in product and service development and community outreach activities to further boost the cyber security awareness of local businesses and the public and promote cyber security best practices and good cyber security hygiene.

- In the UAE, we deepened our cooperation with the Cyber Security Council (CSC), and played an active role in the construction of the local cyber security ecosystem and the improvement of regional cyber security awareness and capabilities. We won the "Cybersecurity Company of the Year" and "Cybersecurity CEO of the Year" awards.

Huawei UAE Chief Security Officer reporting to the chairman of the CSC at the UAE Cyber Security Week

In June 2021, we opened our Global Cyber Security and Privacy Protection Transparency Center in Dongguan, China, providing a communication and collaboration platform. We are committed to strengthening communication and collaboration with stakeholders, promoting common security standards, technological innovation, security governance, testing, and verification, and more. We look forward to collaborating with all stakeholders to build cyber security and privacy protection capabilities, share value, and embrace both challenges and opportunities, to foster a better life for everyone in the future digital world.

Openness. Collaboration. Shared Success.

Over the past year, all countries, businesses, and individuals had to face up to one question: How can we survive and keep growing both steadily and sustainably in an environment full of uncertainty? At the same time, the digital economy is developing rapidly, and industries are going digital and setting green agendas faster than ever before. This will generate new business models, new productive arrangements, and new models for the flow of wealth. All of this means that a more **open, diversified, and inclusive industry ecosystem** will soon be needed.

Huawei remains committed to openness and collaboration for shared success. We work with various industry and ecosystem partners to shape new mindsets, and new models for cooperation and building trust. Together, we will build a harmonious and healthy global industry ecosystem.

■ **New mindsets:** As industries go digital, new business models and new entities, such as industry knowledge platforms, are emerging. Standards will play a different role in the digital economy. To adapt, we need to change our mindsets, and proactively anticipate and analyze future directions and patterns of industry development, as well as the shape of new ecosystem value chains, their key nodes, and the roles of different players.

■ **New cooperation:** As new technologies like AI and 5G develop, we need to collaborate with partners from different industries and domains if we are to adapt to the needs and characteristics of each industry. This is the only way to build stronger industry ecosystems faster and make progress in industry digitalization.

■ **New trust:** Data can create value when it is converted into knowledge assets and services. This will create new systems in which value is created and shared by multiple parties. That means we need to establish principles and frameworks for trustworthy and secure digital governance.

Key Progress and Industry Contributions

As of the end of 2021, Huawei is an active member of approximately 700 standards organizations, industry alliances, open source communities, and academic associations. Within these organizations, we hold more than 400 key positions. We serve as a member of the board or executive committee, or a premium partner in 3GPP, ETSI, IETF, IIC, IEEE SA, the Linux Foundation, CCSA, AII, TM Forum, WFA, WWRF, OpenInfra, IFAA, GP, UWA, VRIF, BBF, OpenAtom Foundation, China's National Technical Committee of Auto Standardization (NTCAS), and AUTOSAR.

Huawei plays an active role in many industry organizations. With our innovative technologies, we help the industry grow, and promote international collaboration. We also focus on customers' specific business needs. We create resources to help implement industry projects including 5G, AI, industrial Internet, video, broad Internet of Vehicles (IoV), and intelligent computing. To ensure the success of these projects, we provide architectures, pathways, and best practices for digital transformation; as well as testbeds, new business models, case studies, open source code, and developers. We also encourage industry organizations to work together and innovate with partners so that our customers can build an edge for success in their own business.

We help create mechanisms for dialogue and exchange at the senior level, including with industry organizations, think tanks, academic researchers, and corporate representatives. This gives industry leaders opportunities to explore topics that are

The GIO White Paper on Industry-Specific Ecosystems was released at the 9th GIO Roundtable. In partnership with leading industry organizations, we continue to organize Global Industry Organizations (GIO) roundtables, which focus on four areas: smart manufacturing, digital health, autonomous digital infrastructure, and industry-specific ecosystems. Within a shared framework of key topics on industry digitalization, we promote sharing, exchange, and collaboration between industry organizations from different regions, industries, and domains. This has allowed GIO participants to develop a more complete and unified understanding of the framework and pace of industry digitalization. GIO participants are working to address industry discontents, and discuss and make recommendations on industrial policies. All these efforts will help advance digital transformation for every industry.

poised to have a major impact on everyday life, such as AI and advanced autonomous driving. We analyze digital transformation trends, key topics, and crucial areas of collaboration, and help build industry consensus. Working with our industry partners worldwide, we have offered national governments advice and recommendations on industrial policies for ICT adoption and digital transformation. We help governments introduce reasonable industrial policies that are necessary to support inclusive economic growth for their countries.

Standards Organizations	**We continue to contribute to standards organizations, work with industry partners to grow the industry, and help create an environment where standards are set in a fair, just, and open manner.**

To date, we have submitted over 65,000 standards contributions in more than 200 standards organizations. Together with industry partners worldwide, we are helping to drive technological progress and push the global industry forward.

In standards organizations for the communications industry, we are working to help promote unified global standards.

- Within 3GPP, we are working with industry partners to create an industry consensus around 5.5G. This has opened a new chapter in 3GPP's development of 5G-Advanced standards.

- Through ETSI, we are supporting efforts to create industry-wide consensus on optical networks, and working to bring Fiber to Everywhere.

- Within the IETF, we are working to improve IP network technologies and formulate standards so that they can meet the requirements for the Internet of Things.

- Through the Internet Society (ISOC), we are working with Internet ecosystem partners to improve the security systems for global Internet routing.

- Within the IEEE, we are helping drive the upgrade of Wi-Fi, Ethernet, and other technologies, so as to support the evolution of carrier, enterprise, and industrial networks.

- Within the Broadband Forum (BBF), we are actively contributing to standards on network architecture, network cloudification, and other related technologies, as part of our efforts to promote unified global standards for broadband networks.

Through the three major international standards organizations, we are helping drive technology upgrade and industry development.

- Within the ITU, we are exploring how to improve spectrum utilization, so as to pave the way for the development of the 5G industry. We are contributing to security standards for financial blockchains and to optical communications standards, which will provide a foundation for ultra-broadband connectivity technology.

- Within ISO/IEC JTC 1, we are working to optimize standards for AI-based audio and video coding and decoding to create a more user-friendly experience.

- Within the IEC, we are working with vertical industry partners to set the vision and lay a foundation of standards for digital transformation, as part of the greater efforts to enable the intelligent transformation of industries.

We actively engage in standards organizations in China and help create a favorable environment for Chinese standards.

- We are exploring the application of 5G in verticals and working with industry experts to develop standards for the use of 5G in different industries, to further advance digital transformation in all industries.

- In cooperation with industry partners, we are building China's systems for market access and standards ecosystems for intelligent vehicles, and promoting the development of connected vehicles with a higher level of intelligence.

- We are contributing to standards for accessibility (including accessibility for older users) and child protection, supporting the healthy development of China's ICT industry.

Industry Alliances	Huawei is a committed partner in major industry alliances. We are working to ensure sustainable industry development, drive green, low-carbon, and healthy industry development, and promote mutual trust and shared success.

- **Developing foundational technologies to ensure sustainable industry development:** We have worked closely with industry organizations such as the GCC, CSIA, AITISA, IPv6 Enhanced, ONA, GIIC, ITMA, SparkLink Alliance, ICCE, and UWA to develop industry-wide consensus. Our work includes incubation of innovative foundational technologies, standards development, and talent cultivation. These efforts will increase the competitiveness of domains like green computing, basic software, AI computing centers, IPv6 Enhanced, optical networks, smart devices, intelligent vehicles, and video, and ensure sustainable industry development.

- **Deepening industry digitalization for green, low-carbon, and healthy industry development:** Huawei is an active partner in industry organizations such as the ITU, GSMA, GSA, AII, 5GAIA, 5GDNA, IMT-2020, and ECC. We actively contribute industry white papers, testbeds, and standards to support the development and application of new digital technologies in sectors like communications, manufacturing, electric power, steel production, coal mining, oil & gas, and ports. We are helping to provide a path to green, low-carbon, and healthy development of traditional industries.

- **Enhancing international collaboration for mutual trust and shared success:** We are an active member of European industry organizations like 5G-ACIA and 5GAA, and have contributed to multiple white papers, testbeds, and other industry projects. We promote ongoing collaboration on digital transformation between the Japan Deep Learning Association, Japan's Industrial Value Chain Initiative, GIO, and other industry organizations.

Open Source Communities	Huawei is a trusted member of open source communities, and we support inclusion, fairness, openness, and solidarity. We contribute to open source communities, and work with partners to build world-class open source communities for basic software, to accelerate industry digitalization.

- **Huawei is an active member and supporter of major open source organizations.** Huawei recognizes the huge advantages that open source software can deliver, and works with ecosystem partners and developers to build up the basic software ecosystem. Huawei actively contributes to global open source communities, and is a premium or founding member of dozens of international open source foundations, including the Apache Software Foundation, Eclipse Foundation, Linux Foundation, OpenAtom Foundation, and Open Infrastructure Foundation. Currently, we serve on dozens of different boards of open source communities and hundreds of Technical Steering Committees and Project Management Committees, and hold hundreds of Project Team Lead, Maintainer, and Core Committer roles.

- **Huawei open sources its own basic software at scale to build a stronger foundation for digital infrastructure ecosystems.** In recent years, Huawei has launched multiple platform-level open source projects, such as EdgeGallery, MindSpore, openEuler, openGauss, and OpenHarmony, to support new trends like cloud native, automation, and intelligence. These basic software projects have attracted many vendors, developers, research institutes, and universities all over the world. Now, hundreds of companies have joined the communities of these open source projects. We have donated openEuler and OpenHarmony to the OpenAtom Foundation, which has quickly gathered more talent to support their ongoing innovation. These projects have combined contributions from global participants through a more open approach, and are promoting the digital transformation of industries. These types of open source software have been downloaded and used in more than 1,000 cities around the world.

- **We are building a basic software ecosystem with partners and developers.**

  - OpenHarmony is a lightweight, compact, and distributed operating system that meets user needs for low latency and multiple functions across different devices. Huawei has contributed more than 30 core subsystems and more than 6 million lines of core code, and the operating system can now support the development of smart devices from as little as 128 KB of memory to GB levels. The OpenHarmony community has more than 30,000 developers and over 40 companies. OpenHarmony applications are being explored in 12 industries, and its code has seen over 20 million downloads.

  - openEuler aims to provide a secure, stable, and easy-to-use operating system for servers, cloud computing, edge computing, embedded applications, and diversified computing. The openEuler community has attracted nearly 10,000 developers and over 300 enterprise members. Using openEuler community releases, our partners have launched more than 10 commercial distributions, with over one million instances currently in commercial use in a range of critical domains.

  - EdgeGallery, MindSpore, openGauss, and other communities have developed into dynamic open source communities for foundational technologies, and are popular with developers.

- **We build sustainable, thriving, and trustworthy open source communities.** Huawei is committed to improving the governance of open source communities to ensure smooth software evolution. Through measurement and feedback mechanisms, we can quickly understand what developers think about the communities and continuously optimize community governance mechanisms. With AI-assisted operations, we are constantly working to make community infrastructure better and smarter, so as to give a better experience to community partners. We are also introducing rules, processes, and toolchains for high-quality code, to inject vitality into our open source communities. We are working to build a diverse, inclusive, and trustworthy industry ecosystem through open source collaboration.

Academic Associations

Huawei actively embraces an open and diverse academic culture. We have strengthened our collaborations with academic associations as part of our diversified, multi-path exploration of the uncertainties that industries face. Advances in basic research and applied technologies foster economic and social prosperity.

- **We promote multilateral exchanges and cooperation between universities, academic associations, and industry players through academic conferences and funds for scientific research. At these exchanges, we share challenges that different industries face and help explore frontiers in academic research.**

  - In 2021, we provided increased funding for scientific research at the China Computer Federation and Chinese Association for Artificial Intelligence.

  - We actively share the industry trends with others. For example, we have identified the challenges for optical communications and display, and suggested future research areas at academic conferences on optics.

  - By discussing the challenges that industries face at flagship conferences such as IEEE/CIC International Conference on Communications in China (ICCC), we engage academic partners to help drive innovation and progress.

- **We are active contributors to academic research activities.** We have published 867 journal and conference papers in high-impact channels like the ACM and IEEE. More than 100 of Huawei's technical experts have served as peer reviewers for scientific journals and conferences.

- **We work with academic associations to cultivate new talent and organize academic competitions.** We have hosted challenge competitions together with the International Collegiate Programming Contest (ICPC). These competitions have allowed outstanding programmers and algorithm designers to engage directly with real industry problems, and encouraged young people to pursue excellence.

Nearly 8,000 competitors from all over the world took part in the Communication Routing Challenge hosted by Huawei and ICPC, and the top 30 contestants and nine coaches received prizes. The picture shows winners receiving gifts from members of the organizing committee.

| Business Alliances | Huawei works and innovates with global partners to advance the digital agenda for industries. |

- **We continue to work openly and grow together with our partners to expand ecosystems.** By the end of 2021, we have developed more than 38,000 partners through business alliances, including over 25,000 sales partners, over 5,000 solution partners, over 6,400 service partners, over 2,000 talent alliances, and over 100 investment and financing partners.

- **We are helping build inclusive and diversified ecosystems for different industries.** By integrating Huawei's capabilities with partner resources and industry know-how, we work with partners to accelerate digital transformation and decarbonization in industries. In 2021, we added more than 500 industry solution partners, and launched more than 700 joint solutions, including over 100 5GtoB scenario-based solutions. These solutions have been adopted in over 10,000 5GtoB projects in the enterprise market, enabling industry applications like smart steel production, smart mining, smart ports, smart cement, smart manufacturing, smart chemicals, and smart oil & gas. These solutions have boosted productivity for enterprises, and improved the working environments and workplace safety for their employees.

- **We enable software and hardware technology partners to innovate using ICT infrastructure, and we work together to build the foundation for the digital economy ecosystem.** Through the Kunpeng and Ascend technology platforms, we continue to open up our hardware, open source our software, and launch development and application enablement kits so that partners can develop innovative application software faster. By the end of 2021, more than 3,600 solutions from over 1,600 partners had been granted Huawei's ICT technical certifications.

| Ecosystems | Huawei brings together developers from around the world to build four unique ecosystems and explore new business scenarios and business models. |

- **Huawei Cloud ecosystem: Huawei aims to create and share value for greater success. We bring together developers worldwide and empower our partners to address the pain points that customers face during digital transformation.**

  - We continue to open up our capabilities. The Huawei Cloud Developer Program has attracted more than 2.6 million developers, and 70,000 of them have obtained Huawei Cloud Career Certifications.

  - We step up efforts to help cultivate more talent. We have developed more than 200 Huawei Cloud courses through partnerships with over 70 leading Chinese universities.

  - We remain committed to our ecosystem strategy for Huawei Cloud, which is to create and share value for greater success. More than 30,000 partners worldwide have joined hands with Huawei Cloud, and together with these partners, we have already developed over 8,000 solutions.

  - In 2021, Huawei Cloud released MacroVerse aPaaS, which has aggregated more than 10,000 APIs across 11 categories, including databases, AI, big data, video, enterprise applications, and mobile applications.

  - Huawei Cloud Marketplace has seen its transactions more than triple. We now provide transaction services to more than 6,000 partners.

- **Kunpeng/Ascend ecosystem: Huawei's strategy is "open hardware, open source software, partner enablement, and talent cultivation". We are working to build a diversified computing ecosystem.**

  - **Open hardware:** We provide comprehensive, full-stack support to enable our partners throughout their innovation efforts. We also maintain a partner-first strategy, and over 80% of Kunpeng- and Ascend-based products shipped in 2021 came from our partners.

  - **Open source software:**

    - Huawei has officially donated openEuler to China's OpenAtom Foundation, and the openEuler community has attracted 304 members. Huawei unveiled openEuler 21.09, the industry's first open source OS that supports digital infrastructure across all scenarios.

    - The openGauss community has attracted over 100 members and seen over 500,000 downloads.

    - The MindSpore community has recorded 163 members and over one million downloads. It supports more than 300 models, and has been recognized as the industry's first trustworthy community for open source AI.

  - **Partner enablement:**

    - The Kunpeng application software ecosystem has developed faster than expected, and Kunpeng applications have been deployed at scale in critical industries, such as government, finance, telecommunications, electric power, and transportation. More than 10,000 solutions, developed by over 3,500 partners, have been certified as Kunpeng-compatible.

    - The Ascend application software ecosystem has also entered the fast lane. We have established 16 Ascend Ecosystem Innovation Centers in China. More than 700 solutions from over 500 partners have been certified. In cooperation with our partners, we have already launched four smart solutions: Ascend Smart City Solution, Ascend Smart Inspection Solution, Ascend Smart Manufacturing Solution, and Ascend Smart Transportation Solution.

  - **Talent cultivation:**

    - Huawei continued with the Intelligent Center model, which is a joint initiative with China's Ministry of Education, to foster industry-academia cooperation on talent cultivation. As part of the initiative, the 72 partner universities have delivered courses to more than 1,300 classes, and over 2,500 instructors have completed the training.

    - We have launched the Kunpeng and Ascend Talent Intern Program, which provides more than 600 internship opportunities, and the Kunpeng and Ascend OpenMind Program, which provides a CNY100 million reward fund and has released more than 2,000 tasks. These two programs have benefited over one million of developers.

- **HMS/HarmonyOS ecosystem: HarmonyOS has become the world's fastest-growing operating system, and HMS has become the world's third largest mobile app ecosystem.**

  - **Devices:** Products that are part of the HarmonyOS Connect ecosystem – Huawei's device hardware ecosystem – can all be connected to Super Device. This will provide seamless connections, service widgets, simplified interaction, and hardware collaboration, and ultimately deliver a Seamless AI Life experience to consumers. In 2021, over 100 million third-party HarmonyOS Connect devices were shipped, and over 1,900 partners joined the HarmonyOS Connect ecosystem.

  - **Applications and services:** HarmonyOS enables one-time development for multi-device deployment, allowing developers to move from a single-device ecosystem to a multi-device ecosystem. Currently, more than 33,000 atomic services are running on HarmonyOS devices. We have launched HMS Core 6, which provides services across different devices, operating systems, and scenarios. This release includes 69 kits and 21,738 APIs in seven domains. These services are secure, reliable, distributed globally, and can be delivered to users worldwide with one-step access. We have more than 5.4 million registered developers worldwide, and over 187,000 apps have been integrated with HMS Core.

- **Intelligent automotive solution ecosystem: As part of our "Platform + Ecosystem" strategy, we have worked with more than 300 upstream and downstream partners from across the automotive industry to build an intelligent automotive ecosystem.**

Car manufacturing has shifted to an ecosystem model that involves many different domains. Huawei has opened up three platforms – the intelligent digital vehicle platform iDVP, intelligent driving computing platform MDC, and HarmonyOS Intelligent Cockpit platform – to provide a digital foundation and development tools for creating intelligent vehicles. More than 300 partners have joined us on these three platforms, accelerating the transition to intelligent vehicles.

- Through iDVP, Huawei helped set up the Software-Defined Vehicle Working Group at the China Association of Automobile Manufacturers. This group has attracted more than 70 component partners, marking an important step towards software-defined vehicles.

- The MDC ecosystem has attracted more than 70 partners for intelligent driving.

- Through the HarmonyOS Intelligent Cockpit platform, we have established partnerships with over 150 hardware and software providers to rapidly develop intelligent cockpit solutions that support multi-device collaboration in all scenarios.

- Huawei has been deeply involved in the SparkLink Alliance, which is committed to driving innovation and building an ecosystem for next-generation short-distance wireless communications technology in the intelligent automotive sector.

Industrial Policies	**We promote inclusive and sustainable digital transformation to bring the benefits of digital technologies to SMEs and the general public.**

In 2021, many countries turned to digital transformation and the digital economy to more effectively fight the pandemic, increase social resilience, and promote economic recovery. Different countries are at different stages of digital infrastructure development, with varying levels of digital skills and digital ecosystems. Accelerating digital transformation is never an easy task. This is especially true for SMEs and remote, often rural areas with weak digital infrastructure. These groups need better representation in national industrial policies, so it is vital that we encourage a more favorable policy environment for that.

Huawei is doing its part to help. We have proactively opened up discussions and dialogue with many international organizations. At the G20 Business 20 Summit, we encouraged strong support for the digital transformation of SMEs. At the World Economic Forum, APEC Business Advisory Council, and the International Chamber of Commerce, we shared Huawei's experience and best practices in digital transformation, such as enabling industry transformation with 5G, cloud first, and inclusive AI. We have also called for efforts to ensure that no one is left behind in the digital world.

We actively participate in public consultations on industrial policies, standards, and specifications in every country in which we operate. We actively share with national governments our recommendations on making digital infrastructure cloud-based and intelligent, implementing programs to help develop digital skills, and incubating new business models. In every country, our goal is to promote inclusive and sustainable digital transformation.

Results of Operations

Financial Performance

(CNY Million)	2021	2020	YoY
Revenue	636,807	891,368	(28.6)%
Gross profit	307,442	327,132	(6.0)%
– Gross profit margin	48.3%	36.7%	11.6%
Total operating expenses	(246,827)	(255,323)	(3.3)%
– as % of revenue	38.8%	28.6%	10.2%
Other income, net	60,797	692	8,685.7%
Operating profit	121,412	72,501	67.5%
– as % of revenue	19.1%	8.1%	11.0%
Net finance income	493	(367)	(234.3)%
Income tax	(8,227)	(7,655)	7.5%
Net profit	113,718	64,649	75.9%

Huawei's total revenue in 2021 reached CNY636,807 million, representing a 28.6% YoY decrease. Net profits grew by 75.9% YoY to CNY113,718 million.

■ The decline in the Group's revenue was primarily due to the decrease in revenue of our consumer business.

■ Net profits grew mainly due to the sale of parts of our business, improvements in operational quality, and the optimization of our product mix.

■ As we continued to invest in future-oriented research and innovation, ecosystem building, and branding, our total operating expenses as a percentage of revenue increased YoY.

Total operating expenses

(CNY Million)	2021	2020	YoY
Research and development expenses	142,666	141,893	0.5%
– as % of revenue	22.4%	15.9%	6.5%
Selling and administrative expenses	104,161	113,430	(8.2)%
– as % of revenue	16.4%	12.7%	3.7%
Total operating expenses	246,827	255,323	(3.3)%
– as % of revenue	38.8%	28.6%	10.2%

In 2021, Huawei's total operating expenses were 38.8% of revenue, representing a YoY increase of 10.2 percentage points. This was attributable to the following two factors:

■ We continued to invest in business continuity as well as future-oriented research and innovation in technologies such as cloud, artificial intelligence, intelligent automotive components, and foundational software technologies. As a result, the company's R&D expenses as a percentage of revenue increased by 6.5 percentage points YoY.

■ We also continued to invest in building our brand and ecosystem. As a result, our selling and administrative expenses as a percentage of revenue increased by 3.7 percentage points YoY.

Net finance income

(CNY Million)	2021	2020	YoY
Net foreign exchange loss	(358)	(1,638)	(78.1)%
Other net finance gains	851	1,271	(33.0)%
Total net finance income	493	(367)	(234.3)%

Huawei's net finance income in 2021 amounted to CNY493 million, an increase of CNY860 million YoY. This increase was primarily attributable to a YoY decrease in net foreign exchange losses due to the easing of currency fluctuations in emerging markets and our intensified efforts in proactive foreign exchange risk management.

Financial Position

(CNY Million)	December 31, 2021	December 31, 2020	YoY
Non-current assets	213,593	185,460	15.2%
Current assets	769,378	691,394	11.3%
Total assets	982,971	876,854	12.1%
Among which: Cash and short-term investments	416,334	357,366	16.5%
Trade receivables	72,242	75,026	(3.7)%
Contract assets	52,544	53,602	(2.0)%
Inventories and other contract costs	161,306	167,667	(3.8)%
Non-current liabilities	175,864	154,114	14.1%
Among which: Long-term borrowings	162,276	141,270	14.9%
Current liabilities	392,455	392,332	0.0%
Among which: Short-term borrowings	12,824	541	2,270.4%
Trade payables	81,694	74,865	9.1%
Contract liabilities	78,149	71,948	8.6%
Equity	414,652	330,408	25.5%
Total liabilities and equity	982,971	876,854	12.1%

As of December 31, 2021, Huawei's balance of cash and short-term investments reached CNY416,334 million, up 16.5% YoY.

As of December 31, 2021, our total short-term and long-term borrowings increased by CNY33,289 million YoY. The primary purpose of these borrowings was to continue with our heavy investment in future-oriented research and innovation as well as investment in business continuity.

Cash Flow from Operating Activities

(CNY Million)	2021	2020	YoY
Net profit	113,718	64,649	75.9%
Adjustment for depreciation, amortization, impairment, net foreign exchange losses and non-operating income and expenses	(22,252)	33,116	(167.2)%
Cash flow before change in operating assets and liabilities	91,466	97,765	(6.4)%
Change in operating assets and liabilities	(31,796)	(62,547)	(49.2)%
Cash flow from operating activities	59,670	35,218	69.4%

In 2021, Huawei effectively made purchases and utilized its funds based on business needs, increasing its cash flow from operating activities to CNY59,670 million, a YoY increase of 69.4%.

Financial Risk Management

In 2021, we closely monitored the changes in our external environment and proactively assessed their impact on Huawei using the financial risk management system we have built over the past years. In addition, we continued to amend and improve our financial risk management policies and processes to further enhance our ability to withstand financial risks and better support our business development.

Liquidity Risk

We have continuously worked to improve our capital structure and short-term liquidity planning, budgeting, and forecasting systems to better assess mid-to long-term liquidity needs and short-term funding shortfalls. We have implemented prudent financial measures to meet our liquidity needs and guarantee our company's business development, including maintaining a robust capital structure and financial flexibility, keeping a proper level of funds, gaining access to adequate and committed credit facilities, creating effective cash plans, and centralizing cash management. As of December 31, 2021, our cash and short-term investments amounted to CNY416,334 million, which shows that we properly managed our liquidity risks.

(CNY Million)	2021	2020	YoY
Cash flow from operating activities	59,670	35,218	69.4%
Cash and short-term investments	416,334	357,366	16.5%
Short-term and long-term borrowings	175,100	141,811	23.5%

Foreign Exchange Risk

Our presentation currency is CNY, but we have foreign currency exposure related to buying, selling, and financing in currencies other than CNY. According to our established foreign exchange risk management policy, material foreign exchange exposures are hedged based on a comprehensive analysis of market liquidity and hedging costs. We have developed a complete set of foreign exchange management policies, processes, and instructions. These include:

■ Natural hedging: We structure our operations to match currencies between procurement and sales transactions, to the greatest extent possible.

■ Financial hedging: For certain currencies where natural hedging does not fully offset the foreign currency position, we hedge through forward foreign exchange transactions.

In countries where local currencies depreciate sharply or that have strict foreign exchange controls, we manage foreign exchange exposure using different measures, including exchange rate protection and financial hedging. We have also adopted solutions like accelerating customer payment and promptly transferring cash out of these countries to minimize risks.

With other conditions remaining unchanged, exchange rate fluctuations will impact our net profit as follows:

(CNY Million)	2021	2020
USD depreciates by 5%	899	1,350
EUR depreciates by 5%	159	270

Interest Rate Risk

Interest rate risks mainly arise from Huawei's long-term borrowings. By analyzing interest rate exposure, the company uses a combination of fixed-rate and floating-rate financing tools to mitigate these interest rate risks.

1. Major interest-bearing long-term financial instruments held by the company as at December 31, 2021

	2021		2020	
	Effective Interest Rate (%)	(CNY million)	Effective Interest Rate (%)	(CNY million)
Fixed-rate long-term financial instruments: Long-term borrowings	3.94	39,250	3.85	44,261
Floating-rate long-term financial instruments: Long-term borrowings	3.27	123,026	3.01	97,009
Total		162,276		141,270

2. Sensitivity analysis

Assuming that the interest rate increased by 50 basis points on December 31, 2021 and other variables remained unchanged, the company's net profit and equity would decrease by CNY503 million (in 2020, the amount decreased by CNY388 million).

Independent Auditors' Report

KPMG

Independent auditors' report on the consolidated financial statements summary to the Board of Directors of Huawei Investment & Holding Co., Ltd.

Opinion

The consolidated financial statements summary of Huawei Investment & Holding Co., Ltd. and its subsidiaries (the Group) set out on pages 98 to 148, which comprises the summary consolidated statement of financial position as at December 31, 2021, the summary consolidated statement of profit or loss and other comprehensive income and the summary consolidated statement of cash flows for the year then ended, and a summary of significant accounting policies and other explanatory information, is derived from the audited consolidated financial statements of the Group for the year ended December 31, 2021.

In our opinion, the accompanying consolidated financial statements summary is consistent, in all material respects, with the audited consolidated financial statements, on the basis described in note 2 to the consolidated financial statements summary.

Consolidated financial statements summary

The consolidated financial statements summary does not contain all the disclosures required by International Financial Reporting Standards. Reading the consolidated financial statements summary and the auditors' report thereon, therefore, is not a substitute for reading the audited consolidated financial statements of the Group and the auditors' report thereon.

The audited consolidated financial statements and our report thereon

We expressed an unmodified audit opinion on the audited consolidated financial statements for the year ended December 31, 2021 in our report dated March 23, 2022.

Management's responsibilities for the consolidated financial statements summary

Management is responsible for the preparation of the consolidated financial statements summary on the basis described in note 2 to the consolidated financial statements summary.

Auditors' responsibilities

Our responsibility is to express an opinion on whether the consolidated financial statements summary is consistent, in all material respects, with the audited consolidated financial statements based on our procedures, which were conducted in accordance with International Standard on Auditing 810 (Revised), *Engagements to Report on Summary Financial Statements*.

KPMG Huazhen LLP
Certified Public Accountants
15th Floor, China Resources Tower
2666 Keyuan South Road
Shenzhen 518052, China

March 23, 2022

Consolidated Financial Statements Summary

Summary Consolidated Statement of Profit or Loss and Other Comprehensive Income

(CNY million)	Note	2021	2020
Revenue	8	636,807	891,368
Cost of sales		(329,365)	(564,236)
Gross profit		307,442	327,132
Research and development expenses		(142,666)	(141,893)
Selling and administrative expenses		(104,161)	(113,430)
Other income, net	9	60,797	692
Operating profit		121,412	72,501
Finance income and expenses	11	493	(367)
Share of associates' and joint ventures' results (post tax)		40	170
Profit before tax		121,945	72,304
Income tax	12	(8,227)	(7,655)
Profit for the year		113,718	64,649
Other comprehensive income (after tax and reclassification adjustments)	13		
Items that will not be reclassified to profit or loss:			
Re-measurement of defined benefit obligations		(341)	3
Equity investments at fair value through other comprehensive income (FVOCI) - net change in fair value		2,530	2,344
		2,189	2,347
Items that are or may be reclassified subsequently to profit or loss:			
Non-equity financial assets at FVOCI – net change in fair value and impairment loss		17	(11)
Translation differences on foreign operations		(6,183)	(3,987)
		(6,166)	(3,998)
Other comprehensive income		(3,977)	(1,651)
Total comprehensive income		109,741	62,998
Profit for the year attributable to:			
Equity holders of the Company		113,672	64,595
Non-controlling interests		46	54
Total comprehensive income attributable to:			
Equity holders of the Company		109,715	62,936
Non-controlling interests		26	62

The notes on pages 102 to 148 form part of this consolidated financial statements summary.

Summary Consolidated Statement of Financial Position

(CNY million)	Note	December 31, 2021	December 31, 2020
Assets			
Goodwill and intangible assets	14	8,104	9,169
Property, plant and equipment	15	124,134	118,378
Right-of-use assets	29	21,666	18,423
Interests in associates and joint ventures	16	4,342	1,839
Other investments and derivatives	17	30,194	10,244
Deferred tax assets	18	10,340	10,748
Contract assets	20	1,207	1,648
Trade and bills receivable	21	3,113	3,963
Other assets	22	10,493	11,048
Non-current assets		**213,593**	185,460
Inventories and other contract costs	19	161,306	167,667
Contract assets	20	51,337	51,954
Trade and bills receivable	21	76,234	74,741
Other assets	22	63,923	39,442
Other investments and derivatives	17	288,183	184,692
Cash and cash equivalents	23	128,395	172,898
Current assets		**769,378**	691,394
Total assets		**982,971**	876,854
Equity			
Equity attributable to equity holders of the Company		414,557	330,325
Non-controlling interests		95	83
Total equity		**414,652**	330,408
Liabilities			
Loans and borrowings	24	162,276	141,270
Deferred tax liabilities	18	4,282	1,921
Lease liabilities		6,552	6,608
Other liabilities	27	2,754	4,315
Non-current liabilities		**175,864**	154,114
Loans and borrowings	24	12,824	541
Employee benefits		99,927	105,245
Income tax payable		2,755	3,979
Trade and bills payable	25	81,694	78,977
Contract liabilities	26	78,149	71,948
Lease liabilities		2,952	3,042
Other liabilities	27	96,711	104,308
Provisions	28	17,443	24,292
Current liabilities		**392,455**	392,332
Total liabilities		**568,319**	546,446
Total equity and liabilities		**982,971**	876,854

The notes on pages 102 to 148 form part of this consolidated financial statements summary.

Summary Consolidated Statement of Cash Flows

(CNY million)	Note	2021	2020
Cash flows from operating activities			
Cash receipts from goods and services		**708,883**	989,447
Cash paid to suppliers and employees		**(701,351)**	(1,010,231)
Other operating cash flows		**52,138**	56,002
Net cash generated from operating activities		**59,670**	35,218
Net cash used in investing activities		**(100,575)**	(30,793)
Net cash generated from financing activities		**871**	1,653
Cash and cash equivalents			
Net (decrease)/increase		**(40,034)**	6,078
At January 1	23	**173,050**	171,070
Effect of foreign exchange rate changes		**(4,621)**	(4,098)
At December 31	23	**128,395**	173,050

The notes on pages 102 to 148 form part of this consolidated financial statements summary.

Notes to the Consolidated Financial Statements Summary

1 Reporting entity

Huawei Investment & Holding Co., Ltd. (the Company) is a limited liability company established in Shenzhen in the People's Republic of China (PRC). The Company's registered office is at Building 1, Zone B, Huawei Base, Bantian, Longgang District, Shenzhen City, PRC.

The Company and its subsidiaries (the Group) principally provide end to end Information and Communications Technology solutions. This includes the research, design, manufacture and marketing of telecom network equipment, IT products and solutions, cloud technology and services, digital power products and solutions and smart devices for telecom carriers, enterprises and consumers. The principal activities and other particulars of the Company's major subsidiaries are set out in note 32(b) to the consolidated financial statements summary.

2 Preparation basis of the consolidated financial statements summary

The Group has prepared a full set of consolidated financial statements (consolidated financial statements) for the year ended December 31, 2021 in accordance with International Financial Reporting Standards (IFRSs).

The consolidated financial statements summary has been prepared and presented based on the audited consolidated financial statements for the year ended December 31, 2021 in order to disclose material financial and operational information.

3 Significant accounting policies

(a) Basis of preparation of the consolidated financial statements

The consolidated financial statements have been prepared under the historical cost basis modified for the fair valuation of certain financial instrument classifications (see note 3(e)).

The preparation of consolidated financial statements in accordance with IFRSs requires management to make judgements, estimates and assumptions that affect the application of policies and reported amounts of assets, liabilities, income and expenses. Estimates and associated assumptions are based on historical experience and various other factors that are believed to be reasonable under the circumstances. Actual results may differ from these estimates.

Estimates and underlying assumptions are reviewed regularly and revised when required. Revisions to accounting estimates are recognised in the period in which the estimate is revised if the revision affects only that period, or in the period of the revision and future periods if the revision affects both current and future periods.

Judgements made by management in the application of IFRSs that have significant effect on the consolidated financial statements and major sources of estimation uncertainty are discussed in note 5.

(b) Functional and presentation currency

All financial information in the consolidated financial statements summary is presented in millions of Chinese Yuan (CNY), which is the Company's functional currency.

(c) Consolidation

(i) Business combinations

The Group accounts for business combinations using the acquisition method when the acquired set of activities and assets meets the definition of a business and control is transferred to the Group. To be considered a business, an acquisition would have to include an input and a substantive process that together significantly contribute to the ability to create outputs.

The Group may determine that an acquired set of activities and assets is not a business if substantially all of the fair value of the gross assets acquired is concentrated in a single identifiable asset or group of similar identifiable assets.

The difference between the fair value of the consideration paid and the fair value of net identifiable assets is recorded as goodwill. Transaction costs incurred in an acquisition are recognised in profit or loss. Where the fair value of the assets acquired less liabilities assumed exceeds the consideration paid, the excess is recognised immediately in profit or loss as a gain.

(ii) Subsidiaries

The financial statements consolidate the results, assets, liabilities and cash flows of all subsidiaries which the Group controls.

Subsidiaries are consolidated from the date that control commences until the date that control ceases. Intra-group balances, transactions, cash flows and any unrealised gains arising from intra-group transactions are eliminated in preparing the consolidated financial statements. Unrealised losses resulting from intra-group transactions are eliminated in the same way as unrealised gains but only to the extent that there is no evidence of impairment.

The Group controls an entity when it is exposed, or has rights, to variable returns from its involvement with the entity and has the ability to affect those returns through its power over the entity. When assessing whether the Group has power, only substantive rights are considered.

(iii) Non-controlling interests

Non-controlling interests represent the carrying value of the net assets of subsidiaries attributable to non-controlling equity holders. The Group measures non-controlling interests at the non-controlling interests' proportionate share of the subsidiary's net identifiable assets. Changes in the Group's interests in a subsidiary that do not result in a loss of control are accounted for as equity transactions, whereby adjustments are made to the amounts of controlling and non-controlling interests within consolidated equity to reflect the change in relative interests, but no adjustments are made to goodwill and no gain or loss is recognised.

(iv) Loss of control

When the Group loses control of a subsidiary, it is accounted for as a disposal of the entire interest in that subsidiary, with a resulting gain or loss being recognised in profit or loss. Any interest retained in that former subsidiary at the date when control is lost is recognised at fair value or, when appropriate, the cost on initial recognition of an investment in an associate or a joint venture (see note 3(d)).

(d) Associates and joint ventures

An associate is an entity in which the Group has significant influence, but not control or joint control, over its management, including participation in the financial and operating policy decisions.

A joint venture is an arrangement whereby the Group and other parties contractually agree to share control of the arrangement, and have rights to the net assets of the arrangement.

An investment in an associate or a joint venture is accounted for in the consolidated financial statements using the equity method until the date on which significant influence or joint control ceases. It is initially recognised at cost and subsequently adjusted to include the Group's share of the profit or loss and other comprehensive income (OCI).

Unrealised profits and losses resulting from transactions between the Group and its associates and joint ventures are eliminated to the extent of the Group's interest in the investee, except where unrealised losses provide evidence of an impairment of the asset transferred, in which case they are recognised immediately in profit or loss.

(e) Financial instruments

(i) Recognition and derecognition

Financial instruments, comprising financial assets and financial liabilities, are recognised in the consolidated statement of financial position when the Group becomes a party to the contractual provisions of the instrument.

The Group derecognises a financial asset when the contractual rights to the cash flows from the asset expire, or it transfers the rights to receive the contractual cash flows in a transaction in which substantially all of the risks and rewards of ownership of the financial asset are transferred or where it neither transfers nor retains substantially all of the risks and rewards of ownership and loses control. When control is retained, the Group continues to recognise the financial asset to the extent of its continuing involvement. Financial assets are also de-recognised when they are written off. Financial assets are written off when there is no reasonable expectation of further recoveries even though there may be enforcement actions ongoing.

The Group derecognises a financial liability when its contractual obligations are discharged, cancelled, or expire.

Financial assets and financial liabilities are offset and the net amount presented in the consolidated statement of financial position when, and only when, the Group currently has a legally enforceable right to set off the recognised amounts and intends either to settle them on a net basis or to realise the asset and settle the liability simultaneously.

(ii) Classification and measurement

All financial assets and liabilities are initially recognised at fair value, with the exception of trade receivables without a significant financing component, which are measured at their transaction price, determined in accordance with the Group's accounting policies for revenue. Subsequently, measurement depends on the financial assets/ liabilities classification as follows:

- Financial assets measured at fair value through profit or loss (FVPL)

  Non-equity financial assets are classified as FVPL if they arise from contracts which do not give rise to cash flows which are solely principal and interest, or otherwise where they are held in a business model which mainly realises them through sale. Such assets are re-measured to fair value

at the end of each reporting period. Gains and losses arising from re-measurement are taken to profit or loss, as are transaction costs.

Equity investments are classified as FVPL unless they are designated as at FVOCI on initial recognition (see below). Dividends from equity investments, irrespective of whether classified as FVPL or FVOCI, are recognised in profit or loss as finance income.

- Financial assets measured at FVOCI

  Non-equity financial assets are classified as FVOCI where they arise from contracts which give rise to contractual cash flows which are solely principal and interest and which are held in a business model which realises some through sale and some by holding them to settlement. They are recognised initially at fair value plus any directly attributable transaction costs, or in the case of trade receivables, at the transaction price.

  At the end of each reporting period they are re-measured to fair value, with the cumulative gain or loss compared to their amortised cost (AC) being recognised as fair value reserve through other comprehensive income, except for the recognition in profit or loss of expected credit losses, interest income (calculated using the effective interest method) and foreign exchange gains and losses.

  When these assets are derecognised, the cumulative gain or loss is reclassified from equity to profit or loss.

  Equity investments are designated as at FVOCI where they are considered strategic to the Group. Such designation is made on an instrument-by-instrument basis, but may only be made if the investment meets the definition of equity from the issuer's perspective. Amounts accumulated in the fair value reserve in respect of these investments are transferred directly to retained earnings on the disposal of the investment. These investments are not subject to impairment.

- Financial assets measured at amortised cost

  Financial assets are held at amortised cost when they arise from contracts which give rise to contractual cash flows which are solely principal and interest and are held in a business model which mainly holds the assets to collect contractual cash flows.

  Financial assets measured at amortised cost when they are not purchased or originated credit-impaired are measured at amortised cost using the effective interest method. For those purchased or originated credit-impaired, the Group applies the credit-adjusted effective interest rate since initial recognition. These assets are also subject to impairment losses (see note 3(j)). Interest income is calculated based on the gross carrying amount of the financial asset unless the financial asset is credit impaired, in which case interest income is calculated on the amortised cost (i.e. gross carrying amount less loss allowance). Interest income is included in finance income.

- Financial liabilities

  Financial liabilities are classified as measured at amortised cost or FVPL. A financial liability is classified as FVPL if it is a derivative, contingent consideration or it is designated as such on initial recognition. Other financial liabilities are stated at amortised cost using the effective interest method. Interest is included in finance expenses unless capitalised into an asset (see note 3(s)).

(f) Investment property

Investment properties are land and buildings which are owned or held under a leasehold interest (see note 3(i)) to earn rental income and/or for capital appreciation.

Investment properties are stated at cost less accumulated depreciation (see note 3(g)(ii)) and impairment losses (see note 3(j)).

Rental income from investment properties is accounted for as described in note 3(p)(ii).

(g) Other property, plant and equipment

(i) Cost

Items of property, plant and equipment are stated at cost less accumulated depreciation and impairment losses (see note 3(j)). Cost includes expenditure that is directly attributable to the acquisition of the assets including for self-constructed assets, the cost of materials, direct labour, the initial estimate, where appropriate, of the costs of dismantling and removing the items and restoring the site on which they are located, and an appropriate proportion of production overheads and borrowing costs.

Construction in progress is transferred to other property, plant and equipment when it is ready for its intended use.

Gains or losses arising from the retirement or disposal of an item of property, plant and equipment are determined as the difference between the net disposal proceeds and the carrying amount of the item and are recognised in profit or loss on the date of retirement or disposal.

(ii) Depreciation

Depreciation is calculated to write off the cost of items of investment property and other property, plant and equipment, less their estimated residual value, if any, using the straight line method over their estimated useful lives as follows:

- Buildings   30 years
- Machinery   2 to 10 years
- Motor vehicles   5 years
- Electronic and other equipment   2 to 5 years
- Decoration and leasehold improvements   2 to 15 years

Where components of an item of investment property and other property, plant and equipment have different useful lives, the cost or valuation of the item is allocated on a reasonable basis between the parts and each part is depreciated separately. Both the useful life of an item of investment property and other property, plant and equipment and its residual value, if any, are reviewed annually.

Freehold land and construction in progress are not depreciated.

(h) Goodwill and intangible assets

(i) Goodwill

Goodwill represents the excess of the fair value of consideration paid to acquire a subsidiary over the acquisition date fair value of the acquiree's identifiable assets acquired less liabilities, including contingent liabilities, assumed as at the acquisition date, less impairment losses (see note 3(j)).

(ii) Other intangible assets

Other intangible assets are stated at cost less accumulated amortisation and impairment losses (see note 3(j)).

(iii) Amortisation

Goodwill is not amortised but subject to impairment testing (see note 3(j)) annually.

The cost of other intangible assets with finite useful lives is amortised to profit or loss on a straight-line basis over the assets' estimated useful lives from the date they are available for use. Their estimated useful lives are as follows:

- Software   2 to 10 years
- Patents and royalties   2 to 10 years
- Trademark and others   2 to 20 years

Both the useful lives and method of amortisation are reviewed annually and revised when necessary.

(iv) Research and development

Research and development costs are all costs directly attributable to research and development activities together with cost which can be allocated on a reasonable basis to such activities. The nature of the Group's research and development activities is such that the criteria for the recognition of such costs as assets are generally not met until late in the development stage of the project when the remaining development costs are immaterial. Therefore, expenditure on research and development activities is generally recognised as an expense in the period in which it is incurred.

(i) Leases

A contract is, or contains, a lease if the contract conveys the right to control the use of an identified asset for a period of time, the lease term, in exchange for consideration. The Group assesses whether a contract is, or contains, a lease on inception.

The lease term is the non-cancellable period of the lease, together with any additional periods when there is an enforceable option to extend the lease and it is reasonably certain that the Group will extend the term, or when there is an option to terminate the lease and it is reasonably certain that the Group will not exercise the right to terminate. The lease term is reassessed if there is a significant change in circumstances.

(i) As a lessee

At commencement, or on the modification, of a contract that contains a lease component, the Group allocates the consideration in the contract to each lease component on the basis of its relative stand-alone prices.

The Group recognises a right-of-use asset and a lease liability at the lease commencement date. The right-of-use asset is initially measured at cost, which comprises the initial amount of the lease liability adjusted for any lease payments made at or before the commencement date, plus any initial direct costs incurred and an estimate of costs to dismantle and remove the underlying asset or to restore the underlying asset or the site on which it is located, less any lease incentives received.

The right-of-use asset is depreciated using the straight-line method from the commencement date to the end of the lease term. If the lease transfers ownership of the underlying asset to the Group by the end of the lease term or if the Group expects to exercise a purchase option, the right-of-use asset will be depreciated over the useful life of the underlying asset, which is determined on the same basis as the Group's other property, plant and equipment.

Right-of-use assets are reduced by impairment losses, if any, and adjusted for certain re-measurements of the lease liability.

The lease liability is initially measured at the present value of the total lease payments due on the commencement date, discounted using either the interest rate implicit in the lease, if readily determinable, or more usually, an estimate of the Group's incremental borrowing rate on the inception date for a loan with similar terms to the lease.

The incremental borrowing rate is estimated by obtaining interest rates from various external financing sources and making certain adjustments to reflect the terms of the lease and type of the asset leased.

Lease payments included in the measurement of the lease liability comprise the following:

- fixed payments, including payments which are substantively fixed;

- variable lease payments that depend on an index or a rate, initially measured using the index or rate as at the commencement date;

- amounts expected to be payable under a residual value guarantee; and

- the exercise price under a purchase option that the Group is reasonably certain to exercise, lease payments in an optional renewal period if the Group is reasonably certain to exercise an extension option, and penalties for early termination of a lease unless the Group is reasonably certain not to terminate early.

The lease liability is measured at amortised cost using the effective interest method. It is remeasured when there is a change in future lease payments arising from a change in an index or rate, if there is a change in the Group's estimate of the amount expected to be payable under a residual value guarantee, if the Group changes its assessment of whether it will exercise a purchase, extension or termination option or if there is a revised in-substance fixed lease payment.

When the lease liability is remeasured in this way, a corresponding adjustment is made to the carrying amount of the right-of-use asset, or is recorded in profit or loss if the carrying amount of the right-of-use asset has been reduced to zero.

Short-term leases and leases of low-value assets

As permitted by IFRS 16 *Leases*, the Group does not recognise right-of-use assets and lease liabilities for leases of low-value assets and short-term leases. Payments associated with these leases are recognised as an expense on a straight-line basis over the lease term.

(ii) As a lessor

When the Group acts as a lessor, it determines at lease inception whether each lease is a finance lease or an operating lease.

To classify each lease, the Group makes an overall assessment of whether the lease transfers substantially all of the risks and rewards incidental to ownership of the underlying asset. If this is the case, then the lease is a finance lease; if not, then it is an operating lease.

When the Group is an intermediate lessor, it accounts for its interest in the head lease and the sub-lease separately. It assesses the lease classification of a sub-lease with reference to the right-of-use asset arising from the head lease, not with reference to the underlying asset. If a head lease is a short-term lease to which the Group applies the exemption described above, then it classifies the sub-lease as an operating lease.

The Group recognises lease payments received under operating leases as income on a straight-line basis over the lease term as part of Revenue (see note 3(p)(ii)).

(j) Impairment of assets

(i) Impairment of financial assets, contract assets and lease receivables

The Group recognises an allowance for impairment on non-equity financial assets held at FVOCI and AC, and also on contract assets and lease receivables on an expected credit loss basis. Increases and decreases in the impairment allowance are recognised in profit or loss. The expected credit losses are the difference (on a present value basis) between the contractual cash flows (or transaction price) and the present value of cash flows expected to be received based on the Group's past loss experience and reasonable and supportable expectations, at the end of the reporting period, about future credit conditions.

For trade receivables, contract assets and lease receivables, the Group recognises impairment both individually and using provision matrices based on the probability that the customer will default during the lifetime of the asset, and the loss that will be incurred given the default (the lifetime expected loss). The Group defines default as the customer being more than 90 days past due.

For all other financial assets that are not purchased or originated credit-impaired, the Group recognises impairment initially based on the probability that the customer or counterparty will default in the next 12 months unless there has been a significant deterioration in credit quality, or the financial asset becomes credit impaired in which case the impairment allowance is increased to the lifetime expected loss.

An asset is credit impaired when it has one or more of the loss events described below:

- significant financial difficulty of the borrower or issuer;

- a breach of contract, such as a default or past due event;

- the restructuring of a loan or advance by the Group on terms that the Group would not consider otherwise;

- it is probable that the borrower will enter bankruptcy or other financial reorganisation; or

- the disappearance of an active market for a security because of financial difficulties.

In the case of purchased or originated credit-impaired financial assets, the Group only recognises the cumulative changes in lifetime expected credit losses since initial recognition as a loss allowance.

(ii) Impairment of other non-financial assets

Internal and external sources of information are reviewed at the end of each reporting period to identify indications that non-financial assets, including property, plant and equipment, right-of-use assets, intangible assets and other long-term assets may be impaired.

Goodwill is tested for impairment at least annually. For the purposes of impairment testing, goodwill is allocated to each cash generating unit, or a group of cash generating units, that is expected to benefit from the synergies of the acquisition. Where impairment testing is of a cash generating unit (or group of units), an impairment loss is recognised in profit or loss where the recoverable value is less than the carrying value of the unit (or group of units) and the impairment loss recognised is allocated first to reduce the carrying amount of any goodwill allocated to the unit (or group of units).

Other assets are impaired and an impairment loss is recognised in profit or loss where the recoverable value of the asset is less than its carrying amount, and reversed where there has been a favourable change in the recoverable amount. Impairment of goodwill is not reversed.

The recoverable amount of an asset or group of assets is the greater of its fair value less costs of disposal and value in use. Value in use is the total estimated future cash flows from the asset or, where the asset does not generate cash flows independent of other assets, a group of assets, discounted to their present value using a pre-tax discount rate that reflects current market assessments of the time value of money and the risks specific to the asset, or group of assets.

(k) Inventories

Inventories are assets which are held for sale in the ordinary course of business, in the process of production for such sales or in the form of material or supplies to be consumed in the production process or in the rendering of services.

Inventories are carried at the lower of cost and net realisable value.

Cost is calculated based on the standard cost method with periodic adjustments of cost variance to arrive at the actual cost, which approximates to weighted average cost. Cost includes expenditures incurred in acquiring the inventories and bringing them to their present location and condition. The cost of manufactured inventories and work in progress includes an appropriate share of overheads based on normal operating capacity.

Net realisable value is the estimated selling price in the ordinary course of business, less the estimated costs of completion and the estimated costs necessary to make the sale.

When inventories are sold, the carrying amount of those inventories is recognised as an expense in the period in which the related revenue is recognised. Any write-down of inventories to net realisable value and all losses of inventories are recognised as an expense in the period the write-down or loss occurs.

(l) Cash and cash equivalents

Cash and cash equivalents comprise cash at bank and on hand, demand deposits with banks and other financial institutions, demand deposits with third party merchants, and short-term, highly liquid investments that are readily convertible into known amounts of cash and which are subject to an insignificant risk of changes in value. Bank overdrafts that are repayable on demand and form an integral part of the Group's cash management are also included as a component of cash and cash equivalents for the purpose of the consolidated statement of cash flows.

(m) Employee benefits

(i) Short-term employee benefits, contributions to defined contribution retirement plans and other long-term employee benefits

Salaries, profit-sharing and bonus payments, paid annual leave and contributions to defined contribution retirement plans and non-monetary benefits are recognised as liabilities and in profit or loss or in the cost of related assets in the period in which the associated services are rendered by employees. Where payment or settlement is expected to be made 12 months after the end of the reporting period, these amounts are discounted and stated at their present values.

(ii) Defined benefit obligations

The Group's obligation in respect of defined benefit plans is calculated separately for each plan by estimating the total amount of future benefit that employees have earned in return for their service in the current and prior periods which is then discounted to present value. The calculation is performed by management using the projected unit credit method.

Service cost and interest cost on the defined benefit obligations and any curtailment gains and losses are recognised in profit or loss.

Re-measurements arising from changes in actuarial assumptions regarding the amounts of future benefits are recognised immediately in other comprehensive income and shall not be reclassified to profit or loss in a subsequent period. However, the Group may transfer those amounts recognised in other comprehensive income within equity.

(n) Income tax

Income tax for the year comprises current tax and movements in deferred tax assets and liabilities. Current tax and movements in deferred tax assets and liabilities are recognised in profit or loss except to the extent that they relate to items recognised in other comprehensive income or directly in equity, in which case the relevant amounts of tax are recognised in other comprehensive income or directly in equity, respectively.

Current tax is the expected tax payable on the taxable income for the year, using tax rates enacted or substantively enacted at the end of the reporting period, and any adjustment to tax payable in respect of previous years.

Deferred tax is recognised on temporary differences, representing the difference between the carrying amounts of assets and liabilities for financial reporting purposes and their tax bases. Deferred tax assets also arise from unused tax losses and unused tax credits.

Deferred tax assets are recognised to the extent that it is probable that future taxable profits will be available against which the asset can be utilised. Future taxable profits that may support the recognition of deferred tax assets arising from deductible temporary differences include those that will arise from the reversal of existing taxable temporary differences, provided those differences relate to the same taxation authority and the same taxable entity, and are expected to reverse either in the same period as the expected reversal of the deductible temporary difference or in periods into which a tax loss arising from the deferred tax asset can be carried back or forward. The same criteria are adopted when determining whether existing taxable temporary differences support the recognition of deferred tax assets arising from unused tax losses and credits, that is, those differences are taken into account if they relate to the same taxation authority and the same taxable entity, and are expected to reverse in a period, or periods, in which the tax loss or credit can be utilised.

No deferred tax is recognised for temporary differences on:

- the initial recognition of goodwill;

- the initial recognition of assets or liabilities that affect neither accounting nor taxable profit (provided they are not part of a business combination); and

- investments in subsidiaries to the extent that, in the case of taxable differences, the Group controls the timing of the reversal and it is probable that the differences will not reverse in the foreseeable future, or in the case of deductible differences, unless it is probable that they will reverse in the future.

The amount of deferred tax recognised is measured based on the expected manner of realisation or settlement of the carrying amount of the assets and liabilities, using tax rates enacted or substantively enacted at the end of the reporting period. Deferred tax assets and liabilities are not discounted.

The carrying amount of a deferred tax a0sset is reviewed at the end of each reporting period and is reduced to the extent that it is no longer probable that sufficient taxable profits will be available to allow the related tax benefit to be utilised. Any such reduction is reversed to the extent that it becomes probable that sufficient taxable profits will be available.

A provision is recognised for those matters for which the tax determination is uncertain but it is considered probable that there will be a future outflow of funds to a tax authority. The provisions are measured at the best estimate of the amount expected to become payable.

Current tax balances and deferred tax balances, and movements therein, are presented separately from each other and are not offset. Current tax assets are offset against current tax liabilities, and deferred tax assets against deferred tax liabilities, if the Group has legally enforceable rights to set off current tax assets against current tax liabilities and the following additional conditions are met:

- in the case of current tax assets and liabilities, the Group intends either to settle on a net basis, or to realise the asset and settle the liability simultaneously; or

- in the case of deferred tax assets and liabilities, if they relate to income taxes levied by the same taxation authority on either:

    - the same taxable entity; or

    - different taxable entities, which, in each future period in which significant amounts of deferred tax liabilities or assets are expected to be settled or recovered, intend to realise the current tax assets and settle the current tax liabilities on a net basis or realise and settle simultaneously.

(o) Provisions and contingent liabilities

Provisions are recognised for liabilities of uncertain timing or amount when the Group has a legal or constructive obligation arising as a result of a past event, it is probable that an outflow of economic benefits will be required to settle the obligation and a reliable estimate can be made. Where the time value of money is material, provisions are stated at the present value of the expenditure expected to settle the obligation.

Where it is not probable that an outflow of economic benefits will be required, or the amount cannot be reliably estimated, disclosure is made of the contingent liability, unless the probability of outflow of economic benefits is remote. Possible obligations, whose existence will only be confirmed by the occurrence or non-occurrence of one or more future events are also disclosed as contingent liabilities unless the probability of outflow of economic benefits is remote.

The main types of provisions are as follows:

■ **Provision for warranties**

The Group provides assurance warranty on its standard consumer and certain enterprise products for a period typically covering 12 to 24 months.

The Group estimates the costs that may be incurred under its assurance warranty obligations and records a liability in the amount of such costs when revenue is recognised. Warranty costs generally include spare parts, labour costs and service centre support. Factors that affect the Group's warranty liability include the amount of products sold, historical and anticipated rates of warranty claims. The Group periodically reassesses its warranty liabilities and adjusts the amounts as necessary.

■ **Provision for onerous contracts**

A provision for onerous contracts is recognised when the expected benefits to be derived by the Group from a contract are lower than the estimated cost of meeting its obligations under the contract. The provision is measured at the present value of the lower of the expected cost of terminating the contract and the expected net cost of continuing with the contract. Before a provision is established, the Group recognises any impairment loss on the assets associated with that contract.

(p) Revenue

Revenue is income arising from sales of products, provision of services or use by others of the Group's properties under leases in the ordinary course of the Group's business.

(i) Revenue from customer contracts

The Group divides its business into three operating segments, Carrier Business, Enterprise Business and Consumer Business. The principal activities of each segment are disclosed in note 7.

The Group applies its revenue accounting policies based on the features of the contracts and the business practices of its business groups.

Revenue is measured based on the consideration the Group expects to be entitled to from the contract with the customer and excludes those amounts collected on behalf of third parties. The Group recognises revenue when it transfers control over a product or service (or bundle) to a customer.

i. Contract combinations and modifications

The Group combines separate customer contracts with the same customer or related parties of the same customers entered into at or near the same time when those contracts are negotiated as a package to form a single commercial objective, are significantly interdependent in nature or contain significant pricing dependencies.

Contract modifications are generally treated either as a new separate contract, or as a prospective change to an existing contract. In cases when the additional or the remaining goods and services are not distinct from those transferred before the date of modification, typically in the Carrier Business and Enterprise Business, modifications are accounted for through a cumulative catch-up adjustment.

ii. Performance Obligations (POB)

In the Consumer Business, POBs are typically terminal devices, accessories and services. In the Carrier Business, there are generally more POBs due to the nature of the contracts which typically involve sales of networking hardware, software and a wide range of services. In the Enterprise Business where the Group delivers bespoke end-to-end solutions, there may in some cases only be a few POBs.

iii. Warranties

In the Carrier Business and Enterprise Business, customer service warranties, except for those related to certain Enterprise products, are generally recognised as a distinct service for which revenue is allocated and recognised over the service period. In the Consumer Business, warranties provided on terminal devices and accessories are generally standard assurance in nature and are accounted for as a warranty provision at the time of the sale (see note 3(o)).

iv. Timing of revenue recognition

The Group determines at contract inception whether it transfers the control of a good or service underlying a POB to the customer over time or at a point in time. A POB is satisfied and related revenue is recognised over time, if one of the following criteria is met:

- The customer simultaneously receives and consumes the benefits provided by the Group's performance as the Group performs;

- The Group's performance creates or enhances an asset that the customer controls as the asset is created or enhanced; or

- The Group's performance does not create an asset with an alternative use to the Group and the Group has an enforceable right to payment for performance completed to date.

If a POB is not satisfied and the control over the related good or service is not transferred over time in accordance with the above criteria, it is satisfied and revenue is recognised at a point in time.

Most Carrier Business contracts include multiple POBs for which revenue is recognised when the Group transfers control of each obligation, either at a point in time such as delivery or acceptance, or over time as the obligation is being fulfilled or the customer obtains control of the goods and/or services. Some Carrier Business construction contracts represent a single or a few POBs for which revenue is recognised over the delivery period.

Within the Enterprise Business certain solution build contracts constitute a single or a small number of POBs for which revenue is recognised over the delivery period. For the remaining contracts with multiple POBs, revenue is recognised as and when control related to each obligation is transferred, either at a point in time, such as delivery or acceptance, or over time, as the obligation is being fulfilled and the customer obtains control of the goods and/or services.

Sales of terminal devices and accessories by the Consumer Business to distribution channels are recognised when control of the goods has transferred. In most cases, this is when the sell-in to the channel occurs; however, in a limited number of cases, this is when the goods are sold to the second tier distribution channels or end-users.

v. Variable consideration

Revenue is measured at the fair value of the consideration received or receivable, adjusted at contract inception for penalties, price concessions, returns, trade discounts, volume rebates and other sales incentives, such as coupons, provided that the level of expected return of goods, volume rebates and other incentives given can be estimated reliably and that revenue is only recognised to the extent that it is highly probable that a significant reversal in the amount of cumulative revenue recognised will not occur. When making an estimate for variable consideration, the Group considers several factors, including but not limited to, contract commitments, business practices, historical experience, customer take-up rates, and expected purchase volumes.

vi. Significant financing component

In the Carrier Business and Enterprise Business, payments are generally received according to the payment milestones set out in the contracts before or after the obligations are fulfilled, usually including advance payments, delivery payments and completion payments. In the Consumer Business and certain business units under the Enterprise Business, advance payments are commonly received. Advance payments are usually received less than one year ahead of satisfaction of a performance obligation.

The amount of consideration in a sales contract is adjusted for the existence of significant financing component in determining the transaction price only when the payment terms exceed one year in duration between performance and payment.

The Group recognises interest income where payment is received more than one year in arrears of satisfaction of a performance obligation, reflecting a deemed lending of cash to a customer. Such interest income is presented in finance income. The consideration attributable to other goods and services in the contract is reduced by a corresponding amount and is included within revenue.

The Group adopts the practical expedient under IFRS 15 *Revenue from Contracts with Customers* (IFRS 15), and does not account for the significant financing components where the Group anticipates at contract inception that the timing difference between transfer of control of a good or service to a customer, and the customer paying for that good or service will be one year or less.

vii. Stand-alone selling prices (SSP)

The transaction price of a contract with a customer is allocated to each POB in proportion to its SSP. The Carrier Business and Enterprise Business primarily use estimated SSP and the Consumer Business uses directly observable SSP.

Within the Carrier Business and the Enterprise Business, the Group establishes the SSP for products mainly using an average price approach by product category. Average price of a product is calculated with reference to the historical stand-alone product sale transactions for the product and the product category is determined with reference to the product family and geographical region.

For services that are regularly sold on a stand-alone basis, most of such services are customised and priced on a project basis, therefore the transaction prices generally reflect the SSP. For the services where an observable transaction price is unavailable such as the services sold in a bundle with products, the Group determines the SSP using a cost-plus approach, taking into account several factors, including but not limited to labour cost, competition and company business strategy.

When a significant discount is granted and is specifically attributable to one or more POBs that discount is allocated to the identified POB(s) if the allocation reflects the Group's regular sales pattern. In all other cases the discount is allocated to the contract overall.

viii. Contract assets and liabilities

When revenue is recognised under a contract with a customer before the Group becomes unconditionally entitled to the consideration under the relevant payment terms of the contract, a contract asset is recognised. Contract assets are reclassified to trade receivables when the right to consideration becomes unconditional.

When consideration is received (or the right to consideration is unconditional) before the related revenue is recognised, a contract liability is recognised.

For a single contract with the customer, either a net contract asset or a net contract liability is presented. For multiple contracts, contract assets and contract liabilities of unrelated contracts are not presented on a net basis.

Trade receivables are recognised when the right to consideration under a revenue contract becomes unconditional, regardless of the billing date.

ix. Refund liabilities

A refund liability, such as the accrued rebates to customers and other sales-based incentives granted, is recognised when the Group receives consideration from the customer and expects to refund some or all of that consideration to the customer. Refund liabilities are presented in Other liabilities in the consolidated statement of financial position.

x. Contract costs

Certain incremental acquisition costs (those paid to acquire a contract such as commission) and fulfilment costs (those incurred to deliver services to customers) are initially capitalised to the extent that the costs are recoverable, and subsequently recognised as expense over the period of expected benefit, which is generally the associated contract duration.

Incremental acquisition costs incurred in its major businesses are minimal and generally expensed immediately.

The Group recognises a contract cost impairment when the carrying amount of unamortised contract costs exceeds the difference between the remaining consideration expected to recover and the associated costs relating to providing those goods and services under the contract.

(ii) Rental income from operating leases

Rental income receivable under operating leases is recognised in profit or loss in equal instalments over the periods covered by the lease term, except where an alternative basis is more representative of the pattern of benefits to be derived from the use of the leased asset. Lease incentives granted are recognised in profit or loss as an integral part of the aggregate net lease payments receivable. Variable lease payments that do not depend on an index or a rate are recognised as income in the accounting period in which they are earned.

(q) Government grants

Government grants are recognised at fair value when there is reasonable assurance that they will be received and that the Group will comply with the conditions attaching to them.

Grants that compensate the Group for the cost of an asset are initially recognised as deferred income and then recognised in profit or loss on a systematic and rational basis over the useful life of the related asset.

Grants that compensate the Group for expenses to be incurred in the future are initially recognised as deferred income and then recognised in profit or loss in the same periods in which the expenses are incurred. Otherwise, the grants are recognised in profit or loss directly.

(r) Translation of foreign currencies

(i) Foreign currency transactions

Foreign currency transactions during the year are translated into the respective functional currencies of group entities at the foreign exchange rates ruling at the transaction dates.

Monetary assets and liabilities denominated in foreign currencies are translated into the functional currency at the foreign exchange rates ruling at the end of the reporting period. Exchange gains and losses are recognised in profit or loss.

Non-monetary assets and liabilities that are measured in terms of historical cost in a foreign currency are translated using the foreign exchange rates ruling at the transaction dates. Non-monetary assets and liabilities denominated in foreign currencies that are stated at fair value are translated using the foreign exchange rates ruling at the dates the fair value was measured.

(ii) Foreign operations

The results of foreign operations, except for foreign operations in hyperinflationary economies, are translated into the presentation currency of the Group (CNY) at the exchange rates approximating the foreign exchange rates ruling at the dates of the transactions. Statement of financial position items are translated into CNY at the closing foreign exchange rates at the end of the reporting period. The resulting exchange differences are recognised in other comprehensive income and accumulated separately in equity in the translation reserve. If the operation is a non-wholly-owned subsidiary, then the relevant proportionate share of the translation difference is allocated to the non-controlling interests.

The results and financial position of foreign operations in hyperinflationary economies are translated to CNY at the exchange rates ruling at the end of the reporting period. Prior to translating the financial statements of foreign operations in hyperinflationary economies, their financial statements for the current year are restated to account for changes in the general purchasing power of the local currencies. The restatement is based on relevant price indices at the end of the reporting period.

When a foreign operation is disposed of in its entirety or partially such that control, significant influence or joint control is lost, the cumulative amount in the translation reserve related to that foreign operation is reclassified to profit or loss as part of the gain or loss on disposal.

(s) Borrowing costs

Borrowing costs that are directly attributable to the acquisition, construction or production of an asset which necessarily takes a substantial period of time to get ready for its intended use or sale are capitalised as part of the cost of that asset. Other borrowing costs are expensed in the period in which they are incurred.

4 Changes in accounting policies

A number of new standards, amendments to standards or interpretations are effective from January 1, 2021 but they do not have a material effect on the Group's consolidated financial statements.

5 Accounting judgements and estimates

(a) Accounting judgements

(i) Revenue recognition

Revenue is recognised when control of a good or service is transferred to a customer as disclosed in note 3(p). To determine the satisfaction of performance obligations the Group applies the following judgements:

- Where revenue is recognised over time, the Group primarily uses the output method to measure progress; however, in a limited number of business units, the input method is adopted when the Group is unable to reasonably measure the outcome of a performance obligation. Judgements applied when using the output method include assessing progress and milestones achieved and determining if that represents the value of goods and/or services delivered to the customer to date. Judgements applied when using the input method include determining if consumption of the resources relative to the total expected amount faithfully depicts the transfer of control of goods and/or services promised to the customer.

- Where revenue is recognised at a point in time, the Group assesses the transfer of control by reference to the contractual terms and the circumstance of the arrangements including a consideration of past business practice, such as whether the Group has a legal right to payment, title has passed, the customer has the risks and rewards of ownership, or the customer is using the asset to generate value for themselves.

- For sales to distribution channels, judgement is also applied in determining when the control of the goods is transferred to distributors. These judgements involve several external and internal factors including, but not limited to, market conditions, product life cycles, distributor sales, competitive conditions and the extent to which the Group has continuing managerial involvement over the goods after their delivery.

(ii) Contract modification

The Group applies judgements in determining whether a contract modification should be treated as a new contract or a prospective change to an existing contract, or accounted for through a cumulative catch-up adjustment to revenue, by considering the nature of the goods and services, and sales price data.

The Group judges a contract modification as a separate contract when the increase in contract scope is due to additional distinct promised goods or services and the price increases reflect the SSP of such goods or services plus any appropriate adjustments. Otherwise, a contract modification is judged as a prospective change to an existing contract when the remaining goods or services are distinct from those transferred before the date of the modification, or accounted for as cumulative catch-up adjustment to the revenue when the new or remaining goods or services are not distinct from those transferred.

(b) Sources of estimation uncertainty

Key sources of estimation uncertainty are as follows:

(i) Revenue recognition

To determine the transaction price and the amounts allocated to performance obligations the Group applies the following estimation:

- Variable consideration is estimated using the most likely amount or expected value based on the nature of the specific consideration and the analysis of relevant contract terms, taking into consideration historical, current and expected information.

- SSP is determined using observable evidence of sales prices, where available. In a number of cases statistical analysis is used to identify the historical price a product/service has been sold for as its SSP. Where observable evidence is not available, SSP is estimated using multiple inputs (see note 3(p)(i)vii). SSP is monitored regularly to ensure it remains appropriate.

- Obligations for returns and refunds are judged based on estimates made from historical information associated with similar products and anticipated rates of claims for the products.

- The collectability of a consideration is estimated at contract inception, based on the Group's assessment on the customer's ability and intention to pay when due and is reassessed if there are significant changes in the facts and circumstances.

Estimation is inherent in revenue recognition and revenue may materially change if management's estimation were to change or to be found inaccurate or the occurrence of unexpected events.

(ii) Impairment of trade receivables and contract assets

The credit risk of customers is regularly assessed with a focus on the customer's ability and willingness to pay, reflected by the Group's estimation of the expected credit loss allowance on trade receivables and contract assets. The Group estimates expected credit loss by assessing the loss that will be incurred given customer default based on past payment experience and adjusted by the cash flow expected from collateral or credit risk mitigation received where these are considered to be integral to the asset, and by assessing the probability of default taking into account information specific to the customer as well as pertaining to the country and economic environment in which the customer operates. The estimate also incorporates forward looking data.

Impairment is assessed on an individual basis for trade receivables and contract assets meeting pre-determined criteria, including customers in financial difficulties, and contracts with risk mitigation arrangements or significant financing arrangements, amongst others. Apart from receivables and contract assets that have been assessed and provided for individually, allowances are estimated using provision matrices by management with reference to the customers' credit risk ratings and aging analysis of the remaining trade receivable and contract asset balances. Different provision matrices have been developed by the Group based on different customer groups which exhibit different risk characteristics.

If the financial condition of customers were to deteriorate or improve, or actual future economic performance is different to the Group's estimates, additional allowances or reversals may be required in future periods.

(iii) Net realisable value of inventories

The net realisable value of inventories is the estimated selling price in the ordinary course of business, less the estimated costs of completion and the estimated costs necessary to make the sale, adjusted by the losses for obsolescence and redundancy.

These estimates are based on the current market condition, economic lives of the Group's products, availability of components required to assemble the Group's products and the historical experience of inventory losses. They could change significantly as a result of industrial technology upgrades, competitor actions, development of the Events as described in note 5(c) or other changes in market condition. Management will reassess the estimations at the end of each reporting period.

(iv) Impairment losses of other non-financial assets

The carrying amounts of other non-financial assets (including property, plant and equipment, right-of-use assets, goodwill and intangible assets and other long-term assets) are reviewed periodically in order to assess whether the recoverable amounts have declined below their carrying amounts. In order to determine the recoverable amount, the Group uses assumptions and develops expectations, which requires significant judgement. The Group uses all readily available information in determining an amount that is a reasonable approximation of recoverable amount, including estimates based on reasonable and supportable assumptions and projections of production volume, sales price, amount of operating costs, discount rate and growth rate.

(v) Income tax

The Group is subject to income taxes in various jurisdictions. Significant judgement is required in determining the Group's provision for income taxes. There are many transactions and computations for which the ultimate tax determination is uncertain during the ordinary course of business. The Group recognises liabilities in the relevant accounting period based on estimates of the probabilities of whether additional taxes will be due. Where the final tax outcome of these matters is different from the amounts that were initially recorded, such differences will impact current and deferred tax liabilities and the taxation charge for the year.

(vi) Provision for warranties

As explained in note 28(b), the Group makes provision for assurance warranties in respect of its Consumer Business and certain Enterprise Business products, taking into account the Group's recent claim experience and anticipated claim rates for affected products. As the Group is continually upgrading its product designs and launching new models, it is possible that the recent claim experience is not indicative of future claims that it will receive in respect of past sales. Any increase or decrease in the provision would affect profit or loss in future years.

(vii) Other provisions

The Group makes provisions for onerous contracts, outstanding litigations and claims based on project budgets, contract terms, available knowledge, legal advice and past experience. The Group recognises provisions to the extent that it has a present legal or constructive obligation as a result of a past event; that it is probable that an outflow of resources will be required to settle the obligation; and that the amount can be reliably estimated. Judgement is required in making such estimates and the ultimate outcome may be different.

The Group makes provisions for onerous contracts in respect of losses arising from non-cancellable procurement agreements when there is a change in the Group's procurement demands such that the Group may not proceed with committed purchase orders or use the goods concerned. Provisions are made taking into account the contract terms, the suppliers' losses resulting from the Group's termination of the agreements and the extent to which the goods under the committed purchase orders will no longer be used in the Group's production. In estimating the losses for redundancies, inventories held on hand and non-cancellable purchase orders are evaluated as a whole. Judgement is required in making the estimates and the ultimate outcome may be different. The Group regularly updates its production plan and procurement demands, estimates probable losses, and adjusts provisions accordingly.

(viii) Deferred tax assets

Estimation uncertainty arises from the recognition of deferred tax assets in respect of unused tax losses and deductible temporary differences. As explained in note 3(n), all deferred tax assets are recognised to the extent that it is probable that future taxable profits will be available against which they can be utilised. Adverse changes to the operating environment or changes in the Group's organisation structure could result in a future write-down of the deferred tax assets recognised.

(c) Financial impact of the Entity List event

On May 16, 2019 and August 19, 2019 (dates in note 5(c) are in U.S. time), the U.S. Commerce Department's Bureau of Industry and Security (BIS) added Huawei Technologies Co., Ltd. and certain non-US affiliates to the Entity List. On August 17, 2020, BIS amended the Foreign-Produced Direct Product Rule by expanding the scope of control over foreign-produced items, and further added certain Huawei non-US affiliates to the Entity List. Upon being added to the Entity List, export, re-export or in-country transfer of items subject to the U.S. Export Administration Regulations (including hardware, software, technology, etc.) to the listed entities shall be subject to a BIS license requirement (collectively referred to as the Events).

As a result, supplies of relevant items to the Group and sales of certain products of the Group are adversely affected. The Group has been taking active measures to mitigate the impact of the Events. In preparing these financial statements, management has applied significant judgments to estimate the impacts arising from the Events and relevant impairments and provisions have been recognised appropriately. The Group continuously assesses these impacts and makes adjustment to relevant estimates based on the development of the Events.

6 Possible impact of amendments, new standards and interpretations issued but not yet effective for the year ended December 31, 2021

The International Accounting Standards Board has issued a number of new standards and amendments which will affect the financial statements in subsequent accounting periods. They are not expected to have a significant impact on the Group's consolidated financial statements.

7 Segment information

Operating segments are determined based on the types of customers, products and services provided, as well as the Group's organisation structure, management requirement and reporting system. The Group divides its business into three operating segments:

- Carrier Business

  The Carrier Business provides global telecom carriers with end-to-end commercial network products, services, and solutions, including wireless networks, cloud core networks, fixed networks, services, and software.

- Enterprise Business

  The Enterprise Business builds ICT infrastructure by using advanced technologies like artificial intelligence, cloud, big data, Internet of Things, video, and data communications to help industries (e.g. smart cities, finance, energy, transportation, manufacturing, and education) go digital. Its products and solutions include Huawei Cloud, intelligent IP networks, Intelligent OptiX Network, computing, data centers, data storage, and 5GtoB.

- Consumer Business

  The Consumer Business provides smartphones, tablets, personal computers, wearable devices, converged home devices, Huawei Zhixuan cars, as well as the applications and services that run on these devices for consumers and businesses. Driven by HarmonyOS and the Huawei Mobile Services (HMS) ecosystem, these products and services are designed to support five key scenarios: smart office, fitness & health, smart home, easy travel, and entertainment.

There are no inter-segment transactions. The financial information of the different segments is regularly reviewed by the Group's most senior executive management for the purpose of resource allocation and performance assessment. During the year, the classification for certain products among operating businesses was changed. Comparative figures have been adjusted to reflect the current year presentation.

Revenue information in respect of business segments

(CNY million)	2021	2020
Carrier	281,469	302,621
Enterprise	102,444	100,339
Consumer	243,431	482,916
Other items	9,463	5,492
Total	636,807	891,368

Revenue information in respect of geographical segments

(CNY million)	2021	2020
China	413,299	597,983
Europe, the Middle East and Africa (EMEA)	131,467	180,819
Asia Pacific	53,675	64,466
Americas	29,225	39,664
Others	9,141	8,436
Total	636,807	891,368

8 Revenue

(CNY million)	2021	2020
Revenue from contracts with customers	**636,080**	890,863
Rental income	**727**	505
	636,807	891,368

Revenue from contracts with customers is analysed by timing of revenue recognition as follows:

(CNY million)	2021	2020
Recognised at a point in time	**520,682**	745,171
Recognised over time	**115,398**	145,692
	636,080	890,863

Further disaggregation of revenue by business and geography is set out in note 7.

The amount of revenue recognised for the year ended December 31, 2021 from POBs satisfied (or partially satisfied) in previous years amounted to CNY 1,351 million (2020: CNY1,706 million). The revenue was constrained in prior years as the relevant customers were high credit risk rated and the collectability of sales consideration was estimated to be low.

Transaction price allocated to remaining performance obligations

As at December 31, 2021, the aggregated amount of transaction price allocated to the remaining performance obligations under the Group's existing customer contracts is CNY82,387 million (2020: CNY96,662 million). This amount mainly represents the remaining performance obligations under the Group's Carrier Business and Enterprise Business contracts. The Group will recognise the revenue in future when control of the corresponding service or product is transferred to the customer as stipulated in note 3(p). 74% of the amount is expected to occur over the next year (2020: 73%), while the remaining portion is expected to occur in the years that follow. The amounts disclosed above do not include any estimated amounts of variable consideration that are constrained.

The Group does not disclose information about remaining performance obligations that have original expected durations of one year or less as permitted by IFRS 15.

Revenue is recognised when a performance obligation is satisfied in accordance with the accounting policies in note 3(p). The timing of payment from customers relative to revenue recognition generates either contract assets or trade receivables for payments received in arrears or contract liabilities for payments received in advance.

Contract assets and contract liabilities are presented in notes 20 and 26 respectively.

9 Other income, net

(CNY million)	Note	2021	2020
Gain on disposal of subsidiaries and businesses	34	57,431	592
Government grants	(i)	2,571	2,785
Commissions on individual income tax payments withheld		573	504
Reversal of/(impairment of) property, plant and equipment, intangible assets, goodwill and right-of-use assets		72	(2,170)
Factoring expenses		(672)	(811)
Donation		(231)	(724)
Net loss on disposal of property, plant and equipment, intangible assets and right-of-use assets		(112)	(205)
Others, net		1,165	721
		60,797	692

(i) During the year ended December 31, 2021, government grants recognised as other income, net included unconditional grants of CNY844 million (2020: CNY904 million), and conditional grants of CNY1,727 million (2020: CNY1,881 million) which are generally related to research and development projects.

10 Personnel expenses

(CNY million)	2021	2020
Salaries, bonuses and allowances	137,140	139,095
Time-based unit plan (TUP)	6,544	9,550
Defined benefit plans	5,240	5,183
Defined contribution plans and others	15,614	12,233
	164,538	166,061

TUP

TUP is a profit-sharing and bonus plan based on employee performance for all eligible employees (recipients) in the Group. Under TUP, time-based units (TBUs) are granted to recipients for a term of five years which entitle them to receive an annual cash incentive based on an annual profit-sharing amount and an end-of-term cumulative appreciation amount. Both the annual profit-sharing and the end-of-term appreciation amount are determined at the discretion of the Group. Recipients receive the annual profit-sharing amount in each year following the financial year in which it is earned during the five-year period. TBUs expire on the earlier of the end of the five-year period or the date recipients leave the Group's employment, when the accrued end-of-term appreciation amount will be paid.

Defined contribution plans

The Group contributes to defined contribution retirement plans for eligible employees. The plans are managed either by the governments in the countries where the employees are employed, or by independent trustees. Contribution levels are determined by the relevant laws and regulations concerned.

11 Finance income and expenses

(CNY million)	Note	**2021**	2020
Interest income on financial assets at amortised cost			
– deposits and wealth management products		**1,699**	3,828
– other financial assets		**669**	691
Interest income on financial assets at FVOCI		**122**	83
Net gains on non-derivative financial assets mandatorily at FVPL	(i)	**4,695**	1,913
Gains on derecognition of debt securities at FVOCI reclassified from OCI	13(b)	**4**	–
Interest income on lease receivables		**28**	33
Dividend income and others		**948**	750
Finance income		**8,165**	7,298
Interest expense on loans and borrowings		**(6,117)**	(4,784)
Less: interest expense capitalised	(ii)	**55**	5
Interest cost on employee benefit obligations		**(684)**	(600)
Interest expense on lease liabilities	29(a)(ii)	**(381)**	(420)
Other interest expense		**(166)**	(229)
Net foreign exchange loss		**(358)**	(1,638)
Impairment (loss)/reversals		**(4)**	5
Bank charges		**(17)**	(4)
Finance expenses		**(7,672)**	(7,665)
Net finance income/(expenses)		**493**	(367)

(i) Non-derivative financial assets mandatorily measured at FVPL mainly represent investment funds and equity securities measured at FVPL.

(ii) Interest expenses capitalised represent interest costs on specific loans for property construction purpose.

12 Income tax in the summary consolidated statement of profit or loss and other comprehensive income

Charge for the year

(CNY million)	**2021**	2020
Current tax		
Provision for the year	**6,592**	8,855
Over provision in respect of prior years	**(108)**	(221)
	6,484	8,634
Deferred tax	**1,743**	(979)
	8,227	7,655

13 Other comprehensive income

(a) Tax effects relating to each component of other comprehensive income

(CNY million)	2021 Before-tax amount	Tax benefit	Net-of-tax amount	2020 Before-tax amount	Tax benefit	Net-of-tax amount
Re-measurement of defined benefit obligations						
– The Group	(350)	9	(341)	1	2	3
Net change in the fair value and impairment loss of financial assets measured at FVOCI:						
Net change in the fair value of equity investments						
– The Group	3,366	(836)	2,530	3,018	(674)	2,344
Net change in the fair value and impairment loss of non-equity financial assets						
– The Group	21	(4)	17	(12)	1	(11)
	3,387	(840)	2,547	3,006	(673)	2,333
Translation differences on foreign operations						
– The Group	(6,183)	–	(6,183)	(3,987)	–	(3,987)
	(3,146)	(831)	(3,977)	(980)	(671)	(1,651)

(b) Components of other comprehensive income, including reclassification adjustments

(CNY million)	2021	2020
Net change in the fair value and impairment loss of financial assets measured at FVOCI:		
Changes in fair value recognised during the year	3,397	3,022
Reclassification adjustment for amounts transferred to profit or loss:		
– Gain on derecognition (note 11)	(4)	–
Loss allowances	(6)	(16)
Net deferred tax debited to other comprehensive income	(840)	(673)
Net movement in the fair value reserve during the year	2,547	2,333
Translation differences on foreign operations:		
Recognised during the year	(6,214)	(3,995)
Reclassification adjustments for amounts transferred to profit or loss:		
– Disposal of subsidiaries	31	8
Net movement in the translation reserve during the year	(6,183)	(3,987)

14 Goodwill and intangible assets

(CNY million)	Goodwill	Software	Patents and royalties (note (a))	Trademark and others	Total
Cost:					
At January 1, 2020	4,469	2,406	11,421	2,100	20,396
Exchange adjustments	(250)	(20)	(16)	(20)	(306)
Additions	–	549	3,105	1,013	4,667
Acquisition of a subsidiary	21	–	–	538	559
Reclassified as assets held for sale	–	(4)	(51)	(30)	(85)
Disposals	–	(192)	(1,080)	(303)	(1,575)
At December 31, 2020	4,240	2,739	13,379	3,298	23,656
At January 1, 2021	**4,240**	**2,739**	**13,379**	**3,298**	**23,656**
Exchange adjustments	**(122)**	**(5)**	**(18)**	**(19)**	**(164)**
Additions	**–**	**73**	**983**	**589**	**1,645**
Disposals	**–**	**(311)**	**(818)**	**(637)**	**(1,766)**
Others	**(4)**	**–**	**–**	**–**	**(4)**
At December 31, 2021	**4,114**	**2,496**	**13,526**	**3,231**	**23,367**
Amortisation and impairment:					
At January 1, 2020	4,102	1,519	4,998	955	11,574
Exchange adjustments	(243)	(16)	(27)	(15)	(301)
Amortisation for the year	–	495	1,986	804	3,285
Impairment loss	17	25	1,324	–	1,366
Reclassified as assets held for sale	–	(3)	(8)	(7)	(18)
Disposals	–	(191)	(967)	(261)	(1,419)
At December 31, 2020	3,876	1,829	7,306	1,476	14,487
At January 1, 2021	**3,876**	**1,829**	**7,306**	**1,476**	**14,487**
Exchange adjustments	**(103)**	**(5)**	**(14)**	**(11)**	**(133)**
Amortisation for the year	**–**	**494**	**1,389**	**635**	**2,518**
Impairment loss	**11**	**–**	**–**	**–**	**11**
Disposals	**–**	**(270)**	**(755)**	**(595)**	**(1,620)**
At December 31, 2021	**3,784**	**2,048**	**7,926**	**1,505**	**15,263**
Carrying amount:					
At December 31, 2021	**330**	**448**	**5,600**	**1,726**	**8,104**
At December 31, 2020	364	910	6,073	1,822	9,169

(a) As at December 31, carrying amounts of patents and royalties are analysed as follows:

(CNY million)	2021	2020
Patents	4,038	3,612
Royalties	1,562	2,461
	5,600	6,073

(b) Based on the use of the related assets, the amortisation charge for the year is allocated to Cost of sales, Research and development expenses, Selling and administrative expenses. Impairment losses are charged to Cost of sales and Other income, net in the summary consolidated statement of profit or loss and other comprehensive income.

(c) As at December 31, 2021 and 2020, all of the carrying amount of goodwill is allocated across multiple CGUs and the amount so allocated to each unit is not significant.

(d) As at December 31, 2021 and 2020, the Group did not hold any intangible assets whose title is restricted or pledged as security for liabilities.

15 Property, plant and equipment

(CNY million)	Freehold land	Buildings	Machinery	Electronic and other equipment	Motor vehicles	Construction in progress	Investment property	Decoration and leasehold improvements	Total
Cost:									
At January 1, 2020	451	26,736	32,994	62,658	591	13,974	348	23,097	160,849
Exchange adjustments	(24)	(191)	(171)	(1,115)	(12)	(96)	(12)	(257)	(1,878)
Additions	1	2,428	1,708	1,499	25	40,912	25	1,319	47,917
Acquisition of a subsidiary	–	–	–	1	–	–	–	–	1
Transfer from construction in progress	–	2,019	6,067	20,643	13	(31,888)	–	3,146	–
Disposals	–	(19)	(249)	(1,807)	(31)	(2)	–	(317)	(2,425)
Reclassified as assets held for sale	–	–	(1,170)	(869)	–	–	–	–	(2,039)
Hyperinflation adjustments	–	–	1	132	8	7	–	26	174
At December 31, 2020	428	30,973	39,180	81,142	594	22,907	361	27,014	202,599
At January 1, 2021	**428**	**30,973**	**39,180**	**81,142**	**594**	**22,907**	**361**	**27,014**	**202,599**
Exchange adjustments	**(29)**	**(75)**	**(93)**	**(934)**	**(22)**	**(60)**	**(25)**	**(337)**	**(1,575)**
Additions	**16**	**1,673**	**2,610**	**4,552**	**54**	**24,086**	**93**	**1,200**	**34,284**
Transfer from construction in progress	**-**	**4,800**	**8,550**	**10,582**	**5**	**(27,936)**	**-**	**3,999**	**-**
Disposals	**-**	**(65)**	**(1,427)**	**(3,561)**	**(51)**	**(1)**	**-**	**(478)**	**(5,583)**
Hyperinflation adjustments	**-**	**-**	**1**	**75**	**9**	**2**	**-**	**49**	**136**
At December 31, 2021	**415**	**37,306**	**48,821**	**91,856**	**589**	**18,998**	**429**	**31,447**	**229,861**
Accumulated depreciation and impairment:									
At January 1, 2020	–	4,421	11,443	34,336	376	10	98	12,446	63,130
Exchange adjustments	–	(17)	(40)	(531)	(11)	–	(2)	(124)	(725)
Depreciation charge for the year	–	923	4,289	14,346	71	–	6	2,912	22,547
Impairment loss	–	–	1,310	483	–	5	–	189	1,987
Disposals	–	–	(173)	(1,561)	(27)	(2)	–	(219)	(1,982)
Reclassified as assets held for sale	–	–	(443)	(435)	–	–	–	–	(878)
Hyperinflation adjustments	–	–	–	112	4	–	–	26	142
At December 31, 2020	–	5,327	16,386	46,750	413	13	102	15,230	84,221
At January 1, 2021	**-**	**5,327**	**16,386**	**46,750**	**413**	**13**	**102**	**15,230**	**84,221**
Exchange adjustments	**-**	**(7)**	**(29)**	**(631)**	**(11)**	**-**	**(2)**	**(222)**	**(902)**
Depreciation charge for the year	**-**	**1,075**	**4,645**	**18,006**	**58**	**-**	**14**	**3,249**	**27,047**
Impairment loss	**-**	**-**	**34**	**(1)**	**-**	**-**	**-**	**(86)**	**(53)**
Disposals	**-**	**(42)**	**(1,054)**	**(3,150)**	**(47)**	**(7)**	**-**	**(414)**	**(4,714)**
Hyperinflation adjustments	**-**	**-**	**1**	**71**	**4**	**-**	**-**	**52**	**128**
At December 31, 2021	**-**	**6,353**	**19,983**	**61,045**	**417**	**6**	**114**	**17,809**	**105,727**
Carrying amount:									
At December 31, 2021	**415**	**30,953**	**28,838**	**30,811**	**172**	**18,992**	**315**	**13,638**	**124,134**
At December 31, 2020	428	25,646	22,794	34,392	181	22,894	259	11,784	118,378

Based on the use of related assets, the depreciation charge for the year is allocated to Cost of sales, Research and development expenses, Selling and administrative expenses. Impairment losses are charged to Cost of sales and Other income, net in the summary consolidated statement of profit or loss and other comprehensive income.

As at December 31, 2021 and 2020, the Group did not hold any property, plant and equipment as collateral for liabilities or contingent liabilities.

Investment property

The fair value of investment property as at December 31, 2021 is estimated by management to be CNY488 million (2020: CNY380 million).

The fair value of investment property is determined by the Group with reference to market conditions and discounted cash flow forecasts, taking into account current lease agreements on an arm's-length basis.

16 Interests in associates and joint ventures

(CNY million)	2021	2020
Associates	3,864	1,672
Joint ventures	478	167
	4,342	1,839

Associates and joint ventures are accounted for using the equity method. None of the associates and joint ventures is individually significant.

Aggregate carrying amounts and summarised financial information of associates and joint ventures are as follows:

	Associates		Joint ventures	
(CNY million)	2021	2020	2021	2020
Aggregate carrying amount	3,864	1,672	478	167
Aggregate amount of the Group's share of those associates' and joint ventures'				
Profit for the year	12	170	28	–
Total comprehensive income	12	170	28	–

17 Other investments and derivatives

(CNY million)	Note	2021	2020
Financial assets at amortised cost			
Investment funds	(i)	–	2,000
Fixed deposits		89,340	34,375
Debt securities	(ii)	4,800	4,595
		94,140	40,970
Less: Loss allowances		(7)	(4)
		94,133	40,966
Financial assets mandatorily at FVPL			
Investment funds	(i)	193,325	143,769
Equity securities and beneficiary rights		13,273	1,097
Compound financial instruments	(iii)	2,998	973
Foreign exchange derivatives		244	224
		209,840	146,063
Financial assets at FVOCI			
Debt securities	(ii)	5,396	3,272
Equity securities	(iv)	9,008	4,635
		14,404	7,907
		318,377	194,936
Non-current portion		30,194	10,244
Current portion		288,183	184,692
		318,377	194,936

(i) Investment funds comprise short-term investments in structured deposits, bond funds, money market funds and variable net asset value wealth management products. Investment funds with guaranteed principal and interest are measured at amortised cost where the Group intends to hold them to maturity; other investment funds are measured at FVPL where the Group intends to sell them or where the investments do not give rise to cash flows which are solely principal and interest.

(ii) Debt securities comprise investments in fixed rate bonds, floating rate notes, certificates of deposit, commercial papers, etc. Debt securities are measured at amortised cost where the Group intends to hold them to collect contractual cash flows. Other debt securities are classified as FVOCI since they are held to collect and for sale, and also give rise to cash flows which are solely principal and interest. The loss allowances on debt securities at FVOCI amounted to CNY2 million as at December 31, 2021 (2020: CNY723 thousand).

(iii) Compound financial instruments comprise equity instruments with redemption options and convertible notes which are designated at FVPL.

(iv) The Group designated equity investments at FVOCI where they are considered strategic to the Group and meet the definition of equity from the issuers' perspective. Dividend income received on these investments amounted to CNY15 million (2020: CNY2 million) for the year ended December 31, 2021.

Certain equity investments at FVOCI were disposed of during the year ended December 31, 2021, and the corresponding cumulative gain in fair value reserve of CNY362 million was transferred to retained earnings upon disposal of these investments.

(v) As at December 31, 2021 and 2020, the Group did not hold any investments pledged as collateral for liabilities or contingent liabilities.

18 Deferred tax assets/(liabilities)

(a) Components of recognised deferred tax assets/(liabilities)

CNY million	2021	2020
Accruals, defined benefit obligations, refund liabilities and unperformed obligations	5,161	6,062
Fair value changes of financial assets at FVOCI	(1,453)	(725)
Depreciation and impairment of property, plant and equipment	(3,175)	(2,139)
Unrealised profit	3,693	3,801
Tax losses	2,343	1,726
Undistributed profits of subsidiaries	(1,126)	(1,034)
Write-down of inventories	613	617
Provision for loss allowances	358	353
Others	(356)	166
Total	6,058	8,827

Reconciliation to the summary consolidated statement of financial position:

(CNY million)	2021	2020
Net deferred tax assets recognised in the summary consolidated statement of financial position	10,340	10,748
Net deferred tax liabilities recognised in the summary consolidated statement of financial position	(4,282)	(1,921)
	6,058	8,827

(b) Deferred tax assets not recognised

Deferred tax assets were not recognised in relation to certain unused tax losses, deductible temporary differences and unused tax credits in accordance with the accounting policy set out in note 3(n).

As at December 31, 2021, deferred tax assets have not been recognised in respect of unused tax losses amounting to CNY79,223 million (2020: CNY32,068 million) and deductible temporary differences amounting to CNY183,404 million (2020: CNY155,083 million); additionally, unused tax credits relating to overseas withholding income tax and research and development expenditure totalling CNY1,079 million (2020: CNY1,739 million) have not been recognised as deferred tax assets.

As permitted by the relevant income tax laws in the PRC, a group entity chose to utilise overseas withholding tax credits from current and previous years against taxable income from its foreign operations in the current year, in priority to utilising unused tax losses. This resulted in a decrease in unrecognised overseas withholding tax credits as at December 31, 2021.

19 Inventories and other contract costs

(CNY million)	2021	2020
Inventories		
Raw materials	91,620	89,196
Manufacturing work in progress	23,191	24,869
Finished goods and consumables	30,557	34,384
Dispatched goods and contract work in progress	12,730	12,534
Other inventories	2,980	6,320
	161,078	167,303
Other contract costs	228	364
	161,306	167,667

As at December 31, 2021 and 2020, the Group did not hold any inventories pledged as collateral for liabilities or contingent liabilities.

(a) Amount of inventories recognised as an expense and included in profit or loss:

(CNY million)	2021	2020
Carrying amount of inventories sold	250,942	460,028
Write-down of inventories	1,387	11,308
	252,329	471,336

The Group wrote down certain raw materials, finished goods and consumables that may not be capable of being used in production as a result of the Events disclosed in note 5(c). The write-down is included in Cost of sales.

(b) Contract costs

The Group's contract costs represent contract fulfilment costs incurred to deliver services to customers, which will be charged to Cost of sales when the corresponding performance obligations are satisfied.

No provision for impairment was required on contract costs as at December 31, 2021 or 2020.

20 Contract assets

(CNY million)	2021	2020
Gross carrying amount	52,810	53,924
Less: loss allowances (note 21(b))	(266)	(322)
	52,544	53,602
Non-current portion	1,207	1,648
Current portion	51,337	51,954
	52,544	53,602

Contract assets relate to the Group's rights to consideration for performance obligations that have been satisfied but not billed, primarily from Carrier Business and Enterprise Business contracts. Contract assets are transferred to receivables when the right to payment becomes unconditional, other than the passage of time. This usually occurs when the Group issues an invoice to the customer in accordance with the billing milestones agreed in the contract, which are generally upon passing of the product acceptance tests.

Significant changes in the gross balances of contract assets during the year are as follows:

(CNY million)	2021	2020
At January 1	53,924	53,389
Addition during the year	49,025	50,497
Transfers to receivables or reversal during the year	(48,765)	(48,375)
Reclassified as assets held for sale	–	(1)
Exchange adjustments	(1,374)	(1,586)
At December 31	52,810	53,924

21 Trade and bills receivable

(CNY million)	Note	2021	2020
Trade receivables			
Trade receivables from third parties	(i)	72,063	74,999
Trade receivables from related parties	31	179	27
		72,242	75,026
Bills receivable			
Bank acceptance bills		1,290	689
Commercial acceptance bills		4,807	2,140
Letters of credit		1,008	849
	(ii)	7,105	3,678
		79,347	78,704
Non-current portion		3,113	3,963
Current portion		76,234	74,741
		79,347	78,704

(i) As at December 31, 2021, the Group's trade receivables that may be sold through reverse factoring arrangements amounted to CNY6,085 million (2020: CNY6,344 million). These trade receivables are managed in a business model whose objective is achieved by both collection and sale, and are therefore measured at FVOCI.

(ii) The Group's bills receivable are due within twelve months from issuance date.

(a) Ageing analysis

At the end of the reporting period, the ageing analysis of trade receivables is as follows:

(CNY million)	2021	2020
Not past due	55,893	63,903
Less than 90 days past due	12,693	8,349
90 days to 1 year past due	4,900	4,548
1 year and above past due	1,611	1,631
	75,097	78,431
Less: loss allowances	(2,855)	(3,405)
	72,242	75,026

Trade receivables are generally due within 30 days from the date of billing.

(b) Loss allowances of trade receivables and contract assets

Loss allowances in respect of trade receivables and contract assets are recorded using an allowance account unless the Group is satisfied that there is no reasonable expectation of further recoveries in which case the receivables are written off (see note 3(e)(i)).

The movement in loss allowances in respect of trade receivables and contract assets during the year is as follows:

(CNY million)	Note	2021	2020
At January 1		3,762	3,953
Loss allowances (reversals)/recognised		(423)	266
Uncollectible amounts written-off		(125)	(233)
Collection of previously written-off debtors		28	31
Reclassified as assets held for sale		–	(2)
Disposal of a subsidiary		–	(2)
Exchange adjustments		(94)	(251)
At December 31		3,148	3,762
Representing loss allowance			
– on trade receivables		2,855	3,405
– on contract assets	20	266	322
– included in OCI on trade receivables at FVOCI		27	35
Total		3,148	3,762

Loss allowances recognised on trade receivables and contract assets are included in Selling and administrative expenses.

As at December 31, 2021, the loss allowances of trade receivables and contract assets decreased mainly due to the reversal during the year, out of which CNY251 million was relating to certain individually assessed trade receivables due from customers in Southern Africa.

(c) Transferred trade receivables not derecognised in their entirety

As at December 31, 2021, the Group's undue trade receivables with the face value of CNY13 million (2020: CNY63 million) have been transferred to banks and the Group received the corresponding remittance of CNY13 million (2020: CNY63 million). As these transactions are with recourse, the Group therefore has retained substantially all the risks and rewards and continues to recognise these trade receivables and the relevant financing as loans and borrowings (note 24).

As at December 31, 2021, the Group's trade receivables with the carrying amount of CNY3,092 million (2020: CNY3,162 million) have been transferred to banks. These trade receivables are covered by insurance policies issued by third party credit insurance agencies with the transferees as the loss payees. In these transactions, the Group retains risk not covered by the insurance, therefore the Group has neither transferred nor retained substantially all the risks and rewards in relation to the trade receivables and the Group is considered to have retained control of these trade receivables as the transferees have no practical ability to sell these trade receivables without the Group's consent. As such, the Group continues to recognise the transferred trade receivables of CNY595 million (2020: CNY695 million) and associated liabilities of CNY641 million (2020: CNY750 million) to the extent of its continuing involvement. The associated liabilities are included in Other liabilities. As at December 31, 2021, loss allowances of CNY419 million (2020: CNY476 million) were made on these transferred receivables.

(d) Collateral

Except as disclosed in note 21(c), as at December 31, 2021 and 2020, the Group did not hold any other trade and bills receivable pledged as collateral for liabilities or contingent liabilities.

22 Other assets

(CNY million)	Note	2021	2020
Advance payments to suppliers		25,386	8,757
Tax receivables on unbilled deliveries	(i)	4,988	4,947
Income tax related assets		1,612	2,947
Other tax related assets		10,563	10,680
Pledged and restricted deposits with banks		1,709	2,305
Other third party receivables		24,447	10,943
Other long-term deferred assets		744	404
Related party receivables	31	263	396
Prepayment for acquisition of long-term assets		4,703	4,889
Assets held for sale		1	4,222
		74,416	50,490
Non-current portion		10,493	11,048
Current portion		63,923	39,442
		74,416	50,490

(i) Under certain tax regulations, value added tax (VAT) and other surcharges are payable at the earlier of delivery of goods and services or issuance of VAT invoices. These balances represent VAT and surcharge receivable from customers on unbilled deliveries and will be reclassified to trade receivables upon billing.

23 Cash and cash equivalents

(CNY million)	2021	2020
Cash on hand	6	6
Deposits with banks and other financial institutions	122,276	162,317
Highly liquid short-term investments	5,931	10,424
Deposits with third party merchants	182	151
Cash and cash equivalents in the summary consolidated statement of financial position	128,395	172,898
Reclassified as assets held for sale	–	152
Cash and cash equivalents in the summary consolidated statement of cash flows	128,395	173,050

Short-term investments included in cash and cash equivalents are highly liquid, readily convertible into known amounts of cash and subject to an insignificant risk of changes in value. As at December 31, 2021, these short-term investments comprised reverse repurchase agreements with maturities of less than three months of CNY3,300 million, money market funds of CNY2,591 million and fixed income broker structured notes of CNY40 million. Money market funds comprise investments in short-term debt securities which have constant or low volatility net asset values and are measured at FVPL. The fixed income broker structured notes are securities issued by Chinese security companies with guaranteed principal and fixed income.

As at December 31, 2021, cash and cash equivalents of CNY531 million (2020: CNY963 million) were held in countries where exchange controls or other legal restrictions were in force.

As at December 31, 2021, the Group held cash equivalent to CNY3,671 million (2020: CNY1,555 million) in multicurrency pooling arrangements to meet its day to day cash requirements and also to economically hedge foreign exchange rate movements arising from foreign currency cash flows. The facilities allow participating subsidiaries to place deposits and borrow funds from the counterparty banks in any freely convertible currency subject to the overall balance on the pools being positive.

As at December 31, 2021 and 2020, the Group did not hold any cash and cash equivalents pledged as collateral for liabilities or contingent liabilities.

24 Loans and borrowings

Contractual terms of the Group's loans and borrowings are summarised below.

(CNY million)	2021	2020
Short-term loans and borrowings:		
– Unsecured	138	177
Long-term loans and borrowings:		
– Intra-group guaranteed	421	691
– Trade receivables financing (note 21(c))	13	63
– Unsecured	122,963	96,691
– Corporate bonds	51,565	44,189
	174,962	141,634
	175,100	141,811
Non-current portion	162,276	141,270
Current portion	12,824	541
	175,100	141,811

Intra-group guaranteed loans are external borrowings which have been raised by one group entity but contractual payments of principal and interest are guaranteed by another group entity.

Terms and repayment schedule

A summary of the main terms and conditions of outstanding loans and borrowings are as follows:

At December 31, 2021

(CNY million)		Interest rate	Total	1 year or less	1 to 5 years	Over 5 years
Intra-group guaranteed bank loans:						
South African Rand (ZAR)	variable	5.43% p.a.	57	57	–	–
CNY	variable	4.31% p.a.	364	159	205	–
			421	216	205	–
Trade receivables financing:						
United States Dollar (USD)	variable	3.48% p.a.	13	5	6	2
Unsecured bank loans:						
CNY	variable	3.65% ~ 4.55% p.a.	88,107	95	49,143	38,869
Euro (EUR)	variable	0.80% ~ 1.00% p.a.	5,116	–	1,900	3,216
Hungarian Forint (HUF)	fixed	4.36% p.a.	55	–	–	55
Hong Kong Dollar (HKD)	variable	1.00% ~ 1.54% p.a.	20,157	–	12,045	8,112
Saudi Arabian Riyal (SAR)	variable	2.89% ~ 3.90% p.a.	134	134	–	–
Mexican Peso (MXN)	fixed	16.40% p.a.	4	4	–	–
USD	variable	1.11% ~ 1.13% p.a.	9,528	–	9,528	–
			123,101	233	72,616	50,252
Corporate bonds:						
CNY	fixed	3.09% ~ 3.65% p.a.	22,965	5,995	16,970	–
USD	fixed	3.25% ~ 4.13% p.a.	28,600	6,375	19,060	3,165
			51,565	12,370	36,030	3,165
			175,100	12,824	108,857	53,419

At December 31, 2020

(CNY million)		Interest rate	Total	1 year or less	1 to 5 years	Over 5 years
Intra-group guaranteed bank loans:						
ZAR	variable	5.10% p.a.	123	59	64	–
CNY	variable	4.41% ~ 4.90% p.a.	568	205	363	–
			691	264	427	–
Trade receivables financing:						
USD	variable	1.84% ~ 4.41% p.a.	63	5	54	4
Unsecured bank loans:						
CNY	variable	3.74% ~ 4.75% p.a.	57,264	95	49,239	7,930
Russian Ruble (RUB)	variable	7.50% ~ 9.00% p.a.	16	16	–	–
EUR	fixed	0.50% p.a.	1	–	1	–
EUR	variable	0.75% ~ 1.00% p.a.	4,482	119	1,846	2,517
HUF	fixed	4.36% p.a.	70	–	–	70
HKD	variable	1.20% ~ 1.67% p.a.	15,548	–	7,449	8,099
SAR	variable	2.61% ~ 3.90% p.a.	42	42	–	–
USD	variable	1.17% ~ 1.19% p.a.	19,445	–	19,445	–
			96,868	272	77,980	18,616
Corporate bonds:						
CNY	fixed	3.09% ~ 3.49% p.a.	14,970	–	14,970	–
USD	fixed	3.25% ~ 4.13% p.a.	29,219	–	12,990	16,229
			44,189	–	27,960	16,229
			141,811	541	106,421	34,849

Certain of the Group's banking facilities are subject to compliance with covenants relating to financial ratios. In the event of breach, the drawn down facilities would become payable on demand. The Group regularly monitors its compliance with these covenants. As at December 31, 2021 and 2020, no covenants had been breached.

Corporate bonds

The Group's CNY and USD corporate bonds were issued by the Company and its wholly-owned subsidiaries respectively. Main terms of the outstanding corporate bonds are as follows:

Corporate bond	Issue date	Principal amount million	Interest rate per annum	Term
USD bond	May 19, 2015	1,000	4.125%	10 years
USD bond	May 6, 2016	2,000	4.125%	10 years
USD bond	February 21, 2017	1,000	3.250%	5 years
USD bond	February 21, 2017	500	4.000%	10 years
CNY medium-term note	October 24, 2019	3,000	3.480%	3 years
CNY medium-term note	November 7, 2019	3,000	3.490%	3 years
CNY medium-term note	March 6, 2020	2,000	3.240%	5 years
CNY medium-term note	March 23, 2020	2,000	3.380%	5 years
CNY medium-term note	April 24, 2020	2,000	3.090%	5 years
CNY medium-term note	June 24, 2020	3,000	3.280%	3 years
CNY medium-term note	January 29, 2021	4,000	3.580%	3 years
CNY medium-term note	March 5, 2021	4,000	3.650%	3 years

USD bonds are fully guaranteed by the Company.

Reconciliation of movements of major liabilities to cash flows arising from financing activities

Year ended December 31, 2021

Related liabilities (CNY million)	Other loans and borrowings	Corporate bonds	Long-term assets instalments	Lease liabilities	Interest payable related to financing activities
Balance at January 1, 2021	97,622	44,189	3,261	9,650	591
Proceeds from borrowings	55,063	10,976	–	–	–
Repayment of borrowings	(26,233)	(3,000)	–	–	–
Long-term assets acquired	–	–	58	–	–
Instalment payments	–	–	(1,248)	–	–
New leases	–	–	–	3,557	–
Payment of lease liabilities	–	–	–	(3,088)	–
Interest incurred during the year	–	–	–	381	5,729
Interest paid	–	–	–	(247)	(5,360)
Amortisation of capitalised interests and transaction costs	123	47	66	–	–
Non-cash transactions (note)	(1,322)	–	–	–	–
Termination of leases	–	–	–	(181)	–
Exchange adjustments	(1,718)	(647)	(139)	(568)	(74)
Balance at December 31, 2021	123,535	51,565	1,998	9,504	886

Year ended December 31, 2020

Related liabilities (CNY million)	Other loans and borrowings	Corporate bonds	Long-term assets instalments	Lease liabilities	Interest payable related to financing activities
Balance at January 1, 2020	74,908	37,254	3,674	9,687	518
Proceeds from borrowings	62,946	8,968	–	–	–
Repayment of borrowings	(32,397)	–	–	–	–
Long-term assets acquired	–	–	1,179	–	–
Instalment payments	–	–	(1,738)	–	–
New leases	–	–	–	3,201	–
Payment of lease liabilities	–	–	–	(3,063)	–
Interest incurred during the year	–	–	–	420	4,525
Interest paid	–	–	–	(251)	(4,403)
Amortisation of capitalised interests and transaction costs	92	39	132	–	–
Issuance cost payable	–	8	–	–	–
Non-cash transactions (note)	(5,110)	–	–	–	–
Termination of leases	–	–	–	(39)	–
Reclassified as liabilities directly associated with the assets held for sale	(95)	–	–	(19)	–
Exchange adjustments	(2,722)	(2,080)	14	(286)	(49)
Balance at December 31, 2020	97,622	44,189	3,261	9,650	591

Note: Under certain financing arrangements, the Group's entitlement to consideration from customer contracts is transferred for cash to financial institutions before the Group obtains unconditional rights, giving rise to financial liabilities included in loans and borrowings. The Group derecognised the relevant loans and borrowings under these arrangements upon becoming unconditionally entitled to the relevant contract consideration.

25 Trade and bills payable

(CNY million)	Note	2021	2020
Trade payables			
Related party trade payables	31	839	702
Third party trade payables		80,855	74,163
		81,694	74,865
Bills payable			
Bank acceptance bills		–	645
Letters of credit payable		–	3,467
		–	4,112
		81,694	78,977

26 Contract liabilities

(CNY million)	2021	2020
Consideration received in advance of performance	10,686	14,561
Billing in advance of performance	67,463	57,387
	78,149	71,948

Significant changes in contract liabilities during the year were as follows:

(CNY million)	2021	2020
At January 1	71,948	69,327
Revenue recognised that was included in the contract liability balance at the beginning of the year	(48,843)	(51,472)
Increases due to cash received or billing for unperformed obligations	57,552	56,477
Reclassified as liabilities directly associated with the assets held for sale	–	(141)
Exchange adjustments	(2,508)	(2,243)
At December 31	78,149	71,948

27 Other liabilities

(CNY million)	Note	2021	2020
Accrued expenses		26,522	33,098
Refund liabilities	(i)	13,092	18,430
Other taxes payable		11,256	9,899
Due in relation to property, plant and equipment		8,003	9,213
Due in relation to intangible assets		2,219	3,954
Foreign exchange derivatives		210	205
Others		38,163	33,001
Liabilities directly associated with the assets held for sale		–	823
		99,465	108,623
Non-current portion		2,754	4,315
Current portion		96,711	104,308
		99,465	108,623

(i) Refund liabilities mainly comprise the rebates and other sales-based incentives to customers.

28 Provisions

(CNY million)	Note	2021	2020
Provision for warranties	(b)	3,269	5,023
Onerous contracts with customers		722	1,049
Onerous contracts with suppliers	(c)	11,031	15,417
Others	(d)	2,421	2,803
		17,443	24,292

(a) Movement in provisions during the year is shown as below:

(CNY million)	Provision for warranties	Onerous contracts with customers	Onerous contracts with suppliers	Others	Total
At January 1, 2021	5,023	1,049	15,417	2,803	24,292
Provisions made/(reversals)	2,344	(62)	(3,722)	16	(1,424)
Provisions utilised	(3,963)	(257)	(663)	(162)	(5,045)
Exchange adjustments	(135)	(8)	(1)	(236)	(380)
At December 31, 2021	3,269	722	11,031	2,421	17,443

(b) Provision for warranties

Provision for warranties relates mainly to products sold during the year and is determined based on estimates made from historical warranty data associated with similar products and the amount of products covered by warranty at the end of the reporting period and their corresponding remaining warranty periods. Most claims are expected to be settled within one year.

(c) Provision for onerous contracts with suppliers

The Group has entered into certain non-cancellable procurement agreements in its normal course of business. As a result of the Events disclosed in note 5(c), certain items under these procurement agreements may not be capable of being used in production and provision has been made for the estimated losses arising from fulfilling, amending or terminating relevant agreements in accordance with the accounting policy set out in note 3(o). The provision is charged to Cost of sales.

(d) Others

Others are mainly provisions for outstanding claims, cases and disputes.

29 Leases

(a) As a lessee

The Group leases office premises, staff apartments, warehouses, production equipment and motor vehicles in its normal course of business. These leases typically run for an initial period of one to ten years. Some property leases contain extension options after the contract period and only a limited number of leases comprise variable payments. The Group also holds land use rights in the PRC, which are recognised as right-of-use assets at the date the Group became entitled to the rights.

Information about leases for which the Group is a lessee is presented below.

(i) Right-of-use assets

(CNY million)	Land use rights	Buildings	Motor vehicles and others	Total
Cost:				
At January 1, 2020	9,189	10,991	950	21,130
Exchange adjustments	(8)	(408)	(39)	(455)
Additions	1,915	2,659	589	5,163
Transfer to investment property	(55)	–	–	(55)
Disposal of a subsidiary	–	(2)	–	(2)
Derecognition	(47)	(643)	(94)	(784)
Reclassified as assets held for sale	–	(23)	–	(23)
Hyperinflation adjustments	–	47	8	55
At December 31, 2020	10,994	12,621	1,414	25,029
At January 1, 2021	**10,994**	**12,621**	**1,414**	**25,029**
Exchange adjustments	**2**	**(650)**	**(74)**	**(722)**
Additions	**3,681**	**2,973**	**583**	**7,237**
Derecognition	**–**	**(1,493)**	**(316)**	**(1,809)**
Hyperinflation adjustments	**–**	**62**	**–**	**62**
At December 31, 2021	**14,677**	**13,513**	**1,607**	**29,797**
Accumulated depreciation and impairment:				
At January 1, 2020	1,014	2,349	350	3,713
Exchange adjustments	–	(140)	(20)	(160)
Depreciation charge for the year	205	2,769	479	3,453
Impairment loss	–	220	4	224
Disposal of a subsidiary	–	(1)	–	(1)
Derecognition	(1)	(560)	(93)	(654)
Reclassified as assets held for sale	–	(6)	–	(6)
Hyperinflation adjustments	–	28	9	37
At December 31, 2020	1,218	4,659	729	6,606
At January 1, 2021	**1,218**	**4,659**	**729**	**6,606**
Exchange adjustments	**–**	**(267)**	**(47)**	**(314)**
Depreciation charge for the year	**240**	**2,713**	**468**	**3,421**
Impairment loss	**–**	**(26)**	**–**	**(26)**
Derecognition	**–**	**(1,290)**	**(315)**	**(1,605)**
Hyperinflation adjustments	**–**	**49**	**–**	**49**
At December 31, 2021	**1,458**	**5,838**	**835**	**8,131**
Carrying amount:				
At December 31, 2021	**13,219**	**7,675**	**772**	**21,666**
At December 31, 2020	9,776	7,962	685	18,423

During the years ended December 31, 2021 and 2020, certain right-of-use assets were derecognised as a result of lease cancellation or entering into finance sub-leases.

(ii) Amounts recognised in profit or loss

(CNY million)	Note	2021	2020
Interest expenses on lease liabilities	11	381	420
Expenses relating to short-term leases		681	913
Expenses relating to leases of low-value assets, excluding short-term leases of low-value assets		33	38
Variable lease payments not included in the measurement of lease liabilities		14	9
Income from subleasing right-of-use assets		75	58

(iii) Amounts recognised in summary consolidated statement of cash flows

(CNY million)	2021	2020
Total cash outflow for leases	5,923	7,715

(b) As a lessor

Most of the Group's leases are operating leases under which certain properties are leased out (see note 8).

As at December 31, a maturity analysis of undiscounted lease payments to be received after the reporting date is as follows:

(CNY million)	2021	2020
Within 1 year	80	69
After 1 year but within 2 years	49	57
After 2 years but within 3 years	31	26
After 3 years but within 4 years	12	12
After 4 years but within 5 years	11	9
After 5 years	66	72
	249	245

30 Capital commitments

(CNY million)	2021	2020
Contracted for acquisition and construction of long-term assets	16,430	9,641
Investment commitment	1,939	386
Total	18,369	10,027

31 Related parties

A related party is a person or an entity that has control or joint control or significant influence over the Group, or is a member of its key management personnel, or is member of the Group, including joint ventures and associates.

Transactions between the Group and related parties are conducted on an arm's length basis. Outstanding receivables and payables with related parties are collected or paid in accordance with contracts, without additional interest or collateral.

Details of the Group's significant transactions with related parties are set out below.

Transactions with related parties

(CNY million)	Associates	
	2021	2020
Sales of goods and services	**1,588**	2,567
Purchase of goods and services	**2,256**	1,422

Balances with related parties

(CNY million)	Associates	
	2021	2020
Trade receivables	**179**	27
Contract assets	**8**	7
Other assets	**263**	396
Trade payables	**839**	702
Contract liabilities	**118**	99
Other liabilities	**222**	470

32 Group enterprises

(a) Parent and ultimate controlling party

The Group's ultimate controlling party is the Union of Huawei Investment & Holding Co., Ltd.

(b) Major subsidiaries

Name of subsidiary	Place of incorporation	Proportion of ownership interest		Principal activities
		2021	2020	
Huawei Technologies Co., Ltd.	Mainland China	**100%**	100%	Development, manufacture and sale of telecommunication and related products and provision of support and maintenance services
Huawei Device Co., Ltd.	Mainland China	**100%**	100%	Development, manufacture and sale of mobile communication products and ancillaries
Huawei Machine Co., Ltd.	Mainland China	**100%**	100%	Manufacture of telecommunication products
Shanghai Huawei Technologies Co., Ltd.	Mainland China	**100%**	100%	Development of telecommunication products
Beijing Huawei Digital Technologies Co., Ltd.	Mainland China	**100%**	100%	Development of telecommunication products
Huawei Tech. Investment Co., Limited	Hong Kong, China	**100%**	100%	Trading of materials
Huawei International Co. Limited	Hong Kong, China	**100%**	100%	Distribution of telecommunication products
Huawei International Pte. Ltd.	Singapore	**100%**	100%	Distribution of telecommunication products
Huawei Technologies Japan K.K.	Japan	**100%**	100%	Development and sale of telecommunication products and ancillary services
Huawei Technologies Deutschland GmbH	Germany	**100%**	100%	Development and sale of telecommunication products and ancillary services
Huawei Device (Shenzhen) Co., Ltd.	Mainland China	**100%**	100%	Development, manufacture and sale of mobile communication products and ancillaries
Huawei Device (Hong Kong) Co., Limited	Hong Kong, China	**100%**	100%	Sale and related services of mobile communication products and ancillaries
Huawei Technical Service Co., Ltd	Mainland China	**100%**	100%	Installation and maintenance of telecommunication products and ancillaries, including consultancy
Huawei Software Technologies Co., Ltd.	Mainland China	**100%**	100%	Development, manufacture and sale of telecommunication software and related products and services. Sale of cloud business
HiSilicon Technologies Co., Ltd.	Mainland China	**100%**	100%	Development and sale of semiconductors
HiSilicon (Shanghai) Technologies CO., LIMITED	Mainland China	**100%**	100%	Development and sale of semiconductors
HiSilicon Optoelectronics Co., Ltd.	Mainland China	**100%**	100%	Development, manufacture and sale of optoelectronic products related to information technology
Huawei Digital Technologies (Suzhou) Co., Ltd.	Mainland China	**100%**	100%	Development and sale of inverter
Huawei Technologies Coöperatief U.A.	Netherlands	**100%**	100%	Intermediate parent company for certain overseas subsidiaries

(c) Acquisition of a subsidiary

The Group did not acquire any subsidiary for the year ended December 31, 2021.

33 Contingent liabilities

(a) On September 2, 2014 (dates in note 33 are in U.S. time), T-Mobile USA, Inc. ("T-Mobile") filed a civil action against the Group's subsidiary, Huawei Device USA Inc., in relation to the alleged misappropriation of trade secrets relating to certain of T-Mobile's mobile phone test equipment. The two parties reached a settlement on November 8, 2017.

On January 16, 2019, the United States Department of Justice issued an indictment against Huawei Device USA Inc. and Huawei Device Co., Ltd., containing 10 charges in relation to the alleged theft of trade secrets relating to the above equipment and alleged wire fraud and obstruction of justice. The charges relate to the years from 2012 to 2014.

(b) On January 24, 2019, the United States Department of Justice issued an indictment against Huawei Technologies Co., Ltd., Huawei Device USA Inc. and other parties. The indictment contains 13 charges in relation to alleged bank and wire fraud, violation of the International Emergency Economic Powers Act of the United States with respect to certain transactions involving Iran, and associated matters.

On February 13, 2020, the United States Department of Justice issued a superseding indictment which, on top of the charges filed on January 24, 2019, added Huawei Device Co., Ltd. and Futurewei Technologies, Inc. as defendants, and added 3 new charges of alleged racketeering conspiracy, alleged conspiracy to steal trade secrets and alleged conspiracy to commit wire fraud. The superseding indictment also includes new allegations including the defendants' alleged involvement in transactions involving North Korea and Iran.

The Group has engaged external counsels to assist it in respect of the matters referred to in (a) and (b) above. With regard to the matter referred to in (a) above, on March 17, 2020, the US Government and the defendants filed a motion requesting the trial to be continued until October 18, 2021 due to the complexity of the charges contained in this indictment, its overlapping with the superseding indictment issued on February 13, 2020 referred to in (b) above and the difficulties for the parties to prepare for the trial as a result of the COVID-19 pandemic. The judge granted the request for continuance and reset the trial date to October 18, 2021. As a result of the continuing outbreak of the pandemic, the US Government and the defendants filed a further motion on February 23, 2021 requesting the trial to be continued until October 17, 2022, and the judge granted the request on February 24, 2021. On February 18, 2022, the US Government and the defendants filed a further motion requesting the trial to be continued until October 16, 2023, and the judge granted the request on February 22, 2022. With regard to the matter referred to in (b) above, it is currently in the process of pre-trial discovery and the trial date has not yet be scheduled.

Given the relatively early stage of these proceedings, as at the date of approval of these financial statements, management considers that both the timing and the outcome of these matters are inherently uncertain, and that the amount of any possible obligation of the Group, if any, cannot be reliably estimated. Accordingly, these indictments give rise to contingent liabilities for the Group and no provision has been made in this regard in these financial statements. It is also not practicable at this stage for the Group to disclose an estimate of the possible future financial effect on the Group's financial statements of these matters.

34 Sale of business and subsidiaries

(a) Honor business

Pursuant to the agreement entered into by the Group and Shenzhen Zhixin New Information Technology Co., Ltd. (Shenzhen Zhixin) in 2020 to sell the entire Honor business (one of the important brands and components of the Group's Consumer Business) to Shenzhen Zhixin, transfer of Honor business related assets and liabilities was completed in 2021. The relevant assets and liabilities were mainly included in Assets held for sale within Other assets and Liabilities directly associated with the assets held for sale within Other liabilities as at December 31, 2020. According to the contract terms, Shenzhen Zhixin should pay the consideration in instalments, and there exists uncertainty over the ultimate consideration the Group is entitled to.

(b) xFusion Digital Technologies Co., Ltd. (xFusion)

In 2021, the Group sold the entire interests in its wholly owned subsidiary xFusion to a third party buyer, and transfer of related assets and liabilities was completed within the same year. xFusion and its subsidiaries are engaged in manufacturing and sales of server products. Assets and liabilities other than cash or cash equivalents in the subsidiaries disposed of mainly represented inventories, machinery and equipment and trade and other payables and were not material for the Group. According to the contract terms and transaction arrangement, the buyer should pay the consideration in instalments, and there exists uncertainty over the ultimate consideration the Group is entitled to.

For the year ended December 31, 2021, consideration received for both transactions, net of cash disposed of, was presented within investing cash flows. The disposal gain recorded in both transactions was included in Gain on disposal of subsidiaries and businesses within Other income, net (note 9). The financial instruments arising from both transactions, being a financial asset and a financial liability respectively, were measured at fair value through profit or loss and included in Other assets and Other liabilities as at December 31, 2021.

35 Subsequent events

(a) In January and February 2022, the Company issued two tranches of 3-year medium-term notes with an aggregate principal amount of CNY8,000 million and one tranche of 5-year medium-term note with principal amount of CNY3,000 million.

(b) In March 2022, the Company issued a super short-term commercial paper with principal amount of CNY3,000 million.

(c) Subsequent to December 31, 2021 and up to the date of approval of these financial statements, the Group has drawn down accumulatively CNY7,033 million from a credit facility entered into by Huawei Technologies Co., Ltd., a wholly-owned subsidiary of the Group.

36 Comparative figures

The presentation of certain prior year comparative figures has been adjusted to reflect current year presentation requirements. None of these changes were material.

Risk Factors

Huawei's risk factors refer to factors that could make the company's ultimate achievement of its business objectives uncertain. Such factors are identified in our strategic plans, business models, financial systems, or the external environment. In this section, we will detail the major risk factors that could significantly impact the company's survival, reputation, financial position, operating results, or long-term prospects.

Huawei's Risk Management System

Huawei uses an Enterprise Risk Management (ERM) system that accounts for our unique organizational structure and operating model, in line with the Committee of Sponsoring Organizations of the Treadway Commission (COSO) framework and referencing the ISO 31000 risk management standard. Under this system, we have defined a robust set of ERM policies and processes, continuously refined our ERM organizations and operating mechanisms, and ramped up efforts to assess risk management. Huawei's ERM system ensures the following:

- The Board of Directors approves the company's plans for managing major risks and crises, and handles unexpected major incidents.

- Business managers, as the primary risk owners in their respective business domains, proactively identify and manage risks to ensure they remain at an acceptable level.

At Huawei, risk management factors are incorporated into both strategic planning and business planning processes: Business departments and field offices systematically identify and assess risks during strategic planning, formulate appropriate countermeasures in their annual business plans, and then monitor and report on high-priority risks during routine operations. Huawei ensures uninterrupted business operations by identifying major risk factors during strategic decision making and planning, and taking necessary measures to control risks during business planning and execution.

Strategic Risks

Digital technology is reshaping the world around us. Humankind will enter an intelligent world over the next two to three decades. We want to make sure that this future is inclusive so that everyone can benefit from the changes brought by digital technology.

Mature commercial applications of new technologies – particularly 5G, cloud computing, AI, and blockchain – are speeding up the digital transformation of all industries. This presents enormous opportunities.

That said, Huawei's external environment is more volatile and complicated than ever, and the COVID-19 pandemic has changed people's lives and hit major industries, including aviation and logistics, very hard. The global economy is struggling, and the world must now face the formidable challenge of deciding how globalization should progress. In the long term, the US government will continue to suppress the development of leading technologies, making it difficult for Huawei to survive and thrive.

The digital economy has already become the world's main engine for growth, and green and low-carbon development is key to sustain this growth. This combination of industry digitalization and green development will present tremendous growth opportunities in both the information processing and communications industries. Huawei will focus on leveraging its ICT strengths to enable the digital transformation of all industries, and ultimately bring digital to every person, home and organization for a fully connected, intelligent world.

Going forward, we will remain committed to embracing and leveraging a global supply chain to hone our competitive edge. In addition to developing leading products, we need to extend our roots deep into the soil and build a diverse ecosystem that does not depend on any one country. We also need to go beyond the limits of the skies above us, striving for theoretical breakthroughs, technological inventions, and groundbreaking products and business models. We will keep enhancing our software engineering capabilities, pressing ahead with our US$2 billion five-year budget for building quality, trustworthy products and solutions.

External Risks

Macro environment: Economic recovery efforts are expected to gain traction in 2022, but growth may slow down due to increasing uncertainty. New variants of COVID-19 will likely hinder industry's ability to ease supply chain bottlenecks and reinvigorate the service sector. Fiscal policies will continue to tighten, and support for the real economy may weaken. With inflation driven high, unexpectedly high increases in interest rates will put countries with high debt under huge pressure. Geopolitical tensions and protectionism will continue to undermine business sentiment and investor confidence. Given this uncertain business environment, Huawei's field offices and business departments will closely monitor risk and promptly adapt response strategies for the foreseeable future.

Compliance: Operational compliance provides a solid foundation on which Huawei can survive and continue serving and contributing to the world. Huawei has always been dedicated to compliance with applicable laws and regulations of the countries and regions in which it operates. Through sustained investment, we have established a compliance management system that applies to all our businesses and employees worldwide and covers all legal obligations including but not limited to trade compliance, financial compliance, anti-bribery compliance, intellectual property (IP) and trade secret protection, and cyber security and privacy. This enables the systematic management of compliance risks through established policies, organizations, regulations, processes, etc.

Despite these efforts, we may still experience impacts due to the complex legal environments of some of the countries and regions in which we operate. For example, there may be a lack of clarity or transparency in regards to local laws or ambiguity surrounding legal systems or law enforcement. Huawei will continue, as always, to learn from industry best practices and take preventive measures to address risks. The certainty of legal compliance is our best bulwark against the uncertainty of the external environment.

Trade: Trade restrictions and the pandemic will remain major obstacles to international trade in 2022. Global collaboration, especially in the digital sphere, will be essential to building a more resilient and sustainable global supply chain as we go low-carbon and digital.

Huawei remains dedicated to innovation. It is through innovation that we provide novel and practical solutions for transforming digital supply chains and tackling the pandemic head-on. Huawei embraces free trade, open markets, and fair competition. We support equitable and non-discriminatory multilateral trade rules and staunchly advocate globalization. We advocate the free trade of technical products and place trade compliance above our own commercial interests. We will never stop contributing to the growth of the global supply chain.

Natural disasters: It is our mission and primary social responsibility to maintain stable network operations. Earthquakes, typhoons, epidemics, and other natural disasters can impact Huawei's business operations in many different ways and thus can impact the operations of the networks we have deployed. We have robust mechanisms for responding to natural disasters and continue to improve our capabilities in this regard. This has helped us to ensure business continuity and effectively support our customers' network stability.

Country-specific risks: Huawei currently operates in more than 170 countries and regions worldwide. This complex international political and economic landscape exposes Huawei to particular risks in certain countries and regions. These risks include economic and political instability, exchange rate fluctuations, capital controls, and sovereign defaults. Bilateral and multilateral tensions between certain countries or regions caused by special circumstances could hinder Huawei's local business operations and bring uncertainty to our local business development. To address these issues, Huawei needs exceptional risk management and response capabilities. We will closely monitor any potential risks or changes in the environment, such as further developments related to the pandemic in specific countries, and promptly employ effective countermeasures to help achieve business objectives.

Operational Risks

Business continuity: In today's highly globalized and highly specialized world, Huawei's operations rely heavily on third parties. This makes business continuity management (BCM) critical. Through years of sustained investment, Huawei has established a BCM system for domains such as R&D, procurement, manufacturing, logistics, and global technical services. This system covers our end-to-end processes, from suppliers to Huawei and on to our customers. As part of this system, we have developed and established effective measures to drive BCM and emergency response upskilling across organizations, allowing them to manage risks that arise during their daily work. Specifically, we have built up management organizations, processes, and IT platforms, embedded key BCM elements into our product designs, prepared business continuity plans and emergency management plans, and organized BCM training and drills for employees.

As a staunch advocate of globalization, we will continue to pursue supply chain diversity. We aim to develop sustainable and stable supply capabilities to prevent dependency on any single supplier, country, or region. Based on the principles of collaboration for shared success and mutual development, Huawei is confident in its ability to work with partners around the world to forge a secure, reliable, competitive, and healthy value chain. We will continue to deliver quality products, solutions, and services to our customers worldwide.

For further information on business continuity, see pages 75 to 76 of this Annual Report.
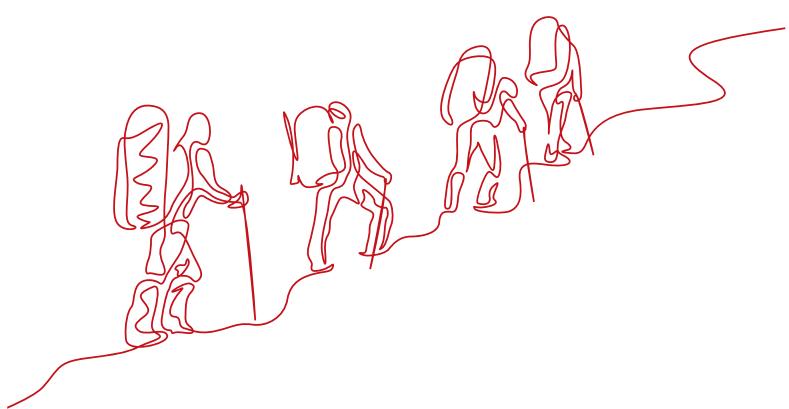
Information security and IP: Although Huawei has adopted stringent information security measures to protect its IP, it is impossible to completely prevent other companies from improperly using our proprietary information. Even when we are able to protect our IP through judicial means, we may still suffer losses due to improper usage.

Huawei has long been dedicated to independent innovation and IP protection. We have a complete IP risk control system in place. Despite this, there still exists the possibility that rights holders may file IP claims against Huawei or third parties may infringe upon our patents, trademarks, or copyrights. Huawei proactively addresses these risks to safeguard our business operations.

Financial Risks

For further information on financial risks, see pages 95 to 96 of this Annual Report.

Corporate Governance Report

The company only exists to serve its customers. The purpose of growing our harvest and increasing the fertility of our soil is to better serve our customers. "Staying customer-centric and creating value for customers" are the company's common values. The conferment of authority is required to drive the facilitation and implementation of the company's common values. However, without effective controls in place, authority un-checked will ultimately hinder such common values. The company has a well-developed internal governance structure, under which all governance bodies have clear and focused authority and responsibility, but operate under checks and balances. This creates a closed cycle of authority and achieves rational and cyclical succession of authority.

The company's fate cannot be tied to any single individual and the governance bodies of the company shall follow a model of collective leadership. This collective leadership model is created upon common values, focused responsibility, democratic centralized authority, checks and balances, and growth by self-reflection.

In addition, the company stays customer-centric, inspires dedication, and continuously improves its governance structure, organizations, processes, and appraisal systems to sustain its long-term and profitable growth.

Shareholders

Huawei Investment & Holding Co., Ltd. is a private company wholly owned by its employees. Huawei's shareholders are the Union of Huawei Investment & Holding Co., Ltd. (the "Union") and Mr. Ren Zhengfei.

Through the Union, the company implements an Employee Shareholding Scheme (the "Scheme"), which involved 131,507 current employees or retired beneficiaries as of December 31, 2021.

The Scheme effectively aligns employee contribution and development with the company's long-term development, fostering Huawei's continued success.

Mr. Ren Zhengfei is the Company's natural person shareholder and also participates in the Scheme. As of December 31, 2021, Mr. Ren's investment accounts for nearly 0.84% of the Company's total share capital.
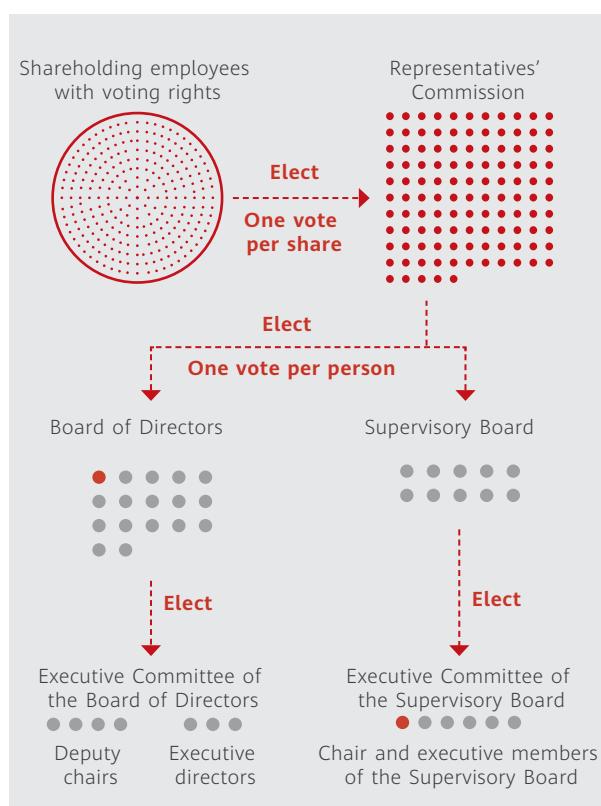
The Shareholders' Meeting and the Representatives' Commission

The Shareholders' Meeting, the company's authoritative body, comprises two shareholders: the Union and Mr. Ren Zhengfei.

The Representatives' Commission (the "Commission") is the organization through which the Union fulfills shareholder responsibilities and exercises shareholder rights. The Commission consists of 115 representatives of shareholding employees ("Representatives") and exercises rights on behalf of all shareholding employees. In 2021, the Commission held two meetings, at which it reviewed and approved the report from the Board of Directors on the company's financial and operating results, the work report from the Supervisory Board, proposals for matters such as annual profit distribution and annual capital increases, the *System of the Supervisory Board*, and the *Supervisory Board Election Rules*.

The Representatives and Alternate Representatives are elected by the shareholding employees with voting rights, and serve for a term of five years. In the event that there is a vacancy in the Commission, the Alternate Representatives shall take up the vacancy in a predetermined sequence.

The shareholding employees with voting rights elect the Commission on a one-vote-per-share basis, after which the Commission elects the company's Board of Directors and Supervisory Board on a one-vote-per-person basis. The Commission, along with the Board of Directors and Supervisory Board, decides on, manages, and monitors major company matters.

At the meeting of the Representatives' Commission in November 2021, representatives of the shareholding employees voted on the *Supervisory Board Election Rules* using the voting system.

Representatives Mr. Wang Shengqing, Mr. Li Jian, Mr. Yin Xuquan, Mr. Liu Hongyun, and Mr. Li Jin'ge left the company, so Alternate Representatives Mr. Wang Nanbin, Mr. Zheng Pingfang, Ms. Cao Yi, Mr. Ran Weidong, and Mr. Du Yanxin became Representatives according to preset rules.

Current members of the Commission are:

Mr. Ren Zhengfei, Ms. Sun Yafang, Mr. Liang Hua, Mr. Guo Ping, Mr. Xu Zhijun, Mr. Hu Houkun, Ms. Meng Wanzhou, Mr. Ding Yun, Mr. Yu Chengdong, Mr. Wang Tao, Mr. Xu Wenwei, Ms. Chen Lifang, Mr. Peng Zhongyang, Ms. He Tingbo, Mr. Li Yingtao, Mr. Yao Fuhai, Mr. Tao Jingwen, Mr. Yan Lida, Mr. Li Jie, Mr. Ren Shulu, Mr. Li Dafeng, Mr. Song Liuping, Mr. Tian Feng, Mr. Yi Xiang, Mr. Li Jianguo, Mr. Peng Bo, Ms. Zhao Minglu, Ms. Shi Yanli, Ms. Zhang Xiaoqing, Mr. Gao Aozhan, Mr. Yang Shubin, Ms. Ji Hui, Mr. Zou Zhilei, Mr. Lu Yong, Mr. Peng Song, Mr. Yang Yougui, Mr. Li Peng, Mr. Cao Jibin, Mr. Wu Weitao, Mr. Chen Hao, Mr. Wang Shengniu, Mr. Wang Jianfeng, Mr. Chen Lei, Mr. Wu Hui, Mr. Meng Ping, Mr. Lv Ke, Mr. Jiang Xisheng, Mr. Pan Shaoqin, Mr. Jiang Yafei, Mr. Zhang Wenlin, Mr. Wang Weijian, Mr. Su Liqing, Mr. Luo Wencheng, Mr. Zhang Hongxi, Mr. Xiong Lening, Mr. Ying Weimin, Mr. Wu Kunhong, Mr. Wei Chengmin, Mr. Wu Qinming, Mr. Xie Guohui, Mr. Wang Kexiang, Mr. Tang Qibing, Mr. Sun Fuyou, Mr. Ma Yue, Mr. Zhou Jianjun, Mr. Xun Su, Mr. Lu Qi, Mr. Lin Baifeng, Mr. Shen Huifeng, Mr. Zheng Liangcai, Mr. Ma Qingqing, Mr. Wang Hua'nan, Mr. Bai Limin, Ms. Yang Li, Mr. Hou Jinlong, Mr. Deng Taihua, Mr. Zheng Yelai, Mr. Hu Kewen, Mr. Zhang Shunmao, Mr. Zha Jun, Mr. Zhou Hong, Mr. Ma Haixu, Mr. Liu Shaowei, Mr. Tang Xinhong, Mr. Yang Chaobin, Mr. Gong Ti, Mr. Cai Changtian, Mr. Gao Ji, Mr. Xiong Yan, Mr. Zhou Taoyuan, Mr. Wang Yixiang, Mr. Li Zhoujian, Mr. Yu Quan, Mr. He Gang, Mr. Zhang Ping'an, Mr. Bian Honglin, Mr. Wang Chenglu, Mr. Xu Qinsong, Mr. Li Xiaolong, Mr. Zhu Ping, Mr. Shao Yang, Mr. Su Jie, Mr. Zhu Yonggang, Mr. Chen Yue, Mr. Bai Yi, Mr. Wu Congcheng, Mr. Ye Xiaowen, Ms. Song Yanling, Mr. Zuo Defeng, Mr. Xia Jian, Mr. Wang Nanbin, Mr. Zheng Pingfang, Ms. Cao Yi, Mr. Ran Weidong, and Mr. Du Yanxin.

Diagram

Shareholding employees with voting rights → **Elect** **One vote per share** → Representatives' Commission

Representatives' Commission → **Elect** **One vote per person** → Board of Directors | Supervisory Board

Board of Directors → **Elect** → Executive Committee of the Board of Directors — Deputy chairs | Executive directors

Supervisory Board → **Elect** → Executive Committee of the Supervisory Board — Chair and executive members of the Supervisory Board

Board of Directors

The Board of Directors (BOD) is the highest body responsible for corporate strategy, operations management, and customer satisfaction. The BOD's mission is to lead the company forward. It exercises decision-making authority for corporate strategy and operations management, and ensures customer and shareholder interests are protected.

The main responsibilities of the BOD are to:

- Develop proposals for corporate governance.
- Review proposals to increase or decrease the company's registered capital, as well as proposals related to profit distribution and loss recovery.
- Review the company's stock options plan and other long-term incentive plans.
- Review or approve plans for entering and exiting different industry sectors, and approve the company's strategic plan.
- Approve major organizational restructuring, management system development, and business transformation.
- Approve major financial policies, financial plans, and business transactions.
- Approve the company's annual budget proposal, annual operations report, and annual audit report.
- Approve the appointment/removal, compensation, and long-term incentives of senior management.
- Approve major HR policies and plans at the corporate level.
- Approve proposals for managing major risks and crises, and manage major emergencies.
- Approve the development of internal controls and compliance systems.

In 2021, the BOD held 11 meetings. At the meetings, the BOD reviewed and approved matters such as the company's medium-to-long-term strategic plan, as well as the company's annual business plan, audit report, profit distribution, and capital increases.

BOD members are elected by the Commission and then voted in by the Shareholders' Meeting. By March 28, 2022, the BOD was comprised of 17 members, including:

- Chairman: Mr. Liang Hua
- Deputy Chairs: Mr. Guo Ping, Mr. Xu Zhijun, Mr. Hu Houkun, and Ms. Meng Wanzhou
- Executive Directors: Mr. Ding Yun, Mr. Yu Chengdong, and Mr. Wang Tao
- Directors: Mr. Xu Wenwei, Ms. Chen Lifang, Mr. Peng Zhongyang, Ms. He Tingbo, Mr. Li Yingtao, Mr. Ren Zhengfei, Mr. Yao Fuhai, Mr. Tao Jingwen, and Mr. Yan Lida

In the event that there is a vacancy in the BOD, alternate directors will take up the vacancy in a predetermined sequence. Alternate directors include Mr. Li Jianguo and Mr. Peng Bo.

From the left in the first row: Ms. Meng Wanzhou, Mr. Hu Houkun, Mr. Guo Ping, Mr. Xu Zhijun, and Mr. Liang Hua

From the left in the second row: Ms. He Tingbo, Mr. Xu Wenwei, Mr. Yan Lida, Mr. Ding Yun, Mr. Ren Zhengfei, Mr. Tao Jingwen, Mr. Li Yingtao, Mr. Wang Tao, Mr. Peng Zhongyang, Mr. Yu Chengdong, Ms. Chen Lifang, and Mr. Yao Fuhai

Mr. Liang Hua
(Howard Liang)

Chairman

Born in 1964, Mr. Liang holds a doctorate degree from Wuhan University of Technology. Mr. Liang joined Huawei in 1995 and has served as President of Supply Chain, CFO of Huawei, President of the Business Process & IT Mgmt Dept, President of the Global Technical Service Dept, Chief Supply Chain Officer, Chairman of the Audit Committee, and Chairman of the Supervisory Board. Mr. Liang is now Chairman of Huawei's Board of Directors.

Mr. Hu Houkun
(Ken Hu)

Deputy Chairman,
Rotating Chairman

Born in 1968, Mr. Hu holds a bachelor's degree from Huazhong University of Science and Technology. Mr. Hu joined Huawei in 1990 and has served as President of the Marketing & Sales Dept in China, President of the Latin America Region, President of the Global Sales Dept, Chief Sales & Service Officer, Chief Strategy & Marketing Officer, Chairman of the Global Cyber Security and User Privacy Protection Committee (GSPC), Chairman of the BOD of Huawei USA, Deputy Chairman of the Board, Rotating CEO, and Chairman of the HRC. Currently, Mr. Hu serves as Deputy Chairman of the Board and Rotating Chairman of Huawei.

Mr. Guo Ping

Deputy Chairman,
Rotating Chairman

Born in 1966, Mr. Guo holds a master's degree from Huazhong University of Science and Technology. Mr. Guo joined Huawei in 1988 and has served as R&D Project Manager, General Manager of Supply Chain, Director of Huawei Executive Office, Chief Legal Officer, President of the Business Process & IT Mgmt Dept, President of the Corporate Development Dept, Chairman and President of Huawei Device, Rotating CEO of Huawei, and Chairman of the FC. Currently, Mr. Guo serves as Deputy Chairman of the Board and Rotating Chairman of Huawei.

Ms. Meng Wanzhou
(Sabrina Meng)

Deputy Chairwoman

Ms. Meng holds a master's degree from Huazhong University of Science and Technology. Ms. Meng joined Huawei in 1993 and has held the positions of Director of the International Accounting Dept, CFO of Huawei Hong Kong, and President of the Accounting Mgmt Dept. Ms. Meng now serves as CFO of Huawei and Deputy Chairwoman of the Board.

In 2003, Ms. Meng established Huawei's globally unified finance organization, and developed the standardized and unified organizational structure, financial processes, financial systems, and IT platforms.

Since 2005, Ms. Meng has led the founding of five shared service centers around the world, and she also promoted the completion of the Global Payment Center in Shenzhen, China. These centers have boosted Huawei's accounting efficiency and monitoring quality, providing accounting services to sustain the company's rapid overseas expansion.

Since 2007, Ms. Meng has been in charge of the Integrated Financial Services (IFS) Transformation Program, an eight-year partnership between Huawei and IBM. This transformation program helped Huawei develop its data systems and rules for resource allocation, operating efficiency improvement, process optimization, and internal controls. IFS also took Huawei's financial management to a new level, creating new DNA for the company's sustainable growth.

In recent years, Ms. Meng has focused on advancing fine-grained and comprehensive financial management at Huawei, working to align these efforts with the company's long-term development plan. Ms. Meng has continually worked to improve treasury risk and tax compliance management systems, and has helped to make financial operations within the company more efficient, agile, and intelligent.

Mr. Xu Zhijun
(Eric Xu)

Deputy Chairman,
Rotating Chairman

Born in 1967, Mr. Xu holds a doctorate degree from Nanjing University of Science & Technology. Mr. Xu joined Huawei in 1993 and has served as President of the Wireless Network Product Line, Chief Strategy & Marketing Officer, Chief Products & Solutions Officer, Chairman of the Investment Review Board, Rotating CEO of Huawei, and Chairman of the SDC. Currently, Mr. Xu serves as Deputy Chairman of the Board and Rotating Chairman of Huawei.

Mr. Ding Yun
(Ryan Ding)

Executive Director

Born in 1969, Mr. Ding holds a master's degree from Southeast University. Mr. Ding joined Huawei in 1996 and has served as Product Line President, President of the Global Solution Sales Dept, President of the Global Marketing Dept, President of Products & Solutions, and President of the Carrier BG.

Mr. Yu Chengdong
(Richard Yu)

Executive Director

Born in 1969, Mr. Yu holds a master's degree from Tsinghua University. He joined Huawei in 1993 and has served as 3G Product Director, Vice President of the Wireless Technical Sales Dept, President of the Wireless Network Product Line, President of the European Area, and Chief Strategy & Marketing Officer. Currently, Mr. Yu serves as CEO of the Device BG, CEO of the Intelligent Automotive Solution BU, and Director of the Investment Review Board for Smart Devices and Intelligent Automotive Components.

Mr. Wang Tao
(David Wang)

Executive Director

Born in 1972, Mr. Wang holds a master's degree from Xi'an Jiaotong University. Mr. Wang joined Huawei in 1997 and has served as R&D Manager in Wireless, Vice President of the UMTS Technical Sales Dept, President of Technical Sales of the European Area, Managing Director of Huawei Italy and Switzerland, President of the Wireless Network Product Line, President of the Network Product Line, and President of Products & Solutions. Currently, Mr. Wang serves as an Executive Director of the Board, Chairman of the ICT Infrastructure Managing Board, President of ICT Products & Solutions, Chairman of the Investment Review Board, and President of ICT Strategy & Marketing.

Mr. Xu Wenwei
(William Xu)

Director

Born in 1963, Mr. Xu holds a master's degree from Southeast University. In 1991, Mr. Xu joined Huawei's Research & Development, leading the development of the first generation of Huawei's public program controlled switches. Mr. Xu also took charge of work related to chips, general technology, strategy planning, and research. He has served as President of the International Technical Sales & Marketing Dept, President of the European Area, Chief Strategy & Marketing Officer, Chief Sales & Service Officer, President of the Joint Committee of Regions, CEO of the Enterprise BG, Chief Strategy Marketing Officer, and Chairman of the Investment Review Board. Mr. Xu is currently President of the Institute of Strategic Research.

Ms. Chen Lifang
(Catherine Chen)

Director

Born in 1971, Ms. Catherine Chen graduated from Northwest University in China. She joined Huawei in 1995 and has served as Chief Representative of the Beijing Representative Office, Vice President of the International Marketing Dept, Deputy Director of the Domestic Marketing Management Office, a member of the Board, President of the Public Affairs and Communications Dept, and Corporate Senior Vice President.

Mr. Peng Zhongyang

Director

Born in 1968, Mr. Peng holds a bachelor's degree from Huazhong University of Science and Technology. Mr. Peng joined Huawei in 1997 and has served as Technical Service Engineer of the South China Area, Transmission Project Manager and Development Engineer of the Russia Representative Office, General Manager of the Yemen Representative Office, Assistant to President of the Middle East and Northern Africa Region, President of the Northern Africa Region, President of the China Region, President of the Corporate Leadership Mgmt Dept, and President of the Enterprise BG. Currently, Mr. Peng serves as the Lead of the Strategic Reserve.

Ms. He Tingbo
(Teresa He)

Director

Born in 1969, Ms. He holds a master's degree from Beijing University of Posts and Telecommunications. She joined Huawei in 1996 and has since served as Chief ASIC Engineer, and R&D Director of HiSilicon. Currently, she serves as President of HiSilicon, President of Technology of the 2012 Laboratories, and Chair of Huawei Scientist Committee.

Mr. Li Yingtao

Director

Born in 1969, Mr. Li holds a doctorate degree from Harbin Institute of Technology. Mr. Li joined Huawei in 1997 and has served as Chief of the Sweden Research Center, Director of the Product Mgmt Dept of Wireless Marketing, Director of the Research Dept of Products & Solutions, Director of the General Technology Office of Products & Solutions, President of the Central Research & Development Unit, President of the 2012 Laboratories, President of Products & Solutions, and President of Network Products & Solutions. Currently, Mr. Li serves as President of Administration of the 2012 Laboratories.

Mr. Ren Zhengfei

Director

Born on October 25, 1944 into a rural family where both parents were school teachers, Mr. Ren Zhengfei spent his primary and middle school years in a remote mountainous town in Guizhou Province. In 1963, he studied at the Chongqing Institute of Civil Engineering and Architecture. After graduation, he was employed in the civil engineering industry until 1974 when he joined the military's Engineering Corps as a soldier tasked to establish the Liao Yang Chemical Fiber Factory. Subsequently, Mr. Ren had taken positions as a Technician, an Engineer, and was lastly promoted as a Deputy Director, which was a professional role equivalent to a Deputy Regimental Chief, but without military rank. Because of his outstanding performance, Mr. Ren was invited to attend the National Science Conference in 1978 and the 12th National Congress of the Communist Party of China in 1982. Mr. Ren retired from the army in 1983 when the Chinese government disbanded the entire Engineering Corps. He then worked in the logistics service base of the Shenzhen South Sea Oil Corporation. As he was dissatisfied with his job, he decided to establish Huawei with a capital of CNY21,000 in 1987. He became the CEO of Huawei in 1988 and has held the title ever since.

Mr. Yao Fuhai

Director

Born in 1968, Mr. Yao holds a bachelor's degree from the University of Electronic Science and Technology of China. Mr. Yao joined Huawei in 1997 and has served as Director of the Pricing Center, Vice President of the Business Process & IT Mgmt Dept, Vice President of the Strategy Cooperation Dept, Vice President of the Global Technical Sales Dept, President of the Global Technical Service Dept, President of the Global Procurement Qualification Mgmt Dept, and a member of the Supervisory Board. Currently, Mr. Yao serves as a member of the Board, Chief Supply Chain Officer, and Director of the Group Procurement Management Committee.

Mr. Tao Jingwen

Director

Born in 1971, Mr. Tao graduated from Beijing University of Posts and Telecommunications. Mr. Tao joined Huawei in 1996 and has served as a product development engineer, Deputy General Manager of the Market Technology Section, Executive Deputy Director of the International Technical Sales Dept, Executive Vice President and President of the Sub-Sahara Region, President of the Global Technical Sales & Marketing Dept, President of Huawei Device, President of the West European Region, and President of the Quality, Business Process & IT Mgmt Dept.

Mr. Yan Lida

Director

Born in 1970, Mr. Yan holds a bachelor's degree from Tsinghua University. Mr. Yan joined Huawei in 1997 and has served as Vice President of the European Region, General Manager of the Japan Representative Office, President of the East Asia Region, and President of the Enterprise BG. Currently, Mr. Yan serves as a member of the Board and Deputy Director of the Corporate Advisory Committee.

Executive Committee

The BOD has established the Executive Committee, which acts as the standing executive body of the BOD. Entrusted by the BOD, the Executive Committee examines and reflects on major issues within the company, decides on issues authorized by the BOD, and oversees their execution. In 2021, the Executive Committee held 19 meetings.

Members of the BOD Executive Committee include Mr. Guo Ping, Mr. Xu Zhijun, Mr. Hu Houkun, Ms. Meng Wanzhou, Mr. Ding Yun, Mr. Yu Chengdong, and Mr. Wang Tao.

Rotating chairs

The BOD and its Executive Committee are led by rotating chairs. During their terms, the rotating chairs serve as the foremost leader of the company. Rotating chairs' terms last six months at a time. The rotation schedule is as follows:

- Mr. Xu Zhijun: October 1, 2019 to March 31, 2020
  April 1, 2021 to September 30, 2021
  October 1, 2022 to March 31, 2023

- Mr. Guo Ping: October 1, 2018 to March 31, 2019
  April 1, 2020 to September 30, 2020
  October 1, 2021 to March 31, 2022

- Mr. Hu Houkun: April 1, 2019 to September 30, 2019
  October 1, 2020 to March 31, 2021
  April 1, 2022 to September 30, 2022

Audit Committee

The Audit Committee (AC) operates under the BOD to oversee internal controls, including the internal control system, internal and external audits, corporate processes, legal compliance, and adherence to the *BCGs*.

The main responsibilities of the AC are to:

- Approve the annual internal audit plan, and review its scope, required resources, and audit outputs.

- Approve corporate policies for internal controls; approve the corporate development plan for internal controls and the plan's key milestones; and regularly assess the company's internal control status.

- Evaluate the effectiveness of the ethics and compliance function, legal compliance, and adherence to corporate policies.

- Approve the selection of the external auditor, notify the BOD of any proposed change to the external auditor for approval, approve related budgets, and evaluate the work of the external auditor.

- Supervise the completeness, accuracy, and legal compliance of the company's financial statements; and review compliance with and application of accounting policies as well as financial disclosures.

- Approve internal control Key Performance Indicators (KPIs), and instruct Global Process Owners (GPOs) and business executives to report internal control results.

The AC generally holds monthly meetings and convenes special sessions as necessary. Business executives and various experts are invited to attend as non-voting participants.

The committee held 11 meetings in 2021. Focusing on topics such as anti-corruption, internal controls, internal and external audit management, and accountability and follow-up regarding issues identified in audit reports, the AC has reviewed and approved the company's annual plans for internal controls and internal audits, as well as anti-corruption plans and improvement progress reports on high-risk businesses including the Consumer BG, Enterprise BG, Carrier BG, and the China Region.

In addition, the committee Chairman and the external auditor discussed the issues identified through the external audit, external audit plans, and proposals for Huawei's management improvements.

Supervisory Board

Pursuant to the requirements of the *Company Law of the People's Republic of China*, Huawei has established its Supervisory Board. The key responsibilities of the Supervisory Board include overseeing the responsibility fulfillment of BOD members and senior management, monitoring the company's operational and financial status, and supervising compliance. Members of the Supervisory Board attend BOD and EMT meetings as non-voting participants.

The Supervisory Board held 13 meetings in 2021. At the meetings, it reviewed the company's annual financial statements, inspected major areas that may face risks, oversaw the company's operations management, and guided and managed oversight-oriented members of the Subsidiary Board Directors Resources Bureau.

Throughout the year, members of the Supervisory Board attended all meetings of the BOD as non-voting participants, overseeing the legitimacy of BOD decisions and operations, as well as the responsibility fulfillment of BOD members and other executives, and assessed BOD members' responsibility fulfilment in 2020.

The members of the Supervisory Board were elected by the Commission and voted in by the Shareholders' Meeting. The company plans to elect a new Supervisory Board at the meetings of the Commission in 2022.

By March 28, 2022, Mr. Li Jian, Mr. Yin Xuquan, and Mr. Li Jin'ge had resigned from their positions as members of the Supervisory Board. The Supervisory Board currently has 6 members, including:

- Chairman: Mr. Li Jie

- Executive members: Mr. Ren Shulu and Mr. Li Dafeng

- Members: Mr. Song Liuping, Mr. Tian Feng, and Mr. Yi Xiang

The Supervisory Board has established the Executive Committee, which acts as authorized by the Supervisory Board. Members of the Executive Committee are Mr. Li Jie, Mr. Ren Shulu, and Mr. Li Dafeng.

Mr. Li Jie

Chairman of the Supervisory Board

Born in 1967, Mr. Li holds a bachelor's degree in wireless communications and a master's degree in computer image processing from Xi'an Jiaotong University. Mr. Li joined Huawei in 1992 and has served as an R&D engineer, General Manager of a representative office in China, General Manager of the Moscow Representative Office, President of the Commonwealth of Independent States Region, President of the Global Technical Sales Dept, President of the Global Technical Service Dept, President of the Human Resource Mgmt Dept, President of the Joint Committee of Regions, President of Huawei University, and President of the Corporate Leadership Mgmt Dept. Currently, Mr. Li serves as Chairman of the Supervisory Board and Chairman of the Audit Committee.

Mr. Ren Shulu
(Steven Ren)

Executive Member of the Supervisory Board

Born in 1956, Mr. Ren holds a bachelor's degree from Yunnan University. Mr. Ren joined Huawei in 1992 and has served as President of Shenzhen Smartcom Business Co., Limited, Chairman of the Capital Construction Investment Management Committee, and Chairman of the Internal Service Management Committee. Currently, Mr. Ren serves as Huawei's Chief Logistics Officer.

Mr. Li Dafeng

Executive Member of
the Supervisory Board

Born in 1966, Mr. Li holds a bachelor's degree from
the Department of Radio Engineering, Changchun
Institute of Posts and Telecommunications, and a
master's degree in signal and information processing,
Harbin Institute of Technology. Mr. Li joined Huawei
in 1996 and has served as Deputy Sales Director of
the Beijing Office, General Manager of the Tianjin
Office, General Manager of the Shijiazhuang Office,
Deputy Director of the China Telecom Account Dept,
Deputy Sales President of the Southern Africa Region,
Director of the MTN Account Dept, President of the
Eastern and Southern Africa Region, President of the
Sales & Delivery Finance Mgmt Dept, President of the
Middle East and Africa Area, and Director of the ICT
Infrastructure Managing Board Office.

Mr. Song Liuping

Member of
the Supervisory Board

Born in 1966, Mr. Song completed his postdoctoral
research at Beijing Institute of Technology. Mr. Song
joined Huawei in 1996 and has served successively
as Manager of the Product Strategy Planning Dept,
Director of the IPR Dept, Director of the External
Cooperation Dept, PSST member, President of the
Legal Affairs Dept, President of the Patent Review
Board, Director of the Trade and Customs Compliance
Committee, a member of the Disciplinary and
Supervisory Sub-committee of the Human Resources
Committee, a member of the AC and Finance
Committee, a member of the Platform Coordination
Committee, Chief Legal Officer, and Chief Compliance
Officer.

Mr. Tian Feng

Member of the
Supervisory Board

Born in 1969, Mr. Tian holds a bachelor's degree from
Xidian University. Mr. Tian joined Huawei in 1995 and
has served as General Manager of the Shijiazhuang
Office, HR Director of the Domestic Marketing Dept,
Director of the Market Finance Dept, EVP of the Middle
East and Northern Africa Area, President of the Middle
East Region, President of the China Region, CEO of
Huawei Agisson, Vice President (acting) of the Human
Resource Mgmt Dept, EVP of Huawei University,
Director of the Institute of Education of Huawei
University, Director of the Disciplinary and Supervisory
Sub-committee of the Human Resources Committee,
an executive member of the Management Team
of the Joint Committee of Regions, Director of the
Subsidiary Board Directors Resources Bureau, President
of the Central Asia and Russia Area, a member of
the Management Team of the Corporate Leadership
Mgmt Dept, a member of the AC, a member of the
ICT Infrastructure Managing Board, Director of the
Disciplinary and Supervisory Committee, President of
the Asia Pacific Area, President of the Internal Audit
Dept, and a member of the Supervisory Board.

Mr. Yi Xiang
(Steven Yi)

Member of the
Supervisory Board

Born in 1975, Mr. Yi holds a bachelor's degree from
Wuhan University. Mr. Yi joined Huawei in 1998
and has served as General Manager of the Pakistan
Representative Office, President of the Middle East
Region, President of the Sales & Delivery Finance
Mgmt Dept, Deputy CFO of Huawei, President of the
Regions Mgmt Dept, and President of the America
Area. Currently, Mr. Yi serves as President of the
Middle East Region, President of the Middle East and
Africa Area, and a member of the ICT Infrastructure
Managing Board.
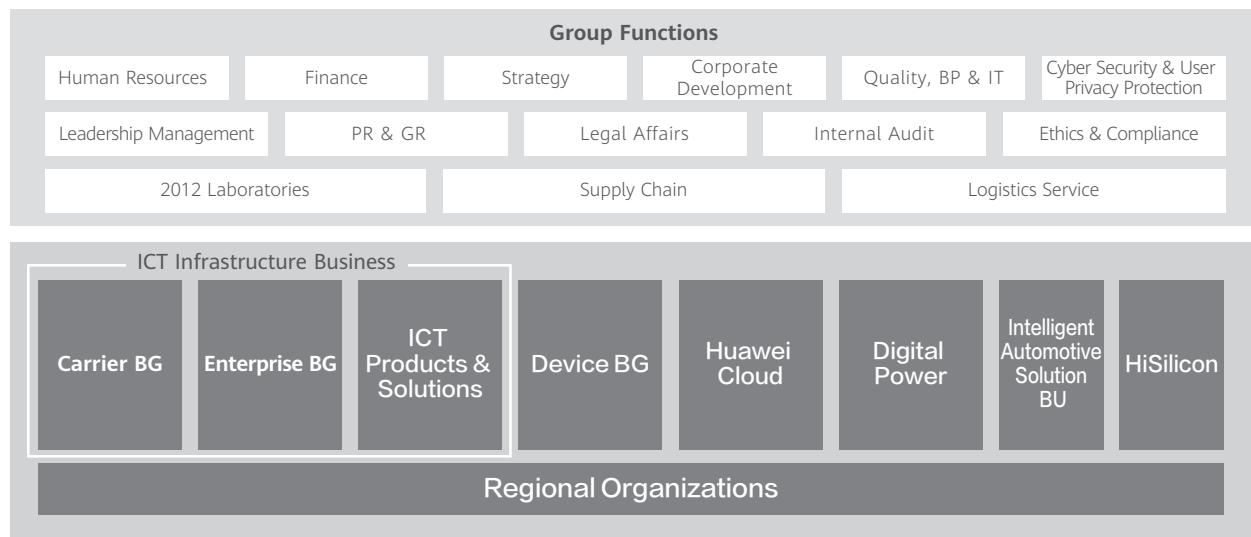
Independent Auditor

An independent auditor is responsible for auditing a company's annual financial statements. In accordance with applicable accounting standards and audit procedures, the independent auditor expresses an opinion as to whether the financial statements are true and fair.

The scope of the financial audit and the annual audit results are subject to review by the Audit Committee. Any relationship or service that may potentially affect the objectivity and independence of the independent auditor must be discussed with the Audit Committee. The independent auditor may discuss any issues identified or any difficulties encountered during the course of the financial audits with the Audit Committee.

KPMG has been Huawei's independent auditor since 2000.

Business Structure

As the primary owner of our business strategy, operations management, and customer satisfaction for ICT infrastructure business, the ICT Infrastructure Managing Board conducts end-to-end operations management of our ICT infrastructure business.

- The Carrier BG and the Enterprise BG manage and support solution marketing, sales, and services that target carrier customers and enterprise/industry customers respectively. The two BGs provide innovative, differentiated, and advanced solutions based on the business characteristics and operational patterns of different customers while continuously improving the company's industry competitiveness and customer satisfaction.

- ICT Products & Solutions is a department that provides ICT infrastructure products and solutions to carriers and enterprise/industry customers. This department is responsible for product planning, development, and delivery as well as for building product competitiveness. ICT Products & Solutions is committed to building world-leading ICT infrastructure products and solutions, including those related to connectivity and computing, developing digital infrastructure ecosystems surrounding Kunpeng, Ascend, and openEuler-related basic software, laying the computing power foundation for the digital world, delivering better service experiences, and enabling customers' business success.

The Device BG focuses on serving device consumers and ecosystem partners, and deals with all aspects of the device domain. This BG is responsible for business performance, risk controls, market competitiveness, and customer satisfaction in the device business. With users at the center of everything it does, the Device BG is committed to creating a Seamless AI Life experience. With five key scenarios (smart office, fitness & health, smart home, easy travel, and entertainment) as the focus, the Device BG achieves business success by providing superior experience and service.

Huawei Cloud is responsible for the end-to-end operations and commercial success of Huawei's cloud services by developing the related organizations and capabilities, including R&D, sales, consulting, service, and supply. Huawei Cloud is committed to providing stable, reliable, secure, trustworthy, and innovative cloud services. By diving into digital, Huawei Cloud aims to deliver everything as a service, and build the cloud foundation for an intelligent world with ubiquitous cloud and pervasive intelligence.

Digital Power is an organization that offers enterprise/industry customers products and solutions like clean power generation, transportation electrification, site power facilities, data center facilities, and embedded power. Digital Power is committed to integrating digital and power electronics technologies to provide customers with high-quality, energy-efficient, green, and low-carbon power electronics products, facilitating their business success.

The Intelligent Automotive Solution BU is an end-to-end organization responsible for the company's intelligent automotive business. By leveraging Huawei's expertise in ICT, the BU is committed to providing new components for intelligent connected vehicles and helping car OEMs build better vehicles.

HiSilicon is a provider of a broad range of chipset and module solutions for sensing, connectivity, computing, and display, serving multiple markets including smart devices, display panels, home appliances, and automotive electronics. The company engages in research and development, marketing, ecosystem development, and sales and services for chipsets and modules. It is independently responsible for its own business results, risk management, market competitiveness, and customer satisfaction.

To gradually build a shared service platform to support the development of our multiple businesses and create an anchor for corporate policy execution, the company operates a Platform Coordination Committee. This committee is designed to push group functions to optimize their execution and operations,

simplify cross-function operations, and strengthen collaboration, so that group functions will become the best service organizations available to support and promote business operations. Group functions provide business support, services, and oversight. They are positioned to offer accurate, timely, and effective services to field offices and strengthen oversight while delegating sufficient authority to them.

Improving the Internal Control System

Huawei continued to design and implement an internal control system based on its organizational structure and operating model. The internal control framework and its management system apply to all business and financial processes of the company and its subsidiaries and business units. The internal control system is based on the five components of the COSO framework: Control Environment, Risk Assessment, Control Activities, Information & Communication, and Monitoring. It also covers internal controls of financial statements to ensure their truthfulness, integrity, and accuracy.

Control Environment

A control environment is the foundation of an internal control system. Huawei is committed to a corporate culture of integrity, business ethics, and compliance with laws and regulations. Huawei has issued the *Business Conduct Guidelines (BCGs)* to identify acceptable business conduct. The BCGs must be observed by all employees, including senior executives. Regular training programs are offered, and all employees are requested to sign the BCGs to ensure that the BCGs have been read, understood, and observed.

Huawei has implemented a mature governance structure, with clearly defined authorization and accountability mechanisms. The governance structure comprises the Board of Directors (BOD), its committees, group functions, and multi-level management teams. Huawei clearly defines the roles and responsibilities of its organizations to ensure the effective separation of authority and responsibilities as well as checks and balances through mutual oversight. The CFO of Huawei is in charge of internal controls. The internal control management department reports to the CFO for any possible defects and improvements already made in terms of internal controls, and assists the CFO in building the internal control environment. The internal audit department independently monitors and assesses the status of internal controls for all business operations.

Risk Assessment

Huawei has a department dedicated to internal controls and risk management to regularly assess risks to the company's global business processes. This department identifies, manages, and monitors significant risks, forecasts potential risks caused by changes to the internal and external environments, and submits risk management strategies along with risk mitigation measures for decision making. All process owners are responsible for identifying, assessing, and managing business risks and taking necessary internal control measures. Huawei has instituted a mechanism for improving internal controls and risk controls to efficiently manage critical risks.

Control Activities

Huawei has established the Global Process Management System and the Business Transformation Management System, released the global Business Process Architecture (BPA), and appointed Global Process Owners (GPOs) in line with the BPA.

Responsible for building processes and internal controls, GPOs:

- Identify key control points and the Separation of Duties Matrix for each process, and apply these to all regional offices, subsidiaries, and BUs.

- Conduct compliance tests on key control points and issue test reports to ensure the effectiveness of internal controls is continuously monitored.

- Optimize processes and internal controls based on business pain points and key requirements for financial statements. The aim is to improve operating efficiency and financial results, ensure compliance and the accuracy and reliability of financial statements, and help achieve business objectives.

- Perform annual assessments of internal controls, comprehensively assess overall process design and process execution within each business unit, and then report the results to the Audit Committee (AC).

Information & Communication

Huawei has developed multi-dimensional information and communication channels to ensure the timely acquisition of external information from customers, suppliers, and other parties. It has also created formal channels for transferring internal information, and offered an online space, the *Xinsheng Community*, for employees to freely communicate their thoughts and ideas. Corporate management holds regular meetings with departments at all levels to effectively communicate management orientation to employees and ensure effective implementation of management decisions. All business policies and processes are available on the company's Intranet.

Managers and process owners regularly organize training programs on business processes and internal controls to ensure that up-to-date information is made available to all employees. The company has established a mechanism for process owners at all levels to regularly communicate with each other, review the execution of internal controls, follow up on internal control issues, and implement improvement plans.

Monitoring

Huawei has established an internal complaint channel, an investigation mechanism, an anti-corruption mechanism, and an accountability system. The *Agreement on Honesty and Integrity* that Huawei has signed with its suppliers clearly stipulates that suppliers may report improper conduct by Huawei employees through the channels stipulated in the *Agreement* to assist the company in monitoring the integrity of its employees. The internal audit department independently assesses the overall status of the company's internal controls, investigates any suspected violations of the *BCGs*, and reports the audit and investigation results to the AC and senior management. Huawei has also implemented a mechanism for internal control appraisals of GPOs and regional managers, holding them accountable and pursuing impeachment when and where necessary. The AC and the CFO regularly review the company's internal control status, and listen to and review reports on action plans for improving internal controls and plan execution progress. Both have the authority to request the relevant GPOs or business executives to explain their internal control issues and take corrective actions.

Creating Social Value

Creating Shared Value and Driving Sustainable Development

The digital economy is changing the way the world creates and distributes value. Businesses are now finding they must strike a balance between business value and social value. The more social value they create through the monetization of business opportunities, the more new business opportunities they are finding. While creating business value for our customers, we recognize the importance of requirements from non-market stakeholders. We work together to create social value that can be shared by all. Huawei's social value framework rests on two pillars:

1. Creating shared value: We work hard to help address societal needs and challenges by joining hands with partners and improving our own business operations, products, and technologies. This includes developing initiatives that boost economic growth and employment, empowering SMEs and industrial upgrades, and cultivating a skilled tech workforce.

2. Promoting sustainability: Our corporate sustainable development strategy consists of four components – digital inclusion, security and trustworthiness, environmental protection, and healthy and harmonious ecosystem.

Key Initiatives and Progress in 2021

Boosting economic growth and employment: Huawei works tirelessly to boost employment and the economies of the countries and regions where we operate as part of our larger "Globalization" strategy. This includes efforts such as hiring locally, investing locally, procuring locally, and establishing research facilities locally.

- Huawei ranked second in the European Commission's 2021 EU Industrial R&D Investment Scoreboard released in December. Huawei established its first European R&D center in Sweden in 2000, and now has 23 R&D centers across Europe.

- Huawei ranked eighth in Forbes' World's Best Employers 2021. Despite many internal and external challenges, Huawei continued its global recruitment of tech talent and created jobs locally.

Enabling the digital transformation of industries: ICT technologies directly create value and drive immense indirect value by transforming other industries. ICT technologies can help improve organizational and social productivity, leading to even greater social benefits as they see wider adoption in the industrial, agricultural, financial, and transportation sectors, among others. Huawei is already exploring applications of 5G tailored for over 20 industries.

- In mines, 5G is used to remotely control underground shearers, roadheaders, and railcars. This improves the working environment for miners by freeing them from unsafe underground operations and greatly enhances the production safety of coal mines.

- In steel mills, 5G-enabled remote control systems increase efficiency and reduce employee exposure to excessively hot and noisy working environments.

- In precision manufacturing, 5G is applied in various scenarios, including machine vision and AR-assisted maintenance. It makes factories more automated, more intelligent, more productive, and capable of flexible manufacturing.

- In the chemical industry where flammables, explosives, high temperatures, and toxic chemicals pose regular safety hazards, 5G-powered inspection robots and mobile monitors are deployed to capture video from the factory floor for 24/7 analysis, allowing for more accurate hazard prediction.

Supporting local industry ecosystems and SMEs: Huawei is committed to open collaboration and innovation to help build thriving industry ecosystems. We help incubate local ICT industry ecosystems and support local digital economies by providing open platforms for local partners, SMEs, and individual developers.

- Huawei was named among the top 25 Global Corporate Startup Stars by the European Commission's Startup Europe Partnership initiative, in recognition of its contributions to startup development. Through Huawei Cloud infrastructure and Huawei Mobile Services, we are helping startups grow, develop new products, and expand into new markets. We also enable tech startups by giving them access to cloud-native, AI, big data, and other technologies.

- In France, our Digital InPulse program has helped more than 80 startups tap into international markets over the past eight years.

Developing digital talent: In a digital economy, digital talent is the key to digital transformation and economic growth. Digital skills and literacy are essential to the development of the digital economy. As per the United Nations, they are also a basic human right in the digital era.

Thanks to intelligent technologies, underground operations at a coal mine in Shaanxi province, China, now rely on few or even no staff, making the coal mine safer, greener, and more productive.

- Since 2008, Huawei has launched or sponsored multiple talent development programs and competitions at the global, regional, and country levels, including scholarship programs, Seeds for the Future, Huawei ICT Academy, Huawei Developers Training, Huawei Cloud Developer Institute, Women in Tech, and Technology for Education (e.g., DigiSchool, DigiTruck, and SmartBus). We have already invested more than US$150 million into these programs as part of our commitment to local ICT talent development, and 1.54 million people from over 150 countries have benefited from them.

- In 2021, Huawei announced Seeds for the Future Program 2.0 at its "Tech & Sustainability: Everyone's Included" forum. As part of this program, we will invest US$150 million in digital talent development over the next five years and we expect this effort to benefit more than three million additional people.

Driving social sustainability: At Huawei, we believe that a digital economy is, first and foremost, a green economy. Digital technologies enable green development and play an indispensable role in addressing environmental challenges and other conservation efforts. Over the years, we have followed the vision of "Tech for a Better Planet" to actively address climate and environmental challenges. In pursuit of this, we have focused on reducing carbon emissions, promoting renewable energy, contributing to a circular economy, and conserving biodiversity with technology.

- Promoting renewable energy: Huawei has teamed up with Huanghe Hydropower Development, a subsidiary of China's State Power Investment Corporation, and built a world-class single-site PV power station in Qinghai, China. Huawei's smart PV solution has enabled the power station to produce more green electricity and increase O&M efficiency. Since the PV power station was built, the local ecosystem has improved greatly, boasting increased soil moisture.

- Contributing to a circular economy: Huawei developed a special oil to replace plastic film, which has been applied to the packaging of many Huawei phones. This optimization alone is expected to reduce the amount of disposable plastic used in packaging by around 46.3 tons for every 10 million phones. We have also applied plastic reduction measures to headphones, watches, bands, and many other products, in a bid to drive green consumption.

In September 2021, Huawei combined multiple training programs to create the Seeds for the Future Women in Tech program in Ghana, the first session of which provided AI training for 50 female college students.

Sustainable Development

Introduction

In 2021, despite all the trials and tribulations, we worked hard to create value for our customers and local communities. Changes in the external environment will not cause us to stray from our ideals or aspirations. We will stay the course and remain committed to our vision and mission: To bring digital to every person, home and organization for a fully connected, intelligent world.

As a tech company, Huawei believes that technology is a force for good. As such, sustainability is a key part of our overall strategy. Under the guidance of our Corporate Sustainable Development (CSD) Committee, we have made ongoing efforts in our four sustainability strategies – digital inclusion, security and trustworthiness, environmental protection, and healthy and harmonious ecosystem. These efforts will contribute to the United Nations Sustainable Development Goals (UN SDGs).

Overview of Huawei's Sustainability Strategies and Initiatives in 2021

Digital Inclusion

Leaving no one behind in the digital world: Huawei launched its TECH4ALL initiative to promote digital inclusion for all. The goal of the initiative is to bring digital technology to every person, home, and organization. We run projects together with our partners and are making technology more inclusive by investing in technology, applications, and skills.

110,000+

teachers and students from 400+ schools, as well as many unemployed young people, have been able to access the Internet and improve their digital skills and scientific and technological literacy through TECH4ALL projects

32

protected areas in 25 countries have used digital technology to more efficiently conserve natural resources and biodiversity with the help of TECH4ALL projects

4.4 million+

visually impaired users and 800,000+ hearing impaired users use the accessibility features on Huawei devices each month, enjoying the convenience of technology

60 million

people in remote areas across 70+ countries have been connected through Huawei's RuralStar solutions

Security and Trustworthiness

Taking responsibility to build trust: Cyber security and privacy protection are a top priority at Huawei, and we continue to invest and remain transparent in both areas. We have worked to improve our software engineering capabilities and practices, build resilient networks, develop trustworthy and high-quality products, and support stable network operations and business continuity.

70+
cyber security certifications were awarded to Huawei, giving our customers internationally recognized security assurances

20,000+
requests from data subjects were promptly and effectively handled by Huawei, respecting and protecting user privacy

35
Authorized Economic Operator (AEO) certificates were awarded to Huawei in 28 countries and regions across five continents, ensuring supply chain security

180+
major incidents where Huawei supported stable network operations

Environmental Protection

Contributing to a clean, efficient, low-carbon, and circular economy: We are committed to minimizing our environmental impact in manufacturing, operations, and over the entire lifecycles of our products and services. Huawei's innovative products and solutions help industries reduce their energy consumption and emissions, and contribute to the circular economy. We actively work with all our industry partners to shrink our carbon footprint.

98%
of our top 100 suppliers and energy-intensive suppliers set carbon emissions reduction targets as encouraged by Huawei

17.6million+
kWh of electricity was generated by the PV plants on Huawei campuses

848,000
fewer tons of GHG emissions as a result of Huawei buying 1.75 billion kWh of electricity from clean sources

89%
less plastic was used in the packaging of our P50 flagship phones compared to the P40 series, with plastic accounting for less than 1% of the packaging

Healthy and Harmonious Ecosystem

Collaborating for the common good: We operate with integrity and in compliance with all applicable laws and regulations, and continue to enhance sustainability risk management. We work to ensure that our employees can develop and realize their personal value. We conduct due diligence on our global supply chain to ensure its sustainability. We actively contribute to the communities we operate in. Our goal is to work with all industry partners to build a healthy and harmonious industry ecosystem.

CNY15 billion+
invested in employee benefits

47
hours of training received annually by every Huawei employee on average

1,600+
major suppliers received risk ratings from Huawei, representing more than 90% of our procurement spending

427
charitable activities run by Huawei worldwide

2021 Sustainability Honors and Awards

Honor/Award Name	Issued by
Huawei DigiTruck in Kenya: WSIS Prizes 2021 Champions	ITU
Nature Guardian: GSMA GLOMO for Outstanding Mobile Contribution to the UN SDGs	GSMA
Huawei RuralStar Pro: Best Mobile Innovation for Emerging Markets of GSMA GLOMO	GSMA
Best Practices for Achieving SDGs in 2021 (Protecting the Environment & Addressing Climate Change)	Global Compact Network China
Leadership Award on Climate Action	CDP
FusionSolar Smart PV solution: Carbon Neutrality Actor – Climate Solver of the Year	World Wide Fund for Nature (WWF)
27 Huawei subsidiaries recognized as a Top Employer	Top Employers Institute
Huawei India: Great Place to Work	Great Place to Work® Institute
Huawei Saudi Arabia: 2021 Sustainability Award in the Core Economic Area	King Khalid Foundation (KKF)
Vodafone Health and Safety Award	Vodafone Group
Excellence in Supply Chain Development	Deutsche Telekom
Huawei Bangladesh: Partner Recognition Award	bKash
Top 10 Green and Low-carbon Companies	Shenzhen Emissions Exchange Co., Ltd.
Huawei Malaysia: Cyber Security Innovation of the Year	CyberSecurity Malaysia (CSM)
Huawei UAE: Cybersecurity Company of the Year and Cybersecurity CEO of the Year	UAE Cyber Security Council (CSC)

Digital Inclusion

As the digital economy continues to develop rapidly, digital technologies like big data, IoT, and AI have been interwoven into every aspect of our lives. Digital inclusion has become a new requirement in this new age. To promote digital inclusion, Huawei launched the TECH4ALL initiative, as we believe that no one should be left behind in the digital world. In 2021, Huawei worked with more than 40 partners, such as the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Union for Conservation of Nature (IUCN), the Belgian nonprofit Close the Gap, and Rainforest Connection (RFCx). We made substantial progress in areas like education, environment, health, and development to contribute to the UN SDGs.

Driving Equity and Quality in Education

UNESCO believes that education is a human right for all throughout life and that access must be matched by quality. Huawei is working with its partners like UNESCO and Close the Gap and using innovative ICT solutions to enable everyone to have equal access to high-quality education, which contributes to the SDG 4 (Quality Education), SDG 5 (Gender Equality), and SDG 8 (Decent Work and Economic Growth). We want to harness the power of technology and increase network coverage and connections to help make high-quality educational resources more accessible. We want to empower more people with digital skills to improve the quality of education and career development. We also support the development of technology courses to improve the scientific and technological literacy of teachers and students in remote areas. By the end of 2021, Huawei's education programs had been rolled out in more than 400 schools worldwide, benefiting more than 110,000 teachers and students.

DigiTruck: Improving the Digital Skills of People in Remote Areas

In Kenya, less than 50% of people use the Internet. This is because over 75% of Kenyans live in remote areas and many do not realize the economic value of digital skills, and have never even used a smartphone or gone online.

To empower people in remote rural areas with digital skills, Huawei launched the DigiTruck project, in partnership with UNESCO, Close the Gap, GSMA, Computers For Schools Kenya (CFSK), and the Kenyan carrier Safaricom. DigiTruck is a mobile digital classroom that has been converted from a shipping container. The entire truck is solar-powered, so classes can be held in remote areas lacking adequate power supplies. Inside the truck, a digital space with smart devices like laptops, LED screens, VR goggles, smartphones, and routers, has been set up. Thanks to the wireless broadband available on the truck, students can access the Internet, learn digital skills, and try the VR devices and other innovative educational tools.

By the end of 2021, DigiTruck had provided more than 38,000 hours of training, benefiting over 2,100 young people in Kenya.

In France, 14 million people are still experiencing at least one form of digital exclusion – whether it be Internet access, computer literacy, or difficulty using devices. As a result, many of them lack the digital skills that employers need, limiting individual opportunities.

Huawei's DigiTruck in Kenya empowering people in remote rural areas with digital skills

Huawei's DigiTruck in France providing digital skills courses

In July 2021, Huawei partnered with a local training institute to provide training in digital skills for unemployed people with the DigiTruck mobile classroom. By the end of 2021, the project had provided more than 700 hours of training to over 1,500 people in nine French cities.

DigiSchool: Enabling Digital Teaching and Learning and Improving Scientific and Technological Literacy in Primary and Secondary Schools

As Progress in International Reading Literacy Study pointed out, 78% of grade four children in South Africa lack basic English reading comprehension skills in the literacy foundation phase from grades one to three. To address this challenge, Huawei launched the DigiSchool project in partnership with the local carrier Rain and the educational non-profit organization Click Foundation. The project aims to help all children in South Africa read fluently and comprehend what they are reading by the end of grade three.

As of the end of 2021, the project had connected 90 schools and reached more than 50,000 students. Nicola Harris, Chief Executive Officer of Click Foundation, said, "With digital education, we're not only addressing the literacy crisis, but also equipping young learners with the digital skills required for future success."

Huawei also launched the DigiSchool project in China to improve the scientific and technological literacy of rural students and teachers. Building on its cutting-edge ICT innovations and knowledge, Huawei developed a series of fun tech courses, opening the door of the technology world to teachers and students in remote rural areas. By the end of 2021, we had delivered the first phase of the project in rural schools in midwestern China, benefiting more than 400 teachers and students.

DigiSchool helping primary school students in South Africa improve English reading comprehension skills

DigiSchool offering fun tech courses to inspire the creativity of primary school students

Conserving Nature with Technology
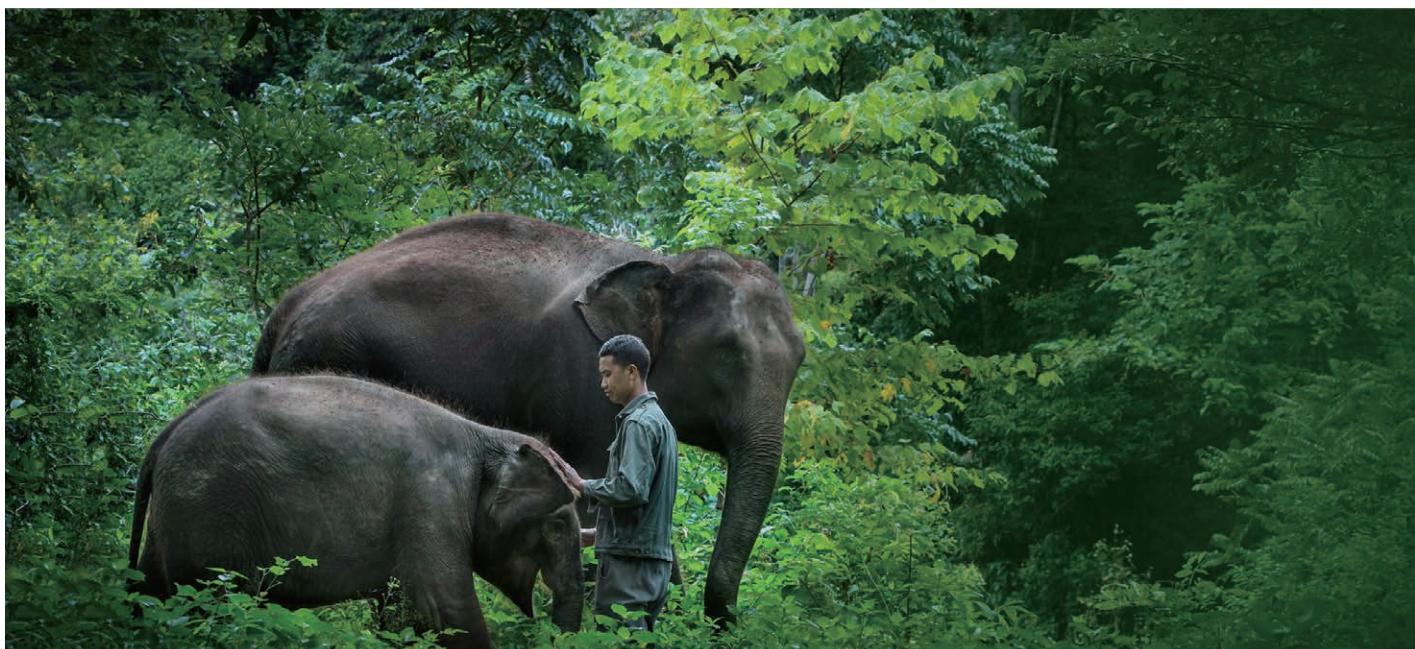
According to a report released by the United Nations Environment Programme, pollution, climate change, and biodiversity loss are the three main environmental crises facing humanity. The 2021 UN Biodiversity Conference (COP15) and the 2021 UN Climate Change Conference (COP26) have once again highlighted the global consensus that we need to work together to address biodiversity and climate change challenges. Countries are actively deploying nature-based solutions (NbS) to combat climate change and support economic recovery. Technology and innovation will play a key enabling role in this process. To this end, Huawei is working with environmental protection organizations and partners on projects that aim to explore the use of ICT to protect forests, wetlands, oceans, and nature more broadly.

Protecting Forests with Technology

Forests are lungs of the Earth and harbor most of the Earth's terrestrial biodiversity. But due to illegal logging, poaching, and deforestation, forests are disappearing at a rate of more than 10 million hectares every year. Huawei is working with its partners to explore how to use ICT solutions, including devices, networks, and the cloud, to help protect the biodiversity of forests.

With the support of Huawei, RFCx has developed Nature Guardian, a cloud- and AI-based acoustic monitoring system that collects audio data from natural environments in real time. The system can automatically identify the gunshots of poachers and the chainsaws and trucks associated with illegal logging, so that rangers in the field can respond in near real time. The system can also identify animal calls, which helps protect biodiversity. Huawei has helped its partners deploy the system in forests and mountains in countries like the Philippines, Malaysia, Costa Rica, Chile, and Greece, protecting local ecosystems and endangered species around the clock.

Through wildlife protection efforts, the number of wild Asian elephants has increased in the tropical rainforest of Xishuangbanna, China. As a result, their living spaces overlap with those of local people. Preventing conflicts between elephants and local residents is a top priority in local ecosystem conservation efforts. China Mobile Yunnan and Huawei jointly built an innovative network and helped Xishuangbanna build China's first Asian elephant protection, monitoring, and warning system. It consists of a warning broadcast system that pushes warnings of elephant movements to locals on a mobile app if an elephant is detected. Monitoring devices are deployed in places where elephants frequently appear. The system has so far collected 1.43 million images and sent more than 6,000 warnings, greatly reducing unplanned human-elephant encounters. According to Tan Xuji, Director of the Asian Elephant Monitoring Center, since deployment, there have been zero incidents of human injury or other conflicts in the areas covered.

A rescuer giving wild training to rescued elephants

Protecting Against Invasive Species with AI

Salmon is a pillar of the Norwegian economy, and wild salmon, also known as the Atlantic salmon, is the basis for the healthy development of salmon farming in the country. But large invasions of humpback salmon and escaped farmed salmon are threatening the survival of wild salmon. These invasive species affect the reproduction of wild salmon and also spread disease, threatening the health of native fish species. The population of Norwegian wild salmon has decreased by half, and it has been listed as a near-threatened species by Norway.

In 2021, Huawei and Berlevag JFF, an association of hunters and anglers in Norway, collected images of river bottoms captured by underwater cameras. They were then able to identify native and invasive fish species in the rivers in real time with the help of Huawei's Ascend AI technology. The technology can identify 91% of wild salmon, reducing manual workloads and protecting biodiversity more efficiently. The project team provided the first comprehensive and dynamic 24/7 report on fish information to local river conservation associations, providing an accurate source of data for river governance efforts. AI represents a ray of hope in the struggle to protect against invasive salmon and conserve the biodiversity of rivers in Norway.

River managers and volunteers installing an underwater AI monitoring system

Enabling Inclusion and Equity in Health

Huawei hopes that everyone at any age, including those living with a disability, can equally and easily benefit from technological advances. That's why Huawei has come up with a wide range of products and services that offer information accessibility functions and provide underprivileged groups with tailored services that are easy to access.

Information Accessibility: Creating More Possibilities

The beauty of technology lies in its potential to benefit all. Technology must not only cater to the needs of the majority, but also be easily accessible to the underprivileged.

HarmonyOS has been built from the ground up with accessibility as a key priority. On this system, the diverse array of original Android-based accessibility features, for example, screen reader labels and accessibility focus and gestures, will continue to work without a hitch. HarmonyOS also offers an accessibility framework and APIs that allow third-party developers to create a greater number of accessibility features. We believe that accessibility is not just for people with disabilities. Anyone can experience impairment, for example, when bedridden from illness or when eyesight deteriorates with age.

■ **Visibility enhancements**

Zhongwei, who is now a piano tuner, has been visually impaired since birth. In 2015, he bought his first Huawei phone, a P8max. Since then, Zhongwei has become very familiar with the accessibility features on Huawei phones, and they have become an important support in his life. He loves using the AI Life app, which can control and manage all of his household appliances and smart devices. With the ScreenReader feature, Zhongwei can turn on his air conditioner, and easily adjust the temperature and direction of the airflow. When friends visit, he can help them connect to his Wi-Fi network. Zhongwei is effusive in his praise for the Huawei AI Life app: "This is beyond what I could have imagined just a few years ago. In the past, every device came with a dedicated remote control. There was no voice command option. I sometimes needed help when using them."

- **Hearing the beauty of classical Chinese poetry**

  Guoguo, who is hearing-impaired, hopes to use technology to help remove the communication barriers facing deaf people. For this reason, she became the project leader for an intelligent sign language translation program called Yiyu. This software, jointly developed by Huawei and its partner, translates speech into text and sign language in real time, helping hearing-impaired people access information more easily. While testing the application, developers noticed that children in special education schools struggled to understand classical Chinese poetry because of a lack of sign language vocabulary and grammar. To solve this problem, the project team developed poetry courses with sign language translations, allowing children to experience the beauty of traditional Chinese literature through vivid illustrations and signing by Yiyu's virtual interpreters. These courses have been delivered in schools for the deaf in several cities in China, and will be offered free of charge in more such schools in the future.

- **Helping elderly people enjoy a digital lifestyle**

Huawei has developed learning materials and teaching practices specifically for elderly people, helping them get familiar with smart devices.

– Huawei developed the *Parent's Mobile Phone Instructions*, a guide that helps elderly people understand which functions are used in specific scenarios. It is now in its ninth edition. Users can get the print version free of charge at over 1,600 Huawei authorized service centers in China.

– Huawei developed the *Bringing You to a Digital Lifestyle* series, which includes seven courses on basic mobile phone use, safe mobile phone use, healthcare, smart travel, and entertainment. Users can sign up and attend these courses in more than 4,000 experience stores in China, or visit the stores anytime they want to inquire about how to use phones. During the 2021 Double Ninth Festival alone, more than 3,000 sessions were delivered.

– Huawei's device stores work closely with local communities, local authorities, senior activity centers, nursing homes, welfare centers, and apartment building managers to hold "Huawei Classes in Communities" events. Seniors can learn at the store nearest to them and resolve their problems with mobile phone usage. Zhang Yimin, a lecturer at a Huawei device experience store in Jilin, gave 14 training sessions in the local community during his spare time in 2021. In fact, there are many lecturers like Zhang at Huawei. They are active in local communities and help elderly people better enjoy the convenience and fun of smart devices.

A Huawei lecturer delivering the *Bringing You to a Digital Lifestyle* courses in a local community

Driving Balanced Development

An estimated 37% of the world's population have still never, ever used the Internet. Many of them are living in remote rural areas. Through its TECH4ALL initiative, Huawei is committed to bridging the digital divide and working with partners to promote individual development for people in remote and rural areas using our digital technologies.

AirPON: Connecting the Unconnected

In the mountains of Chiang Mai, Thailand, a mountain road 60 kilometers long provides the main access route connecting local villages to the nearest city. However, flooding happens whenever it rains due to the steep terrain and lack of drainage, and the road has earned a local nickname: "Water Road". This rugged mountain road and the lack of access are a great inconvenience to residents.

To improve this situation, the National Broadcasting and Telecommunications Commission (NBTC) of Thailand used Huawei's AirPON solution to implement the USO NET project in the mountainous areas in Chiang Mai. During a field visit, the project team found that the residents living in the mountainous areas of Chiang Mai were not just far from the city, but also scattered across many small villages. A traditional FTTH solution would be too costly, and it was difficult to find a suitable place to accommodate all the required facilities. By contrast, Huawei's cost-effective AirPON solution could repurpose existing poles and cables, with equipment rooms installed up on poles, making

communications services available and affordable to local residents.

By the end of 2021, the USO NET project had provided Internet access to 19,652 villages, including 3,920 border villages, and about 600,000 households now have access to high-speed broadband services. Through this project, we also provided targeted ICT skills training to local people to further bridge the digital divide between urban and rural areas.

With high-speed broadband services, local doctors can consult with specialists in large cities through telemedicine devices

Gigabit Optical Network: Helping Boost China's Rural Economy

Guangxi is China's largest producer of dragon fruit. In Long'an, Guangxi, traditional farming methods meant hard labor for local people. They had to perform both fertilization and irrigation by hand. Young people from rural areas are reluctant to work in agriculture. Mechanization and intelligence, both relying on high-speed broadband networks, are the future of farming.

Huawei helped China Telecom build a ubiquitous gigabit optical network across the urban and rural areas of Guangxi with fiber coverage. Thanks to the high-bandwidth, low-latency, and highly reliable connectivity, Jinfu Farm was able to transform its farming methods from labor-intensive to digitally led.

- The integrated fertilization and irrigation management system automatically irrigates up to 900 acres of land, freeing up fruit farmers from having to water trees by barrel under the blistering sun.
- Sensors regularly monitor soil conditions, allowing precise fertilization that in turn cuts fertilizer costs by about CNY6,000 per acre per year.
- The automatic temperature control system sprays and cools the trees in summer. In winter, heaters keep them within the optimum range,

greatly increasing annual yields.
- The visual tracking system monitors the growth of the fruit. With more than 40 GB of data generated every day, the gigabit optical network quickly migrates the data to the cloud. Consumers can scan QR codes to see the place of production.

In 2021, local communities generated additional revenue of more than CNY15 million from dragon fruit, benefiting more than 40,000 low-income farmers. Advances in network and agricultural technology are making a huge difference to local communities. They are making agricultural production easier and the rural economy more dynamic, and bringing people a better life.

Advances in network and agricultural technologies are increasing the yields of dragon fruit and the incomes of farmers, making a huge difference to local communities

Security and Trustworthiness

We live in a highly interconnected world, where the physical and digital realms are converging and network boundaries are increasingly blurred. Cyber security and privacy protection are ever more important. The digital economy brings us both challenges and opportunities. We need to consider how to meet the increasingly strict compliance requirements of regulators, and how to provide secure and trustworthy products and services that fulfill our commitments to customers. We need to embrace a defense-in-depth approach to provide better security, ensure business continuity, and improve efficiency and customer experience while all the time protecting user privacy. We also need to give people access to stable ICT services during major incidents like natural disasters and pandemics.

Cyber Security and Privacy Protection

Over the past three decades, we have built more than 1,500 networks together with carriers, and helped millions of enterprises with their digital transformation. During this time, we have connected over three billion people around the world and maintained a solid track record in security. With digital transformation picking up pace, we are acutely aware that cyber security will become a cornerstone of the future digital world. Business success will not be achieved without security, trustworthiness, and privacy protection. We continue to place cyber security and privacy protection as a top priority. We are committed to confronting cyber security and privacy challenges and opportunities through management transformation, technological innovation, and open collaboration. We want to foster a better life for all in the future digital world by offering secure and trustworthy products, solutions, and services where personal data is lawfully used and always protected.

(More on cyber security and privacy protection on pages 82 to 85)

Openness and Transparency

Cyber security and privacy are a common challenge, one that all stakeholders – including governments, industry and standards organizations, enterprises, technology suppliers and consumers – have a shared responsibility to confront. We reiterate our commitment to communicating and cooperating with all stakeholders in an open, transparent, and responsible manner so that we can jointly improve cyber security and privacy protection capabilities and address the challenges through technological innovation, knowledge sharing, standards development, verification, and other measures. We strive to continually improve cyber security and personal privacy, enabling everyone to enjoy all of the benefits brought by technological advances.

(More on openness and transparency on pages 82 to 85)

Supporting Smooth Communications

ICT infrastructure provides information and communications network services, so it must operate stably at all times. As a network equipment and solution provider, Huawei must support the stable operations of customer networks and services during all types of emergencies, such as wars and epidemics, or natural disasters like earthquakes, floods, and tsunamis. This is one of Huawei's primary responsibilities.

In 2021, the world was still plagued by the COVID-19 pandemic, which posed a huge challenge to network stability. More than 5,000 Huawei engineers worked side by side with our customers and provided 24/7 technical support services. Together, we supported the smooth communications of more than 3 billion people and provided timely responses to more than 180 major incidents worldwide.

Emergency Support During a Heavy Rainstorm in Henan, China

From 8 a.m. on July 20 to 6 a.m. on July 21, 2021, a heavy rainstorm struck the central and northern parts of the Henan Province, China, setting new records for rainfall in a single day. The rainstorm caused severe damage in the city of Zhengzhou and surrounding areas. There were large-scale disruptions to power supplies, network equipment rooms were flooded, and optical cables and infrastructure were severely damaged. As a result, a large number of mobile network base stations were no longer functioning. Communication networks in affected areas were disrupted, which made it impossible to make phone calls or access the Internet. Communication disruption also made flood control command more difficult. Restoring communications services was an imperative.

Our network assurance teams in the China Region gathered immediately, initiated our emergency assurance plan, and began to repair networks and provide onsite support. Working with local carriers around the clock for 16 days, we repaired tens of thousands of mobile sites and core equipment rooms, and quickly restored communications services in all affected areas.

During this process, Huawei was aware of many possible EHS risks: Manhole covers could burst open or collapse on some road sections; there was a risk

of electric shock during emergency repairs; buildings could collapse after being soaked in rainwater; and there could be outbreaks of infectious diseases following the disaster. So we set up an EHS team and specified key safety processes. We also provided training to our network assurance teams to ensure their health and safety.

During the disaster relief process, Huawei's professional emergency response plan and efficient organization-wide collaboration helped minimize losses and allowed people in affected areas to quickly get back on track. Our efforts to fulfill our social responsibility won praise from local communities.

Huawei engineers transporting emergency repair equipment in the rain

Network Recovery and Disaster Relief Following a Flood in Oman

On October 3, 2021, Tropical Cyclone Shaheen slammed into Oman, followed by heavy rainfall, flash floods, and widespread waterlogging. Some telecom equipment was severely damaged, causing significant difficulties for local residents.

On the morning of the same day, Huawei Oman set up a joint work group with the customer. The network assurance team also set out to repair the telecom infrastructure in the affected areas. About 70% of local communications services were restored within 12 hours and 90% within 48 hours. On October 5, the network assurance team purchased supplies for disaster relief from supermarkets and worked with the local government overnight to deliver supplies to the rescue stations in four severely affected areas, helping local people through the difficult time.

Huawei's quick response and timely support for disaster relief were appreciated by local customers, the government, and the community. This is part of our commitment to becoming an active, productive member of local communities.

Huawei donating supplies to affected local residents

Business Continuity

Through years of sustained investment, Huawei has a well-designed, effective business continuity management system (BCMS) in place, for domains such as R&D, procurement, manufacturing, logistics, and global technical services. This system ensures the continuity of our key business activities, covering our end-to-end processes, from suppliers to Huawei and on to our customers. As part of this system, we have released BCM policies, processes, organizations, and management mechanisms, and developed effective measures to manage risks that arise during our daily work.

Environmental Protection

Climate change and environmental degradation pose a serious threat to the continued survival and development of society. It is now more important than ever to shift to green and low-carbon work and lifestyles in our move towards sustainable development. Huawei firmly believes that technology plays a unique, indispensable role in addressing environmental challenges and protecting nature. Over the years, we have followed the vision of "Tech for a Better Planet" to actively address climate and environmental challenges. We focus on using innovative ICT to reduce carbon emissions, promote renewable energy, and contribute to a circular economy, in order to protect our shared planet.

Reducing carbon emissions	Promoting renewable energy	Contributing to a circular economy
We use managerial and technical measures to reduce the carbon footprint of our products. We also engage with our upstream and downstream partners to reduce their environmental impacts and work together to build a greener supply chain. Our innovative ICT solutions can help other industries reduce their carbon emissions, and we take every responsible step that we can to cut carbon emissions.	We use technologies like photovoltaics and AI to improve the utilization of renewable energy, drive the transition to renewable energy, and provide green power for the intelligent world.	We are moving to a less resource-intensive and more sustainable mode of development. Our actions include selecting more eco-friendly materials, reducing the use of raw materials, making products more durable and easier to disassemble, and improving our product recycling program.

Reducing Carbon Emissions

In 2021, Huawei updated its *Green Product Policy*, *Green Operations Policy*, and *Green Partner Policy*, aiming to reduce greenhouse gas emissions across the entire value chain. Below are key points from these policies.

Green products: Huawei has integrated green development into product planning, design, R&D, manufacturing, delivery, and services. We use technological innovation to get more value from less resources; to provide customers with leading, eco-friendly products and solutions; and to enable energy conservation and emission reduction across other industries.

Green operations: Huawei is committed to green manufacturing. We aim to minimize environmental impact and extract the maximum value from resources while ensuring that products deliver the desired functions with high quality and at low cost. Huawei is also building green and eco-friendly campuses. The actions we take include minimizing resource consumption, reducing the waste we produce, and efficiently using and recycling resources as much as technology and budget allow.

Green partners: In alignment with customer requirements and industry best practices, Huawei has incorporated environmental requirements into our "quality first" procurement strategy and processes. Environmental factors are considered during supplier qualification, selection, audit, performance management, and sourcing of materials to ensure that suppliers comply with all applicable environmental laws and regulations. We are also offering appropriate incentives to encourage suppliers to make ongoing improvements. Our ultimate goal is to build a competitive, green supply chain.

Based on these policies, Huawei continues to innovate and deliver more energy-efficient products; to roll out energy-saving projects on its campuses; to use as much clean and renewable energy as possible; and to encourage and train suppliers to set energy saving and emission reduction targets to build a green value chain.

Building Greener Data Centers with an Optimal PUE

Data centers are at the heart of digital economies. To reduce energy consumption and GHG emissions, Huawei Cloud's data center in Gui'an has green and intelligent technologies incorporated into its design. Its power usage effectiveness (PUE) is only 1.12, one of the best figures in the industry. The measures Huawei took include:

- Employing direct ventilation for natural cooling. Cold air from outdoors is filtered and supplied to equipment rooms, and then discharged from the rooftop following a heat exchange through the hot aisle.

- Developing a medium-temperature chilled water system in the facility area and office area of the data center. Part of the heat is naturally cooled by waterfalls and lakes, and part of it is used to heat a swimming pool and office area in winter

with heat recovery technology. This helps fully reuse waste heat and cut carbon emissions.

- Introducing liquid cooling technology to increase power density and cooling efficiency and significantly reduce the PUE.

- Applying AI to service scheduling, peak shaving and valley filling to balance loads among servers and increase resource utilization.

- Replacing copper components in the power supply with power semiconductors to reduce power loss.

When operating at full capacity, the data center is expected to save 1.01 billion kWh of electricity per year, equivalent to over 810,000 fewer tons of carbon emissions.

Huawei Cloud's green data center in Gui'an: Naturally cooled through direct ventilation and by waterfalls and lakes, with an industry-leading PUE of 1.12

Promoting Renewable Energy

A digital economy is, first and foremost, a green economy. Green and low-carbon development has become a globally recognized goal. More and more countries and businesses are increasing investment and transitioning to clean and renewable energy. Building on its experience in power electronics and energy storage, Huawei combines its technical strengths in 5G, cloud, and AI to provide low-carbon or even zero-carbon energy solutions for different industries. We are also helping the energy industry become more intelligent by creating synergies between computing power and electricity. We are increasing the proportion of electricity generated from clean and renewable energy, optimizing energy supply and demand models, and speeding up the shift to a green and low-carbon energy industry. This will ultimately benefit the entire energy sector and society at large and make green and sustainable development a reality.

Smart PV Solution Helps Build a World-class Renewable Energy Hub: Herding Sheep Under Solar Panels

Talatan, Gonghe County, Qinghai Province, is home to a world-class single-site PV power station. It covers 56 square kilometers of land, and has an installed capacity of 2.2 GW. Huawei provided a smart PV solution that enables the power station to increase energy yield by 2% and operation and maintenance efficiency by more than 50%.

Since the plant was connected to the grid, it has generated nearly 5 billion kWh of green electricity per year, and supplied green electricity to Henan Province, more than 1,500 kilometers away, via the Qingyu UHVDC (±800 kV) power transmission line,

the world's first high voltage transmission line carrying 100% clean energy.

Talatan was once a landscape of windswept sand. Since the PV power station was built, the local ecosystem has improved greatly. The project has cut average wind speeds by 41.2% while improving average air humidity by 2.1% and soil moisture (at 20 cm deep) by 32%. Grass has quickly sprouted. Today, the solar farm is also a sheep farm. Shepherds who had to leave this area because of a lack of quality pasture are now able to return to their homes.

Renewable energy hub in Gonghe, Qinghai, built with the support of Huawei's smart PV solution: Herding sheep under solar panels and supplying green electricity to Henan Province, more than 1,500 kilometers away, via an UHVDC line

Contributing to a Circular Economy

As the world's population continues to grow and quality of life keeps improving, the pressure on the world's natural resources is increasing. To adapt to future needs, it is important for us to develop a resource-efficient economic model. Huawei is committed to building a business model that incorporates circular economy practices and a closed-loop value chain so that all resources can be efficiently used, reused, and recycled, to maximize product value with limited resources.

Less Plastic, Greener Consumption

The United Nations Environment Programme estimates that about 8 million tons of plastic end up in the ocean every year, and 60% to 90% of the litter that accumulates on shorelines, the surface, and the sea floor is plastic.
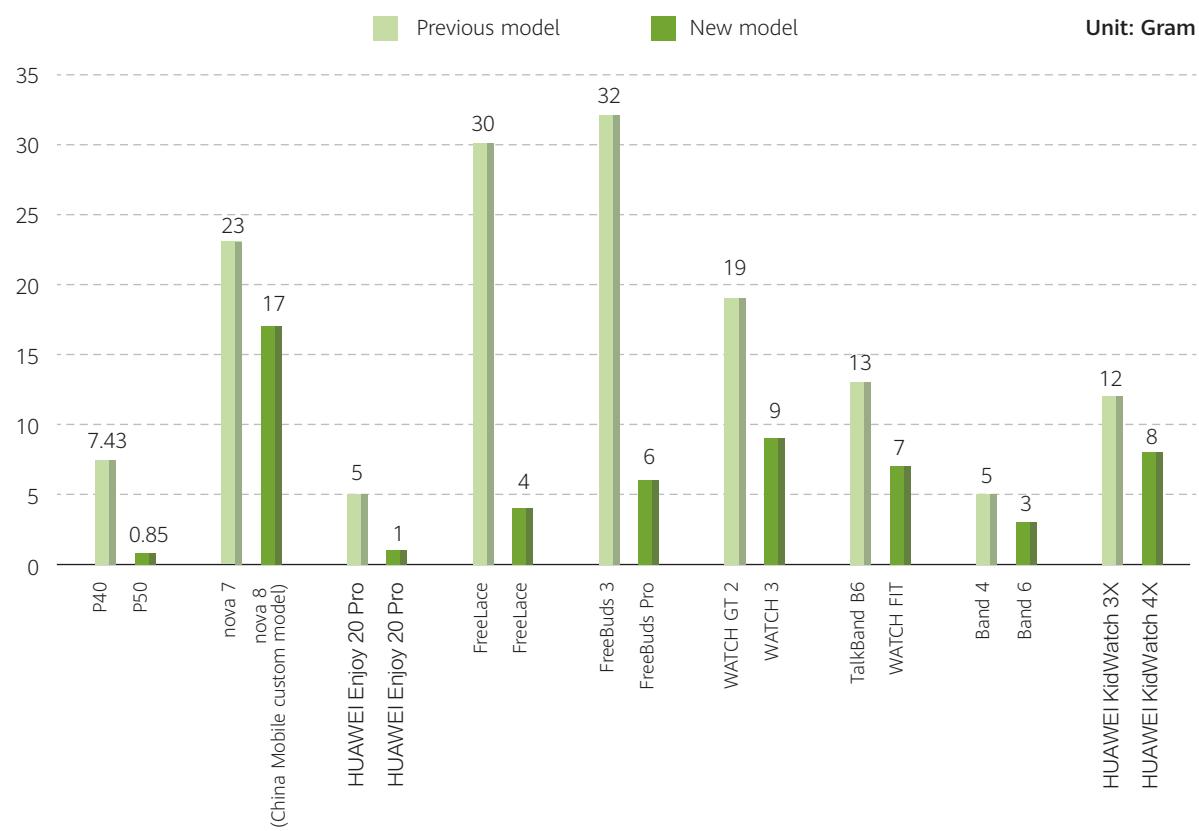
To reduce plastic waste, Huawei keeps improving its product packaging and reducing the amount of plastic used in packaging materials. For example, the surface of a packing box is usually covered with a layer of plastic film to protect the text and printed graphics. Our packaging designers developed a special oil to replace the plastic film, which has been applied to the packaging of the HUAWEI Enjoy 20 Pro and nova 7 SE (5G) models, and will be used in the packaging of more products in the future.

This optimization alone is expected to reduce the use of disposable packaging plastics by 46.3 tons for every 10 million phones.

We are also reducing the plastic used inside gift boxes. For example, the amount of plastic used inside the gift boxes of P50 series phones decreased by 89% compared with the P40 series. Plastic now makes up less than 1% of the packaging of a P50 phone, an industry-leading figure.

We have applied these plastic reduction measures to headphones, watches, bands, and many other products to provide eco-friendly products to our consumers and drive green consumption.

Comparison of plastic packaging over two generations of various Huawei products

Legend: Previous model, New model — Unit: Gram

Data: P40 7.43, P50 0.85; nova 7 23, nova 8 (China Mobile custom model) 17; HUAWEI Enjoy 20 Pro 5, HUAWEI Enjoy 20 Pro 1; FreeLace 30, FreeLace 4; FreeBuds 3 32, FreeBuds Pro 6; WATCH GT 2 19, WATCH 3 9; TalkBand B6 13, WATCH FIT 7; Band 4 5, Band 6 3; HUAWEI KidWatch 3X 12, HUAWEI KidWatch 4X 8

Healthy and Harmonious Ecosystem

As a digital and intelligent world is approaching, Huawei strives to create even greater value for our customers, build better platforms for our partners, provide our employees with more opportunities, and promote more balanced growth for local communities. We are working hard to ensure that the fruits of innovation are benefiting all people, all homes, and all organizations. We are committed to doing our part to promote sustainable and inclusive economic growth.

Caring for Employees

Employees are our most valuable asset. They are the mainstay of Huawei's sustainable development. Our commitment to improving the living and working environments for our employees does not hinge on our business performance. We always strive to offer them better dining, more leisure, and a more comfortable space. We aim to bring in outstanding global talent while also unleashing the potential of our existing teams. Our incentive policies focus on how well employees fulfill their responsibilities, and we offer top talent top pay. In addition, we encourage our employees to dive headfirst into uncertain domains and nurture an open organizational climate. We provide employees with systematic training and empowerment, and encourage managers and experts to engage more with new employees to help them broaden their horizons. We assign the brightest minds to develop even brighter ones.

iLearning Morning Express: One Carefully Selected Course for Employees to Study Every Day

iLearning is Huawei's digital learning platform. In 2021, iLearning began its transition from a learning management platform to a learning experience system, to provide easy-to-use services that precisely reach the right target audiences. iLearning aims to become an open learning platform that supports more scenarios and helps employees worldwide learn the skills they need anytime and anywhere.

By the end of 2021, iLearning had provided more than 30,000 courses and quizzes, growing employee knowledge and skillsets. The only problem is that some employees may have trouble choosing the right course, with so many available for different subjects.

To solve this problem, the iLearning operations team launched the "iLearning Morning Express", which selects one course every day from more than 10,000 courses and extracts the key points from the course into a 10-minute audio clip. At 6 a.m. every work day, the iLearning Morning Express is pushed to Huawei employees worldwide, covering many different domains like business, management, technology, industry insight, and self-improvement. Throughout 2021, the iLearning Morning Express delivered 168 clips and recommended 132 courses to over 45,000 Huawei employees.

Business Ethics

We conduct business with integrity, adhere to standard business ethics, and observe all applicable laws and regulations in the countries and regions in which we operate. This is a guiding principle for our management team. For years, we have worked hard to build a compliance management system that aligns with industry best practices and embedded compliance management into every link of our business activities and processes. These efforts continue to this day. Huawei values and works hard to create a culture of integrity, and requires all employees to comply with its Business Conduct Guidelines (BCGs).

Supply Chain Responsibilities

Corporate social responsibility, or corporate sustainable development, is an important part of Huawei's procurement strategy. Our CSR management system in procurement was designed in accordance with international standards like the *UN Guiding Principles on Business and Human Rights*, the OECD's *Due Diligence Guidance for Responsible Business Conduct*, and the *IPC-1401 Corporate Social Responsibility Management System Standard*. Our CSR agreements signed with suppliers are prepared according to internationally recognized industry standards such as the *Responsible Business Alliance (RBA) Code of Conduct* and the *Joint Audit Cooperation (JAC) Supply Chain Sustainability Guidelines*. We require all of our suppliers to sign the agreements and cascade our requirements to their suppliers. We incorporate CSR requirements into all parts of our supplier management process, from supplier admission, qualification and selection to performance appraisals and portfolio management, and we work closely with customers and industry organizations to help suppliers continually improve.

In 2021, Huawei continued to optimize its CSR management system in procurement, shared due diligence management information with more than 70 customers, nominated three suppliers to participate in the JAC's joint audits, and shared our audit results with customers.

We assigned risk ratings to more than 1,600 major suppliers, who represented over 90% of our procurement spending, and conducted onsite audits on more than 300 new suppliers and existing suppliers that posed medium or high risks. The results of these audits were used in our supplier performance assessments and supplier selection decisions.

We also conducted more than 1,100 EHS audits on our subcontractors around the world. When we discovered problems during an audit, we helped the supplier use the CRCPE (check, root cause analysis, correct, prevent, evaluate) methodology to identify common problems and encouraged them to make improvements until the problems were resolved.

Actively Participating in Industry Exchanges and Collaboration to Accelerate Industry Standardization

Huawei actively collaborates with industry organizations, including the RBA, JAC, the Association Connecting Electronics Industries (IPC), and China Electronics Standardization Association (CESA). This helps us align with industry trends, share our best practices in CSR management, translate industry best practices into industry standards together with our partners, and drive continuous improvement across the whole industry.

In 2021, Huawei led the revision of the *IPC-1401 Corporate Social Responsibility Management System Standard*, which was then released by the IPC globally. Since 2014, more than 20 industry organizations and 300 companies had sent more than 400 expert volunteers to participate in the formulation of the standard. The standard defines CSR as responsible business conduct and responsible products and services. It requires the inclusion of CSR as a business requirement in corporate strategies and activities of functional departments by aligning with five levels of compliance obligations: laws and regulations; ethics; industry standards and best practices; customer requirements; and strategic needs. This standard will help enterprises establish differentiated competitiveness by pursuing innovation in CSR practices, adopt consistent standards, and quickly align with the CSR requirements of the entire supply chain, both upstream and downstream.

IPC-1401A
2021 - October

Corporate Social Responsibility Management System Standard

Supersedes IPC-1401
March 2017

An international standard developed by IPC

Huawei led the revision of the *IPC-1401 Corporate Social Responsibility Management System Standard* as part of its efforts to promote industry standardization

Community Responsibilities

Huawei is an active, productive member of the communities in which we operate. We actively fulfill our social responsibilities and give back to local communities by making a lasting, positive difference with digital technology. We work closely with governments, customers, enterprises, and non-profit organizations to launch charitable events. We work hard to develop skilled local workforces and protect the environment. We also make donations to help people in need.

Seeds for the Future Program's First Global Tech4Good Competition

Huawei's flagship CSR program Seeds for the Future aims to share ICT knowledge with young students by showing them how ICT is applied and how the ICT industry works. It provides leadership and career coaching and helps trainees apply theory to practice, participate in cultural exchanges, and complete graduation projects together. Participants are also given a chance to meet well-known industry experts. Graduates of the program can attend activities organized by the program alumni association to stay in touch and grow together.

In 2021, Huawei held the first Global Tech4Good Competition as part of the Seeds for the Future program in its 13-year history. This competition was designed to help students explore how to use ICT to address a common social issue with coaching provided by Huawei. The competition attracted students from more than 50 countries, and more than 30,000 people watched how the top three winning teams were selected online. The three winning projects were the Thai team's faster emergency treatment solution, the Vietnamese team's sign language translator, and the Libyan team's solution for premature babies. The Brazilian team's easy water supply solution won the Audience Award.

Since its launch in 2008, the Seeds for the Future program has attracted participants from 137 countries and regions, and benefited more than 12,000 outstanding students. In July 2021, Huawei launched its Seeds for the Future 2.0 program, through which Huawei plans to invest US$150 million over the next five years. This upgraded program aims to help groups like college students and young entrepreneurs improve their digital skills, and we expect this effort to benefit more than three million additional people.

Participants of the Seeds for the Future program attending online training

Respecting Human Rights

Huawei believes that connectivity is a basic right for every human being. We are committed to building better network connectivity and providing convenient and affordable information and communications services to billions of people around the world using our innovative technologies. Ubiquitous broadband and connectivity will create jobs, promote development, decrease poverty, and improve quality of life. In addition, connectivity will help us respond to global challenges, reduce the human impact on the environment, and provide essential communications services to support rescue and relief efforts during natural disasters.

Huawei adheres to all applicable international conventions and national laws and policies and respects all basic human rights as promoted by the *Universal Declaration of Human Rights*. We develop products and services in compliance with international standards and certifications. We strive to ensure that our business activities will not cause or contribute to any adverse impacts on human rights. Huawei has been a member of the United Nations Global Compact (UNGC) since 2004, and a member of the Responsible Business Alliance (RBA) since 2018. In addition, Huawei is committed to the *United Nations Guiding Principles on Business and Human Rights* and standards released by the International Labor Organization.

Key Areas

Huawei's Corporate Sustainable Development Committee is responsible for overseeing any human rights risks that may exist within our business activities or supply chain, and strengthening our management of key areas that may have an impact on human rights.

- **Ensuring that technology is used to benefit humanity:** Technology should be used to enhance human, social, and environmental well-being. Huawei firmly opposes the misuse of technology that has an adverse impact on human rights. We carefully evaluate the long-term and potential impact of our new technologies on society based on widely recognized industry standards in the design, development, and use of our products, and work hard to ensure that our products and services are used in accordance with their intended commercial purpose. To address the unknown risks that may arise from the widespread use of new technologies, Huawei has expanded its existing processes and governance programs, and we are committed to working with our suppliers, partners, and customers to manage any potential adverse impact of technology development.

- **Protecting privacy:** Huawei attaches great importance to privacy protection, and we take our responsibilities seriously. We comply with all applicable privacy laws worldwide, including the EU's *General Data Protection Regulation* (GDPR). Huawei has embedded privacy protection requirements into our corporate governance and every phase of our personal data processing lifecycle. We follow the principles of privacy and security by design and by default and conduct privacy impact assessments before the release of any product or service, paying careful attention to sensitive personal data or sensitive usage. Huawei also requires its suppliers to comply with requirements for personal data protection. In addition, Huawei requires all of its employees to receive privacy training to enhance their understanding of the domain, and we encourage

our employees to participate in professional privacy certification programs. A total of 478 Huawei employees have been certified by the International Association of Privacy Professionals, placing Huawei among the top companies globally.

- **Safeguarding labor rights:** Huawei supports and protects the rights of its employees through detailed, equitable regulations that cover all stages of an employee's relationship with the company, including recruitment, employment, and exit. We are committed to providing equal opportunities for all employees. When it comes to employee recruitment, promotion, and compensation, we do not discriminate against anyone on the basis of race, religion, gender, sexual orientation, nationality, age, or disability. We prohibit the use of forced labor, whether overt or covert, and all use of child labor.

- **Maintaining a responsible supply chain:** Huawei has established a CSR management system in procurement in accordance with the OECD's *Due Diligence Guidance for Responsible Business Conduct* and *IPC-1401 Corporate Social Responsibility Management System Standard*. Our CSR agreements signed with suppliers are prepared according to internationally recognized industry standards such as the *RBA Code of Conduct* and *the Joint Audit Cooperation (JAC) Supply Chain Sustainability Guidelines*. During this process, Huawei also works closely with its supply chain, both upstream and downstream. In addition, we comply with our customers' sustainability requirements and conduct joint audits with them.

We also require our direct suppliers to cascade our requirements to their sub-tier suppliers, asking them to respect the rights of their employees and comply with all legal requirements regarding environmental protection, health and safety, privacy, and anti-bribery compliance. Together, our goal is to create a responsible supply chain. Huawei has a comprehensive qualification process for all new suppliers, and carries out risk-informed annual audits on current suppliers. All suppliers are evaluated based on their sustainability performance, the results of audits, and the completion of any corrective actions. Huawei has a zero-tolerance policy towards the use of forced labor, and we will immediately terminate our business relationship with any supplier that is found to have violated this policy. To date, no use of forced labor has been discovered among our suppliers.

Respecting human rights has been a long-standing focus for Huawei. In compliance with all applicable laws, regulations, and standards, we actively communicate with international organizations, governments, and industry institutions to develop human rights standards and guidelines in the use of new technologies. At the same time, we will continue to optimize management mechanisms and work with our suppliers, partners, and customers to promptly identify, manage, and mitigate any human rights risks or adverse impacts.

For more details, please see the *Huawei 2021 Sustainability Report.*

Abbreviations, Financial Terminology, and Exchange Rates

Abbreviation	Full Name
3GPP	3rd Generation Partnership Project
5G	5th Generation
AAU	Active Antenna Unit
ACM	Association for Computing Machinery
AI	Artificial Intelligence
AII	Alliance of Industrial Internet
aPaaS	Application Platform as a Service
API	Application Programming Interface
AR	Augmented Reality
ARPU	Average Revenue Per User
BCM	Business Continuity Management
BG	Business Group
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
CFO	Chief Financial Officer
CSD	Corporate Sustainable Development
CSR	Corporate Social Responsibility
CT	Communications Technology
DC	Data Center
EHS	Environment, Health, and Safety
EMEA	Europe, the Middle East and Africa
EMT	Executive Management Team
ETSI	European Telecommunications Standards Institute
FDD	Frequency Division Duplex
FTTH	Fiber to the Home
FTTR	Fiber to the Room
FVOCI	Fair Value Through Other Comprehensive Income
FVPL	Fair Value Through Profit or Loss
FWA	Fixed Wireless Access
GDPR	General Data Protection Regulation
GIO	Global Industry Organizations
GPO	Global Process Owner
GSMA	Global System for Mobile Communications Association
HCIE	Huawei Certified ICT Expert
HD	High Definition
HDR	High Dynamic Range
HMS	Huawei Mobile Services
HPC	High-Performance Computing
ICT	Information and Communications Technology

Abbreviation	Full Name
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IEEE-SA	IEEE Standards Association
IETF	Internet Engineering Task Force
IFRS	International Financial Reporting Standards
IoT	Internet of Things
IP	Internet Protocol
IPD	Integrated Product Development
ISO	International Organization for Standardization
ISV	Independent Software Vendor
IT	Information Technology
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector
JAC	Joint Audit Cooperation
MBB	Mobile Broadband
MIMO	Multiple-Input Multiple-Output
NESAS	Network Equipment Security Assurance Scheme
NEV	New Energy Vehicle
NOC	Network Operations Center
O&M	Operations and Maintenance
OECD	Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
ONT	Optical Network Terminal
OPEX	Operating Expense
OS	Operating System
OT	Operational Technology
OTN	Optical Transport Network
OXC	Optical Cross-Connect
PC	Personal Computer
POB	Performance Obligation
PUE	Power Usage Effectiveness
PV	Photovoltaics
R&D	Research and Development
RAT	Radio Access Technology
RBA	Responsible Business Alliance

Abbreviation	Full Name	Abbreviation	Full Name
RFCx	Rainforest Connection	TCO	Total Cost of Ownership
RRU	Remote Radio Unit	TUP	Time-based Unit Plan
SaaS	Software as a Service	TWS	True Wireless Stereo
SDG	Sustainable Development Goal	UNESCO	United Nations Educational, Scientific and Cultural Organization
SDK	Software Development Kit		
SIG	Special Interest Group	UNGC	United Nations Global Compact
SLA	Service Level Agreement	UX	User Experience
SME	Small- and Medium-sized Enterprise	VR	Virtual Reality
SSP	Stand-alone Selling Price	WAN	Wide Area Network
SUV	Sport Utility Vehicle	XR	Extended Reality

Financial Terminology

Operating profit

Gross profit less research and development expenses, selling and administrative expenses, plus other (expenses)/income, net

Cash and short-term investments

Cash and cash equivalents plus other current investments

Working capital

Current assets less current liabilities

Liability ratio

Total liabilities expressed as a percentage of total assets

Cash flow before change in operating assets and liabilities

Net profit plus depreciation, amortization, impairment, exchange loss, interest expense, loss on disposal of property, plant and equipment and intangible assets, and other non-operating expense, less exchange gain, investment income, gain on disposal of property, plant and equipment and intangible assets, and other non-operating income

Exchange Rates

CNY/USD	2021	2020
Average rate	6.4441	6.8988
Closing rate	6.3753	6.5198

GENERAL DISCLAIMER

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