FROST & SULLIVAN

50 Years of Growth, Innovation and Leadership

2020 Global Video Conferencing

Market Research Report

A Frost & Sullivan
Research

www.frost.com

Table of Content

1. Research Scope

1.1 Definition and Classification of Video Conferencing Product / Solution

Video conferencing is a technical solution to host live interactive meeting for participants in separate locations by simultaneous audio and video transmission via internet. Video conferencing solution usually includes an interactive set of hardware and/or software to help transmitting and receiving audio and video signals.

With video conferencing, every participant in the video- conferencing joining group can see and hear each other with real-time audio and video images, allowing natural face-to-face conversations, regardless of the multiple geographical location restriction. Video conferencing may also enable sharing documents. For its visible convenience, video conferencing is widely applied in diverse aspect, such as, remote business meeting, remote education, remote recruiting and etc.

Video conferencing solution can be classified as hardware video conferencing solution, software video conferencing solution and comprehensive video conferencing solution. In hardware video conferencing solution, it mainly focuses on the hardware device. Hardware video conferencing solution includes integrated Multiple-point Control Unit(MCU), conferencing room terminal device, desktop terminal device and etc. MCU is deployed in the network centre to deal with the code stream and transmission; conferencing room terminal device will be connected with extra assistant devices, such as video camera, speakers and screen while desktop terminal device will be much smaller with integrated video camera and speaker.

Cloud video conferencing is a term referring to the cloud-based video conferencing product, which has the similar operation mode with hardware video conferencing but it mostly requires extra hardware device as the solution carrier. Cloud video conferencing is a cloud-based digital solution that resource is available to users on-demand via the interwork from a cloud-computing server, including public cloud deployment and private cloud deployment video conferencing solution. Public cloud deployment video

conferencing delivers standard services and meets general video conferencing needs. Enterprises chose cloud video conferencing no longer need to purchase MCUs, renovate network or deploy professional staff for servers maintaining. Public cloud video conferencing allows businesses to hold instant high-definition video meetings with anyone who has a connection to the internet in various scenarios such as conference rooms, personal computers and smart phones. Compared with public cloud deployment, video conferencing deployed in private cloud is more secure because it is deployed in the user's own server and data center. Such way of deployment can make full use of the enterprise's internal technical resources (call centers, communication equipment and etc.) to improve resource utilization and conference stability and security.

1.2 Research Scope of This Market Research Report

This market research report is researched over video conferencing solutions on a global base. The traditional hardware video conferencing, cloud-based video conferencing, comprehensive solutions and related services, have been considered in the report. The market sizing data and revenues of major market players included different types of video conferencing solutions discussed above.

2. Overview of Global Video Conferencing Market

2.1 Historical Development of Video Conferencing Product / Solution

2.1.1 The Early Stage of Video Conferencing (1960-1979)

The early concept of video conferencing, namely the Picturephone, was introduced by AT&T at the World's Fair in 1964, which made it possible for making video calls between two different locations. Later in 1970s, AT&T started to provide its Picturephone service while Ericsson also demonstrated its first video telephone call. In 1976, Danny Cohen introduced Network Voice Protocol (NVP) technology, for transporting voices over packetized communications networks, which was regarded as an early example of Voice over Internet Protocol (VoIP) technology.

In this stage, the main technology of video conferencing was transmitting voices and images over analogic Public Switched Telephone Network (PSTN). It heavily relied on the quality of PSTN. During this period, the main market players were AT&T and Ericsson. As this new communication method was still in the early stage with some remained problems, including high cost, complex use, and huge equipment. Besides, it could only transmit black and white images, and was limited to hold meetings between two fixed locations. It was hard to be reached by most people with limited popularization. Therefore, video conferencing had limited applied into commercial use, and it stayed in the laboratory or private company use.

In the mid and late 70s, digital image and speech coding technology has made great progress, and the analogic system has gradually turned to the digital system. In 1976, Danny Cohen introduced Network Voice Protocol (NVP) technology, for transporting voices over packetized communications networks, which was regarded as an early example of Voice over Internet Protocol (VoIP) technology. However, the early video conferencing systems did not have a uniform standard, and they were all realized on the basis of their own research and development technologies, so it is difficult for various video conferencing products to achieve interoperability.

2.1.2 The Exploratory Stage of Video Conferencing (1980-1999)

In the 1980s, the rapid development of large-scale integrated circuit technology, image encoding and decoding technology provided good conditions for the breakthrough of video conferencing. During this period, besides AT&T and Ericsson, others began to refine video conferencing technologies, such as Randy Cole's packet video protocol (PVP) in 1981, the first video conferencing solution by Compression Labs in 1982, the first PC-based video conferencing solution by IBM and PicTel in 1991 and etc. One of the famous video conferencing solutions in the history, the CU-SeeMe also introduced in early 1990s. Meanwhile, the International Telecommunications Union (ITU) also began developing standards for video conferencing since 1996. The first international standards of video conferencing H.320 was passed, and the compatibility problem of products of different brands was solved.

At this stage, the main technology of video conferencing was digital image compression. It occupies a relatively narrow frequency band, which could help improve the quality and speed of image transmission via broadband.

Along with the industry development, the market was becoming more competitive with various players, such as PictureTel, Mitsubishi, Microsoft, IBM, Cornell and etc. When the updated CU-SeeMe released, which was compatible with Windows solution, video conferencing began available to almost anyone with a personal computer. It had become popular in commercial application market.

2.1.3 The Development Stage of Video Conferencing(2000-2010)

A new chapter in video conferencing industry had begun as it has grown into the faster development stage since 2000. Benefiting from the maturity of communication technology, video conferencing gained popularity and development during this period. In particular, optical fiber access became increasingly common in the market, and high-definition video was also more likely to realize at that time. Internet-based hardware-type and software-only video conferencing products have been widely used. In early 2000s, Samsung launched the first video cell phone while Skype and iChat were introduced to the public as the software video conferencing tools. In 2005, Lifesize introduced the first HD video conferencing solution. In 2006, Cisco entered the video conferencing industry by

launching product called "Telepresence". Technologies, as well as applications, of video conferencing also stepped into a flourishing stage such as the application of Session Initiation Protocol (SIP) and other private protocols from software-based video conferencing vendors. In 2008, Huawei released a 1080P high-definition video conferencing system, which marked the start of the high-definition era. Video compression standards such as H.264 and H.265 emerged. H.264 is a high-performance video decoding technology, which is known as the cornerstone of today's high-definition multimedia communications. The biggest advantage is that H.264 standards has a high data compression ratio, and it has a high compression ratio and high-quality images.

Technology revolutions in both video conferencing and internet has embrace boom of the market. Video conferencing became widely used in various industries and scenarios. With the constant advances in video conferencing solutions, it seems obvious that the technology will continue to evolve and gradually become an integral part of business and personal life.

2.1.4 The Accelerated Growth Stage of Video Conferencing(2010-Present)

Since 2010, video conferencing has entered an era of comprehensive integration of multiple services, benefiting more industries. Video conferencing techniques was able to integrate with multimedia communication management platforms, which can integrate multiple applications such as video conferencing, video surveillance, emergency command and dispatch, instant messaging, video on demand, desktop applications, VOIP phones, and office software collaboration. In addition, video conferencing technology has also begun to support multi-protocol conversion and compatibility, support the integration of mobile networks and the Internet, with large-capacity networking, intelligent network adaptation, high-fidelity video and audio, software and hardware integration, multi-service integration, and platform open to access third-party equipment and other features.

Video conferencing equip with cloud-computing, artificial intelligence, 5G and other technologies to achieve further development, which could offer customized functions or

expand resources and form diversified product forms according to customers' needs. Video conferencing now has integrated voice recognition, multi-language translation, face recognition, image review, video verification and other AI productivity tools. With the advent of the 5G era, the video conferencing market may replace physical conferences to a certain extent. On the other hand, Covid-19 has also brought new development opportunities to the video conferencing industry. Government online communication, school remote teaching, hospital online diagnosis and treatment, and corporate online discussion are all inseparable from video conferencing systems.

2.2　Significance of Video Conferencing Product / Solution

2.2.1 Improving operational efficiency

Video conferencing allows users to connect with anyone from any device and location with a click of button. Business owners can conne7ct with clients and employees and hold discussions without the need to incur travel expenses and time consuming. Users only need to have the necessary equipment and requirements of video conferencing, and be present in front of the screen at the chosen time. Moreover, video conferencing can economically scale adoption making a larger number of participants joining the conference; people no longer need to consider building or renting a larger conferencing room. Strategic planning and meetings which require several members to be present can be carried out with ease, thus projects may get completed faster and deals get finalized within a short period of time. In these ways, video conferencing plays a key role in improving the operational efficiency and reducing costs of running the business.

2.2.2　Facilitate global collaboration

People can interact with one another through video conferencing and this has paved the way for the global collaboration among corporations and businesses. Users can replace the traditional conference by video conferencing without any location restriction and complex operation so that they can have more efficient meeting for international business and trading, more fast response to the market demands and more efficient project implementation. For example, through video conferencing, global teams can share knowledge faster and will be informed in time, which reduces the time cost for non-face-
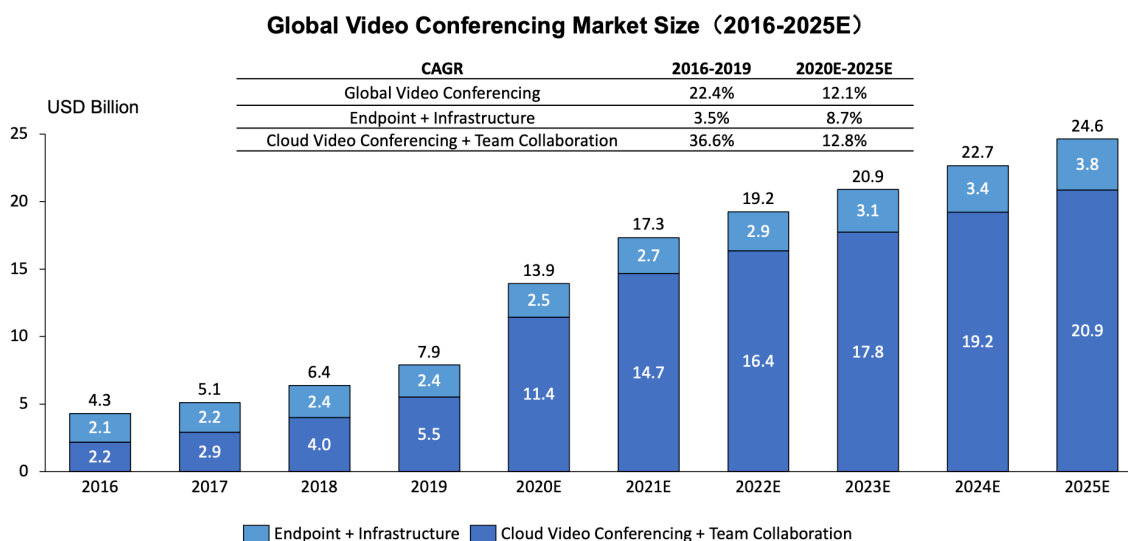
to-face communication around different corners of the world and pushes new products or services to the market in a quicker schedule. Large companies have subject matter experts and qualified resources located around the world. Videoconferencing allows firms to more easily deploy and manage those globally dispersed resources by allowing impromptu, face-to-face meetings between managers, subordinates, and remote peers.

2.2.3 Accelerating decision making

The intangible benefits of video conferencing include more efficient meetings with the exchange of nonverbal communications and a stronger sense of community among business contacts, both within and between companies, as well as with customers. Within companies, the face-to-face connection adds nonverbal communication to the exchange and enables participants to feel more sync with each other, as well as gain trust in their employers. In addition to eliminating the traditional barriers in business meetings between companies, video conferencing may develop a stronger sense of familiarity and trust with individuals they may never actually meet in person. Also, the value of video conferencing lies in adding the human touch to build trust with customers, which is critical to any business decision making and business success.

2.3 Market Sizing and Forecast of Global Video Conferencing

As mentioned above, various key factors are continuing to drive video conferencing spending worldwide as organizations are looking forward that video conferencing could bring them more benefits. Driven by these development factors, the market size of the global video conferencing and team collaboration market has increased at a CAGR of 36.6% from 2016 to 2019, from USD2.2 billion to USD5.5 billion. It is expected that the CAGR will reach a speed of 12.8% from 2020 to 2024.

Global Video Conferencing Market Size（2016-2025E）

CAGR	2016-2019	2020E-2025E
Global Video Conferencing	22.4%	12.1%
Endpoint + Infrastructure	3.5%	8.7%
Cloud Video Conferencing + Team Collaboration	36.6%	12.8%

USD Billion

	2016	2017	2018	2019	2020E	2021E	2022E	2023E	2024E	2025E
Total	4.3	5.1	6.4	7.9	13.9	17.3	19.2	20.9	22.7	24.6
Endpoint + Infrastructure	2.1	2.2	2.4	2.4	2.5	2.7	2.9	3.1	3.4	3.8
Cloud Video Conferencing + Team Collaboration	2.2	2.9	4.0	5.5	11.4	14.7	16.4	17.8	19.2	20.9

■ Endpoint + Infrastructure ■ Cloud Video Conferencing + Team Collaboration

Notes:

（1）The forecast market data is updated on Dec,2020 according to the newest market outlook.

（2）Cloud video conferencing includes cloud video conference MCU, MCU resource management, gateways, account management module and other modules. Team collaboration applications include application services that support team collaboration, such as file transfer and mobile office applications. Endpoints and infrastructure includes hardware video conferencing MCU, hardware video conferencing gateways, etc., but does not include USB Camera, IP phones, and video phones, etc.

Source: Frost & Sullivan

2.4   Drivers of Global Video Conferencing Market

2.4.1 Globalization Development

In today's globalization age, it has seen much closer connections between different countries, regions and districts, which makes further space for the multinational organizations and corporations to grow, while enhancing the communication and collaboration frequency between different locations at the same time. Besides, as the globalization is in further development, companies starts to expand or relocate their working place as the business grows. More and more global workforce takes advantage of anywhere working location for lower cost. With growing numbers of remote workers, the need for collaborative meeting is on the rise to connect on-and-offsite workforces. Conference room equipped with video conferencing has seen increasing popularity as it can provide a relatively low cost but higher efficiency in aid of global communication. It is gaining importance to digitize not only conference rooms, but open workspaces and smaller huddle areas as most think that video conferencing can greatly satisfy the requirement of communication and collaboration that globalization brings about. In such perspective, globalization is one of the key drivers to boost the market of video conferencing.

2.4.2 Technology Progress

Undoubtedly, technology development also widens the market space of video conferencing. On one hand, for external technology development, it has seen various technology drivers. As the HD network transformation is close to the completion, it enhances the network quality for video conferencing, making it more stable and clearer. Other technology drivers can be seen as higher pixel of camera, big data analysis,5G networks, artificial intelligence application and etc. On the other hand, for video conferencing itself, video conferencing suppliers keeps update both hardware and software with the cutting edge features such as cloud application which can help to release the high cost of purchasing cost of video conferencing device, analytical software which could help to collect big data for more personalized service, and integrated all-in-one solution which bring more convenience and tailored consumer service for users. Besides the growing diversified functions, the overall of video conferencing solution has seen gradually optimization in stability, clarity, scalability and compatibility, improving the

user experience with mature technologies, attractive more and more users to adopt video conferencing for better communication and collaboration.

2.4.3 Covid-19 Pandemic create customer stickiness and boost the industrial upgrading

The outbreak of the Covid-19 pandemic has affected the global economy to varying degrees. In order to avoid cluster infection caused by the movement of people, the government encourages people to work from home, and video conferencing has ushered in a period of explosive growth. The pandemic has played a significant role in cultivating the video conferencing market, and customers' activity and stickiness have been significantly improved. With the aforementioned globalization process, the continuous improvement of the technical foundation, and the continuous expansion of the downstream customer base, the pandemic has promoted a surge in demand for video conferencing, thereby prompting the upgrade of the entire video conferencing industry. For instance, increasing professional users have enhanced their requirements for video conferencing professionalism and security, which will further promote the upgrade of video conferencing infrastructures, including hardware configuration and software, cloud products and other integrated solutions. It is expected that the video conferencing industry will still have large market space in the Post-Covid-19 era.

2.4.4 Growth opportunities from existing and replacement markets

In the existing markets, the products are mainly traditional hardware-type video conferencing products. The major customers of traditional hardware video conferencing products are governments and large enterprises. Software-based cloud video conferencing types and other new solutions are currently purchased at a low level, and there is a lot of room for growth. The replacement cycle of IT equipment based on depreciation schedule is generally five years, and it is now at the time of replacing the original video conferencing equipment. Therefore, new solutions such as software-based cloud video conferencing and will be expected to occupy the traditional hardware-based video conferencing market to a certain extent in the future. On the other hand, due to the outbreak of Covid-19, the acceptance of video conferencing by a large number of ordinary

business users has increased. In the huge video conferencing markets such as China, the government's policy orientation towards localization of video conferencing and security concerns provides great opportunities for many domestic companies.

2.5   Development Trends of Global Video Conferencing Market

2.5.1 Unified Solution

Catching up with growing needs and expanding application fields of video conferencing, users expect that there will be a unified solution for video conferencing, which should include a unified solution of both unified communication and video conferencing with all audio visual and video conferencing assets across the organization that is ease of provisioning, monitoring, and management across all assets — digital signage, projectors, conference room solutions, soft collaboration clients, infrastructure, and other peripherals. It is expected that such unified solution can simplify the operation, lower administration, management overheads and implementation costs for organization users. For example, Huawei launched IdeaHub, an intelligent collaboration endpoint, which integrates various functions such as whiteboards, microphones, speakers, projectors, video conferencing equipment, touch screens, etc..IdeaHub relies on a powerful cloud and AI ecosystem to provide users with unified collaborative office solutions, which greatly improves the working efficiency of business.

Moreover, as further integration of CRM, project management and team collaboration with cloud video conference, unified video conferencing solutions will play an increasingly important role in collaborative office and business innovation, which may further contribute to the increase of online and offline connections, improvements in team collaboration efficiency and team potential, as well as stimulate the long term development of the organizations. With the increasing popularity of cloud video conferencing in thousands of industries, the openness regards to industrial applications and insights into the key demands of industry customers has become main competitiveness of market players. Along with this trend, the demand for high-quality after-sales services are expected to witnessed a long-term growth. Additionally, in the future, the unified video conferencing solution should also include through and global-

covered after-sales service to help the clients dealing with the problems, as at presence, most video conferencing vendors has seen weakness in such aspect.

2.5.2 Technological advancements

Shaped by the trends of advanced technologies, such as mobile and cloud proliferation, the Internet of Things(IoT), and Artificial Intelligence (AI), the total market opportunity for video conferencing is increasing.

AI technology application can have various improvements for video conferencing to enhance the user experience. For example, machine learning algorithms will be able to discern which speaker should be active, and ensure that their voice is fully heard by finding and minimizing background disruptions in calls. This means that car horns or distant chatter will no longer disrupt the meetings – and this is only the tip of the iceberg. It is also expected to take conference records and notes automatically to save human work. In the future, further application of AI technology in video conferencing can be dig out along with the industry development.

Additionally, the advent of 5G will serve as a foundation for AR and VR technology to seep their way into video conferencing. It is expected that video conferencing may provide 3D features and herein enhance user experience. Moreover, UHD (ultra-high-definition) 4K video meetings may also become the standard for video conferencing in the foreseeable future.

2.5.3 Enhanced security and privacy features

While privacy and security are top priorities for any organization, it is also the case for video conferencing. It is forecast that the number of digital users will soar globally, and the intensity, with respect to time spent using video conferencing as a core means of communication, will increase over the next few years. With video conferencing moving to the cloud, the security issues concerning a large amount of users' data will be the most important factor affecting customer's buying decisions. Hence, vendors are facing new challenges to offer innovative ways to protect their users 'data and communications against frauds and abuse. In the future, various security features will be integrated into video conferencing solutions, such as firewalls and session border

controllers, multiple authentication levels, intrusion-detection systems and fraud analytics, monitoring, system hardening, and vulnerability scans. It is clear that video conferencing will be an effective and secured choice to transform the global workforce in the future.

2.5.4 Cloud Application

Driving by both user needs and cloud computing development, cloud video conferencing will step out as one of key trends for the industry development. In virtue of the cloud, information technology is maintained as a service, with no need to pay for the costly and complicated on-premise server technology. By using video conferencing software users can quickly conduct a video meeting face to face with colleagues, customers, co-workers and suppliers anytime, from anywhere. Further, as organizations are in increasingly expanding, they expect that video conferencing can have higher scalability alongside with their business growth. In order to satisfy the needs from downstream users, vendors are competing to apply up-to-date technologies into video conferencing solutions to make sure that customers have the bundles they need. Hence, in the future, with the increasing numbers of businesses moving from on-premise video conferencing to cloud-based one, seamless communication and collaboration will become more productive, efficient and effective.

3. The Competence Evaluation of Key Players in Global Video Conferencing Market

3.1 Evaluation Criteria

● **Extensive product portfolio**

Extensive product portfolio refers to whether the provider have the wide-range video conferencing products and solutions covering from hardware infrastructure, software, endpoint devices like camera and microphones, to cloud platforms and cloud services.

The more products the portfolio covers, the stronger ability that the provider can have to meet the customized needs of different customers. Also, the hardware infrastructure and software, endpoint devices will have a stabilized working state and offer better using

experience if they are designed and manufactured in a unified company. Thus, compatibility will be no longer a worry for the testing before the unitized products reached the customers is a must. The companies that provide a complete products chain would have greater advantage over those who focus on either segment of the hardware and software.

Collaboration between endpoint devices and cloud platform emphasizes the importance of cloud platform and evaluates the collaboration between endpoint devices with the cloud platform. Not only the offering of endpoint devices and cloud platform is sufficient, but also have to noticed by all the providers that the compatibility between these former two kinds of service. A good docking will greatly extend their strength.

- **Industry solutions and coverage**

Public Industry solutions and coverage refers to whether the providers offer wide-range and industry-specific video conferencing applications and solutions. The adaptability and pioneering solutions for specific scenarios in the industries is a key factor in measuring the competitiveness of the provider. With the advancement of video conferencing techniques and other complementary technology such as 5G and AI etc., being able to adapt to more industry scenarios can the providers expand to a larger potential market. It is expected that enterprises that provide extensive industry solutions and wide coverage of industries can stand out from the peers.

- **Integrated intelligent techniques and collaborative applications**

Integrated intelligent techniques and collaborative applications refers to whether the products integrate with intelligent and collaborative supplementary applications such as face recognition, simultaneous subtitle, voice interaction, file management, multi-language translation, image review and etc.

With the more widespread and frequent use of video conferencing, users will want more intelligent and efficient products and solutions. For instance, people talk in real time through video conferencing platforms, and most important information is saved in the form of video and audio. However, in actual storage and transmission, the video and audio files are not conducive to circulation. Therefore, people would like a real-time voice-to-

16

text intelligent recording functions that can improve the efficiency of data sorting after the meeting. Video conferencing systems integrated with such applications save a lot of manpower so that provide users with a more efficient and convenient collaborative meeting experience.

- **Extensibility and compatibility**

Extensibility and compatibility refers to the openness and flexibility for the single or some components of the products portfolio from the providers to seamlessly add and cooperate with the complementary components from other providers and whether the products and solutions adopt international video conferencing standards such as H.264, H.323 and etc.

Considering the fact that many potential customers may already have the video conferencing products, but with the bottlenecks of some components from early sourcing, some parts of the devices must be updated to fulfil the present needs. At this point, a flexible and modularized product is a good choice to both enhance the experience and reducing the budget. Therefore, whether solution providers ca provide flexible and accurate product components, and whether they can cooperate with the built-video conferencing systems to maintain stable operation is one of the key points for the competitiveness of video conferencing solutions providers.

Also, collaboration between endpoint devices and cloud platform is also a way of evaluation products' extensibility and compatibility. Not only the offering of endpoint devices and cloud platform is sufficient, but also have to noticed by all the providers that the compatibility between these former two kinds of service. A good docking will greatly extend their strength.

- **Sales and quotation modes**

Sales and quotation modes refer to whether the modularized products can be selected individually with the flexible pricing strategy.

Following the former standard, the possible customized and diversified options of pricing is another component to support flexibility that allows customers to acquire single equipment on a monthly basis or to pay the service fees by quarter/ year. Sometimes the

cooperation will be carrying out by project, the demand for devices is dynamically changed and capability to adjust the price for the collaborators will be a plus. It also shows the power of providers from taking the risk in collaboration.

- **Market share**

Market share refers to the percentage of total sales volume in the market captured by the different components of video conferencing solutions.

- **Global delivery capability**

Global delivery capability refers to whether the key players have the capability to support global deployment and services.

The global delivery capability not only require the providers can deploy the devices including the hardware and software infrastructure all over the world, but also have the capability to offer customers service directly to the users for the problems of their comprehensive and technological inquiries from the providers' globally hosted offices through the ASAP 24-hour response.

3.2 The Evaluation Model

2020 Global Video Conferencing Valuation Model
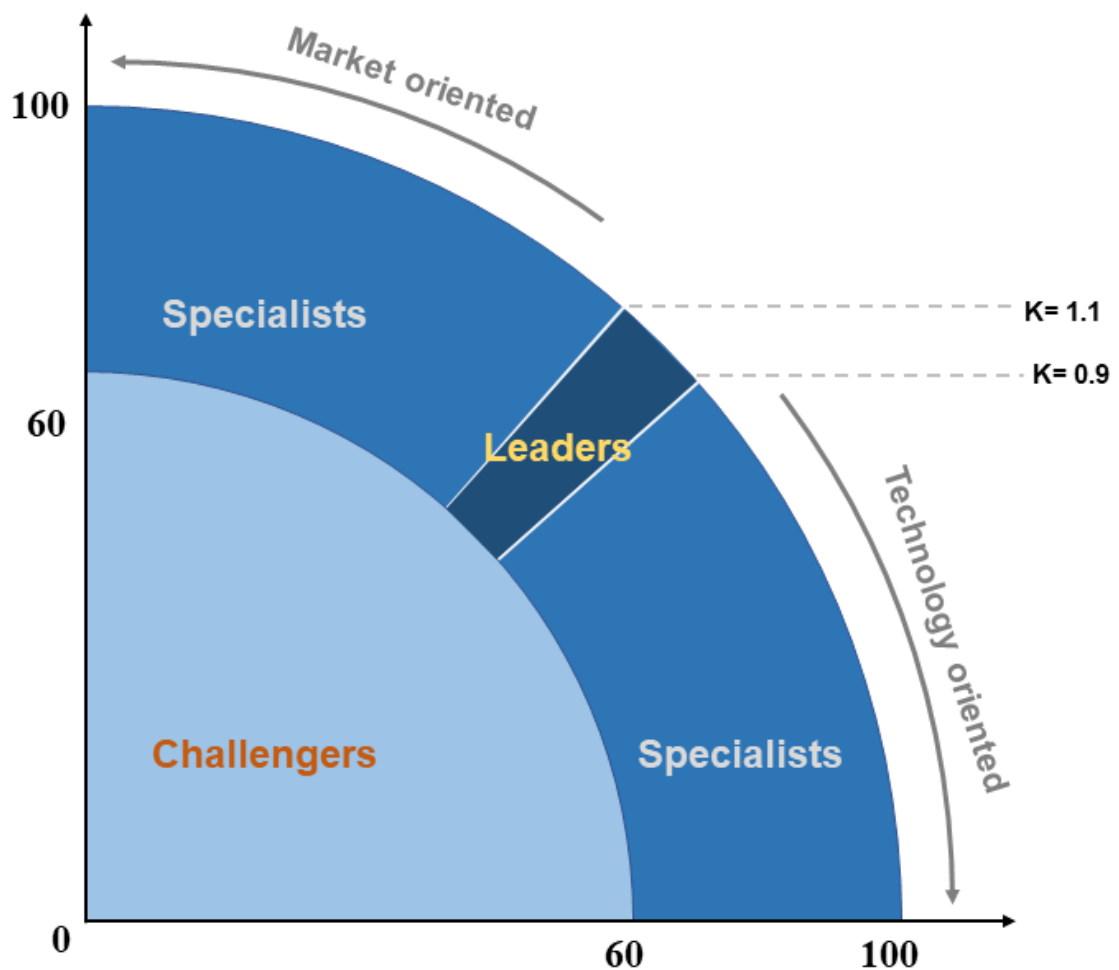
Source: Frost & Sullivan

3.2.1 Methodology

a)   We select video conferencing suppliers based on technological, market or comprehensive selection criteria. Regards to the technological selection criteria, the supplier's product type and combination must be highly representative in the industry. Their products must have been widely used in the industry and have a certain customer base. Moreover, intelligent technologies are applied to the products to enrich their functions and features. In addition, the products can be

better compatible with other applications and have strong interconnection ability. Regards to market selection criteria, the selected supplier's market share has a leading advantage in the industry. Also, they must have a certain brand awareness and market influence. Their product sales quotation model is flexible and representative. Moreover, they also have leading global delivery capabilities. Data source includes public data, internal tracking data, model-based data and third-party experts information.

b) All the video conferencing suppliers will be marked the score on the above eight evaluation criteria from 1- 6 points.

c) The eight criteria were classified into two grand perspectives: The Technology and the Market perspective. The technology perspective includes extensive product portfolio, collaboration between endpoint devices and cloud platform, industry solutions and coverage, integrated intelligent techniques and collaborative applications, extensibility and compatibility. While the market perspective includes sales and quotation modes, market share and global delivery capability. Each criterion was endowed different weight, their scores for different video conferencing suppliers will first do the weighting calculation and then sum up to an overall score of either Market or Technology perspective respectively.

d) The sum of overall Market score and overall Technology score would be the final score for a supplier. At the meantime, a key named by "K", indicates the slope of the straight line connecting the dot that representing a supplier with the Zero point, will be calculated from the overall Market score divided by Technology score.

e) The final score will determine the distance of the supplier from the zero point, whose trail on the model will be a 1/4-circle-length curve. The exact place for the dot that representing the supplier is the crossover point of the half-line starts from the zero point with the corresponding slope and the curve.

f) If the slope key "K" is larger than 1, it shows that the score of Market perspective is larger than that of Technology perspective, emphasizes this supplier would have more competitiveness on the Market side than its capability in Technology.

g) For those suppliers who get final scores over 60 while the slope is between 1.1 and 0.91 (emphasizing the supplier has more balanced development in both market and technology, potentially showing stronger competitiveness), they are marked as the leaders; for those who has a slope beyond the "leaders range", but still has a relatively high final score over 60, they are marked as the specialists; while the rest competitors are marked as the challengers.

3.3 The Competence Overview of Key Players

3.3.1 Criteria

● **Leaders**

Leaders refer to the suppliers who have outstanding performances both in Marketing and Technology, they have complete video conferencing solutions, offer cloud services and good experience utilizing the end-points infrastructure to connect with, their clear product roadmap guarantee the reliable quality and services for no matter the devices at presence or the updates in the future. They are capable to connect their devices to any other suppliers and to deploy at everywhere around the world, providing customers services at any time.

● **Specialists**

Specialists are also reliable by providing customers with their products and flexible options while the quality is still guaranteed. However, their advantages are normally shown in either perspective of the Marketing or the Technology. They are maybe experts in products creativity while the marketing strategy is insufficient, yet they are still non-ignorable among the video conferencing competitors.

● **Challengers**

The challengers have great potentials while chasing the leaders and specialists. Most of them still have a wide range of infrastructure from peripheral equipment to endpoint devices, some of them score a little in a few criteria, but with flexible and customized

sales mode and other potentials, most of them will catch up with the leaders in no time.

3.4 Introduction and Comparison of Video Conferencing Product / Solution of Key Players

2020 Global Video Conferencing Competitive Landscape
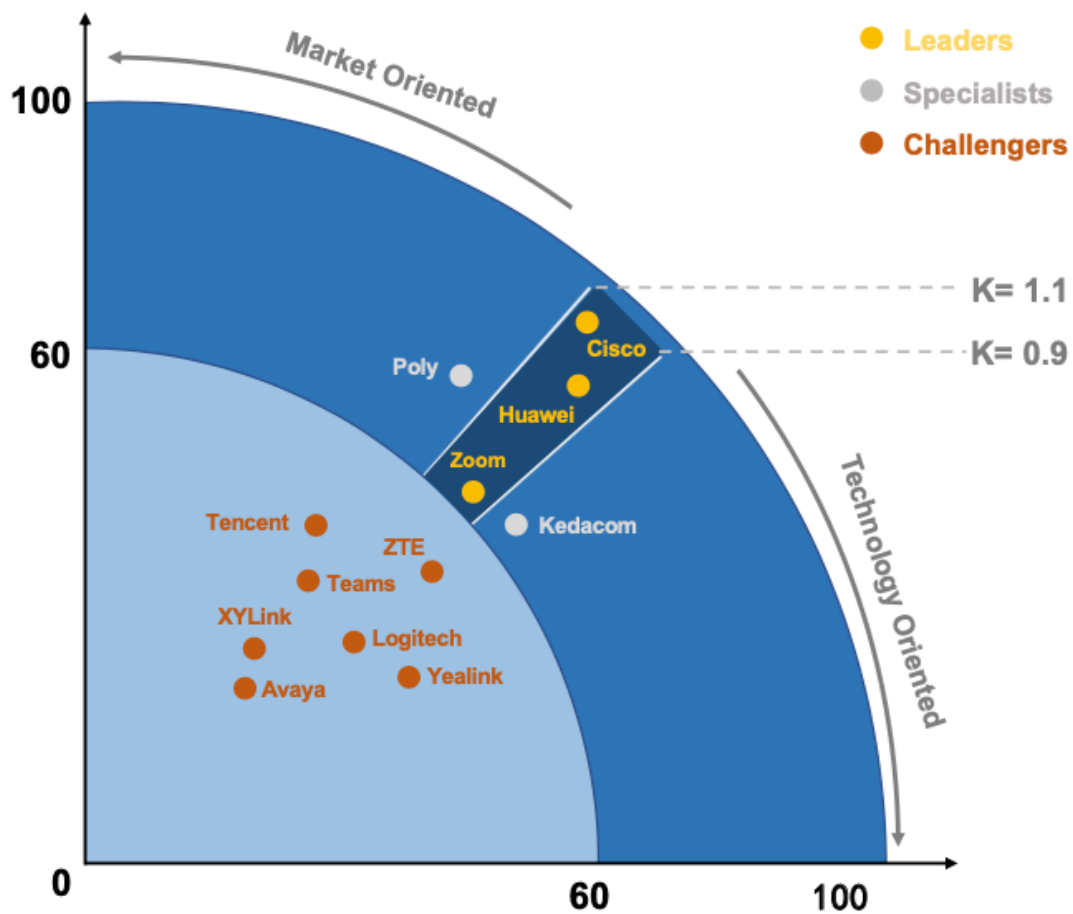
● **Cisco**

Cisco's conferencing products include Meeting Server, Webex Meetings, Webex Board, and Telepresence, etc. The conferencing products of Cisco are based on an integrated,

end-to-end architecture that uses the intelligent network for comprehensive, better user experiences that are highly secure and reliable.

This integrated products portfolio provides liberal and flexible video conferencing communications solutions, can adapt to the various and customised demands from buyers with in-house deployment, cloud service-based deployment or mixed deployment. The solution that only based on the hardware infrastructure had already been the history; the flexibility of deployment is now among the most important criteria of competitiveness.

The reliable technology and creative spirits will prevent Cisco from walking in the old steps and being self-satisfied. In the long term, with their investment and research on the latest technology, Cisco will keep providing the large-scale and complete solutions to their customers. Besides, the training for the customer-service staffs to answer and solve the problems related to mobile network and applications has helped Cisco to get prepared for the upcoming changes in office automation from all over the world and thus strength its leadership in global market.

- **Huawei**

Huawei CloudLink cloud video solutions incorporates collaboration functionality into video conferencing and enables meeting spaces with artificial intelligence to make communication and collaboration more efficient and enjoyable. By integrating cloud video conferencing and collaboration functions, Huawei CloudLink cloud video solutions can get a more efficient and free communication experience. In addition, Huawei CloudLink cloud video solutions integrate various abilities such as video conferencing, interactive collaboration and remote screen transmission, voice control, intelligent tracking, face recognition, into video conferencing. This kind of unified solution can adapt to the new demands generated in the segmented scenarios of various industries.

Featuring 4K ultra-HD, multi-scenarios, simplicity, stability and efficiency, its products engages participants with vivid, seamless communications, which can also realize clear and smooth data sharing. Huawei CloudLink cloud video solutions provide abundant terminals such as high-end immersed telepresence products, split and all-in-one terminals for all types of conference, PC terminals, mobile terminals or even access

without client browsers for various scenarios. Thanks to the capacity of openness, Huawei has delivered sophisticated solutions for different industries covering healthcare, education, transport, public safety, emergency dispatch command and other industries which require intensive interaction and collaboration. For example, President Xi paid visit to Wuhan remotely and led the emergency dispatch command with the help of Huawei CloudLink cloud video solutions.

Huawei CloudLink cloud video solutions can be deployed wholly in cloud, which can provide professional video conferencing service with low cost for medium and small enterprises. In the future, cloud-based video conferencing solutions may become the major trend of the industry. The customer-based, low cost and agile cloud-based video conference can promote high-efficient and intelligent communications. Huawei CloudLink cloud video solutions may become one of the most competitive solutions in the future.

● **Poly**

Poly is established in 2019 by Polycom and Plantronics. Poly video solutions deliver powerful and reliable communication experiences across desktops, meeting rooms, lecture halls, immersive environments, and more. Poly video solutions deliver powerful and reliable communication experiences across desktops, meeting rooms, lecture halls, immersive environments, and more. Organizations utilize Poly's integrated, standards-based video solutions to increase efficiency, extend knowledge, and accelerate decision-making across departments and geographies. As a traditional video conferencing solutions provider, Poly do have advantages outweigh other providers, with certain amount of valid customers.

With an end-to-end collaboration solution, Poly developed a market leading portfolio of integrated solutions, including a complete series of platform, terminal and corresponding peripheral products, and cloud video conferencing solutions Clariti. Poly helps customers drive a culture of collaboration to address the most pressing challenges facing in business.

Poly's video conferencing products enhanced UC capability by working with ecosystem partners and integrating several cloud video conferencing products like Microsoft Teams and Zoom, which extends the benefits of UC platform while simplifying the experience for

users. Built-in investment protection with H.323 and SIP protocol support allows backwards and forwards interoperability of Poly's video solutions. Telepresence Interoperability Protocol (TIP) interoperability delivers connectivity to immersive solutions, making it easier to deploy mixed environments and connect with customers and partners. AES software encryption for the voice, video and data streams of the call, keeping critical meetings confidential and secure.

- **ZTE**

ZTE mainly provides hardware video conferencing solutions, including full series of video infrastructure, telepresence, terminal and accessories and few cloud solutions. ZTE' s compatible and intelligent video conferencing server adopts carrier-class modular design with large capacity, high reliability, good performance and scalability, which is suitable to build video conferencing system for government departments and large enterprises. However, ZTE barely provides cloud-base or cloud integrated solutions and software solutions. The future planning and implementation for solutions need to be improved

ZTE Movable TrueSee System is a new integrated video communications system with codec, high definition PTZ camera, TV and trolley, supports 1080p HD video resolution and broadband audio. The quick and easy deployment can conveniently integrated into many kinds of meeting room, without affecting the layout.

ZTE TrueMeet Room Terminal is regarded as a type of smart, elegant, and intelligent video conferencing terminal, can provide its customers with plentiful video conferencing services together with ZTE video conferencing platform. It adopts the split-type design structure, which can flexibly adapt to multiple types of USB cameras and Bluetooth microphones. It can be laid on the desk or behind the FPD TV, which is suitable to small conference sites.

- **Avaya**

Avaya achieved video performance in real-world network conditions, with crisp, smooth quality, stellar bandwidth efficiency, and error resiliency. Featuring resolutions up to 1080P/60fps, superior bandwidth efficiency and strong fault tolerance brought by H.265 High Efficiency video codec and scalable video codec, Avaya's solutions allow users to

experience clear and smooth high-quality video. Moreover, Avaya's solutions enable participants to interact as if they're all in the same room, face to face—with the ability to collaborate on documents, spread sheets and other content. However, their video conferencing solution is biased towards platforms and base protocol. Their solutions have less end point devices and provide insufficient functions such as tracing camera, panoramic telepresence, etc.

Avaya Equinox Meetings Online eliminates the complexity and capital investment that comes with deploying and supporting on-premises video collaboration. With Avaya's virtual video meeting rooms in the cloud, there are no up-front costs for equipment, rack space, power, and maintenance, neither additional storage space for the rack equipment.

Avaya Scopia Desktop and Mobile Applications can be freely distributed and support the Bring Your Own Device (BYOD) movement with the ultimate standards-based enterprise-grade mobile HD video conferencing applications.

Avaya Scopia Video Conferencing Infrastructure provides scalable, cost-effective, and unparalleled interoperability with other standards-based video endpoints. Support scheduled and ad-hoc conferencing from video conference room systems, desktops, and mobile apps.

Avaya Scopia XT Video Conferencing provides leading, powerful video communications technology that includes immersive telepresence, conference room systems, and desktop applications.

- **Zoom**

Zoom makes video and web conferencing frictionless. Zoom is an important supplier in modern enterprise video communications, with a secure, easy platform for video and audio conferencing, messaging, and webinars across mobile, desktop, and room systems. Zoom Rooms is the original software-based conference room solution used around the world in conference and training rooms, as well as executive offices and classrooms. With Zoom, video meeting can be experienced from desktop, mobile device and conference room.

The Cloud Video Conferencing of Zoom has HD video and HD Voice with dynamic voice detection. The Accessibility features enable users with disabilities to schedule, attend, and participate in Zoom meetings and webinars. The Group Collaboration of zoom allows group messaging, screen share of documents, photos and video clips. Zoom video conferencing can be used in Mac, Windows, Linux, Chromebooks, iOS and Android.

- **Yealink**

Yealink video conferencing one-stop solutions provide reliable and efficient platform for different clients such as large group, small and medium enterprises, manufacturing business, construction companies and government institutions. Yealink Meeting Server connects people with crystal-clear audio, HD video, content and web collaboration, bridging locations across any distance or device and providing users with an enjoyable conferencing experience while cutting costs and improving efficiency. It can support up to 80 video conferences, enable cascading, and satisfy the high-capacity requirements of large companies. Yealink's cloud management service platform makes internal network traversal and business contact management easier than ever. Comprehensive endpoints and product portfolio offer users multiple choices including desktop and mobile terminals or Yealink hardware endpoints such as VC800, VC500, VP59 and VC200.

As a powerful all-in-one meeting server, Yealink Meeting Server brings together a host of key features and services: MCU, registrar server, directory server, traversal server, meeting and device management server, SIP Trunk, WebRTC server, GK & H.460 server, Microsoft SfB (Lync) gateway, recording server and collaboration server. YMS addresses the needs of various conferencing scenarios with rich conference control features, including mute/unmute, turning on/off camera, sharing meeting info, recording, customizing conference video layout for each participant, etc. In addition, YMS supports collaboration features including content sharing, whiteboard and annotation, which greatly improves conference efficiency. As for compatibility, Yealink Meeting Server supports interoperability with Microsoft SfB (Lync) clients for audio, video and content sharing. With H.323/SIP protocols and embedded GK and H.460 Server, Yealink collaboration solution is compatible with mainstream endpoints and MCU products.

- **Logitech**

Logitech not only has excellent hardware civilization, but also performs well in video conferencing solutions. Logitech solutions empower workplace collaboration, it helps teams collaborate from anywhere, without compromising on productivity or continuity. The solutions cover different scenarios including small, medium and large rooms as well as remote education and healthcare industries. Logitech video conferencing solutions for different-scale rooms come pre-configured with a Logitech MeetUp conference cam, an approved mini PC, a PC mount with cable retention, and the Logitech Tap touch controller. For all room solutions, the launch of Logitech Swytch makes every room ready for any meeting through simply connecting Swytch to the laptop via USB and launching the desired application to enjoy broadcast-quality video and content sharing at up to 4K resolution. In addition, for personal workspaces, Logitech Personal Video Collaboration Kits empower dispersed teams to stay engaged and aligned from wherever they work. Each kit features a headset and webcam—delivering studio-quality audio and life-like video for maximum collaboration and peak productivity. All of the above solutions are tailored to suit Google Meet, Microsoft Teams and Zoom.

Logitech provides corresponding peripherals for each video conferencing solution, and actively cooperates with leading companies in the cloud video software industry. Peripherals incorporate PC mount, strong USB cable, rally camera, webcams and headset kits. As for software, Logitech has collaborated with DingTalk and published Logitech Link B1000 to create an efficient, safe and convenient green smart video conference. It realizes the integration of Ali Cloud Conference software and Logitech's hardware. By matching Logitech C925e, CC3500e, CC4000e, CC5000e and other different types of conference cameras, Logitech Link B1000 can meet the application of various conference room scenes, which greatly improves communication efficiency while reducing enterprise collaboration costs.

- **Kedacom**

Kedacom is an early established video conferencing company in China that has strong R&D and innovation capabilities and can develop corresponding solutions in accordance with the needs of local conferences in China. Kedacom provides a comprehensive

coverage of services such as telepresence platforms, terminals, accessories, open platforms, and customized conference room design and construction. Telepresence products include cinematic, immersive, collaborative, and multi-functional types of scenario specific solutions. The platform product line includes video cloud, cloud integrated solutions, MCU, intelligent platform, multimedia recording and broadcasting, data conference server, network TV wall, network management, and conference management products. Terminal product include complete hardware terminals and software terminal series products.

Kedacom has relatively concentrated industry customers, which mainly from police and some corporates. Solutions provided can actually cover varies industry-specific scenarios, but due to customer resources and distribution channel problems, Kedacom has not been able to expand into larger and more diversified industry markets and lack of manpower to cover long-tail customer group.

- **Tencent Meeting**

Tencent Meeting delivers high quality cloud video conferencing service and platform-as-a-service including API and SDK. It came out in 2019 and the number of users has exceeded 100million in less than a year since its release. Tencent Meeting integrates several intelligent collaborative applications, which can communicate and coordinate with office systems such as OAs. Tencent Meeting provides standardized conference solution for team collaboration that speeds global alignment across the enterprise, allowing for better-informed decisions, faster responses and deeper trust. Tencent Meeting adopts international standards of video conferencing, makes it compatible to most of existing hardware platforms in the market such as IOS, Android and etc.

Tencent Meeting current major customers and industry coverage come from the education industry and it also serve large number of long-tail customers from varies industry with reasonable costs. At present, Tencent Meeting product team has no plans to provide customized services for industry- specific scenarios, but it cooperates with a large number of mature ecological partners, provides stable and reliable video conferencing techniques, and collectively explore and develop industry-specific solutions.

- **XYLink**

XYLink offers three relatively complete series of products: cloud, terminal products and open platform services. Specifically, cloud services deliver public cloud services and private cloud local deployment models. Terminal products include both software terminal products and hardware terminal products. Several intelligent and collaborative applications, collectively developed by third-party developers, can be integrated in terminal products with additional costs according to customer needs. Open platform products provide API and SDK open interface services, and provide technical openness for secondary development by customers and partners. Neither XYLink's software terminal products nor its hardware endpoints are compatible to hardware platforms and products from other providers, but XYLink hardware products can only compatible with its own systems.

- **Microsoft Teams**

Microsoft Teams is one of the modules of Microsoft Office 365 product line. It provides video conferencing and instant messaging services for team collaboration and intra-enterprise communication purposes. Microsoft teams works smoothly and can create great collaborative synergy with other office software under Microsoft product ecosystem. Intelligent applications such as voice-to-text, translation subtitles, file storage and etc. are integrated in the product. Microsoft teams can also deliver additional customized intelligent and supplementary applications for customers if needed.'

Microsoft teams has outstanding compatibility and interoperability, which could work smoothly with any hardware platforms as long as the Microsoft teams software can be downloaded and installed. Instant deployment from the internet can greatly reduce set-up costs and the need for technical assistance, significantly speeded alignment across the enterprise and enhanced collaboration efficiency.

3.5 Application Scenarios of Global Conferencing Market

- **Medical and healthcare market**

The applications of video conferencing in the medical field are mainly in the areas of remote visits, remote surgical teaching and remote medical consultations. Remote visits solve the problem of communication between patients and their family members when infectious disease patients directly contact with the outside is prohibited. The remote surgery teaching solves the limitation that clinical teaching requires on-site observation. Remote surgery teaching can greatly increase the number of participants, and reduce the hygiene problems caused by people entering and leaving the operating room. Telemedicine consultations share high-quality medical resources, solve the problem of unbalanced distribution of medical resources, and save travel time and expenses for patients in urgent need of medical treatment.

- **Education Market**

The application of video conferencing in the field of education has changed the traditional teaching model that requires participants sitting in the classroom. Such application is already familiar to the industry and the techniques have become relatively mature. At present, video conferencing solution providers can provide excellent network adaptability, echo cancellation and other technologies to help realize educational resources break though the space and distance limitations, maximize resource utilization, and solve the problem of unequal distribution of high-quality educational resources. Furthermore, video conferencing technique provides students with more freedom in terms of learning styles. Students can start any course of study at any time and place. In addition, the video conferencing system also provides a more direct and convenient way of communication between students and teachers, increases the opportunities and scope of communication, and generally improves the efficiency of teaching.

- **Government and public sector**

For government institutions and organizations, reliable, secure and cost-effective video communication is most important. Video conferencing is situated to help government improve their communication abilities and reduce their operating costs while increasing the services they can offer their citizens. In addition, along with the development of society and the further increase of uncertainty, the governments have put forward higher requirements on the video command and dispatch platform in order to be able to detect

and deal with various emergencies more timely. Traditional command and dispatch systems meet difficulties with satisfying the new standards. With the rapid development of mobile Internet, big data, cloud computing and other technologies, combined with the requirements of law enforcement management in the new era, cloud video conferencing solutions that can effectively enhance command and dispatch efficiency is a major trend. For example, Huawei has created a unified and efficient video command and dispatch system for the emergency management department, based on three-state integration (proprietary hardware + private cloud Cloud MCU + Huawei public cloud), four network connections (information network, government affairs network, Jinan network, Internet connectivity) and five-level coverage (full coverage of ministries, provinces, cities, counties, and individual soldiers/persons), which provide strong support for normal and abnormal video services in the emergency management system. In addition, Kedacom provides with video conferencing solutions to the Fire Department of the Public Security Ministry, to facilitate the actual combating. Combining with the advanced technologies such as cloud computing, big data and the Internet of Things (IoT), Kedacom successfully eliminate the barriers between the back end and front end of the command center, improving the scientific and intelligent level of firefighting and rescuing.

- **Business sector**

For businesses in various areas such as internet, retails and banking, building and maintaining quality relationships with partners, suppliers, internal teams, investors and customers is essential. Video conferencing boosts productivity, saves time, reduces travel expenses, and overall promotes collaboration. For example, Huawei provides ICBC (Industrial and Commercial Bank of China), which is founded in 1984 and is the largest bank by assets in China, with video conferencing solutions based on Kunpeng ecosystem that offers voice, video, AI and team collaboration services. The solution ensures ICBC with efficient communication and collaboration methods, as well as innovations in IT areas. In addition, integration with the videoconferencing system enables employees to join a video conference from meeting rooms, PCs, and tablets, which facilitate highly-efficient communication within the ICBC workspace.

4. Appendix

AI -Artificial Intelligence

A/V- Audio/Video

CAGR – Compound Average Growth Rate

EC- Enterprise Communication

HD – High Definition

IPT- Internet Protocol Telephone

IoT– Internet of Things

MCU- Multiple-point Control Unit

OPEX – Operating Expense

SIP– Session Initiation Protocol

TIP –Telepresence Interoperability Protocol

UC –Unified Communication

VC- Video Conferencing

VoIP –Voice over Internet Protocol